17A TERRESTRIAL ECOLOGY

17A.1 INTRODUCTION

This chapter details the existing terrestrial biological environment in relation to the proposed southern coal seam methane (CSM) water supply pipeline (the proposed pipeline). A particular focus of the work is the likely impacts of the proposed pipeline on rare and threatened species and communities listed under the *Nature Conservation Act 1992* (NC Act), *Vegetation Management Act 1999* (VM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Full details of the biodiversity of the study area are provided TR 17A-1-V2.5 Terrestrial Ecology Impact Assessment. Note that figures/documents with numbering ending in V2.5, for example, refer to figures/documents contained in Volume 2, Book 5 of the EIS.

The specific objectives of the terrestrial ecological assessment were to:

- identify and map areas that are environmentally sensitive in proximity to the proposed pipeline including:
  - Matter of National Environmental Significance (MNES) listed under the EPBC Act
  - important communities, habitats of species listed under the NC Act and/or the EPBC Act as 'Critically Endangered', 'Endangered', 'Vulnerable' or 'Rare'
  - regional ecosystems (REs) recognised by the Environmental Protection Agency (EPA) as 'Endangered' or 'Of concern' or 'Not of concern' but where permits are no longer granted due to being at threshold levels
  - ecosystems that provide important ecological functions, such as riparian vegetation, important buffers to protected areas, drought or fire refugia, or important corridors linking areas of habitat
  - protected areas which have been proclaimed under the NC Act or are under consideration for proclamation.
- describe and map terrestrial flora in proximity to the proposed pipeline including:
  - location and extent of vegetation types including recognised RE type descriptions and any areas of national, state or regional significance
  - location of vegetation types of conservation significance
  - vegetation map unit descriptions, including a list of species present
  - description of REs, their value as habitat for fauna and for conservation of specific rare floral and faunal assemblages or community types
  - the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected areas (e.g. national parks, conservation parks, resource reserves, nature refuges etc)
  - any plant communities of cultural, commercial or recreational significance and
  - the distribution and abundance of significant exotic and weed species.

- describe and map terrestrial fauna present or likely to be present in the area including:
  - species diversity (i.e. a species list) and indicative abundance of animals, including amphibians, birds, reptiles and mammals
  - any species that are poorly known but suspected of being rare or potentially threatened
  - habitat requirements and sensitivity to change, including movement corridors and barriers to movement
  - the existence of feral or exotic animals, including maps of major pest infestations
  - existence of any rare, threatened or otherwise noteworthy species/communities in the study area, including discussion of range, habitat, breeding, recruitment, feeding and movement requirements, and current level of protection (e.g. any requirements of protected area management plans)
  - use of the area by migratory and nomadic birds, in particular areas for breeding or significant congregations.
- provide an assessment of the potential impact on terrestrial flora, fauna and environmentally sensitive areas. This assessment outlines:
  - the significance of impacts at a local, catchment, bioregional, state or national levels
  - direct (or short term) and indirect (or long-term) impacts due to loss of range/habitat, food supply, nest sites, breeding/recruiting potential or movement corridors
  - cumulative effects of direct and indirect impacts
  - impacts on rare and threatened or otherwise noteworthy species
  - threatening processes leading to progressive loss and
  - identification of the conservation importance of identified populations at the regional, state and national levels.
- outline measures to mitigate the impacts of the proposed pipeline on terrestrial flora, fauna and environmentally sensitive areas. These measures include:
  - methods to ensure rapid rehabilitation of disturbed areas following construction, including the species chosen for revegetation, which should be consistent with the surrounding associations. Details of any post construction monitoring programs and what benchmarks would be used for review of monitoring should be included
  - methods of minimising the potential for the introduction and/or spread of weeds or plant disease
  - measures to minimise wildlife capture and mortality during construction and operation
  - methodologies to avoid injuries to native fauna as a result of the proposed pipeline's construction and operational works
  - methods for minimising the introduction of feral animals, and other exotic fauna.

The proposed pipeline was declared a 'controlled action' under the EPBC Act on the basis that it may have a significant impact on listed threatened species and ecological communities (Sections 18 and 18A of the EPBC Act). The biodiversity assessment considers impacts on Matters of National Environmental Significance (MNES) as listed under the EPBC Act and these are summaries in Attachment J of TR 17A-1-V2.5 Terrestrial Ecology Impact Assessment.

17A.2 METHODOLOGY

Technical studies of terrestrial ecology were undertaken to address the requirements of the Terms of Reference (TOR) and other relevant International, Commonwealth and state requirements and policies relating to biodiversity. The approach to the terrestrial ecological impact assessment involved a desk-based assessment of literature and relevant databases followed by field surveys. The literature and database review was used to identify ecologically sensitive areas and compile a list of conservation significant species for consideration in the impact assessment based on known records or predicted habitat in the study area and surrounds.

The study area for the terrestrial ecological impact assessment included all areas that could potentially be affected by the proposal either directly or indirectly, such as ancillary construction areas. The study area was therefore taken to be a 100 m wide corridor along the proposed pipeline from the Condamine Power Station east of Miles to the Wandoan Coal Project (the Project) Mining Lease Application (MLA) areas.

Field surveys were undertaken in the study area in August 2008 (late winter) to verify the presence, and provide site specific descriptions, of vegetation communities, species or their habitats. Flora and fauna surveys of the northern section of the study area within the MLA areas were undertaken in Spring 2007 and Autumn 2008 for the terrestrial ecology impact assessment of the MLA and infrastructure and are the subject of the Terrestrial ecology impact assessment supporting Volume 1 of the EIS (refer TR 17A-1-V1.5 Wandoan Coal Project MLA and Surrounds Terrestrial Ecology Impact Assessment). Further seasonal survey of the proposed pipeline will be completed to verify the findings of the August survey. The assessment of impacts on terrestrial ecology includes remnant and non-remnant vegetation and species of plant and animal identified, or considered likely to occur, within the habitats along the indicative pipeline corridor within the MLA areas.

The survey of terrestrial flora involved verification of RE type and remnant status as mapped by EPA, mapping and description of other vegetation regrowth (non-remnant vegetation) and compilation of a comprehensive list of species of plant that occur in the study area. The survey method for terrestrial flora was based on the approach outlined in the Queensland Herbarium's Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Neldner et al. 2005). The flora survey method also used sample techniques and methods used for the Herbarium's CORVEG secondary and tertiary site data collection (see Appendix 2 of Neldner *et al.* 2005). The location of flora survey effort is shown in Figure 17A-1-V2.3.

The survey of terrestrial fauna aimed to compile a comprehensive list of animal species and their habitats that occur in the study area. The surveys involved a range of survey methods to provide a census of terrestrial vertebrate fauna including trapping, ultrasonic bat detection, spotlighting, call broadcast and active searches for herpetofauna, birds and other incidental evidence of fauna. In addition to these census techniques, fauna habitat assessments were also done to provide a basis for the assessment of likelihood of rare and threatened species to occur in the study area and surrounds (refer Figure 17A-1-V2.3).

17A.3 EXISTING ENVIRONMENT

17A.3.1 REGIONAL CONTEXT

The study area traverses the Taroom Downs, Barakula and eastern edge of the Southern Downs subregions of the Brigalow Belt South bioregion. The Brigalow Belt bioregion covers an area of 279,496 km^2 and is one of the largest of the 80 defined bioregions (Thackway & Cresswell 1995), extending from Gladstone on the Queensland coast, south to Dubbo in New South Wales. Geologically this region consists predominantly of Jurassic and younger deposits of the Great Artesian Basin and Tertiary deposits with elevated basalt flows. Vegetation types include woodlands and open forests of *Eucalyptus populnea* (Poplar Box), *Corymbia citriodora* subsp*. variegata* (Spotted Gum), ironbarks, bloodwoods (e.g. *Corymbia trachyphloia, C. hendersonii*) and *Callitris* spp. (Cypress Pine). Woodland and forests of *Acacia harpophylla* (Brigalow)*, Casuarina cristata* (Belah) and Semi-evergreen vine thicket (SEVT) are also a feature of this bioregion.

This bioregion has been cleared largely of woodlands for grazing and dryland agriculture, with the larger remaining areas of vegetation now generally occurring on the rockier hilly areas, as roadside vegetation, or as relatively small isolated remnants. Country in the study area north of Giligulgul has been largely cleared for grazing and dryland agriculture. Between Giligulgul and Miles however, the proposed pipeline traverses the Great Dividing Range. Soils and geology associated with the Great Dividing Range are less arable and are dominated by shallow rocky or deeply weather soils. As such, country through this section of the study area has not been subject to as extensive broad scale and routine clearing as in the north.

17A.3.2 DRAINAGE LINES

The proposed pipeline traverses a number of named and unnamed drainage lines including:

- Dogwood Creek 2.5 km north of Miles along Gearys Road
- Eleven Mile Creek 2.5 km north of Miles along Gearys Road
- Wallan Creek along the 11 km north of Miles along the Leichhardt Highway
- Eleven Mile Creek 13.5 km and 16.5 km north of Miles along the Leichhardt Highway
- Eight unnamed drainage lines along the Leichhardt Highway between Miles and Gurulmundi
- L-Tree Creek at Gurulmundi along Baileys Road
- Juandah Creek approximately 1 km west of Giligulgul along Baileys Road
- one mapped unnamed drainage line along Baileys Road between Gurulmundi and Giligulgul

- Sandy Flat Creek along Fosters Road
- one mapped unnamed drainage line along Fosters Road
- Frank Creek within the MLA
- three additional mapped unnamed drainage lines within the MLA.

Detailed discussion of the aquatic ecology of the study area and region is provided in Chapter 17B.

17A.3.3 REGIONAL ECOSYSTEMS

A RE is a set of vegetation communities in a bioregion that is consistently associated with a particular combination of geology, landform and soil (Sattler & Williams 1999). Fourteen REs were identified within the study area (see Table 17A-1 and Figure 17A-2-V2.3). Mapping of REs and non-remnant vegetation at 1:40,000 scale is provided in Attachment E of the Terrestrial Ecology Technical Report (TR 17A-1-V2.5).

Table 17A-1: Field verified regional ecosystems within the study area

RE Code	RE description (1)	Qld VMA status	EPA Biodiversity status	EPBC Act status
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Of concern	Of concern	Not listed
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus spp.* tall woodland on alluvial plains	Of concern	Of concern	Not listed
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Not of concern	Of concern	Not listed
11.5.1	*Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii* woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.5.1a	*Eucalyptus populnea* woodland with *Allocasuarina luehmannii* low tree layer Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.5.4	*Eucalyptus crebra, Callitris glaucophylla, C. endlicheri, Eucalyptus chloroclada, Angophora leiocarpa,* woodland on Cainozoic sand plains/remnant surfaces(deep sands)	Not of concern	No concern at present	Not listed
11.5.21	*Corymbia bloxsomei +/- Callitris glaucophylla +/- Eucalyptus crebra +/- Angophora leiocarpa* woodland on Cainozoic sand plains/remnant surfaces	Not of concern	No concern at present	Not listed
11.7.2	*Acacia spp.* woodland on lateritic duricrust. Scarp retreat zone	Not of concern	No concern at present	Not listed
11.7.4	*Eucalyptus decorticans* and/or *Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius* on laterised duricrust	Not of concern	No concern at present	Not listed
11.7.6	*Corymbia citriodora* ssp. *variegata* or *Eucalyptus crebra* woodland on lateritic duricrust	Not of concern	No concern at present	Not listed

RE Code	RE description (1)	Qld VMA status	EPA Biodiversity status	EPBC Act status
11.7.7	*Eucalyptus fibrosa* ssp. *nubila* +/- *Corymbia spp* +/- *Eucalyptus spp.* woodland on lateritic duricrust	Not of concern	No concern at present	Not listed
11.9.5	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Endangered	Endangered	Endangered
11.10.1	*Corymbia citriodora* open forest on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed
11.10.7	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	Not of concern	No concern at present	Not listed

Note: 1 — Environmental Protection Agency (2007)

Queensland's REs have been assigned both a vegetation management status and biodiversity status, as explained below:

- **vegetation management status:** the statutory status of an RE as defined under section 22 of the VM Act is either Endangered, Of Concern or Not of Concern. This status is based on an assessment of the pre-clearing and remnant extent of a RE, and as listed in Schedules 1-5 of the Vegetation Management Regulation 2000. The vegetation management status only applies to remnant vegetation
- **biodiversity status:** the non-statutory status of a RE is defined by the EPA as Endangered, Of Concern or Not of Concern at Present. This status is based on assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem. Although not the statutory status of the RE, the biodiversity status should be used as a guide for decision making.

Three REs with remnant vegetation within the study area have a VM Act status of Endangered or Of Concern, as listed in Table 17A-1-V2.3. One of these Regional Ecosystems, RE 11.9.5, may also be consistent with the Brigalow (*Acacia harpophylla* dominant and co-dominant) Endangered ecological community listed under the Commonwealth EPBC Act. The listing of Brigalow (*Acacia harpophylla* dominant and co-dominant) under the EPBC Act does not automatically dismiss non-remnant vegetation, rather species composition and structural elements typical of that found in undisturbed areas of the listed Brigalow are determining factors. Four field-mapped polygons of RE 11.9.5 were considered to be consistent with the definition of the endangered ecological community, shown in Figure 17A-3-V2.3). While additional Brigalow regrowth between Giligulgul and Foresters Road may also be consistent with the definition of the Endangered ecological community, this section of the proposed pipeline was not assessed during the winter field surveys as permission to access lands from landowners was not obtained.

17A.3.4 SPECIES OF PLANT

Searches of relevant databases identified records of 1,082 species of plant in the study area and surrounds consisting of 983 native species. The high floral diversity is indicative of the numerous REs and habitat types traversed by the proposed pipeline corridor. Field surveys undertaken for this assessment identified 351 species of plant in the Study Area, of which 322 (91.7%) are native. The most diverse families included the grasses (*Poaceae*), daises (*Asteraceae*), wattles (*Mimosaceae*) and eucalypts (*Myrtaceae*).

Three species recorded in the study area are *'declared plants'* listed as Class 2 pests under the *Land Protection (Pest and Stock Route Management) Act 2002*: *Bryophyllum delagoense* (Mother of Millions), *Opuntia stricta* (Prickly Pear) and *Opuntia tomentosa* (Velvet Tree Pear). Class 2 pests are species established in Queensland that have, or could have, an adverse economic, environmental or social impact. The management of these pests requires coordination and they are subject to programs led by local government, community or landowners. Both of the *Opuntia* species were found to occur in most REs, but were most commonly found within vegetation representative of RE 11.9.5. The distribution of *B. delagoense* was restricted to a small distribution of RE 11.5.21 within L-Tree Creek, in the vicinity of Gurulmundi. None of the species were found to occur as a dominant species.

Eleven threatened species of plant listed under the NC Act and twenty under the EPBC Act were identified as potentially occurring within the study area or surrounds from the desk-based assessment. No threatened species of plant was recorded in the study area during the winter survey, however potential habitat exists for twelve of these species, as listed in Table 17A-2.

Table 17A-2: Threatened species of plant considered likely to occur in the study area based on the presence of suitable habitat

Name	Conservation status	
	NC Act	EPBC Act
Acacia barakulensis	V	
Acacia chinchillensis	V	V
Acacia curranii	V	V
Acacia handonis	V	V
Acacia lauta		V
Calytrix gurulmundensis	V	V
Eucalyptus pachycalyx subsp. *waigensis*	E	
Homopholis belsonii	E	V
Homoranthus decumbens	V	V
Micromyrtus carinata	E	
Micromyrtus patula	E	
Westringia cheelii (syn. *W. parvifolia*)	V	V

Four priority taxa species of plant for the Brigalow Belt South (Environmental Protection Agency and Environmental Planning Southwest Queensland 2002) were recorded in the Study Area: *Acacia melvillei* (Yaran), *Acacia omalophylla* (Yarran), *Acacia aprepta* (Miles Mulga) and *Dodonaea macrossanii* (no common name). *Acacia melvillei* and *A. omalophylla* were relatively common in RE 11.7.2 and also occurred in RE 11.7.4. *Acacia aprepta* was recorded at several locations only in RE 11.7.2. *Dodonaea macrossanii* was recorded at one location only in RE 11.7.7.

17A.3.5 FAUNA HABITATS

Seven broad fauna habitat types exist within the study area: Eucalypt woodlands, non-eucalypt woodlands, riparian, wetlands (natural or artificial) and cleared lands. These fauna habitats are broad groupings of the vegetation types/REs present within the study area, as shown in Table 17A-3.

Table 17A-3: Fauna habitats and corresponding RE code

Habitat type	EPA RE code
Dry eucalypt forest	RE 11.5.1, RE 11.5.1a, RE 11.5.4, RE 11.5.21, RE 11.7.6, RE 11.7.4, RE 11.10.1, RE 11.10.7
Eucalypt woodland	RE 11.3.2, RE 11.3.4, RE 11.7.7,
Acacia scrub	RE 11.7.2
Acacia harpophylla and/or *Casuarina cristata* scrub	RE 11.9.5
Riparian	RE 11.3.25
Wetland (artificial and natural)	Does not correspond with any RE
Cleared land	Everything not mapped as RE

Vegetation in the study area north of Giligulgul is highly fragmented with large expanses of cleared land surrounding the proposed pipeline, as depicted in Figure 17A-2-V2.3. In these cleared areas however, even small patches of habitat may provide stepping stones within the wider landscapes (Bennett, 1993).

Expansive vegetation along the Great Dividing Range south of Giligulgul has been identified as a wildlife corridor by state wildlife corridor mapping (Environmental Protection Agency 2004) and under the Biodiversity assessment and mapping methodology (Environmental Protection Agency, 2003) as shown in Figure 17A-4-V2.3.

17A.3.6 SPECIES OF ANIMAL

Database searches returned records of 240 terrestrial vertebrate species within the study area and surrounds comprising 195 species of bird, 11 species of frog, 11 species of mammal and 23 species of reptile.

Field surveys of the study area recorded 160 species of vertebrate fauna, including 148 native species and 12 introduced species. Birds were the most diverse groups of terrestrial vertebrate fauna recorded in the study area followed by mammals, reptiles and frogs respectively, listed in Table 17A-4.

Table 17A-4: Summary of species of terrestrial fauna recorded in the study area during current field surveys

Taxa	Native	Introduced	Total
Mammals	19	7	26
Birds	105	4	109
Frogs	6	1	7
Reptiles	18	0	18
Total	**148**	**12**	**160**

Species diversity was broadly comparable across fauna habitat types with the exception of wetland habitat, where only 27 species (mainly wetland birds and frogs) were recorded, as outlined in Table 17A-5. In other habitat types, the number of species recorded during surveys ranged from 49 (Acacia scrub) to 79 species (*Acacia harpophylla* and/or *Casuarina cristata* habitat).

Table 17A-5: Summary of terrestrial fauna diversity associated with broad habitat types

Group	Dry Eucalypt Forest	Eucalypt woodland	Acacia scrub	*Acacia harpophylla* and/or *Casuarina cristata* scrub	Riparian	Aquatic/ Wetland	Cleared
Mammals	10	14	6	16	12	4	11
Birds	44	46	35	48	47	18	50
Frogs	1	3	0	3	3	4	6
Reptiles	9	10	8	12	8	1	6
Total	**64**	**73**	**49**	**79**	**70**	**27**	**73**

Fifteen rare or threatened species of animal listed under the NC Act and five Threatened species under the EPBC Act were considered likely to occur within the study area and surrounds based on likelihood-of-occurrence assessment as listed in Table 17A-6. During field surveys, three rare or threatened species were recorded in the study area, also listed in Table 17A-6.

Thirty-three non-threatened priority taxa species of animal for the Brigalow Belt South (Environmental Protection Agency and Environmental Planning Southwest Queensland 2002) were considered likely to occur within the study area and surrounds based on likelihood-of-occurrence assessment. Eight of these species were detected within the study area during the field surveys undertaken for this assessment, as discussed further in TR 17A-1-V2.5 Terrestrial Ecology Impact Assessment.

Table 17A-6: Threatened species of animal predicted to occur within the study area

Name	State Conservation status[1]			Likelihood of occurrence
	EPBC Act	NC Act	Priority taxa	
Rough Frog (*Cyclorana verrucosa*)		R	Yes	Moderate
Dunmall's Snake (*Furina dunmalli*)	V	V	Yes	Moderate
Brigalow Scaly-foot (*Paradelma orientalis)*	V	V	Yes	Recorded
Golden-tailed Gecko (*Strophurus taenicauda*)		R	Yes	Recorded
Common Death Adder (*Acanthophis antarcticus*)		R	Yes	Moderate
Yakka Skink (*Egernia rugosa*)	V	V	Yes	Moderate

Name	State Conservation status[1]			Likelihood of occurrence
	EPBC Act	NC Act	Priority taxa	
Square-tailed Kite (*Lophoictinia isura*)		R	Yes	Moderate
Black-necked Stork (*Ephippiorhynchus asiaticus*)		R	Yes	Moderate
Squatter Pigeon (southern race) (*Geophaps scripta scripta*)	V	V	Yes	Moderate
Glossy Black-cockatoo (*Calyptorhynchus lathami)*		V	Yes	Moderate
Powerful Owl (*Ninox strenua*)		V	Yes	Moderate
Black-chinned Honeyeater (*Melithreptus gularis*)		R	Yes	Moderate
Painted Honeyeater (*Grantiella picta*)		R	Yes	Moderate
Little-pied Bat (*Chalinolobus picatus*)		R	Yes	Recorded
Eastern Long-eared Bat (*Nyctophilus timoriensis*)	V	V	Yes	Moderate

1: Conservation significance: State — E = Endangered, V = Vulnerable, R = Rare (NC Act). Priority taxa as identified by the Brigalow Belt South Flora Expert Panel (Environmental Protection Agency and Environmental Planning Southwest Queensland 2002).

17A.3.7 ESSENTIAL HABITAT

Essential habitat is an area or location with essential resources for the maintenance of populations of priority taxa (Environmental Protection Agency, 2002). Essential Habitat may be defined from known records or considered potential according to expert knowledge of habitat relationships. Essential Habitat is considered known where the taxon is present (based on accurate records) and there are indications of reproduction, or where a significant number of individuals are present, or important resources (such as nest sites, roost caves, major food sources) are present, or where important movement corridors for breeding and/or non-breeding (including migratory) individuals have been identified. Alternatively, Essential Habitat is considered possible where there exists suitable habitat of a size capable of supporting one or more breeding units, and important resources (such as nest sites, roost caves, major food sources) are present, or the area is proximal to populations, or may act as a potentially important corridor.

Essential habitat is mapped by the EPA under the Biodiversity Planning Assessment framework (Environmental Protection Agency 2003) and are used by the Department of Natural Resources and Water (NRW) in determination of applications to clear vegetation. The study area traverses areas of essential habitat mapped west of Miles on the Leichhardt Highway and at Gurulmundi on Baileys Road, as shown in Figure 17A-4-V2.3. Much of this essential habitat is incorporated in the Gurulmundi Special Area that incorporates Gurulmundi State Forest, Stones Country Resources Reserve and surrounding remnant vegetation on the escarpment west of the Leichhardt Highway.

17A.4 POTENTIAL IMPACTS

17A.4.1 LOSS OF VEGETATION AND HABITATS (LAND CLEARANCE)

The potential for clearing of native vegetation has been avoided as far as possible through the route selection and preliminary design process, with much of the route following existing road corridors and transmission line easements. In addition, impacts to riparian vegetation will be avoided through the use of directional drill (opposed to trenching) in order to cross drainage lines with minimal impact.

Nonetheless, total avoidance of vegetation clearing is not possible and 85.8 ha of remnant vegetation and regrowth (non-remnant) vegetation and associated fauna habitat will be cleared as a result of the proposed pipeline, as summarised in Table 17A-7. This vegetation is located primarily along the road reserve or easement edge of large patches of vegetation and as such is generally subject to a range of existing edge effects. Much of the vegetation that will be affected is however, in moderate to good condition and of remnant vegetation status under the VM Act. Only 0.6 ha of the vegetation is of an Endangered RE (RE 11.9.5) and 3.3 ha is Of Concern (RE 11.3.2 and RE 11.3.4).

Table 17A-7: Extent of vegetation clearing resulting from the southern CSM water supply pipeline (based on a 20 m wide corridor)

RE code	Remnant status		Total (ha)
	Remnant (ha)	Non-remnant (ha)	
11.3.2	2.1	1.4	3.5
11.3.4	1.3	0.7	2.0
11.3.25	2.7	0.0	2.8
11.5.1	6.9	10.6	17.5
11.5.1A	4.0	6.2	10.2
11.5.4	2.7	3.4	6.2
11.5.21	2.7	0.7	3.4
11.7.2	1.7	0.0	1.7
11.7.4	2.5	0.0	2.5
11.7.6	9.1	3.9	13.1
11.7.7	11.4	0.6	12.1
11.9.5	0.6	0.4	1.0
11.10.7	8.0	1.8	9.9
Total	**55.8**	**30.0**	**85.7**

The vegetation in the study area that will be affected by vegetation clearing has potential to provide habitat for 21 rare or threatened species of plant. The majority of the Rare and Threatened species of plant are likely to occur in the vegetation referred to as the Gurulmundi Special Area under the Biodiversity Planning Assessment (see Figure 17A-4-V2.3) (Environmental Protection Agency and Environmental Planning Southwest Queensland 2002), which comprises Gurulmundi State Forest, Stones Country Resources Reserve and surrounding remnant vegetation on the escarpment west of the Leichhardt Highway.

Vegetation clearing will also directly affect habitat of the 15 rare or threatened species of animal known or likely to occur in the study area and surrounds. Three rare and threatened species of animal were detected in the study area during the winter survey period. Impacts to fauna habitats are also likely to be most significance in the vicinity of the Gurulmundi Special Area which is identified as a State Wildlife Corridor and also consists of large areas of essential habitat for priority taxa, as shown in Figure 17A-4-V2.3.

The potential impact to these biodiversity values resulting from vegetation clearing has however been reduced by following the existing clearing along roads and easements.

17A.4.2 HABITAT FRAGMENTATION AND BARRIER EFFECTS

Habitat fragmentation is the division of a single area of habitat into two or more smaller areas, with the occurrence of a new habitat type in the area between the fragments (Andren 1994; Ford et al. 2001). This new dividing habitat type is often artificial and inhospitable to the species remaining within the fragments. Although the newly created habitat is generally used by some species, those species are usually generalists and are often considered aggressive further decreasing population levels of the species remaining in the fragments. In addition to the loss of total habitat area, the process of fragmentation can impact on species within the newly created fragments in a number of ways, including barrier effects, genetic isolation and edge effects. The degree to which these potential impacts affect the flora and fauna within the newly created fragments depends on a number of variables, including distance between the fragments, local environmental conditions, the species present and mitigation measures. Some of the potential impacts are summarised below:

- **barrier effects:** barrier effects occur where particular species are either unable or unwilling to move between suitable areas of fragmented habitat. This could result in either a complete halt to movement or reduced level of movement between fragments
- **genetic isolation:** genetic isolation occurs where individuals form a population within one fragment are unable to interbreed with individuals from populations in adjoining fragments. Genetic isolation can lead to inbreeding and genetic drift problems for populations isolated within a fragment

Cleared areas present a barrier to the movement of some species that occur in woodland habitats (Bennett & Radford 2004; Radford & Bennett 2007). The proposed pipeline alignment will however generally following existing clearings through larger patches of woodland and forest habitat, such as roads and transmission line easements. As such, it will not result in new or increased fragmentation of habitats in most of the study area.

17A.4.3 EDGE EFFECTS

Edge effects are zones of changed environmental conditions (i.e. altered light levels, wind speed and/or temperature) occurring along the edges of habitat fragments. These new environmental conditions can promote the growth of different vegetation types (including weeds) and allow invasion by pest animals specialising in edge habitats. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators. The distance of edge effects can vary, with edge effects in roads having been recorded at distances greater than 1,000 m from the road surface (Forman et al. 2000). However in a comparison of edge effects in a variety of different habitat types, Bali (2000;

2005) estimated that average edge effects in roads generally occur up to 50 m away from the road edge.

The proposed pipeline alignment will generally follow existing clearings through larger patches of woodland and forest habitat such as roads and transmission line easement. As such, it is unlikely to result in the introduction of new or novel edge effects to habitats adjoining the proposed pipeline alignment.

17A.4.4 MORTALITY

Clearing of native vegetation results in direct mortality of plants and less mobile animals in the areas being cleared, including potentially Threatened species. This would directly impact any species (including threatened species) occurring in the areas cleared.

Fauna injury or death has the greatest potential to occur during the construction phase when vegetation and habitats are being cleared. While some mobile species, such as birds, may be able to move away from the path of clearing, other species that are less mobile, or those that are nocturnal and restricted to tree hollows may find it difficult to move rapidly to adjoining areas of suitable habitat. Threatened species that could be affected by the clearing include microchiropteran bats and the Brigalow Scaly-foot.

There may also a chance of animals entering the pipeline trench during construction and being trapped. This would particularly be the case for ground-dwelling fauna including reptiles, amphibians and small mammals.

17A.4.5 WEEDS AND PEST SPECIES

Twenty-nine species of weed were recorded in the study area. Amongst these were three declared plants as listed under the *Land Protection (Pest and Stock Route Management) Act 2002*.

The construction and operation of the proposed pipeline has the potential to disperse weeds into areas of remnant vegetation where weed species are currently limited. The most likely causes of weed dispersal associated with the proposed pipeline would include earthworks, movement of soil and attachment of seed (and other propagules) to vehicles and machinery. This may, in turn, reduce the habitat quality of the sites for Threatened species.

Twelve species of introduced animals were recorded in the study area, as listed in Table 17A-8. Amongst these were five declared pest species listed under the *Land Protection (Pest and Stock Route Management) Act 2002*. These pest species are all listed under Class 2, which are pests that are established in Queensland and have, or could have, a substantial adverse economic, environmental or social impact. Management of these pests requires coordination and they are subject to programs led by local government, community or landowners. Landowners must take reasonable steps to keep land free of Class 2 pests.

Table 17A-8: Pest animals recorded in the study area

Common name	Species	Declared animal class1
Cane toad	*Rhinella marinus* (listed as *Bufo marinus*)	Non-declared animal
Dingo/wild dog	*Canis lupus dingo*	Class 2
Red fox	*Vulpes vulpes*	Class 2
Feral cat	*Felis catus*	Class 2
Brown hare	*Lepus capensis*	Non-declared animal
Rabbit	*Oryctolagus cuniculus*	Class 2
House mouse	*Mus musculus*	Non-declared animal
Feral pig	*Sus scrofa*	Class 2
Common starling	*Sturnus vulgaris*	Non-declared animal
Spotted turtle dove	*Streptopelia chinensis*	Non-declared animal
Rock dove (feral pigeon)	*Columba livia*	Non-declared animal
House sparrow	*Passer domesticus*	Non-declared animal

1. Declared animal classes as listed under the *Land Protection (Pest and Stock Route Management) Act 2002.* 'Non- declared' refers to introduced species that are not listed Class 1-3.

It is likely that the pest species recorded in the study area already exist in vegetation and habitats surrounding the study area, as such the proposal is unlikely to result in the further establishment of pest species into areas where they are currently limited. However, the dispersal of these species may result in an increase in predation on or competition with native wildlife in areas into which they re-establish.

17A.4.6 NOISE AND DUST

During construction of the proposed pipeline there will be increased noise in the local area for a short period of time. This may cause disturbance to fauna in the area, although given the proximity of the proposed pipeline to existing roads, it is expected that the impact of this would be minor. Operational access for maintenance vehicles may cause intermittent disturbance, however, as the pipeline predominantly follows existing roads and transmission easement, the impacts associated with this are likely to be minor.

Dust also has potential to impact surrounding vegetation and fauna habitats during construction. This impact is likely to be temporary and reversible following rehabilitation of the construction footprint.

17A.4.7 CUMULATIVE IMPACTS

The potential biodiversity impacts of the proposed pipeline have been considered as a consequence of the construction and operation of the proposed pipeline within the existing environment. The incremental effect of multiple sources of impact (past, present and future) are referred to as 'cumulative impacts' (Contant & Wiggins 1991; Council on Environmental Quality 1978) and provide an opportunity to consider the proposed pipeline within a strategic context. This is necessary so that impacts associated with the proposed pipeline and other activities within the region are examined collectively.

Potential developments in the nearby area that may interact with the construction of the proposed pipeline include:

- the mine and associated infrastructure of the Project (refer to Volume 1 of the EIS)
- the coal transport corridor for the Project
- other proposed water sources for the Project.

All such developments are likely to contribute to a greater extent of vegetation clearing in the region and a further fragmentation of habitat if not appropriately managed.

17A.4.8 OPERATION OF THE PIPELINE

There is a small chance of fauna mortality during the operation of the proposed pipeline through vehicle collision from maintenance vehicles. Generally, rates of vehicle strike mortality are directly proportional to the distance of native vegetation/fauna habitat crossed by a project (Foreman *et al.* 2003) and the number of vehicles present. Considering the nature of the proposed pipeline, this impact is likely to be very low.

17A.4.9 SIGNIFICANCE OF IMPACTS

A number of threatened REs, communities, species of plant and species of animal have either been recorded in the study area or are considered likely to occur (moderate or high likelihood), and may be affected by the proposed pipeline.

For ecological communities and species listed under the EPBC Act, impact assessments were completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines. As the VM Act and NC Act do not outline factors for consideration in assessing impacts of a project, the assessment was based on the following matters for consideration:

- the conservation value of the area affected for the species or community
- the importance of the individuals and habitats being affected to maintaining long-term viability of the population or community
- whether or not the impacts will be long-term, permanent and irreversible.

The impact assessments also consider the range of impact mitigation measures proposed to avoid, reduce and mitigate environmental impacts. Significance assessments for communities and species are included in Attachment I of the technical report TR 17A-1-V2.5 Terrestrial Ecology Impact Assessment.

A summary of significance assessments undertaken for threatened biodiversity is provided below in Table 17A-9. These impact assessments conclude that the proposed pipeline is not likely to have a significant impact on threatened species or communities, nor would it interfere with their recovery, assuming suitable mitigation measures are put in place.

Table 17A-9: Summary of threatened biodiversity for which significance assessments were undertaken and their likelihood of being significantly affected by the proposed pipeline

Name	EPBC Act [1] Status	NC Act Status [2]	VM Act	Likely to be significantly affected	Reason for the outcome
REs					
RE 11.9.5	E	—	E	No	Small extent to be affected in study area (1 ha)
Ecological communities					
Brigalow (dominant co-dominant)	E	—	—	No	Small extent to be affected in study area (1 ha)
Plants					
Westringia cheelii	V	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Acacia barakulensis	—	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Acacia curranii	V	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Acacia handonis	V	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Calytrix gurulmundensis	V	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Eucalyptus pachycalyx subsp. waajensis	—	E	—	No	Not recorded therefore size and extent of population likely to be limited.
Homoranthus decumbens	V	V	—	No	Not recorded therefore size and extent of population likely to be limited.
Micromyrtus carinata	—	E	—	No	Not recorded therefore size and extent of population likely to be limited.
Micromyrtus patula	—	E	—	No	Not recorded therefore size and extent of population likely to be limited.
Homopholis belsonii	V	E		No	Not recorded therefore size and extent of population likely to be limited.

Name	EPBC Act [1] Status	NC Act Status [2]	VM Act	Likely to be significantly affected	Reason for the outcome
Reptiles					
Brigalow Scaly-foot (*Paradelma orientalis*)	V	V	—	No	Low density of animals recorded (1) and similar suitable habitat available in the surrounding landscape
Yakka Skink (*Egernia rugosa*)	V	V	—	No	Not recorded within study area and no important habitat present
Dunmall's Snake (*Furina dunmalli*)	V	V	—	No	Not recorded within study area and no important habitat present
Birds					
Squatter Pigeon (southern race) (*Geophaps scripta scripta*)	V	V	—	No	Not recorded within study area and no important habitat present
Satin Flycatcher (*Myiagra cyanoleuca*)	M	—	—	No	Not recorded within study area and no important habitat present
Powerful Owl (*Ninox strenua*)	—	V	—	No	Not recorded within study area and no important habitat present
Glossy Black-cockatoo (*Calyptorhynchus lathami*)	—	V	—	No	Low density of animals recorded (2), similar suitable habitat available in the surrounding landscape, and no evidence of breeding detected within atudy area
Mammals					
Eastern Long-eared Bat (*Nyctophilus timoriensis*)	V	V	—	No	Not recorded within study area and no important habitat present

17A.5 MITIGATION MEASURES

17A.5.1 AVOIDING ENVIRONMENTAL IMPACTS

Avoiding environmental impacts has been considered where possible throughout the route selection, planning and preliminary design phases. There will also be ongoing opportunities to further avoid impacts at a local scale through the detailed design process.

At the route selection stage, four potential pipeline route alignments were identified and evaluated though a comparative assessment, as discussed in Chapter 2 Project Need and Alternatives, including assessment of threatened species, remnant vegetation communities and watercourses from desk based resources. All southern CSM water supply pipeline options were required to traverse extensive areas of remnant vegetation and associated significant habitats including over the Great Dividing Range. As such, the proposed pipeline route has followed existing roads and easements as far as possible to minimise impacts to biodiversity.

Following terrestrial ecological assessment along a section of the proposed pipeline, being along Geary's Road north of Miles, this section of the proposed pipeline was realigned away from Geary's Road so as to co-locate with an existing transmission line easement. The existing transmission line is located parallel and to the south of Geary's Road, running in an east-west direction, with mid and upper storey vegetation already cleared from the area. This realigned section of the proposed pipeline will be subject to further survey, as discussed in Section 17A-5-3.

17A.5.2 MANAGEMENT OF THE MITIGATION PROCESS

The impacts and mitigation associated with the proposed pipeline are discussed below in general terms. As part of the detailed design, and prior to the start of construction, more detailed mitigation measures will be developed and presented in a biodiversity management plan relating to both the construction and operation of the proposed pipeline. The biodiversity management plan will include, where appropriate, procedures for:

- detailed design of mitigation measures such as fauna underpasses and fencing (as required associated with access tracks)
- general impact mitigation
- staff/contractor inductions and ongoing education
- pre-clearing surveys and fauna salvage/translocation where practical
- rehabilitation and restitution of adjoining habitat where possible
- weed control
- pest management
- rehabilitation protocols
- monitoring.

The biodiversity management plan will include clear objectives and actions for the proposed pipeline including, where appropriate:

- minimising human interferences to flora and fauna
- minimising vegetation clearing/disturbance
- minimising impact to threatened species and communities
- minimising impacts to riparian and aquatic habitats and species
- ongoing monitoring of impacts on flora and fauna.

The biodiversity management plan will include mitigation measures as outlined in Table 17A-10.

Table 17A-10: Summary of mitigation measures

Mitigation measure	Design	Construction	Operation
▪ Further survey is required to increase the likelihood of detecting Rare and Threatened species in the study area and surrounds and assess sections of the study area that could not be accessed during the winter surveys.	Y		
▪ Refine alignment of pipeline in light of biological knowledge and design constraints in accordance with this report.	Y		
▪ Utilise trenchless technology to cross drainage lines. Directional drilling launch and receiving pad areas should be carefully planned in order to avoid removal of mature trees. If this is not possible, the number of trees to be affected should be minimised. It is envisaged, however, that any directional drilling should take place from within the cleared easement.	Y	Y	
▪ Prepare and implement a flora and fauna management plan.	Y	Y	Y
▪ Provide for designated areas in cleared and degraded land for stockpiles and equipment lay-down to minimise the overall impact of construction and avoid unnecessary vegetation and habitat removal.	Y	Y	
▪ Conduct staff/contractor inductions on site a suitably qualified staff/contractor (e.g. a trained ecologist or other qualified environmental specialist).		Y	
▪ Implement dust suppression during construction.		Y	
▪ Implement appropriate erosion and sediment control strategies.		Y	
▪ Utilise preferred seed mixes for revegetation works, ideally to be collected from the study area and surrounds.		Y	
▪ Procedures for specific targeted species searches for those threatened species and priority taxa considered to have potential to occur prior to any staged development will be implemented. If located, consideration will be given to translocation of individuals according to guidelines from the Australian Network for Plant Conservation (Vallee et al. 2004) or fauna guidelines such as those in the Nature Conservation (Koala Conservation) Plan 2006 (Environmental Protection Agency & Queensland Parks and Wildlife Service 2005).		Y	Y
▪ Prepare weed and feral animal management plans, including vehicle washdown procedures to limit edge effects such as the establishment of aggressive weeds, and the spread of annual and perennial exotic herbs.		Y	Y
▪ Sensitive areas, such as those containing fauna habitat, will be cleared of fauna prior to construction activities commencing in co-ordination with a trained ecologist or other qualified environmental specialist in order to: ▪ mark the limits of clearing in sensitive areas (e.g. Endangered and Of concern REs) to avoid unnecessary vegetation and habitat removal ▪ place transportable habitat features such as large logs and boulders in adjacent retained areas to allow their continuation as potential fauna refuge sites ▪ implement pre-clearing surveys for fauna. Pre-clearing involves removal of the understorey and smaller non-hollow bearing trees in order to disturb fauna and encourage them away from the clearing area.		Y	
▪ Except for trenching, vegetation clearing should involve only the removal of above-ground plant parts, with root systems and the soil profile left undisturbed.		Y	

Mitigation measure	Design	Construction	Operation
▪ Areas not necessary for the operation of the pipeline should be rehabilitated in a progressive manner as construction proceeds. Revegetate areas to improve habitat value and visual amenity, including: ‣ planting of a range of locally occurring native shrubs, trees and groundcover plants, in keeping with the former vegetation types present. Choice of species would be in consultation with the Environmental Protection Agency (EPA) and should include Allocasuarina, Eucalyptus, Angophora and Corymbia species to compensate for any impacts to habitat of the Koala and other hollow dependant species ‣ increasing the overall vegetation cover within the proposed pipeline alignment area ‣ incorporating existing natural vegetation where possible ‣ linking vegetation remnants ‣ focusing on riparian vegetation to protect waterways ‣ excluding stock from rehabilitated areas.		Y	Y
▪ Soil that may contain seeds of exotic species should be stockpiled away from drainage lines, and vegetated areas and weed-free soil stockpiles. Weed infested stockpiles would be covered to eliminate the spread of the soil and seed during rainfall and high wind events.		Y	
▪ No materials, spoil or machinery should be stored or parked within the drip-line of any trees.		Y	
▪ The amount of open trenching should be generally limited to 100 m per crew at any one time.	Y	Y	
▪ Trenches should be backfilled so as to cover as much open trench as practicable by the end of each day's work. If this is not possible, the ends of the open trenches would be graded to allow escape for any animals that may venture into the trench.		Y	
▪ Implement a flora and fauna monitoring program (as part of the greater Wandoan Coal Project flora and fauna monitoring program) aiming to better understand and manage impacts and rehabilitation actions to flora and fauna throughout the study area. Monitoring would also include exotic weeds and feral animals. The detailed monitoring plans would be incorporated into the biodiversity management plan for the Wandoan Coal Project.		Y	Y

17A.5.3 FURTHER SURVEY

Surveys of the proposed pipeline were completed in late winter 2008. Weather conditions during this survey period were generally cool and sub-optimal for detecting herpetofauna (reptiles and frogs). The cool dry weather and general season (late winter) is also a time of reduced vegetative growth and reproductive activity for many species of plant, particularly grasses and other herbaceous ground cover species. Further seasonal surveys will be undertaken in late spring/early summer 2008 and late summer/early autumn 2009 in order to better detect threatened and rare species and inform detailed design.

17A.6 RESIDUAL IMPACTS AND OFFSETS

Residual impacts are those that remain after implementation of the proposed pipeline and all associated mitigation and other environmental management measures have been undertaken. Residual impacts for the proposed pipeline include the removal of 55.8 ha remnant vegetation and 30.0 ha of regrowth (non-remnant) vegetation and associated habitat. Where there is residual loss or degradation of vegetation and habitat after detailed design, and determination of mitigation measures, compensation in the form of compensatory habitat, land rehabilitation and/or contribution to research can be employed (i.e. offsets).

A Green Offsets Package for the proposed pipeline will be developed in consultation with EPA and Depart of Water, heritage and the Arts (DEWHA) giving consideration to relevant State and Commonwealth policies relating to offsets, as outlined below. This Green Offsets Package will address both state and Commonwealth offsetting requirements.

17A.6.1 OFFSETS

A draft framework for WJV's Biodiversity Offset Strategy is detailed in Appendix 17A-1-V1.4 of Volume 1 and has been developed as the primary ameliorative measure to minimise the residual impact of the proposed pipeline on biodiversity. Once a raw water pipeline option is selected, a detailed strategy incorporating offsets for vegetation impacts from the pipeline and related infrastructure will be developed in consultation with stakeholders, DEWHA and EPA.

The draft strategy is being developed to address both Australian Commonwealth and State Government requirements relating to biodiversity offsets.

The draft strategy aims to provide a net improvement in ecological value as a result of the proposed pipeline, including providing protection immediately for an equal or greater area of similar habitat as that lost through the contraction of the pipeline. These offsets will complement those proposed for the Project.

A mixture of offsets providing immediate protection and those produced to provide additional conservation during development of the mine is proposed. Subject to further verification and consultation with key interest groups, the draft strategy proposes a target ratio of 3:1 of "like for like" in terms of the vegetation protected in offsets compared with that disturbed by the proposed pipeline. Offset areas are proposed to be located both within and outside the mining area.

It is proposed to actively increase the habitat value of the offset areas through appropriate means which may include planting of native species. An estimate of the area within each proposed offset suitable for active planting will be made based primarily on topography, as this heavily influences the ability to conduct planting.

Detailed assessments for the characteristics and quality in terms of ecological value of the offsets compared with the area proposed to be disturbed will be undertaken. Such assessments will include reviews of foraging value, availability of habitat (e.g. roost trees), and physiological characteristics such as topography and soil type.

This draft strategy is viewed as the starting point for a Green Offsets Package for the proposed pipeline that will be developed in consultation with EPA and DEWHA giving consideration to relevant State and Commonwealth policies relating to offsets, as outlined below.

Queensland Government Environmental Offsets Policy

The Queensland Government Environmental Offsets Policy aims to provide a supporting framework for environmental offsets in Queensland including principles and guidelines for using environmental offsets and guidance on when offsets should be uses. The Queensland Government Environmental Offsets Policy applies to decisions on development approvals under a range of approval processes including the *Integrated Planning Act 1997*, *State Development and Public Works Organisation Act 1971* (SDPWO Act) and the *Environment Protection Act 1994*.

The Queensland Government Environmental Offsets Policy outlines seven principles for seven policy principles that direct the way offsets must be used to contribute to environmental sustainable development (ESD) as follows:

1. Offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy.
2. Environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact.
3. Offsets must achieve an equivalent or better environmental outcome.
4. Offsets must provide environmental values as similar as possible to those being lost.
5. Offset provision should minimise the time-lag between the impact and delivery of the offset.
6. Offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values.
7. Offsets must be legally secured for the duration of the offset requirement.

The Green Offsets Package developed for the proposed pipeline will follow these principles and the guidelines of the Queensland Government Environmental Offsets Policy.

State policy for vegetation management offsetting

The requirements for offsets under state legislation fall under the subordinate policies of the VM Act and NC Act, specifically the:

- Regional Vegetation Management Code (Department of Natural Resources and Water 2006)
- Policy for Vegetation Management Offsets (Department of Natural Resources and Water 2007)
- Policy 2 of the Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (The Koala Plan) (Environmental Protection Agency & Queensland Parks and Wildlife Service 2005).

The offsets strategy will be determined following detailed design of the proposed pipeline and based on the residual impacts once all reasonable alternatives to avoid impacts have been exhausted. This is also necessary in order to determine the minimum requirements for offsetting following the 'maintain existing extent' test for REs, essential habitat and conservation status thresholds under the Regional Vegetation Management Code for the Brigalow Belt and New England Tablelands Bioregions (Department of Natural Resources and Water 2006).

Environmental offsets for impact on Matters of National Environmental Significance

Environmental offsets for impacts on Matters of National Environmental Significance (MNES) may be used to maintain or enhance the health, diversity and productivity of the environment as it relates to MNES. Environmental offsets are not applicable to all approvals under the EPBC Act and their requirement is assessed on a case-by-case basis.

The Australian Government has identified eight principles for the use of environmental offsets under the EPBC Act. These eight principles will be used to assess any proposed environmental offsets to ensure consistency, transparency and equity under the EPBC Act. The Australian Government's position is that:

1. Environmental offsets should target the matter protected by the EPBC Act that is being impacted.
2. A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3. Environmental offsets should deliver a real conservation outcome.
4. Environmental offsets should be developed as a package of actions — which may include both direct and indirect offsets.
5. Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6. Environmental offsets should be located within the same general area as the development activity.
7. Environmental offsets should be delivered in a timely manner and be long lasting.
8. Environmental offsets should be enforceable, monitored and audited (Department of the Environment and Water Resources 2007).

The DEWHA define offsets as *'actions taken outside a development site that compensate for the impacts of that development — including direct, indirect or consequential impacts'* (Department of the Environment and Water Resources, 2007). Actions that constitute a suitable offset will differ between projects and there is no prescriptive formula for what constitutes an adequate offset. As such, if required the DEWHA will be negotiated with through the development of the Green Offsets Package to ensure all relevant requirements are met for offset of the proposed pipeline.

17A.7 CONCLUSIONS

The proposed pipeline will traverse a range of land uses and areas of different biodiversity value. Country in the study area north of Giligulgul has been largely cleared for grazing and dryland agriculture. Between Giligulgul and Miles however, the study area traverses the Great Dividing Range. Soils and geology associated with the Great Dividing Range are less arable and are dominated by shallow rocky or deeply weathered soils. As such, country through this section of the study area has not been subject to as extensive broad scale and routine clearing as in the north. Vegetation associated with the Great Dividing Range forms part of a State Wildlife Corridor and also includes areas of essential habitat

mapped under the Biodiversity Planning Assessment framework (Environmental Protection Agency 2002). Vegetation associated with the Great Dividing Range is also referred to as the Gurulmundi Special Area under the Biodiversity Planning Assessment which comprises Gurulmundi State Forest, Stones Country Resources Reserve and surrounding remnant vegetation on the escarpment west of the Leichhardt Highway. The Gurulmundi Special Area is known to provide habitat for numerous rare and threatened species.

Only one Endangered RE was identified in the study area, RE 11.9.5. This RE is consistent with the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community listed under the EPBC Act and only 0.6 ha of this community will be affected by the proposed pipeline. Three rare or threatened species of animal were also recorded in the study area:

- Brigalow Scaly-foot (Paradelma orientalis)
- Little Pied Bat (Chalinolobus picatus)
- Golden-tailed Gecko (Diplodactylus taenicauda syn. Strophurus taenicauda).

No threatened species of plant was recorded. However, surveys were not done in the optimum period to identify many of the threatened species of plant that may occur in the study area. In addition to the threatened species recorded, 21 rare or threatened species of plant and 15 rare or threatened species of animal were considered likely to occur in the study area and surrounds. Additional targeted seasonal surveys will be done to determine the location size and extent of threatened species likely to be affected by the proposal.

Despite the efforts to avoid impacts to native vegetation and associated habitats, the proposed pipeline will result in clearing 55.8 ha of remnant vegetation and 30.0 ha of non-remnant vegetation (regrowth). This vegetation is primarily located along the road reserve or easement edge of large patches of vegetation and as such is generally subject to a range of edge effects. Much of the vegetation that will be impacted is however, in moderate to good condition and of remnant vegetation status under the VM Act. Only 0.6 ha of the vegetation is of an Endangered RE (RE 11.9.5) and 3.3 ha is Of Concern (RE 11.3.2 and RE 11.3.4).

Assessment of the significance of impacts associated with the proposed pipeline was done for: threatened species that were recorded in the study area or considered likely to occur (moderate or high likelihood of occurrence); migratory species (for which the study area is at their distributional range limit); and endangered ecological communities and endangered REs.

Based on the investigations undertaken to date, the proposed pipeline is considered unlikely to result in a significant impact to any threatened species or communities. However, many of the threatened species considered likely to occur, a local population should be considered an important population in accordance with the definition under the EPBC Act if they were recorded in the study area. As such, if detected during further surveys, direct impacts to these species are likely change the conclusions of the significance assessments.

The impact assessments concluded that the proposed pipeline is unlikely to result in a significant impact to any Threatened species of plant or animal, RE or ecological community. Nonetheless, the impacts of the proposed pipeline are acknowledged and should be reduced where possible during detailed design. Detailed mitigation measures

should be developed and presented in a biodiversity management plan relating to the construction and operation of the pipeline. Furthermore, the residual impacts of the proposed pipeline should be accounted for in the Green Offsets Package developed for proposed pipeline.

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