9. Assessment of key issues

This chapter assesses issues identified as key issues in the Director-General's Requirements (DGRs) (see Appendix B and below), which may be associated with the project, including biodiversity, traffic and transport, Aboriginal heritage, noise and vibration, hydrology, and social and economic impacts.

DGRs	Where addressed
An **assessment of the key issues**, with the following aspects addressed for each key issue (where relevant):	Chapter 9 Technical Papers (Volume 2)
▪ Describe the existing environment. ▪ Assess the potential impacts of the project (direct, indirect and cumulative) at both construction and operation stages, in accordance with relevant policies and guidelines. ▪ Identify how relevant planning, land use and development matters (including relevant strategic and statutory matters) have been considered in the impact assessment and/or in developing management/mitigation measures. ▪ Describe measures to be implemented to avoid, minimise, manage, mitigate, offset and/or monitor the impacts of the project and the residual impacts.	

9.1 Flora and fauna

A detailed flora and fauna assessment for the project was undertaken as presented below. This assessment is supported by *Technical Paper 1 — Flora and Fauna* (Volume 2).

DGRs	Where addressed
Flora and fauna (including but not limited to):	
Terrestrial and aquatic flora and fauna impacts, including vegetation loss, weed infestation, habitat fragmentation and impacts to wildlife corridors.	Sections 9.1.3 Technical Paper 1 (Volume 2)
Threatened terrestrial and aquatic species, populations, ecological communities and/or critical habitat, consistent with the draft *Guidelines for Threatened Species Assessment* (DEC and DPI 2005).	Sections 9.1.2, 9.1.3 Technical Paper 1 (Volume 2)
Targeted surveys of threatened flora and fauna species, including White Box, Yellow Box, Blakely's Red Gum Woodland, Squirrel Glider and Brown Tree Creeper.	Section 9.1.1, 9.1.2 Technical Paper 1 (Volume 2)

9.1.1 Assessment approach

The biodiversity assessment was undertaken in accordance with the *Draft Guidelines for Threatened Species Assessment under Part 3A* (DEC 2005b) and the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (DEH 2006).

The assessment built on the work undertaken for the *Hume Highway Tarcutta Bypass: Preliminary Ecological Assessment* (Environmental Resources Management Australia 2007). A detailed description of the methodology for this assessment is provided in Chapter 2 of Technical Paper 1 (Volume 2). The assessment included:

- Review of databases and literature to identify threatened flora, fauna and ecological communities recorded, or predicted to occur, in the NSW south-western slopes bioregion.
- Terrestrial survey between 4 and 9 November 2008, and aquatic survey of Tarcutta Creek between 30 November 2008 and 2 December 2008. The surveys sought to assess the extent and condition of vegetation communities and potential flora and fauna (including fish) habitat, with particular consideration given to species of conservation concern (eg threatened and migratory species or locally significant species). Targeted surveys were completed for threatened species considered likely to be present based on findings of the database/literature review, including White Box, Yellow Box, Blakely's Red Gum Woodland, Squirrel Glider and Brown Tree Creeper. For cryptic species, and where survey was completed outside the optimal time for detecting species, a precautionary approach was taken and it was assumed that the species was present if suitable habitat was observed.
- Significance assessments on species, populations and ecological communities listed under the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* that were recorded or predicted to occur with a moderate or greater likelihood.

9.1.2 Existing environment

Landscape context

The project is located within the NSW south-western slopes bioregion, which consists of more than eight million hectares of foothills and ranges, comprising the western fall of the Great Dividing Range to the edge of the Riverina bioregion.

Remaining native vegetation in the south-western slopes bioregion is dominated by eucalypt woodlands, Callitris forests and woodlands, and eucalypt tall open forests. Patches of low closed forests and closed shrublands, eucalypt open woodlands, grasslands, and Acacia forests and woodlands occur (NSW National Parks and Wildlife Service 2003). The region has been largely cleared of eucalypt woodlands for grazing and dryland agriculture, such that the larger areas of remnant vegetation generally occur on the rockier, hilly areas or as roadside vegetation.

The project would cross Tarcutta and Keajura creeks. The latter is a tributary of Tarcutta Creek, joining it near the intersection of the existing Hume Highway and Humula Road. The catchment of Tarcutta Creek has been highly modified by agricultural land use practices since the mid-1800s. Tarcutta Creek is a waterway under a high level of environmental stress (DLWC 2001), owing to extraction for the purposes of stock watering, domestic uses and irrigation, and to recent drought conditions.

Wildlife corridors and connectivity

Wildlife corridors are retained or restored linear vegetation systems that, at a minimum, enhance the connectivity of wildlife populations. These wildlife corridors are important for a range of species, functioning as areas of cover, foraging and habitat resources, and movement between habitat patches.

Vegetation within the locality of the project is highly fragmented, with isolated patches of vegetation surrounded by large expanses of cleared land. Although some vegetation patches are of sufficient size to maintain viable populations, in many cases there is limited connectivity among the patches, given the extent of clearing and the distance between vegetation patches. In this modified landscape, vegetation within roadside reserves and riparian corridors plays an important role in the connectivity of these remnant patches of vegetation.

Roadside vegetation occurs along the existing highway, and riparian corridors occur along the sections of both Tarcutta and Keajura creeks. This linear vegetation is likely to be used by a range of species as part of a wider corridor network.

Vegetation communities, including threatened communities

Vegetation communities

Based on the *Forest Ecosystem Classification and Mapping of the Southern Comprehensive Regional Assessment Region* (Thomas et al 2000), the following three broad vegetation community types occur in the assessment area:

- Western Slopes Dry Grass Woodland.
- Western Tablelands Dry Shrub/Grass Forest.
- Western Slopes Riparian Moist Sedge Woodland.

Ground-truthing, aerial photograph interpretation and detailed flora surveys identified that the majority of the assessment area is dominated by highly modified and/or artificial grassland communities associated with past intensive agricultural land uses. Where remnant vegetation is present, it is characterised by seven distinct vegetation communities.

Four of the vegetation communities observed in the assessment area correspond with two threatened ecological communities, White Box, Yellow Box, Blakely's Red Gum Woodland (Box-Gum Woodland) and Inland Grey Box Woodland. Table 9-1 provides details of vegetation communities identified in the assessment area, which are shown in Figure 9-1 and Figure 9-2. Box-Gum Woodland is present at the northern and southern ends of the project. At the southern end, a considerable patch is located within a travelling stock reserve. Inland Grey Box Woodland is mainly found at the northern end of the project, both as roadside vegetation and vegetation patches.

Table 9-1 Vegetation communities identified in the assessment area

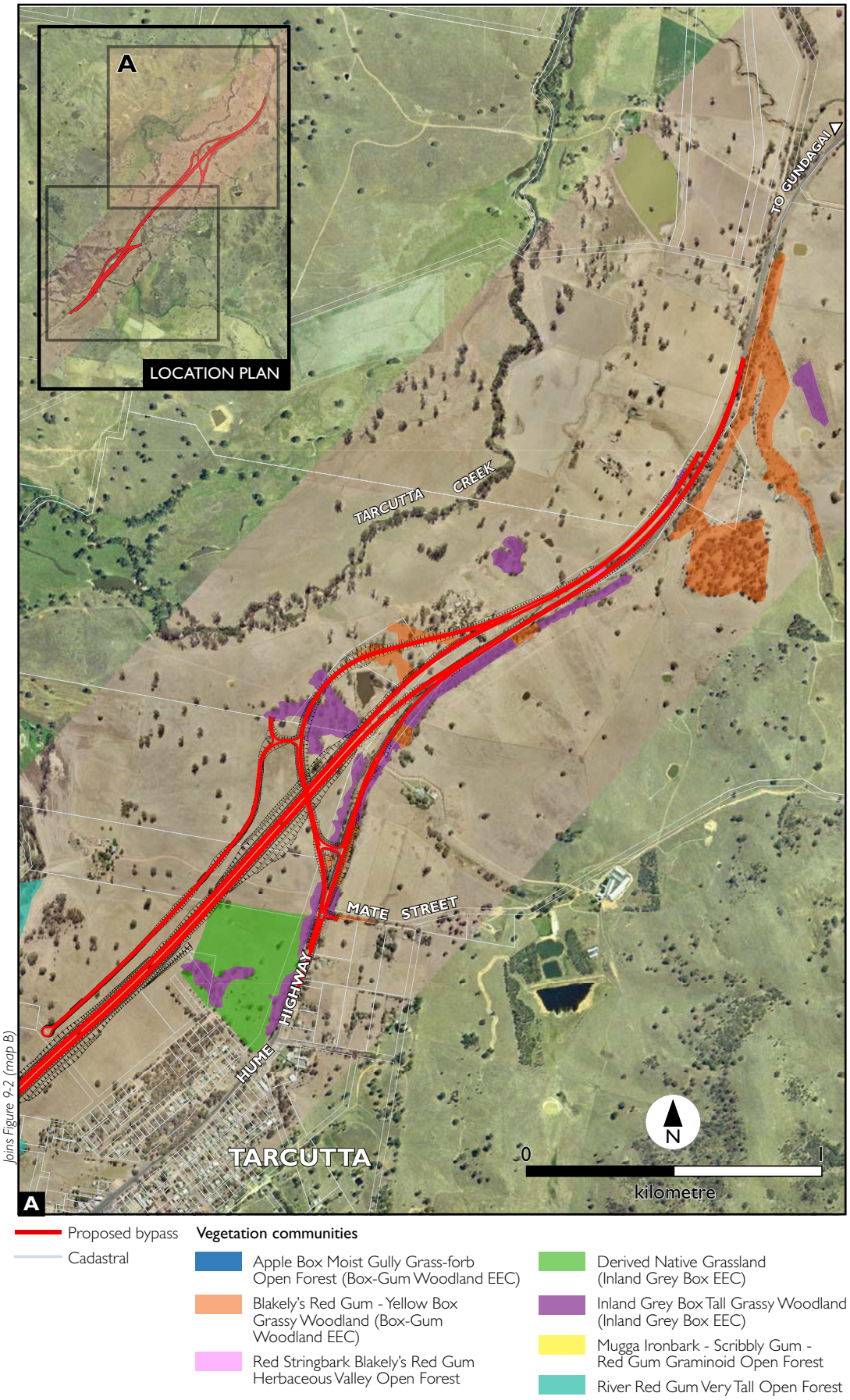
Broad community type	Vegetation community	Corresponding threatened ecological community[1]	Observations
Forest Ecosystem 117: Western Slopes Dry Grass Woodland	Blakely's Red Gum – Yellow Box Grassy Woodland.	Box-Gum Woodland[2] (TSC Act and EPBC Act)	Some patches were highly disturbed by past and current land uses, including the existing Hume Highway, grazing and other agricultural practices. These disturbances have fragmented the vegetation community, and modified the floristic composition and structure. The majority of patches were in moderate condition.
	Apple Box Moist Gully Grass-forb Open Forest of the NSW South Western Slopes and South Eastern Highlands Bioregions.	Box-Gum Woodland[2] (TSC Act and EPBC Act)	Roadside patches were generally highly disturbed by past land uses, including edge effects, construction of the Hume Highway, and grazing and other agricultural practices. These disturbances have fragmented the vegetation community, and modified the floristic composition and structure.
	Inland Grey Box Tall Grassy Woodland on Alluvial Loam and Clay Soils in the NSW South Western Slopes and Riverina Bioregions.	Inland Grey Box Woodland[3] (TSC Act and EPBC Act (preliminary listing))	This community had a highly disturbed paddock variation within the northern section. The majority of patches were in moderate condition.
Forest Ecosystem 119: Western Tablelands Dry Shrub/Grass Forest	Mugga Ironbark – Scribbly Gum – Red Gum Graminoid Open Forest on Hillcrests in the NSW South Western Slopes Bioregion.	-	Disturbances in this community were restricted to past selective logging and some grazing. These disturbances have fragmented the vegetation community, and modified the floristic composition and structure. The majority of patches were in moderate condition.
	Red Stringybark – Red Box – Long-leaved Box – Scribbly Gum Shrub – Tussock Grass Open Forest of the Southern Section of the NSW South Western Slopes Bioregion.	-	The majority of this community was in moderate condition.

Broad community type	Vegetation community	Corresponding threatened ecological community[1]	Observations
Forest Ecosystem 43: Western Slopes Riparian Moist Sedge Woodland	River Red Gum Very Tall Open Forest of the NSW South Western Slopes Bioregion.	-	Two distinct variations of this community were observed: ▪ Typical riparian association that was associated with Tarcutta and Keajura creeks. ▸ Affected by a range of agricultural disturbances. ▸ Typically in moderate condition. ▪ Disturbed open variation associated with the floodplain depressions and dry billabongs surrounding the creeks. ▸ Typically in moderate condition.
-	Derived Native Grassland.	Inland Grey Box Woodland[3] (TSC Act)	This was a disturbed grassland community with isolated mature paddock trees.

Notes: 1. TSC Act = *Threatened Species Conservation Act 1995*; EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*.

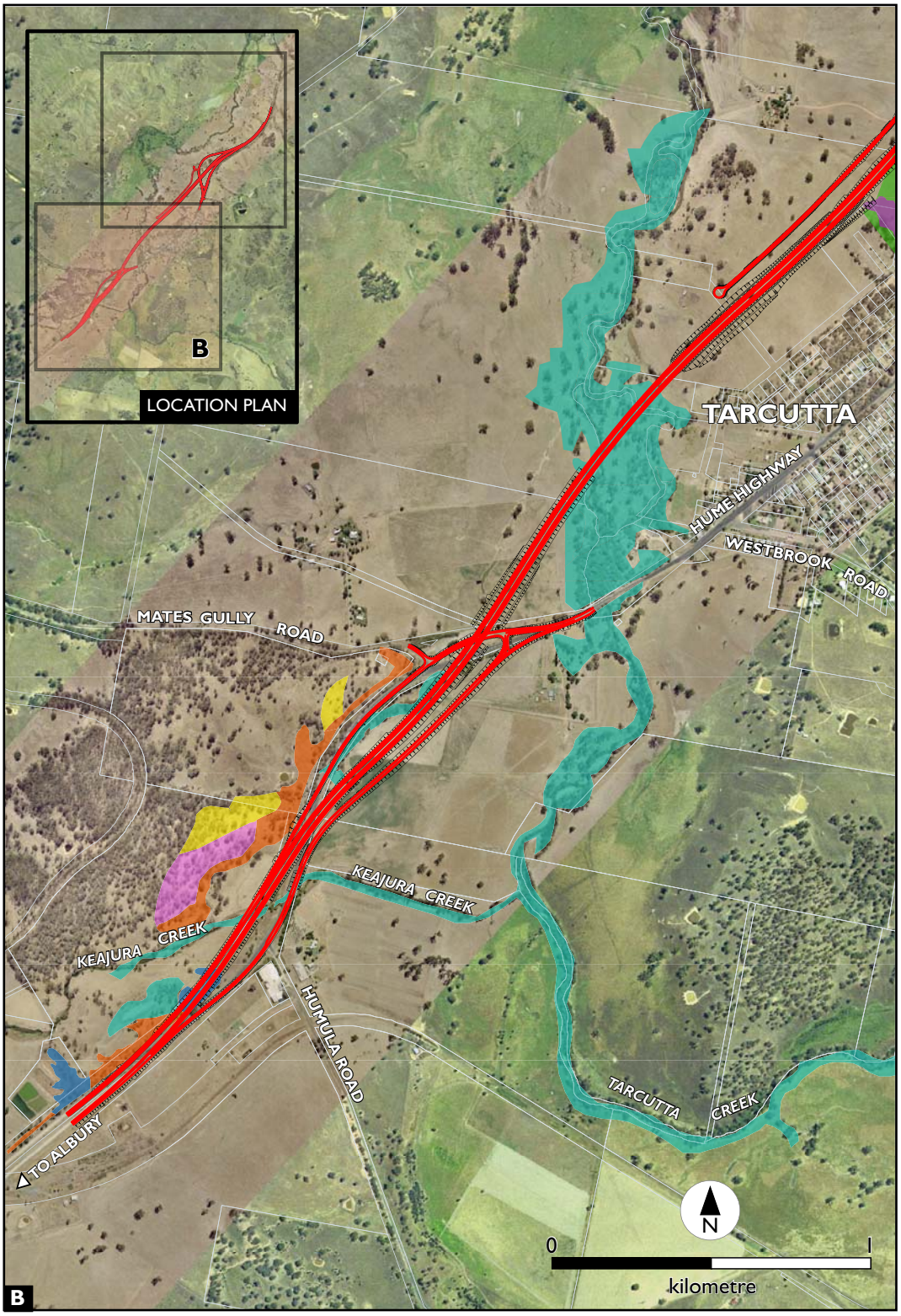
2. White Box, Yellow Box, Blakely's Red Gum Woodland.

3. Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South bioregions.



Note: Box-Gum Woodland CEEC listed under the Environment Protection and Biodiversity Conservation Act 1999 *falls within but does not form all of the Box-Gum Woodland EEC mapped.*

Figure 9-1 **Vegetation communities identified in the assessment area (northern section)**



Proposed bypass

Cadastral

Vegetation communities

- Apple Box Moist Gully Grass-forb Open Forest (Box-Gum Woodland EEC)
- Blakely's Red Gum - Yellow Box Grassy Woodland (Box-Gum Woodland EEC)
- Red Stringbark Blakely's Red Gum Herbaceous Valley Open Forest
- Derived Native Grassland (Inland Grey Box EEC)
- Inland Grey Box Tall Grassy Woodland (Inland Grey Box EEC)
- Mugga Ironbark - Scribbly Gum - Red Gum Graminoid Open Forest
- River Red Gum Very Tall Open Forest

Note: Box-Gum Woodland CEEC listed under the Environment Protection and Biodiversity Conservation Act 1999 *falls within but does not form all of the Box-Gum Woodland EEC mapped.*

Figure 9-2 **Vegetation communities identified in the assessment area (southern section)**

Threatened ecological communities

Box-Gum Woodland is protected under both Commonwealth and State legislation. Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a critically endangered ecological community. Under the NSW *Threatened Species Conservation Act 1995*, White Box, Yellow Box, Blakely's Red Gum Woodland is listed as an endangered ecological community. It should be noted that the classification of the Box-Gum Woodland threatened ecological community differs under the Commonwealth and State legislation.

Inland Grey Box Woodland is protected under the NSW *Threatened Species Conservation Act 1995*, where it is listed as an endangered ecological community. This community has also been nominated for listing under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. At the time of this environmental assessment, a determination had not been made on the listing.

The *Fisheries Management Act 1994* lists the Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment as an endangered ecological community (the Lower Murray River endangered ecological community). The Lower Murray River endangered ecological community includes all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray River below the Hume Weir, the Murrumbidgee River below Burrinjuck Dam, and the Tumut River below Blowering Dam, as well as all their tributaries and branches. These tributaries and branches include Billabong Creek, Yanco Creek, Colombo Creek and their tributaries, the Edward River and the Wakool River and their tributaries, Frenchmans Creek, the Rufus River and Lake Victoria. The Lower Murray ecological community also includes all native fish and aquatic invertebrates within these water bodies. Excluded from the definition are the Lachlan River and the Darling River and their tributaries. Artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs are also excluded (NSW Fisheries 2002). Tarcutta Creek flows into the Murrumbidgee River below the Burrinjuck Dam. Therefore, Tarcutta Creek, its tributary Keajura Creek and their tributaries form part of this endangered ecological community (see Figure 9-7 for the drainage in the assessment area, which forms part of the Lower Murray River endangered ecological community).

Terrestrial flora, including threatened species

A total of 222 species of plant were recorded in the assessment area, of which 129 species were native. The most diverse family recorded was Poaceae (grasses) followed by Asteraceae (daisies) and Fabaceae (pea flowers). Appendix A of Technical Paper 1 (Volume 2) lists all the plant species recorded in the assessment area.

Threatened flora

Eleven threatened flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and 11 threatened flora species listed under the *Threatened Species Conservation Act 1995* have been recorded, are predicted to occur, or have habitat in the assessment area. No threatened species were identified during the field surveys for this project. Three species are considered to have a moderate likelihood of occurrence in the assessment area, based on the presence of suitable habitat and the precautionary approach adopted for the assessment; Table 9-2 lists these species.

Table 9-2 Threatened flora species predicted to occur in the assessment area

Scientific name	Common name	Conservation significance		Habitat within the assessment area	Likelihood of occurrence in assessment area[3]
		TSC Act[1]	EPBC Act[2]		
Ammobium craspedioides	Yass Daisy	V	V	Box-Gum Woodlands	Moderate
Amphibromus fluitans	River Swamp Wallaby-grass	V	V	Water bodies	Moderate
Diuris tricolour	Pine Donkey Orchid	V	V	Box-Gum Woodlands	Moderate

Notes: 1. *Threatened Species Conservation Act 1995*, V = Vulnerable.

2. *Environment Protection and Biodiversity Conservation Act 1999*, V = Vulnerable.

3. See Appendix C of Technical Paper 1 (Volume 2) for more information on likelihood of occurrence.

Weeds

Ninety-three weed species were recorded in the assessment area. Seven of these, shown in Table 9-3, are listed under the *Noxious Weeds Act 1993* for the Wagga Wagga local government area (LGA).

Table 9-3 Noxious weeds recorded in the assessment area

Scientific name	Common name	*Noxious Weeds Act 1993* control category[1]
Xanthium sp.		Class 4
Echium plantagineum		Class 4
Hypericum perforatum	St Johns Wort	Class 4
Rosa rubiginosa	Sweet Briar	Class 5
Rubus fruticosus[2]	Blackberry	Class 4
Salix babylonica[2]	Weeping Willow	Class 5

Notes: 1. *Noxious Weeds Act 1993*: Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Class 5: The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with.

2. Listed as a Weed of National Significance (Thorp and Lynch 2000).

Fauna habitats

Terrestrial habitats

The suitability, size and configuration of the fauna habitats in the assessment area correlated broadly with the structure, floristics, connectivity and quality of the local and regional vegetation types, as described in Table 9-4 and shown in Figure 9-3 and Figure 9-4. The majority of the fauna habitat was restricted to remnant stands of vegetation in an otherwise modified landscape. These areas of vegetation provide habitat for a range of woodland birds and mammals and limited reptiles, and were in poor to good condition.

Table 9-4 Fauna habitat in the assessment area with corresponding vegetation description

Fauna habitat description	Corresponding vegetation community[1]
Box-Gum Woodland	Blakely's Red Gum – Yellow Box Grassy Woodland Apple Box Moist Gully Grass-forb Open Forest Inland Grey Box Tall Grassy Woodland Mugga Ironbark – Scribbly Gum – Red Gum Graminoid Open Forest Red Stringybark – Red Box – Long-leaved Box – Scribbly Gum Shrub
Riparian Woodland	River Red Gum Very Open Forest of the NSW South Western Slopes
Grazed pasture land[2]	Derived Native Grassland

Notes: 1. Refer Table 9-1.

2. This fauna habitat also includes areas that are not mapped as Derived Native Grassland.

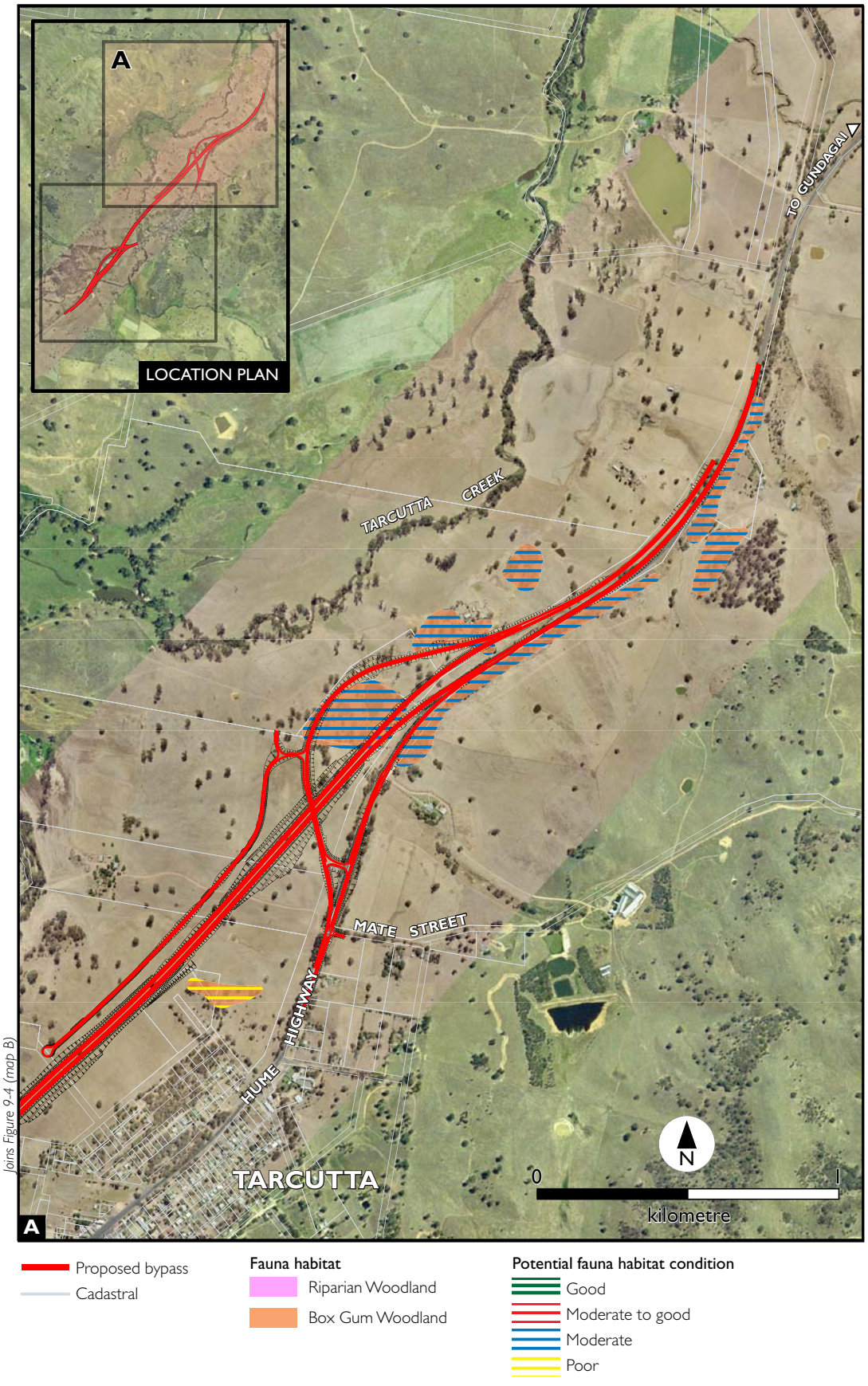


Figure 9-3 **Terrestrial fauna habitat in the assessment area (northern section)**

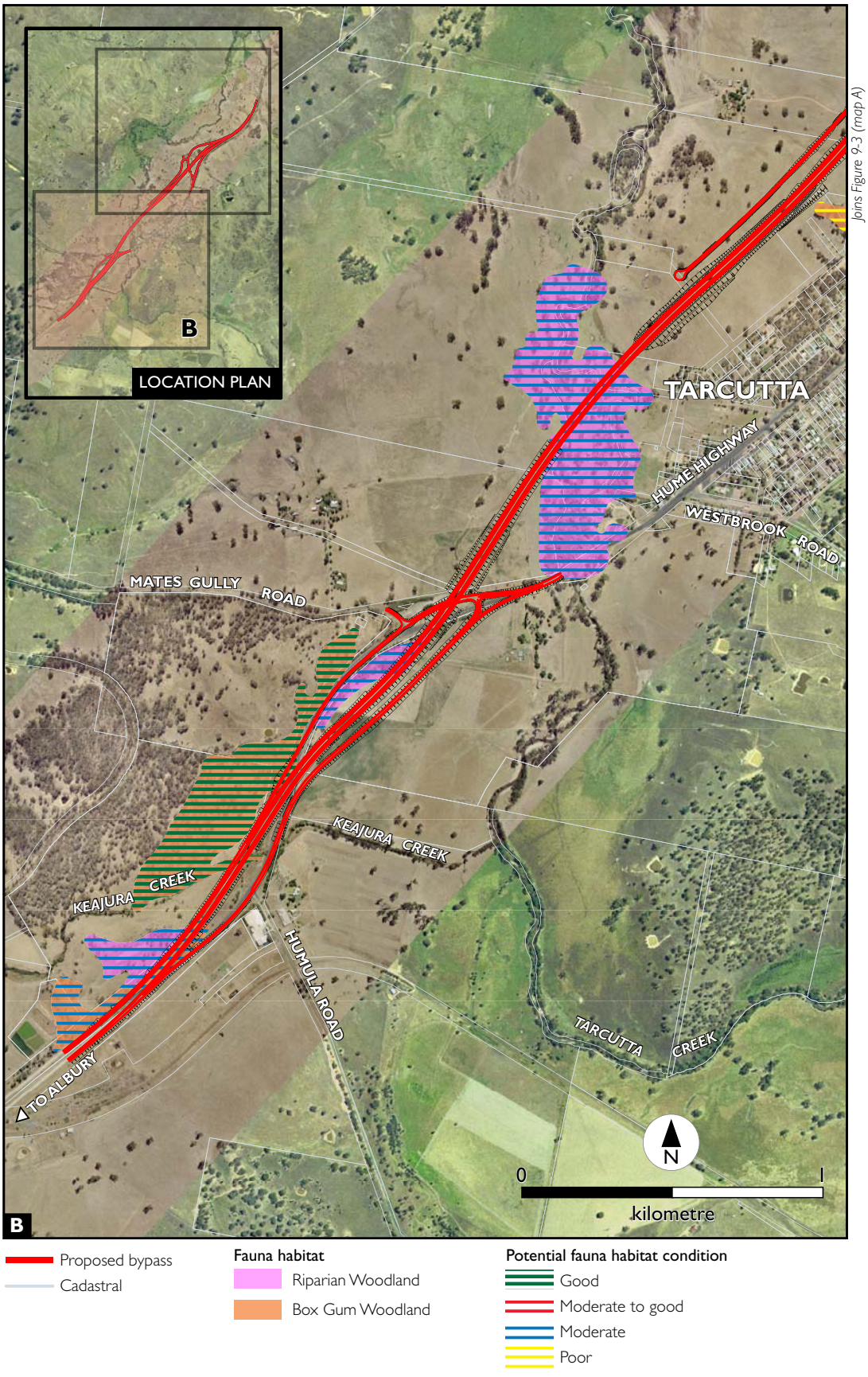


Figure 9-4 **Terrestrial fauna habitat in the assessment area (southern section)**