# CHAPTER 16

# Biodiversity

**ALBURY TO ILLABO** ENVIRONMENTAL IMPACT STATEMENT

ARTC | INLAND RAIL
An Australian Government Initiative

# Contents



## Figures



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# 16. Biodiversity

This chapter provides a summary of the potential impacts of the Albury to Illabo (A2I) section of the Inland Rail program (the proposal) on terrestrial and aquatic biodiversity. The assessment is provided in Technical Paper 8: Biodiversity development assessment report and Technical Paper 9: Aquatic biodiversity impact assessment. The consideration of ecologically sustainable development principles is provided in Chapter 28: Justification of the proposal.

## 16.1 Summary

The proposal is located within the existing rail corridor in areas that have been predominantly cleared. The landscape in the study area surrounding the proposal has been heavily fragmented by agricultural practices and development, with existing habitat connectivity limited to creek lines and road reserves. The condition of native vegetation in the proposal site is predominately low, with some patches of moderate condition.

The proposal would require the clearing of about 4.44 ha of native vegetation. This vegetation includes threatened ecological communities (TEC) listed under the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), and areas used as foraging and breeding habitat for fauna species. The reduction in the extent of native vegetation is unlikely to threaten the persistence of any populations of native plants, vegetation or fauna communities. This is due to the location of the proposal in the existing rail corridor surrounded by a highly fragmented regional and rural landscape. It is also unlikely that an ecologically significant proportion of any regional plant populations would be located entirely within the proposal site.

The proposal would potentially require the removal of 0.03 ha of native riparian vegetation and habitat features. Instream works would also occur within two creeks mapped as Key Fish Habitat (Sandy Creek, Uranquinty and Jeralgambeth Creek at Illabo), and there is potential for indirect impacts at the Murray River due to bridge alterations. These potential impacts would be minimised by implementing the construction mitigation and management measures provided by the EIS. No significant impacts on aquatic threatened species or communities are predicted.

Existing development and land uses have created barriers of movement for some fauna species. The removal of vegetation may exacerbate fragmentation for certain species, and the operation of the proposal is likely to result in minor increases in localised fragmentation of regional wildlife patches along the creek lines and road reserves. However, the operation of the proposal is considered unlikely to result in fragmentation on a regional or landscape scale and the impacts to habitat connectivity is low with the implementation of the proposed design features and mitigation measures. ARTC has also committed to considering regional connectivity enhancements to deliver benefits beyond the proposal site.

Measures to minimise impacts to biodiversity values have been considered throughout the development of the reference design and planning process including refining the design of construction compounds to minimise impacts to native vegetation, riparian areas, wetlands and other areas of suitable native fauna habitat as far as practicable.

Priority to minimise direct impacts to moderate condition vegetation in favour of vegetation of lower condition was taken, where possible, and construction access was designed to use existing access tracks where possible to avoid vegetation clearance. The area of direct impact would be further refined during detailed design, with the aim of reducing the amount of vegetation clearing required, as far as practicable

ARTC would retire the biodiversity offset obligation for the proposal and this would include consideration of potential offset sites and/or opportunities to purchase biodiversity credits to offset the impacts of the proposal and/or apply the variation rules, according to the requirements for major projects under the EP&A Act, the NSW Biodiversity Offset Scheme, and the assessment bilateral agreement between the Australian Government and the NSW Government.

## 16.2 Approach

### 16.2.1 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements (SEARs) related to biodiversity, and where in the environmental impact statement (EIS) these have been addressed, are detailed in Appendix A: Secretary's Environmental Assessment Requirements.

### 16.2.2 Relevant legislation, policies and guidelines

The assessments were undertaken in accordance with the SEARs and with reference to the requirements of relevant legislation, policies and/or assessment guidelines, including:

- The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), *Biodiversity Conservation Act 2016* (NSW) (BC Act), Biodiversity Conservation Regulation 2017 (NSW) (BC Regulation), *Fisheries Management Act 1994* (NSW) (FM Act), *Biosecurity Act 2015* (NSW) (BS Act), *Local Land Services Act 2013* (NSW) (LLS Act), *Water Management Act 2000* (NSW) (WM Act) and associated regulations
- *Biodiversity Assessment Method* (Department of Planning, Industry and Environment (DPIE), 2020a) (the Biodiversity Assessment Method)
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation (DEC), 2004)
- *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage (OEH), 2016b)
- *'Species credit' threatened bats and their habitats* (OEH, 2018)
- Australian Department of Agriculture, Water and the Environment's survey guidelines for threatened species under the EPBC Act
- *Risk assessment guidelines for groundwater dependent ecosystems* (Serov, et al., 2012)
- *Matters of National Environmental Significance—significant impact guidelines 1.1* (Department of the Environment, 2013)
- *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015b)
- *EPBC Act Condition-setting Policy* (Department of Agriculture, Water and Environment (DAWE), 2020)
- *Policy and guidelines for fish habitat conservation and management* (Department of Primary Industries (DPI), 2013c)
- *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003)
- *Aquatic ecology in Environmental Impact Assessment – EIA Guideline* (Department of Planning, 2003)
- *Guideline for controlled activities on waterfront land* (DPI, 2012b)
- *NSW Sustainable Design Guidelines* (Transport for NSW (TfNSW), 2017b)
- Freshwater threatened species distribution maps (DPI, 2016–2021).

A detailed description of the legislative and policy context for the assessment is provided in Chapter 2 of both Technical Paper 8: Biodiversity development assessment report and Technical Paper 9: Aquatic biodiversity impact assessment.

### 16.2.3 Methodology

#### Study area

**Terrestrial biodiversity**

The study area includes the proposal site and surrounding areas with the potential to be directly or indirectly impacted by the proposal. Due the linear shape of the proposal site, a 500-metre (m) buffer following the centre line of the proposal has been applied for native vegetation cover calculations, in accordance with the Biodiversity Assessment Method.

The database searches undertaken for the study area were based on a search area within a radius of up to 20 kilometres (km) of the proposal site. This search area was extended from the typical 10-km radius to account for the sparsity of survey data that is expected for areas west of the Great Dividing Range.

**Aquatic flora and fauna**

The study area includes the proposal site and adjoining areas within 200 m of the proposal site, following previous biodiversity site investigations. The database searches were based on the boundaries of the Murrumbidgee and Murray River catchments.

#### Key tasks—biodiversity development assessment report

The Biodiversity Assessment Method sets out how biodiversity values will be assessed, prescribes requirements to avoid and minimise impacts, establishes rules for calculating the number and class of credits required for

unavoidable impacts, and determines the trading rules that will apply. The Biodiversity Assessment Method Calculator specifies the type and extent of surveys required for a biodiversity assessment and then processes survey data to calculate the number and type of biodiversity credits that are required to offset the impacts of a development. Threatened species are assessed as either ecosystem credit species, species credit species or a combination of the two (referred to as 'dual credit species') in accordance with the Biodiversity Assessment Method, as follows:

- ecosystem credit species (predicted): threatened species where the likelihood of occurrence and/or elements of its habitat can be confidently predicted by vegetation surrogates and landscape features.
- species credit species (candidate): threatened species that cannot be reliably predicted by habitat surrogates.

A detailed description of the assessment methodology is provided in Stage 1 of Technical Paper 8: Biodiversity development assessment report.

**Key tasks**

The assessment involved:

- background research, including reviewing previous assessments relevant to the study area, aerial photographs and maps, consultation with relevant agencies and stakeholders, and database searches, to confirm the:
  - approach and methodology, given access constraints and ongoing drought conditions affecting the vegetation assessment and detectability of threatened species
  - spatial patterns in vegetation, land use and landscape features
  - land use categorisation as defined under the LLS Act
  - likely distribution of native vegetation and threatened ecological communities (TECs) (listed under the BC Act and/or the EPBC Act)
  - likely presence of threatened flora and fauna (listed under the BC Act and/or the EPBC Act)
  - likely presence of migratory fauna species listed under the EPBC Act
  - potential presence of groundwater dependent ecosystems (GDEs)
- assessing the potential for species credit species to occur in the proposal site and be impacted by the proposal
- undertaking field surveys (see following section)
- assessing the native vegetation cover, extent and connectivity, and broad condition of vegetation types within a 500 m buffer of the proposal site, using aerial photography and GIS software. The condition of vegetation types considers the combination of tree cover, shrub cover, ground cover and weed cover attributes
- assessing the potential impacts on native vegetation and habitats, threatened species, protected areas, key threatening processes and matters of national environmental significance
- assessing cumulative impacts on biodiversity
- identifying measures to mitigate and offset the impacts identified, including biodiversity offsets
- preparing a biodiversity development assessment report to describe the results of the assessment in accordance with section 6.12 of the BC Act, clause 6.8 of the BC Regulation and the Biodiversity Assessment Method.

**Field surveys**

Field surveys were undertaken across a range of seasons and years to map native and non-native vegetation and identify whether threatened flora and fauna species or communities listed under the BC Act and/or EPBC Act are present. Field surveys were undertaken in November 2020, February 2021, May 2021 and October 2021, and included the following:

- native vegetation and targeted threatened flora surveys
- targeted threatened fauna surveys including:
  - fauna habitat assessments
  - opportunistic sightings of fauna and evidence of fauna activities (such as nests, scats, burrows, etc.)
  - targeted seasonal surveys of birds, bats, mammals, reptiles and amphibians.

Where targeted seasonal survey timeframes could not be met, and species habitat features were recorded in the study area, assumption of presence has been required for *Crinia sloanei* (Sloane's froglet) based on known records, results of survey and habitat values present. Assumed presence has also been required for the *Keyacris scurra* (Key's Matchstick Grasshopper) as this species was identified in an update to the database that supports the BAM (known as the BAM calculator) following the completion of the survey and initial assessment. This species will be assumed to be present within suitable habitat until survey is completed within the required period.

Further information is provided in Technical Paper 8: Biodiversity development assessment report.

## Key tasks—aquatic flora and fauna assessment

### Key tasks

The assessment involved:

- desktop assessment, including reviewing previous assessments relevant to the study area and database searches, to confirm the:
  - known key fish habitats and fish community status
  - watercourses classified as low, medium and high priority based on key factors, including key fish habitat mapping, likelihood of threatened aquatic species and stream order
  - riparian and aquatic vegetation
  - likely presence of threatened flora and fauna and/or TECs (listed under the FM Act and/or the EPBC Act)
  - potential presence of groundwater and surface water dependent ecosystems
- undertaking field surveys
- assessing the potential impacts on threatened species and sensitive receiving environments
- assessing cumulative impacts on aquatic flora and fauna
- identifying measures to mitigate and offset the impacts identified.

A detailed description of the assessment methodology is provided in Chapter 3 of Technical Paper 9: Aquatic biodiversity impact assessment.

### Surveys

Field surveys were undertaken in February and May 2021 to assess the potential for threatened flora and fauna species or communities listed under the BC Act and/or EPBC Act within the study area. Field surveys were undertaken at all high- and moderate-priority watercourses within the study area and included the following:

- aquatic habitat assessment
- targeted threatened fauna surveys.

Further information is provided in Technical Paper 9: Aquatic biodiversity impact assessment.

### 16.2.4 Key risks

An environmental risk assessment was undertaken for the proposal (refer Appendix E: Environmental risk assessment). Potential impacts on biodiversity with an overall assessed risk rating of medium or above are:

- clearing of native vegetation (including riparian vegetation) resulting in the loss of fauna habitat, habitat fragmentation and loss of connectivity
- direct impacts on listed threatened flora species and endangered terrestrial ecological populations and communities
- impacts on potential habitat for listed threatened fauna species.

The biodiversity assessments considered the potential risks identified by the environmental risk assessment, in addition to potential risks and impacts identified by the scoping report, the SEARs, and relevant guidelines and policies (as appropriate).

## 16.3 Existing environment

### 16.3.1 Landscape context

The study area for the biodiversity assessment is located in the NSW South Western Slopes bioregion, including the Lower slopes and Inland slopes subregions. The proposal is located within the existing rail corridor in areas that have been predominantly cleared. The landscape in the study area surrounding the proposal has been heavily fragmented by agricultural practices and development, with existing habitat connectivity limited to creek lines and road reserves.

The study area for the aquatic biodiversity assessment is located in the Murray River and Murrumbidgee catchments. The major river system in the study area is the Murray River. The proposal site also crosses a number of other watercourses, which provide riparian vegetation connectivity for terrestrial and aquatic fauna. A small number of artificial waterbodies (such as dams) are also present within the study area. The Murrumbidgee River is also a major river system within the wider area but is not located within the biodiversity study area (refer to section 16.2.3). Further information on the hydrological context of the proposal site is provided in section 16.3.4, Chapter 18: Hydrology, flooding and water quality, and Technical Paper 9: Aquatic biodiversity impact assessment.

There are no areas of geological significance or outstanding biodiversity value in the study area.

Native vegetation cover represents about 22.01 ha of the study area. The study area includes about 90 ha of non-native vegetation, including highly disturbed areas and ornamental plantings.

### 16.3.2 Terrestrial flora

#### Vegetation communities

Broad vegetation communities along the proposal site (threatened native vegetation, native vegetation and non-native vegetation/cleared) are shown in Figure 16-1 to Figure 16-5.

Native vegetation in NSW is classified using the Plant Community Type (PCT) classification system, approved by the NSW Plant Community Type Control Panel and described in the BioNet Vegetation Classification Database (DPIE, 2021). 22.01 ha of native vegetation was identified within the study area across two PCTs, being:

- River red gum herbaceous-grassy very tall open forest wetland on inner floodplains (PCT 5)
- Blakely's red gum—Yellow box grassy tall woodland (PCT 277).

A description of the two PCTs that are present in the study area is provided in Section 4.5 of Technical Paper 8: Biodiversity development assessment report.

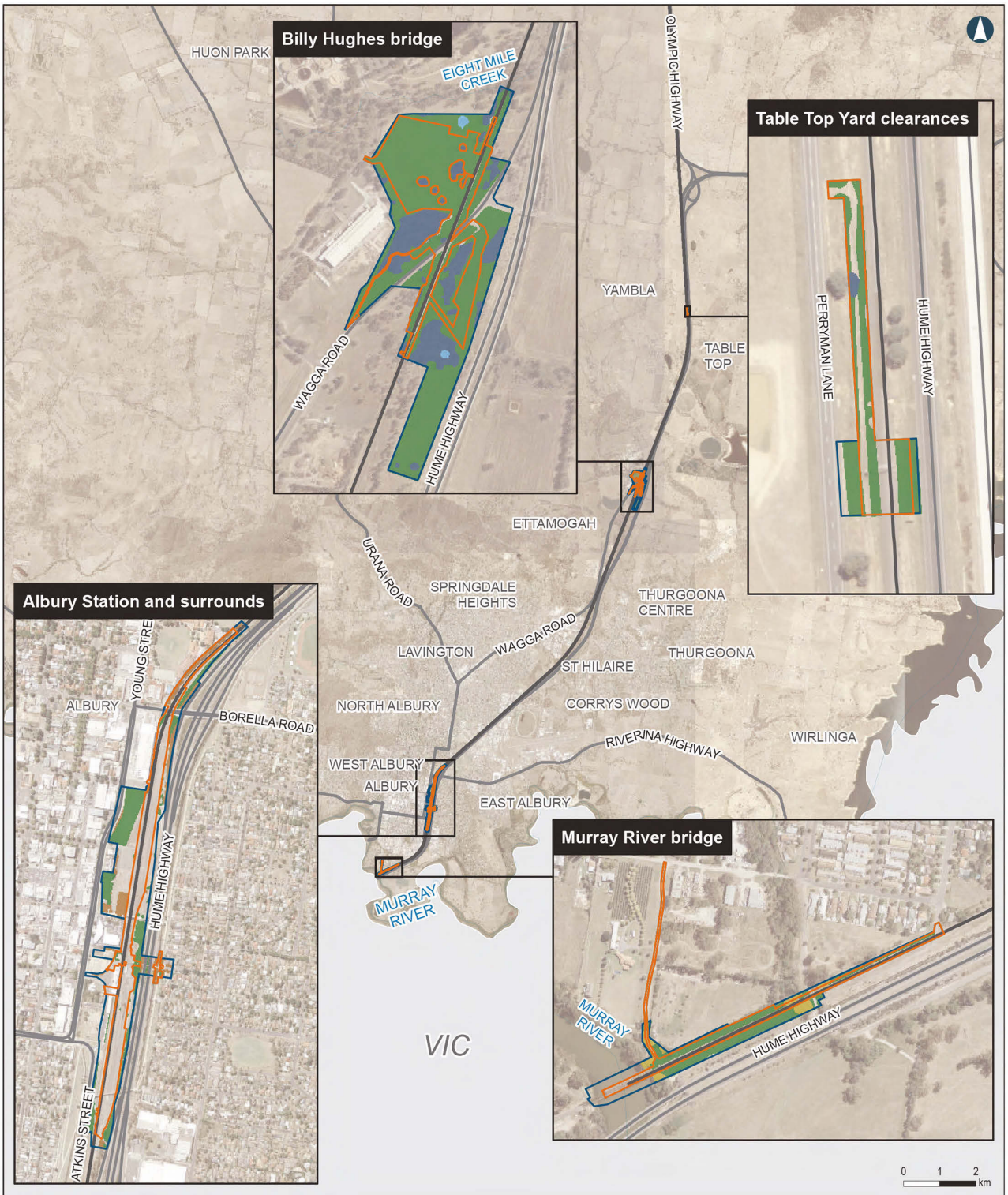


Figure 16-1 Vegetation communities of Albury precinct enhancement sites

Data Sources: ARTC, NSWSS

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:150,000
Paper size: A4
Date: 13/12/2021

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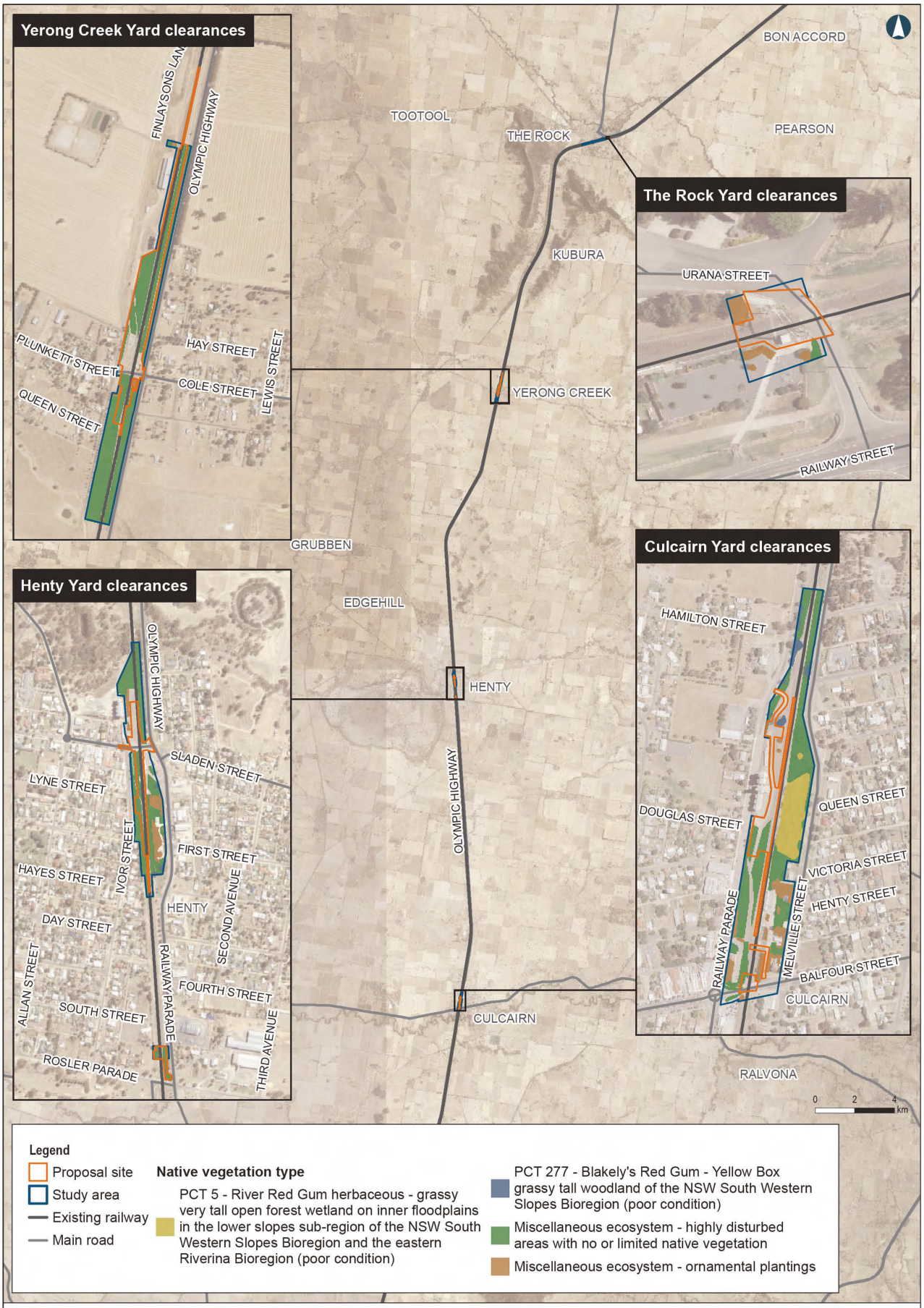


Figure 16-2 Vegetation communities of Greater Hume-Lockhart precinct enhancement sites

Data Sources: ARTC, NSWSS

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:250,000
Paper size: A4
Date: 12/11/2021

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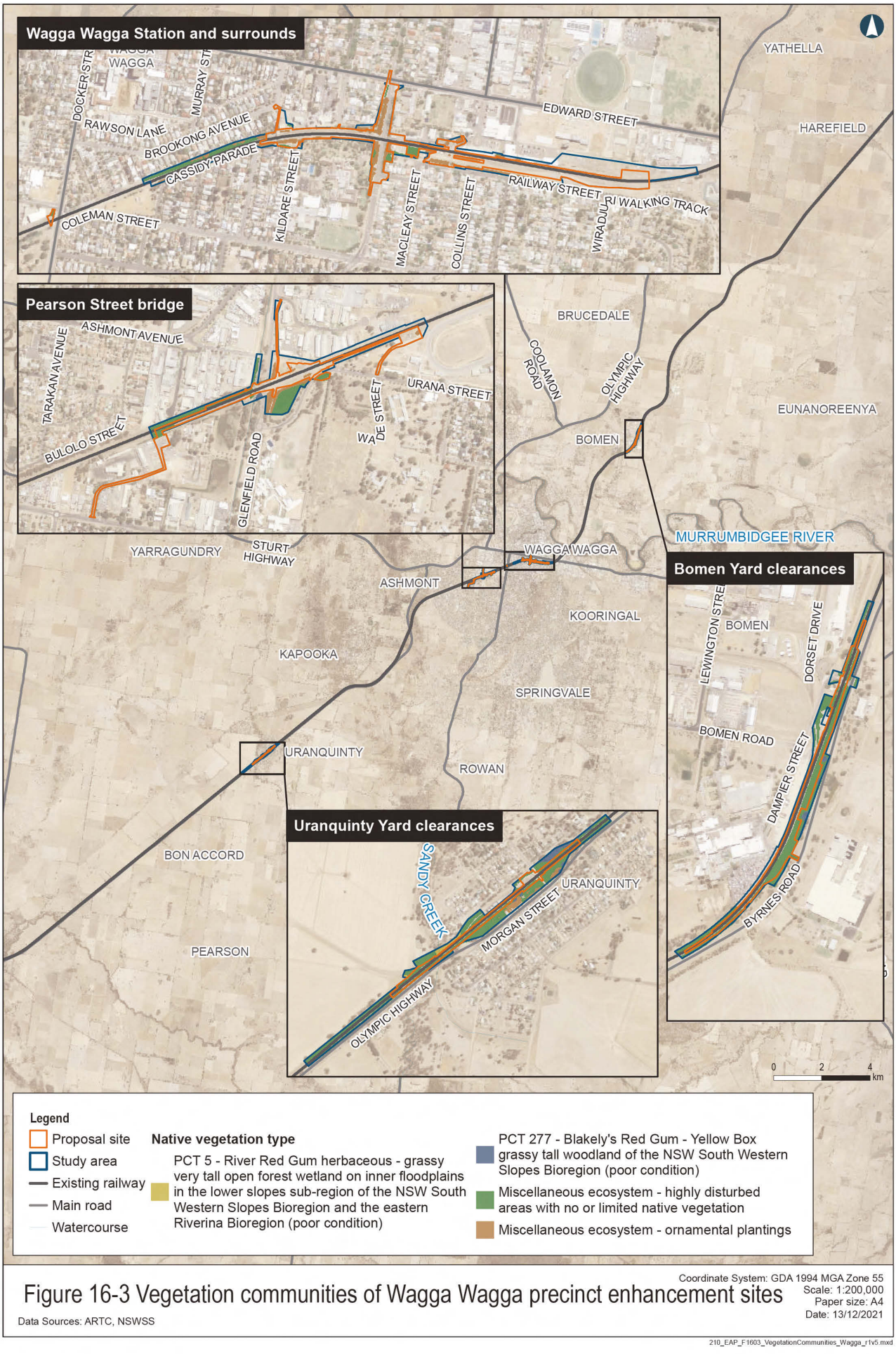


Figure 16-3 Vegetation communities of Wagga Wagga precinct enhancement sites

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:200,000
Paper size: A4
Date: 13/12/2021

Data Sources: ARTC, NSWSS

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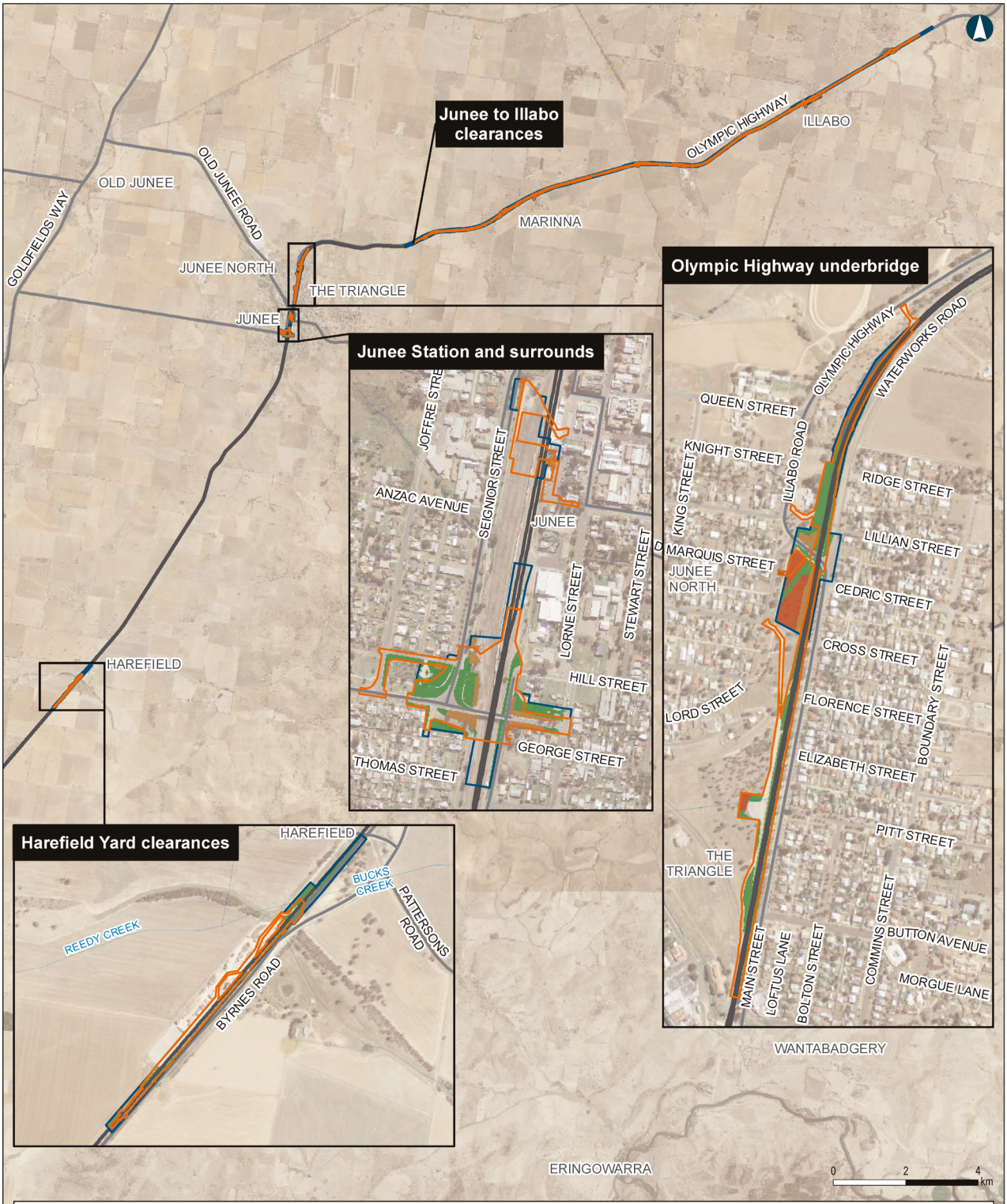
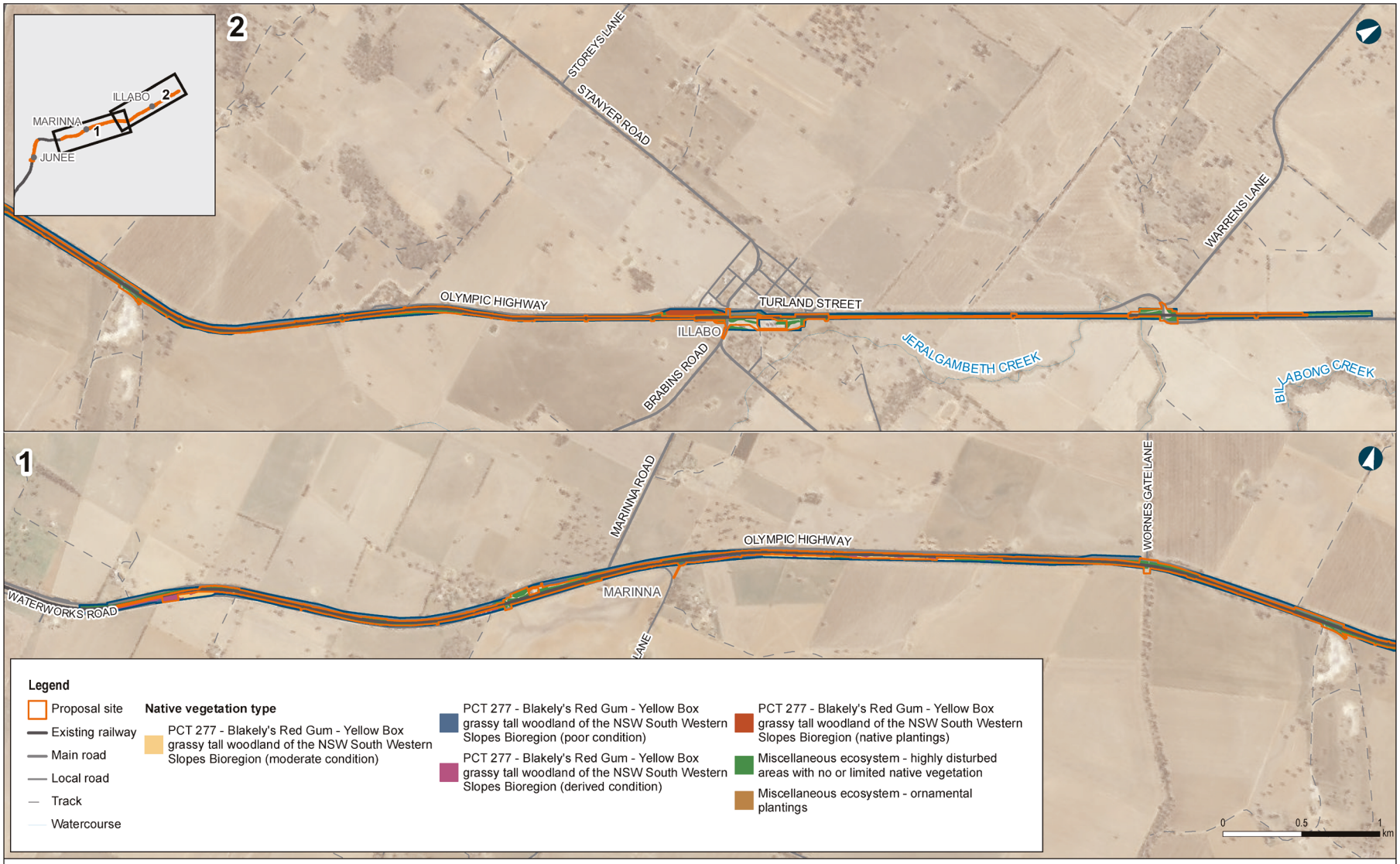



Figure 16-4 Vegetation communities of Junee precinct enhancement sites

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:150,000
Paper size: A4
Date: 19/02/2022

Data Sources: ARTC, NSWSS

210_EAP_F1604_VegetationCommunities_Junee_r1v6.mxd




## Figure 16-5 Vegetation communities of Junee to Illabo clearances

Data Sources: ARTC, NSWSS

Coordinate System: GDA 1994 MGA Zone 55
Scale: 1:32,000
Paper size: A4
Date: 27/05/2022

210_EAP_F1605_VegetationCommunities_Junee_r1v5.mxd

### Threatened ecological communities

About 6.87 ha of PCT 277 within the study area forms part of the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (moderate condition) TEC listed as Critically Endangered under the BC Act. 2.79 ha within the study area forms part of the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (moderate condition) threatened ecological community listed as Critically Endangered under the EPBC Act.

### Threatened flora species

No threatened species were recorded during field surveys of the study area.

Potential habitat for threatened flora is largely predicted by PCTs, bioregions and subregions, and the presence of watercourses in the study area.

A total of nine candidate flora species were considered to have potential associated habitat within the study area:

- Ausfeld's Wattle (*Acacia ausfeldii*)—listed as vulnerable under the BC Act
- Yass Daisy (*Ammobium craspedioides*)—listed as vulnerable under the BC Act and EPBC Act
- Small Scurf-pea (*Cullen parvum*)—listed as endangered under the BC Act
- Euphrasia arguta (*Euphrasia arguta*)—listed as critically endangered under the BC Act and EPBC Act
- Tarengo Leek Orchid (*Prasophyllum petilum*)—listed as endangered under the BC Act and EPBC Act
- Small Purple-pea (*Swainsona recta*)—listed as endangered under the BC Act and EPBC Act
- Silky Swainson-pea (*Swainsona sericea*)—listed as vulnerable under the BC Act
- River Swamp Wallaby-grass (*Amphibromus fluitans*)—listed as vulnerable under the BC Act and EPBC Act
- Austral Pillwort (*Pilularia novae-hollandiae*)—listed as endangered under the BC Act.

### Weeds

Two priority weed species identified by the BS Act were recorded in plots in the study area. The general biosecurity duty under the BS Act requires any person who deals with weeds to ensure that the biosecurity risk of the weed is prevented, eliminated or minimised, as far as reasonably practicable.

Weed species can also be identified as high-threat weeds that can invade and out-compete native plant species. The presence of these species in a plot affects the vegetation integrity score of a vegetation zone. Thirteen high-threat weeds were recorded in plots.

Weeds of national significance that occur in the study area include bridal creeper (*Asparagus asparagoides*) and blackberry (*Rubus fruticosus* agg.). Weeds of national significance are weeds that have been prioritised by the Australian government based on their potential for spread, their invasiveness, and their social and economic impacts.

## 16.3.3 Terrestrial fauna

### Threatened fauna species

During the field surveys, six threatened fauna species listed as vulnerable under the BC Act were recorded in the proposal site. Threatened fauna species identified during surveys are provided in Table 16-1. In addition to the known threatened fauna species, 30 predicted fauna species listed under the BC Act are assumed to be present based on the PCTs and bioregions within the study area, including bird and mammal species.

21 candidate fauna species listed under the BC Act are assumed to be present based on the PCTs and bioregions within the study area, including nine bird species, six mammal species, two frog species, two reptile species and two insect species.

Of the threatened fauna species recorded or assumed to be present in the study area, two known threatened fauna species, five predicted fauna species and three candidate fauna species are also listed under the EPBC Act.

**TABLE 16-1 SUMMARY OF THREATENED SPECIES IDENTIFIED IN THE PROPOSAL SITE DURING SURVEY**

| Common name | Scientific name | BC Act | EPBC Act |
|---|---|---|---|
| Spotted Harrier | *Circus assimilis* | Vulnerable | |
| Grey-headed Flying-fox | *Pteropus poliocephalus* | Vulnerable | Vulnerable |
| Diamond Firetail | *Stagonopleura guttata* | Vulnerable | |
| Little Eagle | *Hieraaetus morphnoides* | Vulnerable | |

| Common name | Scientific name | BC Act | EPBC Act |
|---|---|---|---|
| Squirrel Glider | *Petaurus norfolcensis* | Vulnerable | |
| Superb Parrot | *Polytelis swainsonii* | Vulnerable | Vulnerable |

### Endangered population

The Squirrel Glider population in the Wagga Wagga local government area (LGA) is listed as an endangered population under the BC Act and is considered to have a moderate likelihood of occurrence in the study area. Parts of the study area are likely to support seasonal habitat for this species.

### Migratory species listed under the EPBC Act

One migratory species listed under the EPBC Act, the White-throated Needletail (*Hirundapus caudacutus*), is considered to have a moderate likelihood of occurrence in the study area due to the presence of suitable habitat. The White-throated Needletail is also listed as vulnerable under the EPBC Act.

## 16.3.4 Aquatic flora and fauna

### General description of aquatic flora and fauna habitat

The study area is located within the Murray River (Albury and Greater Hume–Lockhart precincts) and Murrumbidgee (Greater Hume–Lockhart, Wagga Wagga and Junee precincts) catchments. The 14 watercourses that cross and/or are located near the proposal site are described in Chapter 18: Hydrology, flooding and water quality. All watercourses within the study area are non-perennial (i.e. either intermittent or ephemeral), with the exception of the Murray River, which is permanently flowing.

The visual assessment of watercourses that cross and/or are located near the proposal site indicated that the water quality, instream habitat and riparian zones (as outlined in *Guideline for controlled activities on waterfront land* (DPI, 2012b) were moderately to very highly disturbed. This is based on a number of observations during field surveys, including (but not limited to) the disruption of the natural hydrology (due to road and rail bridges), land uses in the catchment, removal of riparian vegetation, water discolouration, and the presence of exotic species (including instream invasive species at some locations). Further detail on the aquatic habitat of the watercourses is provided in section 4.5 of Technical Paper 9: Aquatic biodiversity impact assessment.

Based on a review of publicly available information, water quality in the Murray and Murrumbidgee catchments varies from ‘poor’ to ‘excellent’ when considered against the key water quality indicators of pH, dissolved oxygen (DO), total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP) and salinity. There is limited water quality data available for watercourses within the study area; however, given the high proportion of land developed for urban and agricultural purposes, it is likely that runoff from these areas contributes to degradation of water quality (see Chapter 18: Hydrology, flooding and water quality).

### Threatened aquatic species

The database searches identified a number of threatened species, endangered populations, and aquatic matters of national environmental significance (MNES) in the study area, listed under the FM Act and/or EPBC Act. Following site inspections, habitat assessment and targeted surveys, species considered to have the potential to occur within watercourses in the study area are listed in Table 16-2.

**TABLE 16-2 SUMMARY OF THREATENED AQUATIC SPECIES WITH POTENTIAL TO OCCUR WITHIN WATERCOURSES IN THE STUDY AREA**

| Common name | Scientific name | FM Act | EPBC Act | Occurrence |
|---|---|---|---|---|
| **Threatened aquatic species** | | | | |
| Flathead Galaxias | *Galaxias rostratus* | Critically endangered | Critically endangered | Possible to occur in the Murray River and Sandy Creek (during flow events) |
| Macquarie Perch | *Macquaria australasica* | Endangered | Endangered | Unlikely to occur within the study area |
| Murray Cod | *Maccullochella peelii* | | Vulnerable | Likely to occur in the Murray River |
| Murray Crayfish | *Euastacus armatus* | Vulnerable | | Likely to occur in the Murray River |
| Silver Perch | *Bidyanus* | Vulnerable | Critically endangered | Likely to occur in the Murray River |
| Southern Purple Spotted Gudgeon | *Mogurnda adspersa* | Endangered | | Unlikely to occur within the study area |
| Southern Pygmy Perch | *Nannoperca australis* | Endangered | | Possible to occur in Buckaringah Creek (during flow events) |
| Trout Cod | *Maccullochella macquariensis* | Endangered | Endangered | Likely to occur in the Murray River |
| **Endangered populations** | | | | |
| Olive Perchlet (western population) | *Ambassis agassizii* | Endangered population | | Unlikely to occur within the study area |
| Eel Tailed Catfish (Murray Darling Basin population) | *Tandanus tandanus* | Endangered population | | Unlikely to occur within the study area |

### Threatened ecological communities

The study area does not contain any threatened aquatic ecological communities; however, it occurs within the mapped distribution of one endangered ecological community listed under the FM Act—the Lowland Murray River aquatic ecological community. As such, all watercourses within the study area are considered to form part of the endangered ecological community.

## 16.3.5 Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) rely on a supply of groundwater to support the species composition, structure and function of the ecosystem. GDEs are classified as aquatic (dependent on the surface expression of groundwater) or terrestrial (dependent on the subsurface presence of groundwater).

A review of the *Groundwater Dependent Ecosystem Atlas* (Bureau of Meteorology (BoM), 2021) identified the following potential GDEs within the study area:

- Murray River (Murray River bridge enhancement site)—moderate aquatic GDE potential
- Sandy Creek (Uranquinty Yard clearances enhancement site)—high aquatic GDE potential
- Jeralgambeth Creek (Junee to Illabo clearances enhancement site)—high aquatic GDE potential.

## 16.3.6 Protected and sensitive environments

### Wetlands

One nationally important wetland listed under the EPBC Act was identified in proximity to the study area, being the Doodle Comer Swamp. This wetland is located in the Doodle Comer Swamp Nature Reserve about 1-km south-west of the study area at Henty Yard clearances and approximately 2.3 km downstream of Buckaringah Creek. The

nearest wetlands of international importance (Ramsar wetlands) are located more than 100 km from the study area and are unlikely to be directly or indirectly impacted by the proposal.

### Key fish habitat

Table 16-3 lists the areas of key fish habitat within the study area. These are areas classified as Type 3 (minimal key fish habitat) or above in accordance with *Policy and guidelines for fish habitat conservation and management* (DPI, 2013c). Watercourses have been ordered from south to north and categorised into precincts. While Sandy Creek at Uranquinty has been mapped as Key Fish Habitat (Type 1), the field survey identified no instream gravel beds, snags or native aquatic plants (other than emergent species); therefore, it is considered unlikely to provide fish habitat.

**TABLE 16-3 KEY FISH HABITAT**

| Watercourse | Potential for threatened species (DPI, 2016) | Habitat sensitivity type (DPI, 2013c) | Classification of watercourse for fish passage (DPI, 2013c) |
|---|---|---|---|
| **Albury precinct** | | | |
| Murray River, Albury | Yes | Type 1—Highly | Class 1—Major |
| Oddies Creek, Albury | No | Type 2—Moderately | Class 2—Moderate |
| Eight Mile Creek, Ettamogah | No | Type 3—Minimally | Class 4—Unlikely |
| **Greater Hume–Lockhart precinct** | | | |
| Buckaringah Creek, Henty | Yes | Type 2—Moderately | Class 2—Moderate |
| Sandy Creek, Yerong Creek | No | Type 3—Minimally | Class 4—Unlikely |
| Yerong Creek, Yerong Creek | No | Type 2—Moderately | Class 2—Moderate |
| **Wagga Wagga precinct** | | | |
| Sandy Creek, Uranquinty | Yes | Type 2—Moderately | Class 2—Moderate |
| **Junee precinct** | | | |
| Jeralgambeth Creek—north arm | No | Type 2—Moderately | Class 2—Moderate |

### Waterfront land

The proposal site includes areas of waterfront land as defined by the WM Act. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 m of the highest bank of the river, lake or estuary.

### Critical habitat

No critical habitat listed under the EPBC Act has been recorded or is considered likely to occur within the study area.

## 16.4 Impact assessment—construction

Potential impacts on biodiversity during construction include:

- direct impacts as a result of vegetation clearing and disturbance in the proposal site
- indirect impacts on flora and fauna located outside the proposal site as a result of activities within the site.

A summary of the results of the impact assessment is provided in the following sections.

### 16.4.1 Native vegetation

It is estimated that up to about 4.44 ha of native vegetation would need to be removed. The PCTs that would be directly impacted by the proposal are listed in Table 16-4. The proposal site is primarily located within the existing rail corridor in already disturbed areas. These areas contain little native vegetation cover and have limited habitat value for native plants. The reduction in the extent of native vegetation is unlikely to threaten the persistence of any populations of native plants and vegetation communities. It is unlikely that an ecologically significant proportion of any regional plant populations would be located entirely within the proposal site.

**TABLE 16-4 PLANT COMMUNITY TYPE—EXTENT OF IMPACTS WITHIN PROPOSAL SITE**

| Plant community type | Vegetation zone | Extent of impact (ha) | Relevant enhancement sites |
|---|---|---|---|
| PCT 5–River Red Gum herbaceous–grassy very tall open forest wetland on inner floodplains | Poor condition | 0.05[1] | ▸ Murray River bridge<br>▸ Harefield Yard clearances<br>▸ Uranquinty Yard clearances |
| | Subtotal (ha) | 0.05 | |
| PCT 277—Blakely's Red Gum – Yellow Box grassy tall woodland | Moderate condition | 0.50 | ▸ Junee to Illabo clearances |
| | Poor condition | 1.29 | ▸ Albury Yard clearances<br>▸ Billy Hughes bridge<br>▸ Table Top Yard clearances<br>▸ Bomen Yard clearances<br>▸ Harefield Yard clearances<br>▸ Olympic Highway underbridge<br>▸ Junee to Illabo clearances |
| | Derived condition | 2.34 | ▸ Junee to Illabo clearances |
| | Native plantings | 0.26 | ▸ Olympic Highway underbridge<br>▸ Junee to Illabo clearances |
| | Subtotal (ha) | 4.36 | |
| | **Total extent of impact (ha)** | **4.44** | |

1. The difference in the extent of impact calculations reported in section 16.4.4 is the result of different calculation requirements prescribed by the BAM and the *Guideline for controlled activities on waterfront land* (DPI, 2012b), respectively.

#### Threatened ecological communities

The proposal would result in direct impacts to about 2.84 ha of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, listed under the BC Act. About 0.50 ha of the impacted vegetation is also listed as a critically endangered TEC in moderate condition under the EPBC Act.

The proposal is unlikely to result in serious, irreversible or significant impacts on these communities due to the small area of these communities to be removed and existing fragmentation of vegetation in the area. To mitigate the potential impacts on biodiversity, offsets would be provided as described in section 16.6.

#### Groundwater dependent ecosystems

The groundwater assessment undertaken for the proposal (refer to Chapter 19: Groundwater) considered potential impacts on aquifers and GDEs using the minimal impact considerations of the *NSW Aquifer Interference Policy* (DPI, 2012a). The assessment concluded that the proposal complies with Level 1 criteria under the *NSW Aquifer Interference Policy*, under which impacts to GDEs are considered acceptable (refer to section 19.5).

#### Non-native vegetation

Non-native vegetation occurs within and adjacent to the proposal site—two non-native vegetation communities were identified. About 39.96 ha of non-native vegetation including urban exotic/native landscape plantings would be removed. It is unlikely that the removal of a small area of non-native vegetation patches would have a significant impact on native threatened fauna.

Trees and shrubs associated with non-native vegetation offer foraging, nesting and sheltering habitat to locally occurring threatened birds. The removal of non-native vegetation will result in negligible direct and indirect impacts on these threatened species.

### 16.4.2 Terrestrial flora

#### Species listed under the BC Act

The proposal is unlikely to result in serious and irreversible impacts on this threatened flora species given the small area to be removed. This is due to the unlikelihood that an ecologically significant proportion of potential habitat would be located entirely within the proposal site.

#### Species listed under the EPBC Act

No threatened flora species listed under the EPBC Act were recorded during targeted surveys carried out for the proposal; as such, there would be no impact to any threatened flora species listed under the EPBC Act.

### 16.4.3 Terrestrial fauna

#### Fauna habitat and connectivity

The removal of the vegetation communities described in section 16.4.1 would impact fauna habitats due to the removal of foraging and breeding habitat of fauna species.

The proposal would be largely located in the existing rail corridor surrounded by a highly fragmented regional and rural landscape. Existing development and land uses, such as agriculture and road infrastructure, have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences. Vegetation removal for the proposal may exacerbate fragmentation for the Squirrel Glider (*Petaurus norfolcensis*), whose movement is limited by gliding distances between areas of habitat. This species was recorded foraging in woodland patches at the Billy Hughes bridge enhancement site and in areas located 3 km to the north of the Uranquinty Yard clearances enhancement site. At the Billy Hughes bridge enhancement site, compounds and access tracks have been sited to avoid vegetation clearance. Implementation of mitigation measures (such as gliding poles) would further limit the effects of habitat fragmentation for this species (refer to section 16.6).

Construction could also result in the injury or mortality of individuals of less mobile fauna species, and other small terrestrial fauna that may be sheltering in vegetation within the proposal site, during clearing and construction activities, and unable to move out of the area. This could include nesting birds, small terrestrial mammals, lizards and frogs, nocturnal fauna sheltering in hollows and less mobile species, such as koalas. More mobile native fauna, such as adult birds, and larger terrestrial mammals and reptiles that may be sheltering in vegetation in the proposal site, are more likely to evade injury during construction activities.

A range of fauna species are at risk of vehicle strike during construction. Fauna at risk of injury and mortality include terrestrial fauna, as well as birds, bats and gliders.

**Human-made structures**

Bat habitat survey investigations across the proposal identified 15 human-made structures (i.e. bridges and culverts) that provide a high likelihood of microbat utilisation (utilisation at least on a seasonal basis). The majority of structures that provided potential microbat habitat occurred within the Junee to Illabo clearances enhancement site. Of these structures, the presence of Fairy Martin nest provided the most ideal habitat for microbats. Only one structure—Billy Hughes bridge—was observed to be used by microbats during the survey period, with two Lesser Long-eared Bats occupying a Fairy Martin nest under the bridge (which are not listed threatened species). No threatened species were recorded in the study area during the targeted seasonal survey.

Not all human-made structures would be impacted or significantly disturbed due to the proposal. Billy Hughes bridge would not be directly impacted due to the proposal, as works are associated with track lowering. Works on human structures within the Junee to Illabo clearances enhancement site would be minor; however, any works within structures identified as high likelihood of microbat utilisation would be subject to mitigation measures (i.e. microbat exclusion) to reduce the impact on species using these structures. At the Billy Hughes bridge enhancement site, compounds and access tracks have been sited to avoid vegetation clearance. Implementation of mitigation measures (such as gliding poles) would further limit the effects of habitat fragmentation for this species (refer to section 16.6)

#### Species listed under the BC Act

As a result of vegetation removal, the proposal would impact potential habitat for 30 predicted fauna species and 7 candidate fauna species, of which:

- one is listed as Critically Endangered
- two are listed as Endangered
- 33 are listed as Vulnerable.

In accordance with the BC Regulation, species credits are required (see section 16.6).

### Species listed under the EPBC Act

The proposal would impact known or potential habitat for seven threatened fauna species listed under the EPBC Act, of which:

- two are listed as Critically Endangered
- one is listed as Endangered
- four are listed as Vulnerable.

The proposal is considered unlikely to have a significant impact on these species.

### Migratory species

The proposal is not likely to significantly impact important habitat for the White-throated Needletail (*Hirundapus caudacutus*). The species does not breed in Australia and the proposal would impact a small area of aerial foraging habitat used by this highly mobile species (PCT 5 and PCT 277). The alteration of this aerial foraging habitat is not likely to have a significant impact on the available resources for this species in the vicinity of the study area or its wider locality.

## 16.4.4 Aquatic flora and fauna

Construction has the potential to impact on watercourses, water quality and waterfront land in the study area (see Chapter 18: Hydrology, flooding and water quality). While all of the watercourses crossed by the proposal site (except for the Murray River) have been defined as ephemeral, they have the potential to connect isolated water bodies to defined waterways during times of flow. Associated potential worst-case impacts on aquatic flora and fauna may include the following direct impacts:

- removal of 0.03 ha of native riparian vegetation (PCT 5) and habitat features within the proposal at Murray River bridge, Uranquinty Yard clearances and Harefield Yard clearances enhancement sites. Vegetation at Murray River bridge enhancement site would involve trimming to enable construction access to work areas
- temporary obstruction of fish passage associated with bridge and culvert works at Sandy Creek (Uranquinty Yard clearances) and Jeralgambeth Creek (Junee to Illabo clearances), and any vehicle access across watercourses
- removal of in-stream vegetation and large woody debris that may provide shelter, feeding and spawning habitat at Sandy Creek (Uranquinty Yard clearances) and Jeralgambeth Creek (Junee to Illabo clearances)
- impacts to water quality associated with clearing of riparian vegetation and instream works
- impacts on fish in any other waterbodies within the proposal site, including an artificial wetland near the Pearson Street bridge enhancement site.

Potential indirect impacts on aquatic flora and fauna may occur as a result of:

- disturbance of soils and sediments has the potential to increase sediment load in watercourses, which could, in turn, indirectly impact on water quality
- accidental release of contaminants, such as lubricating oils, hydraulic fluids and fuel from construction equipment, has the potential to impact on water quality.

As noted in section 16.3.1, the majority of watercourses that cross the proposal site are ephemeral. Potential water-quality impacts would be addressed by implementing standard mitigation measures designed to minimise erosion and sedimentation, and potential water-quality impacts (see Chapter 18: Hydrology, flooding and water quality and Chapter 20: Soils and contamination).

Some of the watercourses crossed by the proposal site comprise key fish habitat (see section 16.3.6) The risk of impact to key fish habitat in the following watercourses would occur due to instream works, bridge alterations and/or removal of riparian vegetation:

- Murray River (Murray River bridge enhancement site) (bridge alterations, which may pose a water quality impact, and vegetation trimming only)
- Sandy Creek (Uranquinty Yard clearances enhancement site) (temporary creek crossing, bridge modifications and vegetation removal/trimming)
- Jeralgambeth Creek north arm (Junee to Illabo clearances enhancement site) (culvert modification).

All other watercourses within the proposal site with key fish habitat were assessed as low or negligible risk of impact. This was due to the lack of key fish habitat features and/or the minor nature of the works proposed at these watercourses.

Risk of impact at all watercourses can be effectively managed through the implementation of mitigation measures (see section 16.6) and no long-term impacts on aquatic flora and fauna are predicted with the implementation of appropriate construction mitigation measures.

Based on discussions with DPI (Fisheries), the temporary creek crossing would not require temporary fish passage in accordance with *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003). This is due to the degraded condition of Sandy Creek and its highly ephemeral nature. Mitigation measures have been identified in section 16.6 for the construction of the temporary crossing and rehabilitation of the impacted area

The proposal site is considered to provide possible or likely habitat for six aquatic threatened species and one aquatic ecological community listed under the FM Act. Assessments of significance of the potential impact on these matters were undertaken as part of the aquatic flora and fauna assessment provided in Technical Paper 9: Aquatic biodiversity impact assessment.

The results of the aquatic flora and fauna assessment determined that the proposal would not significantly compromise the functionality, long-term connectivity or viability of habitats, or ecological processes within assemblages of biota beyond the small affected areas. The impacts would be temporary and, with the implementation of appropriate mitigation measures to return aquatic areas to their pre-works condition (or better) (see section 16.6), the residual impacts on aquatic flora and fauna would be minimal.

### 16.4.5 Impacts on key threatening processes

The BC Act, FM Act and EPBC Act list a series of key threatening processes. These are defined as an action, activity, project or potential threat that:

- adversely affects two or more threatened species, populations or ecological communities
- could cause species, populations or ecological communities that are not currently threatened to become threatened.

The proposal itself does not constitute a key threatening process. The proposal would result in or exacerbate the following key threatening processes during construction and operation:

- clearing of native vegetation/land clearance (BC Act and EPBC Act)
- infection by *Psittacine Circoviral* (beak and feather) disease affecting endangered psittacine species and populations (BC Act and EPBC Act)
- infection of native plants by *Phytophthora cinnamomic* (BC Act and EPBC Act)
- introduction and establishment of Exotic Rust Fungi of the order *Pucciniales* pathogenic on plants of the family *Myrtaceae* (BC Act)
- infection of frogs by the water-borne pathogen *Batrachochytrium dendrobatidis* (Chytrid Fungus) causing the disease chytridiomycosis (EPBC Act)
- invasion and establishment of exotic vines and scramblers (BC Act)
- invasion of native plant communities by exotic perennial grasses (BC Act)
- loss of hollow-bearing trees (BC Act)
- removal of dead wood and dead trees (BC Act)
- degradation of native riparian vegetation along NSW water courses (FM Act)
- installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams (FM Act)
- removal of large woody debris from NSW rivers and streams (FM Act).

The approach to managing the potential impacts of the proposal is described in section 16.6.

### 16.4.6 Indirect impacts

A summary of the potential indirect impacts associated with construction is provided in Table 16-5. Indirect impacts have been assessed in accordance with the Biodiversity Assessment Method and are unlikely to affect threatened species due to the highly disturbed nature of the landscape along the existing rail corridor.

**TABLE 16-5 POTENTIAL INDIRECT IMPACTS**

| Potential indirect impact | Description | Consequence |
|---|---|---|
| Inadvertent impacts on adjacent habitat or vegetation | Construction of the proposal has the potential to result in sedimentation and erosion, and mobilisation of contaminants within the proposal site, and into adjoining native vegetation and ephemeral drainage lines, through soil disturbance and construction activities. Sediment-laden runoff and spills affect water quality and adversely affect aquatic life, particularly during construction near creek lines.<br>The mobilisation of sediments would be contained within the disturbance area as sediment containment measures would be implemented as part of mitigation measures. | Low |
| Connectivity and habitat fragmentation | Overall, the habitat present within the landscape has been heavily fragmented due to agricultural practices. Existing connectivity is limited to creek lines and road reserves. The impacts from the proposal would largely involve small areas of disturbance of vegetation patches, which would not result in significant habitat fragmentation.<br>The predicted level of fragmentation from the proposal would not be enough to prevent the breeding and dispersal of plant pollinators or the dispersal of plant propagules (i.e. seed or other vegetative reproductive material) between habitat patches. The reduction in vegetation patch sizes may impact the dispersal of relatively sedentary species such as mammals, frogs and reptiles.<br>The existing functional connectivity for many species would remain in the proposal site and would be further supported with connectivity mitigation measures. | Low |
| Reduced viability of adjacent habitat due to edge effects | Edge effects from existing agricultural activities impact native vegetation in the study area, particularly through weed invasion.<br>As the proposal involves clearing into moderate condition native vegetation, this impact is likely to be exacerbated and the works may introduce this impact into additional areas of native vegetation and habitat; however, the vegetation recorded in the proposal site mostly occurred within a rural agricultural setting with some degree of weed invasion already present. | Negligible |
| Reduced viability of adjacent habitat due to noise, dust or light spill | During construction of the proposal, increased noise and vibration levels in the proposal site and immediate surrounds are likely due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence. The indirect impacts from noise emissions are likely to be localised to the construction areas and are not considered likely to have a significant, long-term impact on wildlife populations outside the area of impact.<br>Dust pollution is likely to be greatest during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and decommissioning activities, and during adverse weather conditions; however, indirect dust pollution is likely to be highly localised, intermittent and temporary, and is therefore not considered likely to be a major impact of the proposal.<br>Night works would be required during the construction phase of the proposal and would increase light pollution. The changes to light conditions associated with the construction phase of the proposal are temporary and would therefore be unlikely to have a significant indirect impact on local fauna populations. | Low |
| Transport of weeds from the site to adjacent vegetation | The clearing of native vegetation for the proposal, including earthworks, would increase the potential for weed invasion into adjacent patches of native vegetation. Management measures in accordance with the *Biosecurity Act 2015* (NSW) would be required to minimise the risk of introduction and spread of weeds (refer to section 16.6.2). | Negligible |
| Transport of pathogens from the site to adjacent vegetation | Construction activities have the potential to increase the spread of pathogens that threaten native biodiversity values, such as the soil-borne pathogen *Phytophthora cinnamomi* (Phytophthora) and *Austropuccinia psidii* (Myrtle rust), and the water-borne pathogen *Batrachochytrium dendrobatidis* (Chytrid Fungus).<br>This indirect impact type corresponds to several Key Threatening Processes listed under the BC Act, including infection of native plants by *Phytophthora cinnamomi*, introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae, and infection of frogs by *Batrachochytrium dendrobatidis* causing the disease Chytridiomycosis. Standard management measures would minimise the risk of transporting pathogens from the site to adjacent vegetation (refer to section 16.6.2). | Low |

| Potential indirect impact | Description | Consequence |
|---|---|---|
| Increased risk of starvation, exposure and loss of shade or shelter | Displacement of resident fauna species during native vegetation clearing is considered relatively low due to the extensive vegetation adjacent to the proposal site. Given the small-scale impact (around 22 ha) associated with the proposal, and relative mobile nature of most potential resident fauna species, the increased risk of starvation, exposure and loss of shade or shelter due to the proposal is likely to be low. | Low |
| Loss of breeding habitats | The loss of breeding habitat, such as hollow-bearing trees and fallen timber, has the potential to affect native animals such as hollow-dependent mammals, hollow-nesting and canopy-nesting birds, arboreal mammals and reptiles. Potential breeding habitat for Sloane's Froglet has been mapped in the study area, in lieu of survey, in appropriate seasonal contexts. This species was considered to have a high likelihood of occurrence in the study area; particularly in association with Billy Hughes bridge and Table Top Yard clearances. | Low |
| Increase in predatory species populations | Predation by feral cats and foxes is listed as a key threatening process under the BC Act and has potential to impact local fauna populations in adjacent habitats. It is unlikely that the proposal would further exacerbate the impact on predator species populations than what currently exists within the locality due to the small area of impact in the proposal site. | Low |
| Reduction in water quality | The existing hydrological conditions of the proposal site are already affected by surrounding land uses, including urban development and agriculture (refer to Chapter 18: Hydrology, flooding and water quality). The potential reduction in water quality of watercourses within the study area are also associated with the mobilisation of sediments and spill of pollutants, with indirect impacts to terrestrial and aquatic biodiversity moving up the food chain. To avoid further reduction in water quality during the construction of the proposal (e.g. due to increased mobilisation of sediments by earthworks), appropriate soil and water construction management measures would be implemented. | Low |
| Changes to geomorphology of watercourse | During construction, temporary changes in creek flows and velocities downstream of the temporary crossing at Sandy Creek may occur following a heavy rainfall event. Mobilised sediment could build up in the waterways in and downstream of the proposal site. Implementation of water controls and runoff would be implemented to ensure any indirect impacts to creek flows and velocities are not significantly changed and to avoid any erosion, and bed and bank stability impacts. | Low |

## 16.5 Impact assessment—operation

Operation of the proposal has the potential to result in the following impacts:

- injury and mortality of fauna attempting to cross the rail line and roads
- additional noise, vibration, dust and light impacts as a result of train operations
- impacts on habitat connectivity for limited terrestrial and aquatic species
- spread of weeds and pests.

Operational impacts are discussed in the following sections. No other operational activities, such as maintenance inspections or monitoring, would impact on native flora and fauna or other biodiversity values.

### 16.5.1 Fauna injury and mortality

Increased train movements and the running of taller trains (6.5 m) in the study area may result in adverse impacts on locally occurring fauna species as a result of vehicle (train) strike. This mainly has the potential to affect mobile terrestrial species but could also affect birds, microbats and gliders. The Squirrel Glider would be at an increased risk of train strike due to its limited gliding distance between areas of habitat. While it is not possible to eliminate the risk of train strike, minimising train strike during operation would be delivered during detailed design, through the provision of crossing infrastructure (where such infrastructure would be effective) and landscaping plans.

It is unlikely that the operation of the proposal would contribute significantly to vehicle strike to native fauna, and the consequences of impacts to species would be negligible.

### 16.5.2 Noise, vibration, dust and light impacts

Train operations in the study area may result in adverse impacts on locally occurring fauna species as a result of noise, vibration, dust and light. Increased noise, vibration, dust and light levels in the rail corridor and immediate surrounds are likely due to maintenance machinery and train movements, and general human presence. Noise, vibration and light from passing trains would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours, and may result in fauna temporarily avoiding habitats adjacent to the proposal site. Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the rail, resulting in reduced growth rates and decreases in overall health of the vegetation.

Fauna are currently subject to varying levels of disturbance from noise, vibration and light as the proposal site mostly encompasses an existing operational rail corridor that is located adjacent to existing roads in urban centres, rural townships and agricultural settings. Thus, there would be some habituation of fauna to noise and vibration in the study area.

Given the proposal's ecological setting, the impacts from noise, vibration, dust and light emissions during operation are likely to be highly localised to the rail corridor and intermittent, with low impacts to flora and fauna species.

### 16.5.3 Habitat connectivity

The operation of the proposal is likely to result in minor increases in localised fragmentation of the regional wildlife patches along the creek lines and road reserves. Due to the importance of connectivity, dispersal opportunities and habitat quality for species at a local scale, this impact has the potential to be negative to the dispersal of relatively sedentary species such as mammals, frogs and reptiles.

The operation of the proposal is considered unlikely to result in a large increase to landscape scale fragmentation and to further limit connectivity and movement corridors than what already exists in the proposal site, as it occurs within an already highly fragmented landscape with limited large patches of remnant vegetation. Blockages at water crossing structures following a heavy rainfall event also have the potential to block fish passage.

The predicted level of fragmentation from the proposal would not be enough to prevent the breeding and dispersal of plant pollinators or the dispersal of plant propagules (i.e. seed or other vegetative reproductive material) between habitat patches. Overall, the potential for habitat connectivity impacts during operation is considered to be low, with the implementation of the proposed design features and mitigation measures described in section 16.6.

### 16.5.4 Weeds and pests

The clearing of native vegetation for the proposal, including earthworks, would increase the potential for weed invasion into adjacent patches of native vegetation during operation. The proposal has the potential to increase the transport of pathogens and pest species that threaten native biodiversity values during train movement, such as the soil-borne pathogen *Phytophthora Cinnamomi* (Phytophthora) and *Austropuccinia psidii* (Myrtle Rust), and the water-borne *Batrachochytrium dendrobatidis* (Amphibian Chytrid Fungus).

Management measures would be required to minimise the risk of introduction and spread of weeds and pests; however, the impact during operations is predicted to be low to negligible.

## 16.6 Mitigation and management

### 16.6.1 Approach to mitigation and management

Environmental management for the proposal would be carried out in accordance with the environmental management approach, as detailed in Chapter 27: Approach to mitigation and management and Appendix H: Construction environmental management plan outline of the EIS.

Impacts of the proposal have been avoided, minimised and offset in accordance with section 9 of the Biodiversity Assessment Method. The proposal has been designed to avoid and minimise impacts to biodiversity where possible, as discussed in Chapter 6: Alternatives and proposal options of this EIS and in Chapter 8 of Technical Paper 8: Biodiversity development assessment report. Where impacts have been unable to be avoided, the mitigation measures outlined in section 16.6.2 have been developed to minimise the impact of the proposal. Where impacts to species listed under the BC Act cannot be avoided or minimised to an appropriate level, offsets have been developed in accordance with the ARTC Biodiversity Offset Delivery Strategy – New South Wales (refer to section 16.6.4).

Biodiversity impacts would be managed in accordance with the biodiversity management sub-plan, which would be prepared prior to construction and implemented as part of the CEMP. The plan would include measures to avoid and minimise the potential for impacts during construction. The plan will include, but not be limited to:

- measures to manage impacts to terrestrial biodiversity, including:
  - pre-clearance surveys, including breeding habitats (including burrows, trees, logs, existing culverts and structures, and potential Sloane's Froglet breeding habitat)

- the clearing extents/site boundary/limit of works is clearly defined with flagging or marking tape, signage or other suitable means to delineate no-go areas
- vegetation-clearing protocols to reduce risk of fauna mortality, including staged clearing, safe tree felling and log removal
- exclusion fencing for retained habitat within or adjacent to the proposal site, including consideration of temporary frog exclusion fencing where construction compounds/ laydown areas occur adjacent to potential Sloane's Froglet breeding habitat.
- inspection requirements for machinery and excavations to detect the presence of fauna
- animal-handling protocols, including relocation and emergency care
- measures to manage biosecurity risks (weeds and pathogens) in accordance with the *Biosecurity Act 2015*.

- measures to manage impacts to aquatic biodiversity, including:
  - removal and displacement of habitat features (riparian vegetation, instream vegetation and or large rocks and woody debris within the bed) would be avoided as far as practicable
  - salvage protocols for aquatic fauna from watercourses and remnant pools prior to construction on watercourses directly impacted
- a flora and fauna unexpected find protocol.

A rehabilitation strategy will be developed for the proposal, as a component of the CEMP. The strategy will be based on the Inland Rail Landscape and Rehabilitation Strategy, the Inland Rail Landscape and Rehabilitation Framework and property-specific reinstatement commitments. As a minimum, it would establish the following:

- objectives for rehabilitation, reinstatement and/or stabilisation—objectives will differ for within the rail corridor and outside of the rail corridor
- procedures, timeframes, measurable performance objectives and responsibilities for monitoring the success of rehabilitation and/or reinstatement/stabilisation areas.

### 16.6.2 Mitigation measures

Measures that will be implemented to address potential impacts on biodiversity are listed in Table 16-6.

**TABLE 16-6 BIODIVERSITY MITIGATION MEASURES**

| Stage | Ref | Impact/issue | Mitigation measure |
|---|---|---|---|
| Detailed design/ pre-construction | BD1 | Avoiding impacts on biodiversity | Detailed design and construction planning will seek to identify refinements that further avoid or minimise the need to further impact or disturb native vegetation, fauna habitat and riparian habitat. |
| Detailed design/ pre-construction | BD2 | Connectivity and fauna passage | During detailed design, provision of one glider pole on each side of the rail corridor will be further investigated to enhance habitat connection between patches of remnant vegetation for Squirrel Glider at the Billy Hughes bridge enhancement site. |
| Detailed design/ pre-construction | BD3 | Connectivity and fauna passage | A regional connectivity strategy will be prepared and implemented with reference to the *Fauna Design Guidelines for the Inland Rail Project* (2021) to consider further enhancements, including beyond the proposal site. |
| Detailed design/pre-construction/ construction | BD4 | Fish passage | Fish passage will be maintained at Jeralgambeth Creek (Junee to Illabo clearances). |
| Pre-construction/ construction | BD5 | Avoidance of fauna impacts | Pre-clearance surveys will be carried out prior to construction by a suitability qualified ecologist in accordance with the biodiversity management sub-plan. This would include:<br>- inspections of structures that provide potential microbat habitat. If bats are identified roosting in these structures, individuals will be excluded from this habitat (meaning bats can exit the habitat unharmed during their nocturnal activity period, but not re-enter).<br>- native aquatic fauna salvage in watercourses of residual pools directly impacted by construction. All salvaged aquatic fauna will be relocated to similar habitat nearby. |

| Stage | Ref | Impact/issue | Mitigation measure |
|---|---|---|---|
| Pre-construction/ construction | BD6 | Managing the potential for biodiversity impacts during construction | Exclusion areas will be established and maintained around native vegetation and riparian vegetation to be retained; particularly, areas of biodiversity value adjoining the proposal site that are located in close proximity to work areas. |
| Pre-construction/ construction | BD7 | Managing the potential for biodiversity impacts during construction | Construction workforce will be supplied with sensitive area maps (showing clearing boundaries and exclusion zones), including updates, as required. |
| Construction | BD8 | Riparian vegetation and aquatic habitats | Activities within vegetated riparian zones will be managed to minimise impacts to aquatic environments as far as practicable. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated. |
| Construction | BD9 | Sloane's Froglet | Temporary frog exclusion fencing will be considered where construction compounds/laydown areas occur adjacent to potential Sloane's Froglet breeding habitat. |
| Construction | BD10 | Instream impacts | Instream works at Sandy Creek (Uranquinty Yard clearances) and Jeralgambeth Creek (Junee to Illabo clearances) will be undertaken in dry conditions, as far as practicable. Where works cannot be conducted in the dry, appropriate erosion and sediment control would be installed (i.e. a silt curtain or sediment boom around the work area and attached to the same side of the bank to maintain fish passage).<br>Appropriate erosion and sediment control will be installed and maintained.<br>Aquatic habitat will be returned to pre-works condition (or better) in accordance with the rehabilitation strategy. |
| Construction | BD11 | Instream impacts | Any instream habitat features (woody debris, large rocks and boulders) at the temporary creek crossing location at Sandy Creek (Uranquinty Yard clearances) is to be removed and placed up or downstream of the construction area in consultation with a suitably qualified aquatic ecologist.<br>Any such aquatic features will be reinstated within the watercourse at the completion of construction. |
| Construction | BD12 | Unexpected finds (biodiversity) | A species unexpected finds protocol will be implemented if threatened ecological communities, flora and fauna species, not assessed in the biodiversity assessment, are identified in the proposal site.<br>This will include stop work orders in the immediate area and notifying DPE. |
| Construction and operation | BD13 | Instream impacts | Refuelling will be conducted outside of waterfront land, so far as is practicable, with appropriate measures in place to avoid impacts to waterways, aquatic habitats, and groundwater. This includes spill kits always kept with maintenance vehicles and/or machinery within 100 m of a watercourse. |
| Operation | BD14 | Fish-passage impacts | Instream structures (bridges and culverts) that provide for the flow of watercourses will be inspected and maintained during routine track inspections to address any issues that may contribute to the blockage of fish passage. |

## Effectiveness of mitigation measures

The mitigation measures specified in Table 16-6 are anticipated to be effective in reducing the likelihood and/or consequence of the identified risks. The biodiversity sub-plan would include procedures to address any unexpected discovery of threatened species, and to monitor and maintain effective controls.

The mitigation and management measures detailed in Table 16-6 are consistent with best-practice management of biodiversity values on large-scale linear infrastructure projects. They are anticipated to be effective in reducing the likelihood and/or consequence of short-term or permanent impacts to biodiversity. Any disturbed areas would be managed in accordance with the rehabilitation strategy.

### 16.6.3 Interactions between mitigation measures

Mitigation measures in other chapters that are relevant to the management of biodiversity include:

- Chapter 12: Land use and property, specifically details measures that address weed management
- Chapter 18: Hydrology, flooding and water quality, specifically details measures that address water quality impacts.

There are no mitigation measures identified in the assessment of other environmental aspects that are likely to affect the assessment of biodiversity.

### 16.6.4 Biodiversity offsets

#### Biodiversity offset requirements under the BC Act

The offsets required to compensate for the residual biodiversity impacts under the BC Act were determined using the Biodiversity Assessment Method Calculator. In accordance with the offset rules established by the BC Regulation, offset obligations can be achieved by retiring the appropriate biodiversity credits from an established Biodiversity Stewardship Site, monetary payment directly into the Biodiversity Conservation Fund, or funding an approved biodiversity action.

A total of 137 ecosystem credits (primarily due to impacts to PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion) and 195 species credits are required for the proposal. Species credits would be required for the Squirrel Glider, Superb Parrot, Key's Matchstick Grasshopper and Sloane's Froglet.

ARTC is managing implementation of the offset strategy for the Inland Rail program. ARTC has invited landowners within 100 km of the Inland Rail Program route in NSW to contact them regarding establishing a Biodiversity Stewardship Site so that ARTC can purchase the appropriate credits. Where credits are not available for purchase, or cannot be obtained in other ways (such as generation from an ARTC site), another option would be for ARTC to make a payment into the Biodiversity Conservation Fund. Where suitable offsets for the proposal are unable to be sourced, ARTC may seek to apply the variation rules for retirement of some ecosystem and species credits; particularly, those that may be difficult to source. Further information is provided in Technical Paper 8: Biodiversity development assessment report.

#### Biodiversity offset requirements under the FM Act

Key fish habitat would not be permanently lost or disrupted, provided the mitigation measures, rehabilitation strategy, and operational monitoring and management are implemented. As such, no aquatic biodiversity offset strategy is required.

### 16.6.5 Residual risk

Residual impacts are impacts of the proposal that may remain after implementation of the management and mitigation measures detailed in sections 16.6.1 and 16.6.2. These are summarised in Table 16-7. The proposal would result in some unavoidable residual impacts, which would reduce the biodiversity values within the study area. As identified in section 16.6.4, biodiversity offsets would be required.

Further information on the approach to the environmental risk assessment, including descriptions of criteria and risk ratings, is provided in Appendix E: Environmental risk assessment.

**TABLE 16-7 RESIDUAL RISK MANAGEMENT—BIODIVERSITY**

| Stage | Potential impact | Pre-mitigated rating | Mitigation measures[1] | Residual risk rating | Residual risk management[2] |
|---|---|---|---|---|---|
| Construction | Clearing of native vegetation resulting in loss of fauna habitat, habitat fragmentation and loss of connectivity | High | BD1, BD2, BD3, BD5, BD6, BD9 | Medium | A fauna connectivity strategy would be prepared to guide detailed design and would include crossing structures.<br>The biodiversity management plan would include measures to manage impacts on threatened flora species and endangered ecological communities. Implementation of these measures would minimise the potential for residual impacts. |

| Stage | Potential impact | Pre-mitigated rating | Mitigation measures[1] | Residual risk rating | Residual risk management[2] |
|---|---|---|---|---|---|
| Construction | Direct impacts on listed endangered terrestrial ecological populations and communities | High | BD1, BD6, BD7 | Medium | The biodiversity management plan would include measures to manage impacts on threatened flora species and endangered ecological communities. Implementation of these measures would minimise the potential for residual impacts. |
| Construction | Impacts on potential habitat for listed threatened fauna species | High | BD1, BD2, BD3, BD5, BD6, BD7, BD9, BD11 | Medium | The fauna connectivity strategy includes crossing structures for threatened fauna species.<br>The biodiversity management plan would include measures to manage impacts on threatened fauna species. Implementation of these measures would minimise the potential for residual impacts. |
| Construction | Increased impacts from pest plants and animals during construction from movement of vehicles, machinery and materials in and out of site | Low | CEMP | Low | N/A |
| Construction | Indirect impacts on fauna species due to increased dust, sedimentation, and erosion, noise, light and contamination pollution | Low | CEMP | Low | N/A |
| Construction | Native fauna mortality from vehicle strikes from construction vehicles | Low | CEMP | Low | N/A |
| Construction | Potential impacts on GDEs | Low | CEMP | Low | N/A |
| Construction | Potential impacts on aquatic ecosystems and threatened species, including as a result of construction on rail bridges/culverts and the temporary waterway crossing at Uranquinty | Medium | BD4, BD5, BD8, BD10, BD11, BD13 | Low | N/A |
| Construction | Potential impacts on protected and sensitive lands, which includes waterfront land and Key Fish Habitat | Medium | BD5, BD6, BD8 | Low | N/A |
| Operation | Increase in injury and mortality of fauna from train strikes | Medium | BD2, BD3 | Low | N/A |
| Operation | Impacts to aquatic ecosystems due to changes in water quality or deterioration to fish passage | Medium | BD4, BD8, BD10, BD11, BD13, BD14 | Low | N/A |
| Operation | Increase in impacts on fauna from noise, vibration and light during operation | Low | N/A | Low | N/A |

1. As defined in Table 16-6.
2. For residual impacts with a risk rating of medium or above.