





INLAND RAIL - PARKES TO NARROMINE

Aquatic Ecology Assessment

Prepared by Umwelt (Australia) Pty Limited on behalf of Australian Rail Track Corporation

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Executive Summary

The Australian Government has committed to building a significant new piece of national transport infrastructure by constructing an inland railway between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. The Inland Rail Project ('Inland Rail') is a major national Project that will enhance Australia's existing national rail network and serve the interstate freight market. This report relates to the Parkes to Narromine section of Inland Rail.

The Project will involve upgrading the existing rail corridor between Parkes and Narromine including upgrading the existing track and track formation, replacing culverts and bridges, constructing three new crossing loops, rationalising and upgrading level crossings, curve easing and other ancillary works.

This Aquatic Ecology Assessment has been prepared on behalf of the Australian Rail Track Corporation (ARTC) to assess the potential impacts of the proposal on aquatic ecosystems and threatened aquatic species.

The proposal crosses 29 watercourses in the Lachlan and Bogan River catchments. While the watercourses range from first order streams to fifth order streams the catchments are characterised by variable and unpredictable patterns of flow and water levels exacerbated by heavily cleared catchments and prevalence of agricultural land use.

The majority of watercourses along the existing rail corridor between Parkes and Narromine are first order streams with intermittent flow following rain events, little or poorly defined channels with no

aquatic flora species. The watercourses have been modified by crossing structures for rail and road; and agricultural land practices with minimal native vegetation retained along the banks of the watercourses. Accordingly, following DPI Fisheries guidelines these watercourses have been classified as Class 4 unlikely key fish habitats that are considered to be Type 3 minimally sensitive fish habitat.

Third order tributaries of Burrill Creek, Barrabadeen Creek, Bulldog Creek, Tomingley Creek, Bradys Cowal, Yellow Creek and Backwater Cowal have all been assessed as being Class 3 minimal key fish habitat with semi-permanent pools evident upstream or downstream of the existing rail corridor. All of these watercourses were assessed as type 3 minimally sensitive fish habitats as they are ephemeral with little to no native aquatic vegetation evident in the immediate environs of the existing rail corridor. Burrill Creek was the only watercourse in the proposal area that was assessed as moderately sensitive habitat and class 2 moderate fish habitat.

A number of State and Commonwealth listed threatened fish species, endangered populations and TECs are recorded or predicted to occur in major watercourses within the Parkes and Narromine LGAs. None of the threatened species or endangered populations are likely to occur in the watercourses within the proposal area due to a lack of preferred habitat. The Inland Rail alignment intersects watercourses associated with the Bogan River that may be part of the Fisheries Management Act 1994 (FM Act) listed Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling

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River downstream of Peak Hill and tributaries of Ridgey Creek that may be part of the FM Act Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River. An assessment of significance of impact of the proposal on these two threatened ecological communities (TECs) has identified that the proposal is unlikely to have an adverse impact on either of these communities, with the adoption of appropriately designed fish friendly crossing structures and other mitigation measures to further reduce impacts.

The assessment has considered the impact of the proposal on matters of national environmental significance (MNES) as listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). No nationally listed aquatic dependent threatened aquatic species, endangered populations, TECs or aquatic migratory species are expected to occur in the watercourses within the proposal area.

Potential groundwater dependent ecosystems (GDEs) in the proposal area are associated with the River Red Gum Forest along Burrill Creek and the Belah woodland at Tomingley Creek. Given that the works to culverts and bridges are not expected to significantly change local surface water flow regimes and the proposal will not require extraction of groundwater, the proposal is not expected to adversely impact these potential GDEs.



Glossary

ARTC	Australian Rail Track Corporation
AUSRIVAS	Australian River Assessment System
BAR	Biodiversity Assessment Report
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CMA Subregion	Catchment Management Authority Subregion
DECC	NSW Department of Environment and Climate Change (now OEH)
DoEE	Commonwealth Department of the Environment and Energy
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
EP	Endangered Population
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
FBA	Framework for Biodiversity Assessment
FM Act	Fisheries Management Act 1994
GDE	Groundwater Dependent Ecosystem
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
KP	Kilometre point (rail line kilometrage)
LGA	Local Government Area
LPI	Land and Property Information
MGA	Map Grid of Australia
MNES	Matters of national environmental significance
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
PCT	Plant Community Type
PMST	Protected Matters Search Tool
proposal	Construction and operation of the Parkes to Narromine section of the Melbourne to Brisbane Inland Rail.
proposal area	The area of impact within the proposal boundary.
SPRAT	Species Profile and Threats Database (Commonwealth)
SSI	State Significant Infrastructure
Strahler Stream Order	Classification system that gives a waterway an 'order' according to the number of tributaries associated with it. Mapped at 1:50 000 scale
TEC	Threatened Ecological Community
TSC Act	Threatened Species Conservation Act 1995 (NSW)



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1.0 Introduction

The Australian Government has committed to delivering a significant piece of national transport infrastructure by constructing a high performance and direct interstate freight rail corridor. The Inland Rail programme (Inland Rail) involves the design and construction of a new inland rail connection, about 1,700 kilometres long, between Melbourne and Brisbane, via central-west New South Wales (NSW) and Toowoomba in Queensland. Inland Rail would enhance Australia's existing national rail network and serve the interstate freight market.

Australian Rail Track Corporation Ltd (ARTC) has sought approval to construct and operate the proposal.

The proposal requires approval from the NSW Minister for Planning under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

This report has been prepared by Umwelt Australia Pty Ltd (Umwelt) as part of the environmental impact statement (EIS) for the proposal. The EIS has been prepared to accompany the application for approval of the proposal, and address the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 8 November 2016 and the terms of the assessment bilateral agreement between the Commonwealth and the State of New South Wales under the EPBC Act.

1.1 The proposal

1.1.1 Location

The proposal is generally located in the existing rail corridor between the towns of Parkes and Narromine, via Peak Hill. In addition, a new connection to the Broken Hill rail line ('the Parkes north west connection') is proposed outside the existing rail corridor at the southern end of the proposal site near Parkes. The location of the proposal is shown in **Figure 1.1**.

1.1.2 Key features

The key features of the proposal involve:

- upgrading the track, track formation, and culverts within the existing rail corridor for a distance of 106 kilometres between Parkes and Narromine
- realigning the track where required within the existing rail corridor to minimise the radius of tight curves
- providing three new crossing loops within the existing rail corridor, at Goonumbla, Peak Hill, and Timjelly
- providing a new 5.3 kilometre long rail connection to the Broken Hill Line to the west of Parkes ('the Parkes north west connection'), including a road bridge over the existing rail corridor at Brolgan Road ('the Brolgan Road overbridge').

The key features of the proposal are shown in **Figure 1.2**.



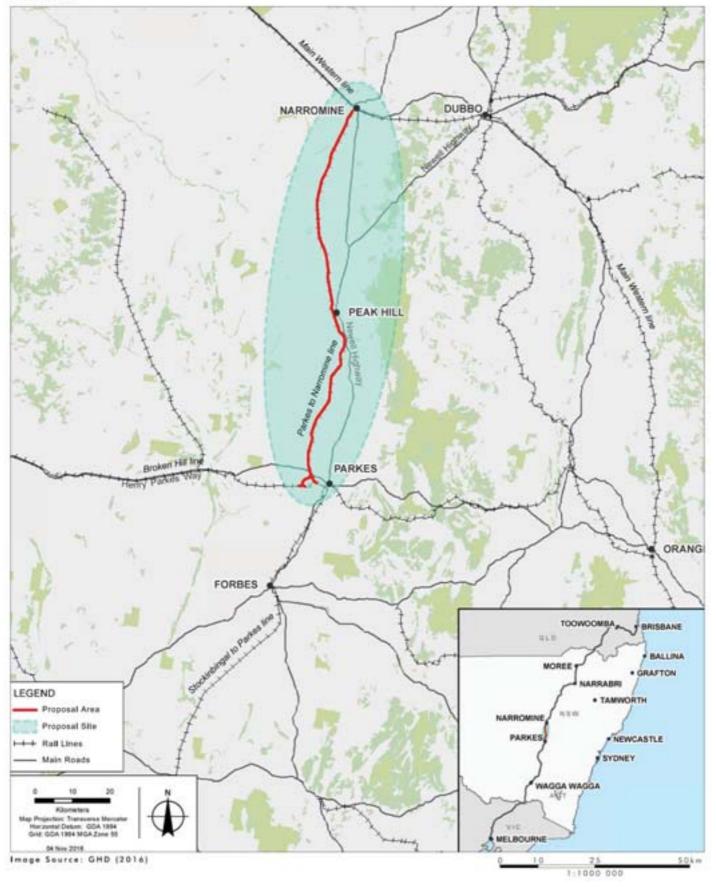
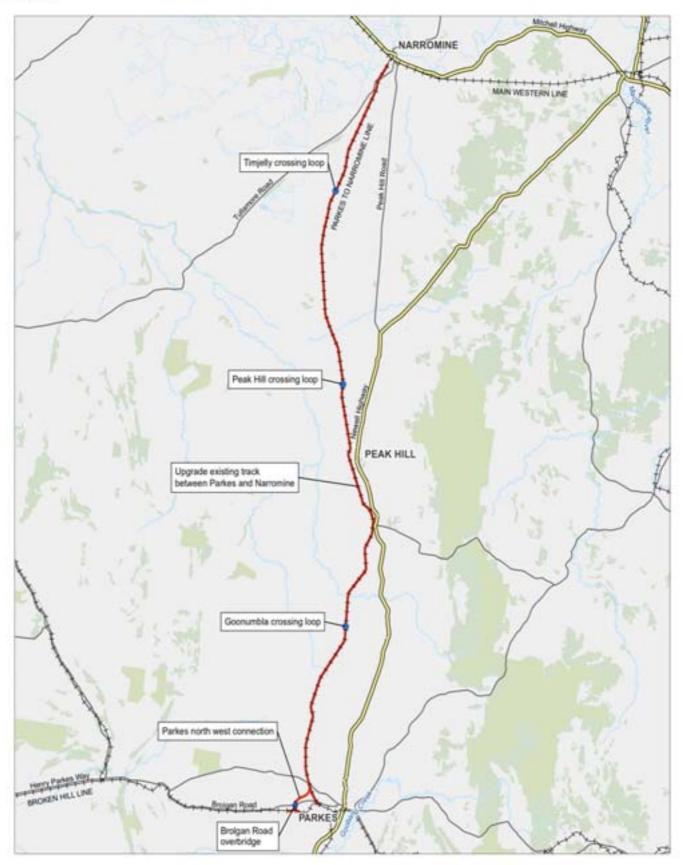


FIGURE 1.1

Location of the Proposal





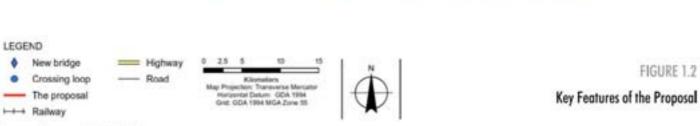


Image Source: GHD [2017]



Ancillary work would include works to level crossings, signalling and communications, signage and fencing, and services and utilities.

Further information on the proposal is provided in the EIS.

1.1.3 Timing

Subject to approval of the proposal, construction is planned to start in early to mid 2018, and is expected to take about 18 months. Existing train operations along the Parkes to Narromine line would continue prior to, during, and following construction. Inland Rail as a whole would be operational once all 13 sections are complete, which is estimated to be in 2025.

1.1.4 Operation

Prior to the opening of Inland Rail as a whole, the proposal would be used by existing rail traffic, which includes trains carrying grain and ore at an average rate of about four trains per day. It is estimated that the operation of Inland Rail would involve an annual average of about 8.5 trains per day in 2025, increasing to 15 trains per day in 2040. The trains would be a mix of grain, intermodal (freight), and other general transport trains.

1.2 Purpose and Scope of this Report

This report provides the results of the Aquatic Ecology Assessment of the proposal. It addresses the specific requirements of the SEARs and the submission from the Department of Primary Industries (Fisheries) (DPI – Fisheries) in relation to aquatic ecology as summarised in **Table 1.1**.

Specifically, this assessment:

- describes the existing aquatic environment in terms of ecological values, including type and condition
 of aquatic habitats and groundwater dependent ecosystems, with a particular focus on waterway
 crossings
- determines the presence or likelihood of occurrence of threatened species, populations and Endangered Ecological Communities (EECs) as listed under the Fisheries Management Act 1994 (FM Act)
- determines the presence or likelihood of occurrence of matters of national environmental significance (MNES) as listed under the Environment Biodiversity and Conservation Act 1999 (EPBC Act)
- identifies threatened fish species, populations and ecological communities within the proposal area that have the potential to be impacted by the proposal, and
- assesses the impact of the proposal on threatened fish species, populations and ecological communities.



Table 1.1 Relevant SEARs

Agency/Key Issue/Requirements for Aquatic Ecology	Y +	Where addressed in this report
DPE SEARs – Biodiversity		
The Proponent must assess any impacts on biodiversity values not covered by the FBA as specified in s2.3.	S	Section 4
The Proponent must identify whether the Project as a whole, or any component of the Project, would be classified as a Key Threatening Process in accordance with the listing in the <i>Threatened Species Conservation Action 1995</i> (TSC Act), <i>Fisheries Management Act 1994</i> (FM Act) and <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).		Section 4
Guidelines:	<u> </u>	This report
 Framework for Biodiversity Assessment – Appendix 2 (OEH, 2014); Policy and Guidelines for Fish Habitat Conservation and Management - Update (DPI, 2013); Why do fish need to cross the road? Fish passage requirements for waterway crossings (NSW Fisheries 2003); and 	70	
Aquatic Ecology in Environmental Impact Assessment EIA Guideline (Marcus Lincoln Smith 2003). DE SEABLE Districted and Societive Lands		
Dre Scans – riotected and Sensitive Lands		
The Proponent must assess the impacts of the Project on environmentally sensitive land and processes (and the impact of processes on the Project) including, but not limited to: (a) protected areas (including land and water) managed by OEH and/or DPI Fisheries under the <i>National Parks and Wildlife Act 1974</i> ; (b) Key Fish Habitat as mapped and defined in accordance with the <i>Fisheries Management Act 1994</i> (FM Act); (c) waterfront land as defined in the <i>Water Management Act 2000</i> ; (d) land or waters identified as Critical Habitat under the TSC Act, FM Act or EPBC Act; and (e) biobank sites, private conservation lands and other lands identified as offsets.	life Act	Section 4 addresses aspects relevant to aquatic ecology



Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report
DPE SEARs – Water Hydrology	
The Proponent must describe (and map) the existing hydrological regime for any surface and groundwater resource (including reliance by users and for ecological purposes) likely to be impacted by the Project, including stream orders, as per the FBA.	Section 3 addresses aspects relevant to aquatic ecology
The Proponent must assess (and model if appropriate) the impact of the construction and operation of the Project and any ancillary facilities (both built elements and discharges) on surface and groundwater hydrology in accordance with the current guidelines, including:	Section 4 addresses aspects relevant to aquatic ecology
(a) natural processes within rivers, wetlands, estuaries, marine waters and floodplains that affect the health of the fluvial, riparian, estuarine or marine system and landscape health (such as modified discharge volumes, durations and velocities), aquatic connectivity and access to habitat for spawning and refuge;	
(b) direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses;	
Guidelines:	Section 3 and 4
 Framework for Biodiversity Assessment – Appendix 2 (OEH, 2014) Risk assessment Guidelines for Groundwater Dependent Ecosystems (Office of Water, 2012). 	
Department of Primary Industries (Water)	
Assessment of impacts on surface and ground water sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.	Section 4 addresses aspects relevant to aquatic ecology
Department of Primary Industries (Fisheries)	
The environmental assessment should specifically address the impacts on the aquatic ecology, waterway crossings and riparian buffer zones.	Section 4 addresses aspects relevant to aquatic ecology

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Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report
General Aquatic Ecological Assessment The aquatic ecological environmental assessment should include the following information:	Section 3
• A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided.	Section 3
 Area which may be affected either directly or indirectly by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs). 	Figure A.1
 Waterways within the area of development are to be identified. 	Section 3
 Description and quantification of aquatic and riparian vegetation should be presented and mapped. This should include an assessment of the extent and condition of riparian vegetation and the extent and condition of freshwater aquatic vegetation and the presence of significant habitat features (e.g. gravel beds, snags, reed beds, etc). 	Section 3. Appendix A provides maps of each watercourse.
 Quantification of the extent of aquatic and riparian habitat removal or modification which will result from the proposed development 	Section 4
 Details of the location of all waterways crossings and construction designs, such as bridges, culverts, or temporary access tracks. 	Section 3
 Aspects of the management of the Project, both during construction and after completion, which relate to impact minimisation. 	Section 4



Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report
Waterway Crossings DPI Fisheries need to be consulted with regards to the crossing methodology and site specific mitigation measures for replacement of culverts and bridges in watercourses that are considered to be Key Fish Habitat. The design and construction of bridges, culverts, and temporary access tracks across all waterways should be undertaken in accordance with the Department's Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013). The replacement of waterway crossings needs to ensure that the works are undertaken with minimal impact on the aquatic environment within the immediate vicinity of the proposed works. The environmental assessment should provide details on methods of dredging, duration and timing of works, and the proposed mitigation measures to protect riparian and aquatic habitat. Another concern is the requirement to avoid temporary waterway crossings for heavy machinery wherever possible. DPI Fisheries should be consulted with regards to any temporary measures that will result in blocking fish passage. This includes coffer dams, temporary access tracks or redirecting flows whilst works are conducted.	Section 4 addresses aspects relevant to aquatic ecology
Riparian Buffer Zones DPI Fisheries policy advocates the use of terrestrial buffer zones as per the Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013) available on the Department's website at http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-andmanuals/fish-habitat-conservation which states that "NSW DPI will generally require riparian buffer zones to be established and maintained for developments or activities in or adjacent to TYPE 1 or 2 habitats or CLASS 1-3 waterways." The department anticipate that adequate riparian buffer zones will be maintained adjacent to the 29 watercourses that will be crossed as part of this Project.	Section 4



Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report
Department of Primary Industries (Attachment A)	
Relevant Policies and Guidelines	This report
The EIS should take into account the following policies (as applicable):	
 Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012) 	
 NSW State Rivers and Estuary Policy (1993) 	
 NSW Wetlands Policy (2010) 	
 NSW State Groundwater Policy Framework Document (1997) 	
 NSW State Groundwater Quality Protection Policy (1998) and 	
 NSW State Groundwater Dependent Ecosystems Policy (2002). 	
Groundwater Dependent Ecosystems	Section 3.4
The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:	
 Identify any potential impacts on GDEs as a result of the Project including: 	
o the effect of the Project on the recharge to groundwater systems	
 the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections and 	
$\circ~$ the effect on the function of GDEs (habitat, groundwater levels, connectivity).	
 Provide safeguard measures for any GDEs. 	



4	Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report
>	Watercourses, Wetlands and Riparian Land	Appendix A provides
⊢ :=	The EIS should address the potential impacts of the Project on all watercourses likely to be affected by the Project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses	maps of each watercourse.
О	potentially affected by the Project, including:	Descriptions of the
•	Scaled plans showing the location of:	watercourse and riparian corridor are
	o wetlands/swamps, watercourses and top of bank;	provided in Section 3.
	o riparian corridor widths to be established along the creeks;	Impact assessment
	 existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed); 	provided in Section 4 .
	o the site boundary, the footprint of the Project in relation to the watercourses and riparian areas; and	
	o proposed location of any asset protection zones.	
•	• Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken;	
•	• A detailed description of all potential impacts on the watercourses/riparian land;	
•	 A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands. 	
•	• A description of the design features and measures to be incorporated to mitigate potential impacts.	
•	 Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains. 	

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1.3 Proposal Area Information

For the purposes of this assessment, the proposal area represents the area within the existing rail corridor, particularly focused on where the proposal area overlays mapped watercourses. The proposal area is shown on **Figure 1.3** and in **Appendix A**.

1.3.1 Location

The proposal would generally be located within the rail corridor between Parkes and Narromine in the central-west of NSW (refer to **Figure 1.1**).

Parkes, at the southern end of the proposal (**Figure 1.1** and **Figure 1.3**), is located close to the geographical centre of NSW, about 784 kilometres south-west of Brisbane, 290 kilometres west of Sydney and 594 kilometres north-east of Melbourne. The rail corridor passes through the small town of Peak Hill, approximately 47 kilometres north of Parkes, and 55 kilometres south of Narromine (**Figure 1.3**). The proposal ends at Narromine approximately 100 kilometres north of Parkes (**Figure 1.3**). The important regional service centre of Dubbo is located about 37 kilometres east of Narromine.

The southern section of the proposal is in the Parkes local government area (LGA) and the northern section in the Narromine LGA. The two LGAs are predominantly rural, with the main regional land uses based around agriculture (mainly wheat, fruit and wool) with some mining and urban land uses associated with the rural towns.

The proposal area is generally defined by fences located approximately 20 metres either side of the rail line, however in some sections where fences are not present the rail corridor may be wider, extending out to about 30 to 40 metres from the rail line. The proposal area varies along the length of the rail alignment depending on the construction activities that are to take place in any given area. A new Parkes north west connection is also proposed at the southern end of the proposal area.

1.3.2 Topography and Natural Features

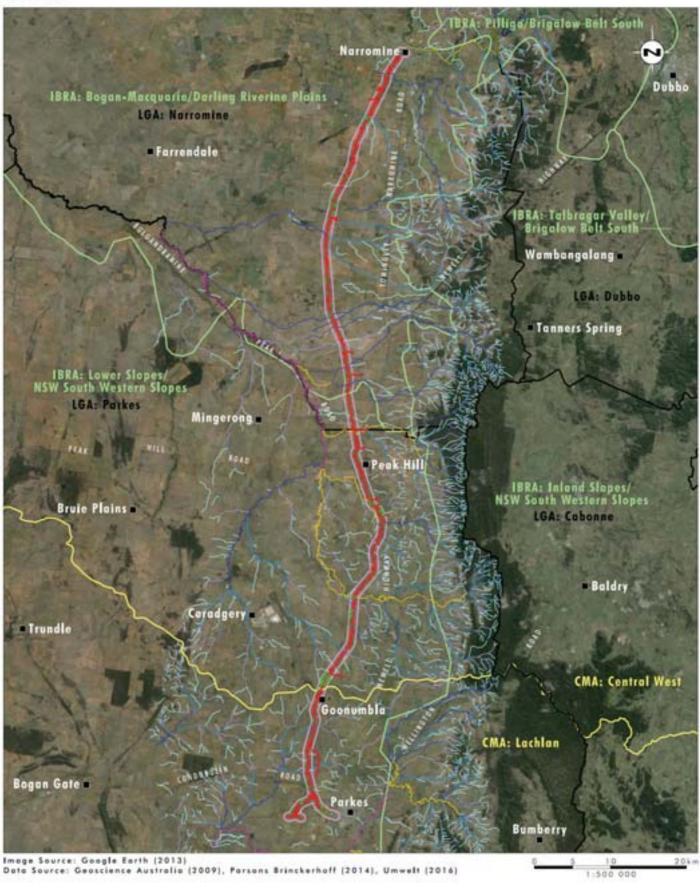
The proposal area is dominated by open flat plains that grade from Parkes at an approximate altitude of 330 metres above sea level (ASL), down towards Narromine at an approximate altitude of 230 metres ASL.

The proposal crosses 29 watercourses including major creeks (such as Burrill Creek, Stanfords Creek, Barrabadeen Creek, Tomingley Creek and Yellow Creek) and other watercourses, the majority of which are ephemeral.

The southern extent of the project (at Parkes) is situated in the Lachlan River sub-catchment of the Murrumbidgee River catchment in the Murray-Darling basin. The main watercourse in Parkes is Goobang Creek that flows from Goobang National Park, to the north east of Parkes, around the southern end of town before flowing south west (refer to **Figure 1.4**). Ridgey Creek, a tributary of Goobang Creek, flows parallel to and to the west of the existing rail corridor north west of Parkes (refer to **Figure 1.4**). Goobang Creek flows into the Lachlan River near Condobolin.

Watercourses around and north of Peak Hill area all flow to the Bogan River. Named tributaries of the Bogan River that occur within the proposal area include Cookopie Creek, Burrill Creek, Ten Mile Creek, Barrabadeen Creek, Bulldog Creek, Gundong Creek, Tomingley Creek and Bradys Cowal (refer to **Figure 1.4**). The Bogan River starts in Herveys Range in Goobang National Park to the east of Peak Hill. It flows to the north west through the towns of Nyngan and Gongolgon to join the Darling River near Bourke (Green et al 2011a). It is part of the Macquarie-Bogan sub-catchment in the Darling River catchment of the Murray-Darling Basin (Green et al 2011a).

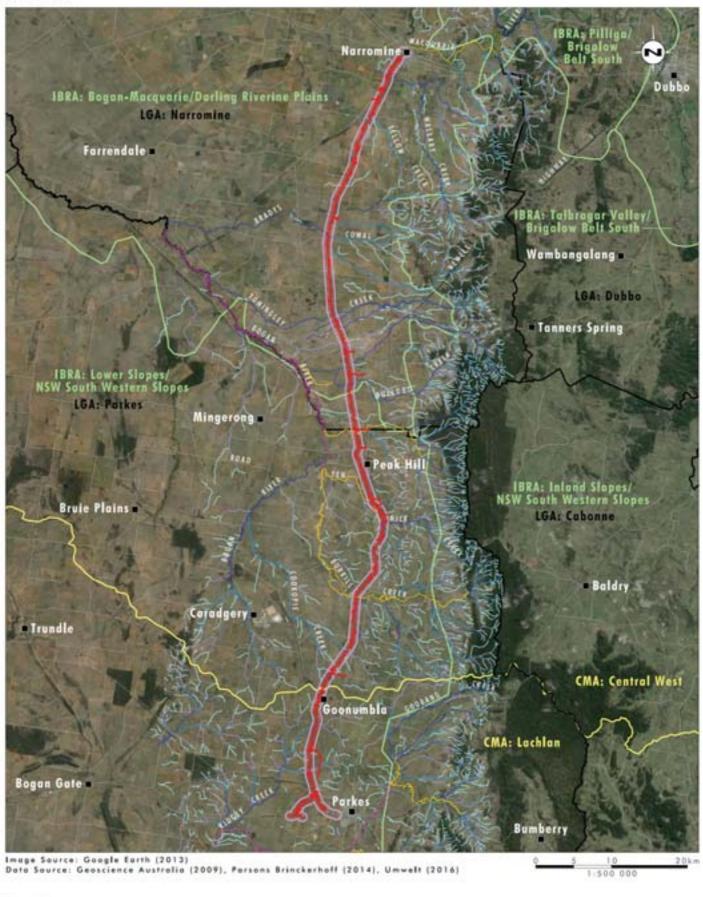






Stream Order: Proposal Area 550m Buffer Area 1st Order FIGURE 1.3 2nd Order IBRA Regions and Subregion Areas Local Government Area 3rd Order Parkes to Narromine Catchment Management Authority 4th Order Proposal Area Native Vegetation Area 5th Order - 6th Order ■ Town Location





Legend

Proposal Area Streem Order: 550m Buffer Ares 1st Order 18RA Regions and Subregion Areas 2nd Order Local Covernment Area 3rd Order Catchment Management Authority 4th Order Creek Line 5th Order # Town Location 6th Order

FIGURE 1.4

Parkes to Narromine Proposal Area - Watercourses



Narromine is located on the banks of the Macquarie River (refer to **Figure 1.4**). Downstream of Narromine, the Macquarie River flows to the north west across alluvial plains to the Barwon River near Bourke (Green et al 2011a). The Ramsar listed Macquarie Marshes are located on the Macquarie River between Marebone Weir and Carinda, over 100 kilometres downstream of Narromine. The marshes are a large wetland complex of shallow swamps, lagoons, creeks and floodplains that cover more than 200,000 hectares when fully flooded (Green et al 2011a).

The proposal is located within the Central Lachlan Fold Belt. Near surface materials include Tertiary to Quaternary aged red silty alluvium over folded and faulted Silurian and Ordovician aged sedimentary and minor metamorphic sequences which outcrop intermittently along the alignment (GHD 2014). Thick reactive brown and grey clay soils are predominantly associated with the near level terrain north of about Peak Hill while moderately thick red and brown sandy and silty clay soils are typically associated with the undulating terrain south of about Peak Hill (GHD 2014).

Much of the Bogan River catchment is underlain by fractured rock which yields very little groundwater, with aquifers in the alluvium being thin and low yielding (Green et al 2011a).

The majority of the existing rail corridor has been heavily modified by past and ongoing rail disturbances and surrounding agricultural activities. Clearance and maintenance of the rail corridor has resulted in the fragmentation and subsequent high disturbance and degradation of vegetation communities. Beyond the proposal area, the area is in relatively poor condition with a long history of broad scale cultivation and other agricultural activities, with significant cotton, wheat and livestock industries.

Patches of native vegetation exist sporadically within the proposal area and are sometimes connected to small woodland patches in adjacent agricultural land. These patches generally comprised a woodland community with the dominant canopy species including inland grey box (*Eucalyptus microcarpa*), fuzzy box (*Eucalyptus conica*) and yellow box (*Eucalyptus melliodora*). Patches of weeping myall (*Acacia pendula*) were also recorded within the proposal area (Umwelt 2016a). Full description of the vegetation within the proposal area is provided in the Biodiversity Assessment Report (BAR) (Umwelt 2016a).

A summary of the landscape features is provided in **Table 1.2**.



Table 1.2 Proposal area in the Landscape

	Existing Rail Corridor Location (KP)		
	449 – 466.5	466.5– 509	508.5– 555.5
IBRA Bioregion	NSW South Western Slopes	NSW South Western Slopes	Darling Riverine Plains
IBRA Subregion	Lower Slopes	Lower Slopes	Bogan Macquarie
Catchment Management Authority	Central West	Central West	Central West
Mitchell Landscapes	Bimbi Plains Goonumbla Hills	Bogan Alluvial Plains Goonumbla Hills	Bogan Alluvial Plains Bogan Channels and Floodplains Boggy Cowal Alluvial Plains Boggy Cowal Channels and Floodplains Narromine Hills
LGA	Parkes	Parkes/Narromine	Narromine
Catchment	Lachlan River	Bogan River	Bogan/Macquarie River

1.4 Legislative Context

1.4.1 State

1.4.1.1 Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) and the Environmental Planning and Assessment Regulation 2000 (the Regulation) provide the framework for development assessment in NSW. The EP&A Act and the Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision making process prior to proceeding to construction.

Part 5 of the EP&A Act defines the assessment process for projects that do not require development consent. In accordance with the requirements of section 112, ARTC has formed the opinion that the proposal has the potential to significantly affect the environment. As a result, an EIS is being prepared.

Under section 115U(3), development may be declared to be State Significant Infrastructure if it is development 'that a State environmental planning policy permits to be carried out without development consent under Part 4: (a) infrastructure, (b) other development that (but for this Part and within the meaning of Part 5) would be an activity for which the proponent is also the determining authority and would, in the opinion of the proponent, require an environmental impact statement to be obtained under Part 5.' As noted above, ARTC is of the opinion that an EIS is required and given that clause 14 and



Schedule 3 of *State Environmental Planning Policy (State and Regional Development) 2011* (see **Section 1.4.1.3**) permit the proposal to be carried out without development consent, the proposal is declared State Significant Infrastructure and under section 115W of the EP&A Act, the approval of the NSW Minister for Planning is required.

Under section 115ZG of the EP&A Act, a number of authorisations and the provisions of any act that may prohibit a State Significant Infrastructure proposal, do not apply.

1.4.1.2 Fisheries Management Act 1994

The Fisheries Management Act 1994 (FM Act) provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. The FM Act establishes mechanisms for:

- the listing of threatened species, populations and ecological communities or key threatening processes
- the declaration of critical habitat, and
- consideration and assessment of threatened species impacts in the development assessment process.

Section 3.3 of this report identifies threatened species, populations and communities likely to occur in the proposal area and **Section 4.6** of this report assesses likely impacts of the proposal in accordance with section 5A of the EP&A Act.

Division 3 of the FM Act provides for the conservation of the biodiversity of fish and aquatic vegetation and protection of fish habitat though management of dredging and reclamation works. Upgrades of waterway structures such as bridges or culverts and the upgrade or construction of waterway crossings would require 'dredging' (excavation of water land or removal of material from water land) or 'reclamation' (using material to fill/reclaim or depositing material to construct anything other water land). Under section 199 a public authority must notify Fisheries and consider any matters raised by the department prior to carrying out dredging or reclamation work. **Section 3** of this report describes aquatic habitats and **Section 4** describes proposed works within the waterways.

Any upgrades of waterway structures and/or crossings will need to consider fish habitat class and the use of an appropriately designed structure that does not obstruct fish passage. **Section 3** of this report describes fish habitat class and **Section 4** identifies appropriately designed structures for waterways.

1.4.1.3 Summary of State Legislative Context

In summary, the proposal is declared State Significant Infrastructure and an EIS is being prepared under Part 5.1 of the EP&A Act. The environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs) have been issued and this report will consider those requirements as relevant to aquatic habitat (**Table 1.1**) including impact on threatened fish, population and ecological communities as listed under the FM Act and consideration of the protection and management of fish habitat and fish passage.



1.4.2 Commonwealth

1.4.2.1 Environment Protection and Biodiversity Conservation Act 1999

The Environment Biodiversity and Conservation Act 1999 (EPBC Act) is the primary piece of Federal legislation relating to the environment. Under the EPBC Act any 'action' that is has, or is likely to have, a significant impact on a matter of national environmental significance (MNES) requires approval from the Commonwealth Minister for the Environment. An 'action' is defined as a project, development, undertaking, activity (or series of activities), or alteration of any of these. These matters are:

- listed threatened species and communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Great Barrier Reef Marine Park
- nuclear actions and
- a water resource, in relation to coal seam gas development and large coal mining development.

The Action (that is, the proposal as described in **Section 1.1**) was deemed to comprise a 'Controlled Action' by DoEE on 11 October 2016, due to the potential for significant impacts on the following matters protected under the EPBC Act:

• listed threatened species and communities (18 and 18A).

DoEE considers the proposed action is likely to have a significant impact on MNES, including but not limited to:

- the removal of up to 33.82 ha of critically endangered White Box-Yellow box Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community
- the removal of up to 41.67 ha of endangered Grey Box (*Eucalyptus microcarpa*) Grassy woodlands and Derived Native Grasslands of South-eastern Australia
- the removal of over 60 ha of known foraging habitat for the Superb Parrot (Polytelis swainsonil), and
- the removal of approximately 15 ha of known foraging habitat for the Regent Honeyeater (*Anthochaera phrygia*), and Swift Parrot (*Lathamus discolor*).

The Department considers that *Tylophora linearis* may be present within the proposed action area and a significant impact on this species from the proposed action is possible. The controlling provisions do not relate to aquatic species or communities that are the subject to this report, however an assessment of the impact of the proposal on aquatic MNES is provided in **Section 4.4**.



2.0 Assessment Methodology

2.1 Literature and Database Review

A desktop review of previous documents and reports relevant to the proposal was undertaken. The following public ecological database searches were undertaken:

- a 10 kilometre buffer search from the existing rail corridor on the Commonwealth Department of the Environment Protected Matters Search Tool (DoE 2016 accessed 1 April 2016)
- a search of the Parkes and Narromine Local Government Areas (LGAs) using the Primary Industries Fishing and Aquaculture Records Viewer (DPI 2016).

Relevant documents included:

- Melbourne Brisbane Inland Railway Parkes to Narromine and Narrabri to North Star Ecological Investigations (Umwelt 2014a)
- Water Resources and Management Overview: Macquarie-Bogan catchment (Green et al 2011a)
- Water Resources and Management Overview: Lachlan catchment (Green et al 2011b)
- Key Fish Habitat mapping for Parkes and Narromine LGAs as prepared by DPI
- Tomingley Gold Project Ecology Assessment (OzArk Environmental & Heritage, 2011)
- Tomingley Gold Project Surface Water Assessment (SEEC, 2011)
- Online publications and determinations for threatened fish, endangered populations and ecological communities as listed under the FM Act and the EPBC Act.

The information obtained was used to inform survey design, and was also used to assist in the description of ecological context, assessment of potentially occurring threatened species, endangered populations (EPs) and Threatened Ecological Communities (TECs).

2.2 Stream Order Mapping

In characterising the watercourses in the area, consideration has to be given to the Strahler ordering system, as described in *NSW Government Gazette no. 37* on 24 March 2006.

The Strahler ordering system is a hierarchical numbering system based on the degree of branching within a watercourse and provides an indication of the complexity of a creek system. The methodology used is as follows:

- at its origin, a watercourse is numbered as first order. The watercourse remains first order until it joins another watercourse
- if the watercourse joins another first order watercourse, downstream of the confluence is deemed second order. The confluence of two watercourses with a similar order results in the order increasing by one, so that two second order streams joining will result in a third order stream, and so on, moving downstream



 where a watercourse of a higher order joins with a lower order watercourse, downstream of the confluence remains at the higher order.

The Strahler stream orders have been assigned to Land and Property Information (LPI) natural drainage line layer, based on the Strahler number algorithm, using in-house Microstation tools. The first stream order has been manually assigned for irrigation channels and other artificial drainage lines. Stream orders have been mapped at 1:50000 scale.

2.3 Aquatic Habitat Description and Mapping

Preliminary mapping of the broad scale aquatic habitats within the proposal area was undertaken using recent aerial photography in conjunction with topographic maps prior to field surveys. Topographic maps were used to gain a broad understanding of catchment characteristics including adjacent land use, elevation, access routes, distance from source and location of barriers to fish passage, such as dams and weirs.

An assessment of the aquatic habitat characteristics within each of the sampling sites was undertaken, and indicators of stream condition were also noted. The aquatic habitat characteristics were recorded using standard recording sheets (adapted from those developed for the AUSRIVAS sampling protocol available as a web resource (AUSRIVAS 2007)).

Some of the habitat features and stream condition indicators assessed included:

- characteristics of bed substrate
- presence of in-stream woody debris
- presence of gravel beds
- presence of drought and flood refuge areas
- depth of water
- width of channel
- presence of pool, riffle and edge habitats
- height of bank and evidence of erosion
- channel geomorphology
- evidence of sediment deposition
- degree of bank erosion
- the presence of natural or artificial barriers to fish passage upstream and downstream
- colour and clarity of water, and any visual evidence of water quality
- characteristics of in-stream, riparian and floodplain vegetation.



Detailed assessments were undertaken at two locations along the alignment at Burrill Creek and the Backwater Cowal near Narromine as these sites were identified as containing permanent or semi-permanent aquatic habitats.

2.4 Riparian and Aquatic Vegetation Survey and Mapping

The riparian and aquatic vegetation were surveyed in conjunction with plot/transect data collected to inform the Biodiversity Assessment Report (BAR) (Umwelt 2016a). These surveys were undertaken over 15 days and two survey periods, being: 11 to 21 January 2016 and 2 to 5 May 2016.

At each plot/transect data was recorded according to Section 5 of the Framework for Biodiversity Assessment (FBA) (OEH 2014). This involved setting out 20 x 50 metre and 20 x 20 metre plots and a 50 metre transect. The location of each quadrat was recorded using a hand-held GPS with accuracy of ± 5 metres. The Map Grid of Australia (MGA) coordinate system was used. The location of the 19 plots/transects undertaken within the proposal area for the BAR is shown on **Figure A1** to **A21**, **Appendix A**.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of the shrub, mid-storey, canopy and emergent layers were also thoroughly examined. Effort was made to search the tree canopy and tree trunks for mistletoes, vines and epiphytes. Full details of the survey effort and data collected are provided in Section 2.3.3 of the BAR (Umwelt 2016a).

2.4.1 Semi-quantitative Rapid Sampling

15 rapid vegetation assessments completed within the proposal area (refer to **Figure A1** to **A21**, **Appendix A**) for the biodiversity assessment assessed riparian vegetation. Assessment areas were not fixed area-based, but were generally confined to an area similar to that of a 20 x 20 metre quadrat. These surveys were undertaken over three days between 16 and 18 September 2014 as part of the ecological constraints analysis undertaken by Umwelt (2014a).

Rapid sampling was used in combination with rapid reconnaissance and meandering transects primarily to assist in the delineation and refinement of vegetation mapping with respect to the distribution of native and non-native vegetation areas. Rapid vegetation assessment points were located within distinct vegetation community units (rather than within ecotones) to allow data collection for each community without confounding effects from adjacent communities. Dominant, common and some uncommon plant taxa were recorded within each rapid vegetation assessment points. The vegetation structure at each rapid vegetation assessment point was documented, including the dominant species in each stratum.

2.4.2 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the proposal area for the BAR (Umwelt 2016a). Vegetation mapping involved the following key steps:

- preliminary review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- preliminary review of the modelled distribution of vegetation communities as part of the Reconstructed and Extant Distribution of Native Vegetation in the Lachlan Catchment (DEC 2006)



- predicting the distribution of particular vegetation communities based on understanding the distribution of Biometric vegetation types (OEH 2014b)
- preparation of draft vegetation community map based on interpretation of digital airborne imagery and preliminary delineation of vegetation community floristics
- ground-truthing of vegetation map based on survey effort documented in the BAR (Umwelt 2016a)
- revision of vegetation community floristic delineations based on plot data
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Communities were named in accordance with their site character, with consideration of the naming conventions of those vegetation communities identified by the NSW Biometric vegetation types database (OEH 2014b).



3.0 Results

3.1 Catchment Description and Waterway Classification

As noted in **Section 1.4.2**, the proposal falls within two main sub-catchment areas of the Murray-Darling basin, being the Lachlan and the Macquarie-Bogan. The southern extent of the proposal (around Parkes) is situated in the Lachlan River sub-catchment of the Murrumbidgee River catchment in the Murray-Darling basin. Between Goonumbla and Peak Hill the existing rail corridor crosses into the Macquarie-Bogan catchment with the majority of watercourses along intersected by the existing rail corridor draining to the west or north west into the Bogan River. Approximately 20 kilometres south of Narromine the existing rail corridor crosses into the Macquarie River catchment.

The existing rail corridor crosses 29 watercourses and there are two watercourses within the proposal area flowing parallel to the existing rail corridor (Ridgey Creek and an un-named drainage line). The 31 watercourses include: 11 first order streams; three second order streams; five third order streams; eight fourth order streams; and four fifth order streams. **Figure A1** to **A21** in **Appendix A** and **Table 3.1** provide details of the location of the watercourse crossings (based on the rail corridor kilometrage from south to north), Strahler stream order, the existing watercourse crossing structure, brief descriptions of the catchment, vegetation mapping in the rail corridor and a representative photo of the watercourse and/or structure in the rail corridor. Photographs were sourced from ecological investigations in the rail corridor and/or high level flood investigations undertaken by Umwelt in 2014 (Umwelt 2014b). Descriptions of the catchment were based upon an analysis of topographic maps and aerial photography.



Table 3.1 Watercourses along alignment and description of existing structures and catchment

Photos		Downstream of existing rail corridor	
Vegetation Mapping in Corridor ¹		Cleared/Non- native Vegetation with Zone 14 PCT276 Yellow Box Grassy Tall Woodland, Figure A2	Cleared/Non- native Vegetation, Figure A3
Catchment Description		Flat plain, cleared for agriculture.	Tributary of Ridgey Creek. Instream dams upstream and down; agricultural land.
Strahler Order		Second	First order
Structure		Cement bridge	Timber Bridge, 30m Iong Goobang Junction
Watercourse	Lachlan River Catchment	Unnamed	Unnamed
KP	Lachlan Ri	452.721	454.844



Photos		
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A3	Cleared/non native vegetation and Zone 15 PCT276 Yellow Box Grassy Tall Woodland — Derived Native Grassland, Figure A3.
Catchment Description	Flat plain. Tributary of Ridgey Creek. Numerous in-stream dams; agricultural land and cleared land with some scattered trees.	Flat plain. Tributary of Ridgey Creek. In-stream dams upstream and down; cleared land with some scattered trees upstream.
Strahler Order	Third Order	First Order
Structure	corrugated pipes, 24m	Pipes
Watercourse	Unnamed	Unnamed
КР	455- 455.5	456.992



Photos		Not available
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation with Zone 8 PCT76 Western Grey Box Tall Grassy Woodland – Derived Native Grassland,	Cleared/Non- native Vegetation, Figure A4
Catchment Description	Tributary of Ridgey Creek. Instream dams upstream and down; agricultural land and/or cleared land with some scattered trees upstream; quarry upstream. Headwaters in Currumbenya Range.	Tributary of Ridgey Creek. Instream dams upstream and down; agricultural land and/or cleared land with some scattered trees upstream.
Strahler Order	Third Order	First Order
Structure	Timber bridge, 18m	1
Watercourse	unnamed	Unnamed
КР	461.157	464



Photos			View of crossing looking north
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A5		Cleared/Non- native Vegetation, Figure A6
Catchment Description	Tributary of Ridgey Creek. Instream dams upstream and down; agricultural land and/or cleared land with some scattered trees upstream. Locality of Goonumbla.		One of the first order tributaries of Cookopie Creek. In-stream dams upstream and down; agricultural land; cleared land with some scattered trees and stands of remnant vegetation upstream.
Strahler Order	First Order		First
Structure	Four box culverts, 15m		Timber bridge, 24.5m
Watercourse	Unnamed	Bogan River Catchment	unnamed
КР	464.69	Bogan Rive	468.565



Photos	Watercourse downstream of existing rail corridor	
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A6	Cleared/Non- native Vegetation, Figure A7
Catchment Description	One of the first order tributaries of Cookopie Creek. In-stream dams upstream and down; agricultural land; cleared land with some scattered trees upstream.	Tributary of Cookopie Creek. In-stream dams upstream and down; agricultural land; cleared land with some scattered trees upstream.
Strahler Order	First order	Third
Structure	Pipes	Concrete bridge, 17m
Watercourse	unnamed	Unnamed
Ą	469.524	472.047



Photos	Not available	View of watercourse looking north along the existing rail corridor.
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A7	Cleared/Non- native Vegetation with stand of native vegetation upstream, Figure A9.
Catchment Description	One of the first order tributaries of Cookopie Creek. In-stream dam upstream; agricultural land upstream.	Tributary of Burrill Creek (downstream of 476-477). In-stream dams upstream; agricultural land; cleared land with some scattered trees upstream.
Strahler Order	First order	Third order
Structure	ı	Timber bridge, 18m long Mickibri underbridge
Watercourse	Unnamed	unnamed
KP	472- 472.5	478.262



Photos	Burrill Creek downstream from existing rail corridor View of crossing structure from upstream.
Vegetation Mapping in Corridor ¹	Zone 2 PCT36 River Red Gum Tall to Very Tall Open Forest Woodland, Figure A9
Catchment Description	Remnant vegetation retained along creek and in the Herveys Range in the headwaters of Burrill Creek. Dams in tributaries upstream. Agricultural land; cleared land with some scattered trees upstream.
Strahler Order	order
Structure	Concrete bridge, 40m long
Watercourse	Burrill Creek
KP	479.346



Photos	Not available	
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A11	Cleared/Non- native Vegetation, Figure A11
Catchment Description	Tributary of Hallinans Creek that flows on the eastern edge of the rail corridor in an area identified for temporary impacts.	Tributary of Hallinans Creek downstream of three dams in cleared agricultural land.
Strahler Order	Second	First order
Structure	N/A	pipes
Watercourse	Unnamed	Unnamed
КР	486.5- 488	487.960



Photos		
Vegetation Mapping in Corridor ¹	Cleared/Non- native Vegetation, Figure A12	Cleared/Non native vegetation with Zone 11 PCT201 Fuzzy Box Woodland downstream and upstream, Figure A12
Catchment Description	Confluence of Hallinans Creek and Stanfords Creek approximately 340m upstream of existing rail corridor. Newell Highway and agricultural land; cleared land with some scattered trees upstream. Dam instream 200m downstream of existing rail corridor.	Large catchment extending to headwaters in Herveys Range. Remnant vegetation along creek otherwise largely cleared of vegetation. Township of Trewilga and Newell Highway upstream of existing rail corridor. Confluence with Stanfords Creek approximately 940m downstream.
Strahler Order	Fourth	Fourth
Structure	20 corrugated pipes over 35m	Box culverts, 30m long
Watercourse	Stanfords Creek	Ten Mile Creek
КР	489.844	490.605



Photos	View of Ten Mile Creek downstream from existing rail corridor	Barrabadeen Creek upstream of existing rail corridor
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation with remnants of Zone 12 PCT267 White Box- White Cypress Pine-Western Grey Box woodland, Figure A13	Cleared/non native vegetation, Figure A14
Catchment Description	Creek on western side of proposal area. Scattered trees along watercourse.	Large catchment extending to headwaters in Herveys Range. Some areas of remnant vegetation along creek otherwise largely cleared of vegetation.
Strahler Order	Fifth	Fifth
Structure	N/A	Timber bridge, 10m
Watercourse	Ten Mile Creek	Barrabadeen Creek
КР	493.7	503.599



Photos		
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation, Figure A14	Cleared/non native vegetation, Figure A15
Catchment Description	In-stream dams upstream and downstream; agricultural land; cleared land with some scattered trees upstream.	In-stream dams immediately upstream and downstream of existing rail corridor. Catchment extending to headwaters in Herveys Range. Largely cleared of vegetation.
Strahler Order	First order	Fourth
Structure	Timber bridge	Timber bridge
Watercourse	Unnamed	Bulldog Creek
KP	505.502	509.649



Photos	Erosion evident along Gundong Creek downstream of existing rail corridor	Control of the state of the sta
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation, Figure A15	Cleared/non native vegetation, Figure A16
Catchment Description	Township of Tomingley and the Tomingley Gold Mine are both in catchment approximately 5.5 km upstream of the existing rail corridor. Gundong Creek modified by diversions upstream of Tomingley including reports that historically it dissipated at a place called 'Ten Ponds' (SEEC 2011). Evidence of erosion upstream and downstream of existing rail corridor.	Flat plain. In-stream dams upstream and downstream; agricultural land; cleared land.
Strahler Order	Fourth	Second
Structure	Corrugated pipes	Timber bridge, 11m long
Watercourse	Gundong Creek	Unnamed
КР	512.120	515.011



Photos		
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation, Figure A16	Cleared/non native vegetation, Figure A17
Catchment Description	Flat plain. Large dam approximately 100m downstream. In-stream dams upstream and downstream; agricultural land; cleared land.	Flat plain, distributary of Tomingley Creek. Cleared of vegetation
Strahler Order	First order	Fourth
Structure	Timber bridge, 10m long	Concrete bridge
Watercourse	Unnamed	Unnamed
КР	515.601	517.428



Photos	Not available	Tomingley Creek view downstream
Vegetation Mapping in Corridor ¹	Zone 5 PCT55 Belah Woodland- Derived Native Grassland,	Zone 5 PCT55 Belah Woodland- Derived Native Grassland, Figure A17
Catchment Description	Flat plain, distributary of Tomingley Creek. Cleared of vegetation.	Flat plain. Large catchment extending to headwaters in Herveys Range. Some areas of remnant vegetation otherwise largely cleared of vegetation.
Strahler Order	Fourth	Fourth
Structure	Yes, unknown	Timber Bridge
Watercourse	Unnamed	Tomingley Creek
KP	518.55	519.224



Photos		
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation, Figure A18	Cleared/non native vegetation, Figure A20
Catchment Description	The existing rail corridor is 450m downstream of the confluence of Bradys Cowal and Fiddlers Creek. Catchments of both are largely cleared of vegetation.	Tributary of Yellow Creek. Cleared catchment.
Strahler Order	Fourth	First order
Structure	Timber Bridge	Pipes, 17.8m long
Watercourse	Bradys Cowal	Unnamed
KP	529.768	546



Photos		View of Backwater Cowal from Northern Bank.
Vegetation Mapping in Corridor ¹	Cleared/non native vegetation with Zone 7 Western Grey Box Tall Grassy Woodland, Figure A20	Cleared/non native vegetation with Zone 9 PCT105 Poplar Box Grassy Woodland, Figure A21
Catchment Description	Remnant vegetation along the creek either side of existing rail corridor. Catchment largely cleared.	Wide channel with sparse remnant native vegetation either side of existing rail corridor. Cleared for agricultural land.
Strahler Order	Third order	Fourth
Structure	Low timber bridge, 21.5m long	New bridge with concrete bed and walls 38m
Watercourse	Yellow Creek	Sackwater New bridge Fourth Cowal with concrete bed and walls 38m
ΚΡ	546.542	552.631

1. Vegetation mapping as described in BAR (Umwelt 2016a) and shown in Figures A1 to A21, Appendix A



3.1.1 Key Fish Habitat Classification and Sensitivity Analysis

Key fish habitat mapping has been prepared by Fisheries Ecosystems Branch of NSW DPI for LGAs across NSW. The key fish habitat map outputs for the Parkes and Narromine LGA were reviewed and are provided in **Appendix B**. Major watercourses have been mapped as key fish habitat including Goobang Creek, Ridgey Creek, Burrill Creek, Ten Mile Creek, Barrabadeen Creek, Bogan River Bulldog Creek, Gundong Creek, Tomingley Creek, Fiddlers Creek, Bradys Cowal and the Macquarie River. Whether watercourses along the rail corridor are mapped as key fish habitat as defined by DPI is identified in **Table 3.2**.

For the purposes of the application of the FM Act, NSW DPI has developed a classification scheme for the sensitivity of key fish habitat, to define the importance of habitat for the survival of fish and the ability of the habitat to withstand disturbance. Key fish habitat is defined in DPI (2013) as:

- Type 1 Highly sensitive key fish habitat including freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants
- Type 2 Moderately sensitive key fish habitat including:
 - o freshwater habitats and brackish wetlands, lake and lagoons other than those defined in Type 1 and
 - o weir pools and dams up to full supply level where the weir or dam is across a natural waterway; or
- Type 3 Minimally sensitive key fish habitat including:
 - o coastal and freshwater habitats not included in Type 1 or 2
 - o ephemeral aquatic habitat not supporting native aquatic of wetland vegetation.

It is noted that for the purposes of the *Policy and Guidelines for Fish Habitat Conservation and Management* that first and second order streams on gaining streams are not considered key fish habitat (DPI 2013). Accordingly, the habitat sensitive type of third order and higher watercourses in the proposal area, from south to north along the existing rail corridor, has been assessed and is identified in **Table 3.2**.

The functionality of the watercourse as fish habitat has been defined by NSW DPI (DPI 2013) to assess impacts of activities on fish habitat, in conjunction with habitat sensitivity, and to make management recommendations to minimise the impact of watercourse crossing structures on fish passage. Waterways are classified by NSW DPI (DPI 2013) for fish passage as:

- Class 1 major key fish habitat including marine or estuarine waterway or permanently flowing or flooded freshwater waterway (eg river or major creek), habitat of a threatened or protected fish species or 'critical habitat' or
- Class 2 moderate key fish habitat including non-permanently flowing (intermittent) stream, creek or
 waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent
 waters in pool or in connected wetland areas. Freshwater aquatic vegetation is present. Type 1 and 2
 habitats present or
- Class 3 minimal key fish habitat including named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeing areas for aquatic fauna (eg fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise any minor waterway that interconnects with wetlands or other Class 1-3 fish habitats or



Class 4 Unlikely key fish habitat including waterway (generally unnamed) with intermittent flow
following rain events only, little or no defined drainage channel, little or no flow or free standing water
or pools post rain events (eg dry gullies or shallow floodplain depressions with no aquatic flora
present).

The classification of watercourses for fish passage has been assessed in accordance with NSW DPI (DPI 2013) and is identified in **Table 3.2** from south to north along the existing rail corridor. This classification and type is based on the watercourses in the vicinity of the existing rail corridor. **Table 3.2** does not include the two watercourses that occur in the proposal area but are not crossed by the existing rail corridor. These occur at KP 493.7 and between KP 486.5 and KP 488.

The majority of watercourses along the existing rail corridor between Parkes and Narromine are first and second order streams with intermittent flow following rain events, little or poorly defined channels with no aquatic flora species. The watercourses have been modified by crossing structures for rail, road and agricultural land practices with minimal native vegetation retained along the banks of the watercourses. Accordingly these watercourses have been classified as Class 4 unlikely key fish habitats that are considered to be Type 3 minimally sensitive fish habitat.

Table 3.2 Habitat Sensitivity Analysis of Rivers and Major Creeks in the Proposal Area

КР	Watercourse	Strahler Order	Habitat Sensitivity Type	Classification of Watercourse for Fish Passage	Key Fish Habitat Mapping ¹
Lachlan Riv	ver Catchment				
455- 455.5	Unnamed	Third Order	Type 3 – Minimal	Class 4 – Unlikely	Tributary of Ridgey Creek, mapped as key fish habitat
461.157	unnamed	Third Order	Type 3 – Minimal	Class 4 – Unlikely	Tributary of Ridgey Creek, mapped as key fish habitat
Bogan Rive	er Catchment				
472.047	Unnamed	Third order	Type 3 – Minimal	Class 4 – Unlikely	Not identified
478.262	Unnamed	Third order	Type 3 – Minimal	Class 3 – Minimal	Tributary of Burrill Creek, mapped as key fish habitat
479.346	Burrill Creek	Fifth order	Type 2 – Moderately sensitive	Class 2 – Moderate	Mapped as key fish habitat



КР	Watercourse	Strahler Order	Habitat Sensitivity Type	Classification of Watercourse for Fish Passage	Key Fish Habitat Mapping ¹
489.844	Stanfords Creek	Fourth order	Type 3 – Minimal	Class 4 – Unlikely	Tributary of Ten Mile Creek, mapped as key fish habitat
490.605	Ten Mile Creek	Fourth Order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat
503.599	Barrabadeen Creek	Fifth order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat
509.649	Bulldog Creek	Fourth order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat
512.120	Gundong Creek	Fourth order	Type 3 – Minimal	Class 4 – Unlikely	Mapped as key fish habitat
517.428	Unnamed	Fourth order	Type 3 – Minimal	Class 4 – Unlikely	Not identified
518.55	Unnamed	Fourth order	Type 3 – Minimal	Class 4 – Unlikely	Not identified
519.224	Tomingley Creek	Fourth order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat
529.768	Bradys Cowal	Fourth order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat
546.542	Yellow Creek	Third order	Type 3 – Minimal	Class 3 – Minimal	Not identified
552.631	Backwater Cowal	Fourth order	Type 3 – Minimal	Class 3 – Minimal	Mapped as key fish habitat

¹ Key Fish Habitat as mapped by DPI for Parkes or Narromine LGA. For reference, these are provided in Appendix B.

A third order tributary of Burrill Creek, Barrabadeen Creek, Bulldog Creek, Tomingley Creek, Bradys Cowal, Yellow Creek and Backwater Cowal have all been assessed as being Class 3 minimal key fish habitat with semi-permanent pools evident upstream or downstream of the existing rail corridor. All of these watercourses have been assessed as type 3 minimally sensitive habitats as they are ephemeral with little to no native aquatic vegetation evident in the immediate environs of the existing rail corridor. Burrill Creek was the only watercourse in the proposal area that was assessed as moderately sensitive habitat and class 2 moderate fish habitat.



3.2 Sensitive Aquatic Habitat Characteristics

3.2.1 Burrill Creek

Burrill Creek is one of the major tributaries of the Bogan River rising in the western foothills of the Hervey Range to the west of the Newell Highway between Alectown and Peak Hill, approximately 20 kilometres upstream of the existing rail corridor. It flows into Ten Mile Creek and the Bogan River approximately 20 kilometres and 22 kilometres, respectively, downstream of the existing rail corridor.

In the proposal area, Burrill Creek is a fifth order stream in the Bogan Alluvial Plains Mitchell Landscape (**Figure A9, Appendix A**). It is mapped as key fish habitat by NSW DPI and has been assessed as moderately sensitive habitat and class 2 moderate fish habitat.

A corridor of native vegetation has been retained either side of the creek within the agricultural landscape. Riparian vegetation has been mapped as River Red Gum Tall to Very Tall Open Forest Woodland (PCT36).

An aquatic habitat assessment of Burrill Creek was undertaken in May 2016. The creek bed has no gravel, cobbles or boulders present with only clay soils present in stream. A large bed of native sedges *Juncus* sp (**Plate 3.1**), some fallen timber, exposed roots of the river red gums (*Eucalyptus camaldulensis*) and small semi-permanent pools occur that may provide fish habitat. There is a defined channel upstream and downstream of the existing rail corridor and the banks were assessed as moderately stable with 25 to 49 per cent vegetative coverage dominated by river red gums with grass cover and some clumps of *Juncus* and/or sedges on the banks (**Plate 3.2**).



Plate 3.1

Large bed of native sedges and defined channel of Burrill Creek downstream of the existing rail corridor

© Umwelt, 2016





Plate 3.2

Defined channel of Burrill Creek upstream of the existing rail corridor with River Red Gums on the banks

© Umwelt, 2016

The existing bridge structure (see **Table 3.1**) does not provide an impediment to fish passage. From an analysis of topographic maps and aerial photography there appear to be a number of farm dams along Burrill Creek downstream that may be an impediment to fish passage from and/to the Bogan River.

3.2.2 Backwater Cowal

The existing rail corridor crosses Backwater Cowal on the outskirts of Narromine on the flat open alluvial plains of the Bogan and Macquarie Rivers. Approximately 11 kilometres downstream of the existing rail corridor Backwater Cowal meets Boggy Cowal.

In the proposal area, Backwater Cowal is a fourth order stream in the Bogan-Macquarie/Darling Riverine Plains Mitchell Landscape flowing through the Boggy Cowal Channels and Floodplains Mitchell Landscapes downstream of the existing rail corridor (**Figure A21, Appendix A**). It is mapped as key fish habitat by NSW DPI but has been assessed as minimally sensitive habitat and class 3 minimal fish habitat at the existing rail corridor crossing.

Scattered trees occur along either side of the watercourse within the agricultural landscape. While the rail corridor has been mapped as Cleared/non native vegetation the banks have been mapped as Poplar Box Grassy Woodland (PCT105) (Umwelt 2016a).

An aquatic habitat assessment of Backwater Cowal was undertaken in May 2016. The channel is approximately 90 metres wide, has no gravel, cobbles or boulders present with only clay soils present in stream. No instream aquatic habitat was observed. Some aquatic plant species (including *Persicaria decipens*) were observed in the weed dominated vegetation characterising the bed and banks of the watercourse (**Plate 3.3**).





Plate 3.3

Vegetation within the channel of Backwater
Cowal upstream of the existing rail corridor.
Riparian vegetation present along banks in the distance

© Umwelt, 2016

No pools were present at the time of the survey however it was noted that pools had been observed opportunistically during other field investigations. A review of aerial photography identified that the channel may be characterised by large pools at times. The banks of the watercourse are poorly defined.

There is a new watercourse crossing structure at Backwater Cowal. This structure is not an impediment to fish passage. From an analysis of topographic maps and aerial photography there appear to be a number of farm dams downstream along Backwater Cowal and the Cobacho Dam on Boggy Cowal that could provide an impediment to fish passage from and/to the Bogan River.

3.3 Threatened Aquatic Species and Communities

The results of a search of the online Commonwealth Department of the Environment Protected Matters Search Tool (PMST) are provided in full in **Appendix C** and summarised in **Table 3.3**.

Table 3.3 Matters of National Environmental Significance within the proposal area and a 10 kilometre buffer

MNES	Identified in the PMST Report ¹	Relevance to the Proposal
Listed threatened species and communities	19 species 5 TEC	Of the 19 threatened species three are fish and are considered further in Table 3.4 and Section 4.5 . All of the TEC are terrestrial communities and have been assessed in the BAR (Umwelt 2016a).
Migratory species protected under international agreements	10 migratory species	All of the species are birds. No migratory fish species. No further consideration required



MNES	Identified in the PMST Report ¹	Relevance to the Proposal
Ramsar wetlands of international importance	5 wetlands downstream	See Section 3.3.3
Commonwealth marine environment	None	Not applicable
World Heritage properties	None	Not applicable
National Heritage places	None	Not applicable
Great Barrier Reef Marine Park	None	Not applicable
Nuclear actions	Not applicable	Not applicable
A water resource, in relation to coal seam gas development and large coal mining development.	Not applicable	Not applicable

¹ PMST results provided in full in Appendix C

3.3.1 Threatened Aquatic Species

Online search of the DoE PMST (see **Appendix C**) identified three fish species listed as threatened under the EPBC as predicted to occur within the existing rail corridor:

- trout cod (Maccullochella macquariensis)
- Murray cod (Maccullochella peelii)
- Macquarie perch (Macquaria australasica).

Search of the NSW DPI records viewer for listed threatened species within the Parkes and Narromine LGAs prior to 1980 and post 1980 identified the following:

- DPI have no records of threatened fish species within the Parkes LGA
- two threatened fish species were recorded in the Narromine LGA area:
 - Murray cod (*Maccullochella peelii*) has been recorded in the Macquarie River at Narromine in 2001, 2007, 2008 and 2009, upstream of Narromine in 2006 and downstream in 2000 and 2001
 - o silver perch (*Bidyanus bidyanus*) has been recorded in the Macquarie River upstream of Narromine in 2006
- there are records of the freshwater catfish/eel tailed catfish (*Tandanus tandanus*) endangered population in the Murray/Darling Basin in the Macquarie River at Narromine in 2008 and 2009, upstream of Narromine in 2006 and downstream in 2000.



There are no threatened fish records for the watercourses crossed by the existing rail corridor between Parkes and Narromine. Further, review of the EPBC Act referral guidelines for the vulnerable Murray cod (*Maccullochella peelii*) (Commonwealth of Australia 2016) determined that the proposal area does not provide habitat for an important population of the Murray cod.

The Macquarie-Bogan catchment overview report identifies that five fish species that potentially occur within the Macquarie-Bogan Catchment are listed as threatened under the FM Act: trout cod, river snail (Notopala sublineata), silver perch, purple spotted gudgeon (Mogurnda adspersa) and the olive perchlet (Ambassis agassizii) endangered western population (Green et al 2011a). The trout cod and silver perch have been the subject of conservation stocking programs (Green et al 2011a).

An assessment of the likelihood of occurrence of threatened fish species and endangered populations in watercourses along the rail corridor is provided in **Table 3.4**.

3.3.2 Threatened Ecological Communities

The PMST report identified five Commonwealth listed TECs within the proposal area and 10 kilometre buffer (**Appendix C**). All of these communities are terrestrial and have been assessed in the BAR (Umwelt 2016a).

The rail corridor between Parkes and Narromine occurs within the mapped distribution of two ecological communities listed as endangered under the FM Act:

- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River.

An assessment of the likelihood of occurrence of the two endangered ecologically communities in watercourses along the rail corridor is provided in **Table 3.4**.

3.3.3 Ramsar Listed Wetlands

The PMST report identified that the proposal area and 10 kilometre buffer occur within the catchment of five Ramsar listed wetlands of international importance (**Appendix C**). The Ramsar listed wetlands include:

- Banrock station wetland complex
- The Coorong, and Lakes Alexandrina and Albert
- Riverland
- Hattah-Kulkyne Lakes
- The Macquarie Marshes.

Banrock station wetland complex, Coorong and Lakes Alexandrina and Albert, and Riverland wetlands are all located in South Australia approximately 600-900 kilometres (straight line distance) from the proposal area. The Hattah-Kulkyne Lakes occur in Victoria between 500-600 kilometres from the proposal area.



The Ramsar listed Macquarie Marshes are located on the Macquarie River between Marebone Weir and Carinda, over 140 kilometres downstream of Narromine. The marshes are a large wetland complex of shallow swamps, lagoons, creeks and floodplains that cover more than 200,000 hectares when fully flooded (Green et al 2011a).

The watercourses along the existing rail corridor between Parkes and Narromine are part of the Lachlan or Bogan River catchments. Neither the Lachlan nor the Bogan River are within the catchment of the Macquarie Marshes. Accordingly, no further consideration of the impact of the proposal on the Ramsar listed Macquarie Marshes is required.



Table 3.4 Threatened and Migratory Species and TECs Recorded or with Potential to Occur within the Proposal Area

Scientific Name	Common Name	Legislative Status	ative us	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Threatened Ecological Communities	nmunities			
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River	nity in the f the Lowland iver	EEC	1	Aquatic Ecological Community in the Natural Drainage System of the Lowland associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within NSW, including the Menindee Lakes and the Barwon River. In its natural state, many of the water-bodies in this area are characterised by variable and unpredictable patterns of high and low flows. The natural morphology of the river systems includes deep channels, deep pool areas, suspended load depositional 'benches', higher floodplain 'benches', braided channels, terminal wetland complexes, gravel beds and riffle zones. The floodplain is also an integral part of this river system. Many fish species rely on the seasonal flow pattern and inundation of the floodplain for successful reproduction. The complex river morphology provides a multitude of habitats that play a critical role in the life cycles of the species making up this ecological community. The proposal area intersects with this community in the Bogan River catchment as defined by the determination, downstream from Peak Hill include Barrabadeen Creek, Bulldog Creek, Gundong Creek, Tomingley Creek, Bradys Cowal, Yellow Creek and Backwater Cowal. These watercourses have minimal to unlikely fish habitat and have been assessed as Type 3 minimal sensitivity key fish habitat (Table 3.2).

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Scientific Name	Common Name	Legislative Status	ntive us	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM	EPBC Act	
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River	nity in the f the Lowland Siver	EEC	-	Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River includes all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, floodrunners, effluent streams, and the floodplains of the Lachlan River within NSW. In its natural state, many of the water-bodies in this community are characterised by variable and unpredictable patterns of high and low flows and water levels. The natural morphology of the river systems includes deep channels, deep pool areas, sandymuddy banks, terraces formed by floods, suspended load depositional 'benches', higher floodplain 'benches', paleochannels, floodrunners, anabranches, wetlands, and a terminal wetland complex. The floodplain is also an integral part of this river system. Many fish species rely on the seasonal flow pattern and inundation of the floodplain for successful reproduction. The complex river morphology provides a multitude of habitats that play a critical role in the life cycles of the species making up this ecological community. The determination identifies that Goobang Creek as included in the community. The proposal area does not cross Goobang Creek however two third order streams within the proposal area (between Parkes and Goonumbla) are tributaries of Ridgey Creek that is itself a tributary of Goobang Creek. Both of these watercourses have been assessed as unlikely fish habitat and have been assessed as Type 3 minimal sensitivity key fish habitat (Table 3.2).



Scientific Name	Common Name	Legislative Status	ative us	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM	EPBC Act	
Endangered Populations				
Tandanus tandanus – Eel tailed catfish in the Murray/Darling Basin	ailed catfish in	ш	1	Eel tailed catfish (<i>Tandanus tandanus</i>) is non migratory and lives in a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons. Although it inhabits flowing streams, it prefers sluggish or still waters. It can be found in clear to turbid waters, and over substrates ranging from mud to gravel and rock. It is rare in natural riverine habitats but can be found in farm dams throughout inland NSW and southern Queensland. Remnant populations occur in the Macquarie catchment upstream of Warren, the Castlereagh catchment upstream of Mendooran, the Namoi catchment upstream of Wee Waa, the Gwydir catchment upstream of Moree and the Border Rivers catchment upstream of Goondiwindi (Fisheries Scientific Committee 2008). Eel tailed catfish (<i>Tandanus tandanus</i>) have been recorded north of the proposal area in the Macquarie River, upstream, downstream and at Narromine between 2000 and 2009. There are no records in the Bogan River (records viewer accessed May 2016). The species is not known to occur in the catchment of the proposal area and no further assessment required.
Ambassis adassizii – Western Olive Perchlet western population	ern Olive Perchlet	ш	1	Small native fish that was once widespread in the Murray-Darling in sheltered areas within rivers, creeks, ponds and swamps in slow-flowing or still waters (DPI 2013a). Now known from limited sites in the Darling River drainage including lower reaches of the Bogan River and an isolated population in the central Lachlan catchment (DPI 2013a). The habitats occurring within the proposal area are outside the known range of the species and review of the DPI Threatened and protected species – records viewer did not identify any historic records of the species in the proposal area or local area. No further assessment required.



Scientific Name	Common Name	Legislative Status	ntive us	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Threatened Fish				
Bidyanus bidyanus	silver perch	>	CE	Silver perch (<i>Bidyanus bidyanus</i>) prefers fast-flowing waters, especially where there are rapids. This species migrates to spawn. Historical records show that the species was widespread and abundant in most of the Murray-Darling drainage, excluding the cool, high, upper reaches of streams on the western side of the Great Diving Range. Only one natural population is known, which occurs downstream of Torrumbarry Weir in the Murray River (DPI 2006). Analysis of the DPI Threatened and protected species – records viewer indicates that the silver perch (<i>Bidyanus</i>)has been recorded in the Macquarie River upstream of Narromine in 2006 (records viewer accessed May 2016). Green <i>et al</i> (2011a) note that the silver perch (<i>Bidyanus bidyanus</i>) has been the subject of conservation stocking programs in the Macquarie-Bogan catchment. Given habitat preferences, the silver perch (<i>Bidyanus bidyanus</i>) is not expected to occur in the watercourses within the proposal area and no further assessment is required.



Scientific Name	Common Name	Legisla Statu	ative tus	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Maccullochella macquariensis	trout cod	ш	ш	The natural distribution and abundance of trout cod (<i>Maccullochella macquariensis</i>) has declined since European settlement. Currently, the only known breeding populations of trout cod include a naturally occurring population in the Murray River below Yarrawonga Weir, a translocated population in Seven Creeks (a tributary of the Goulburn River) below Polly McQuinns Weir in Victoria (Ingram and Richardson, 1989; Ingram et al. 1990), a stocked population in Loombah Weir in Victoria (Douglas and Brown 2000) and a translocated population in Cataract Dam in coastal NSW (outside the species range) (DPI 2008). In December 2015 trout cod (<i>Maccullochella macquariensis</i>) fingerlings were released at a number of sites in the upper Macquarie River upstream of Lake Burrendong (http://www.dpi.nsw.gov.au/fishing/species-protection/conservation/what-current/endangered-species/trout-cod). Trout cod (<i>Maccullochella macquariensis</i>) are often found in faster flowing water with rocky and gravel bottoms as well as slower flowing, turbid lowland rivers where there is lots of large woody debris. The habitats occurring within the proposal area are outside the known range of the species and review of the DPI Threatened and protected species — records viewer did not identify any historic records of the species. No further assessment required.



Scientific Name	Common Name	Legisla Stat	lative tus	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Maccullochella peelii	Murray cod	1	>	Murray cod (<i>Maccullochella peelii</i>) occurs naturally in the waterways of the Murray-Darling basin in a wide range of warm water habitats ranging from clear, rocky streams to slow flowing turbid rivers and billabongs. It is a long lived, highly territorial species that is highly dependent on in-stream woody structures or large rocks for habitat (National Murray Cod Recovery Team 2010).
				Analysis of the DPI Threatened and protected species – records viewer indicates that the Murray cod (<i>Maccullochella peelii</i>) has been recorded north of the proposal area in the Macquarie River, upstream, downstream and at Narromine between 2000 and 2009. There are no records in the Bogan River (records viewer accessed May 2016). Given habitat preferences of the Murray cod (<i>Maccullochella peelii</i>) it is not expected to occur in the watercourses within the proposal area. No further assessment required.
Macquaria australasica	Macquarie perch	ш	ш	Macquarie perch (<i>Macquaria australasica</i>) are found in both river and lake habitats, especially in the upper reaches. The western form is known historically from the southern Murray Darling basin with a viable population in the upper Lachlan River (upstream of Wyangala) and the Abercrombie River (DPI 2016b). The habitats occurring within the proposal area are outside the known range of the species and review of the DPI Threatened and protected species – records viewer did not identify any historic records of the species. No further assessment required.



Scientific Name	Common Name	Legislative Status	ıtive us	Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Mogurnda adspersa	purple spotted gudgeon	ш	1	Purple spotted gudgeon (<i>Mogurnda adspersa</i>) is a small robust fish that is a benthic species usually found in rivers, creeks and billabongs with slow-moving or still waters; often amongst weeds, rocks or snags. The western population historically occurred throughout the Murray-Darling basin drainages but is now largely confined to the Gwydir River (DPI 2013b).
				Habitats within the watercourses along the proposal area are not preferred by this species and given the retracted known distribution of the population it is not expected to occur in the proposal area. No further assessment required.
Notopala sublineata	Darling River snail	5	1	Once common and widely distributed throughout the Murray-Darling basin, found in flowing rivers, along banks attached to logs and rocks or crawling in the mud (DPI 2016c). Recent surveys in the lower Darling River, upper Darling/Barwon River, Namoi River and Pilliga outwash failed to find any living individuals. Old shells were found near Bourke, Brewarrina and Walgett (Fisheries Scientific Committee 2016).
				The proposal area is in the Bogan River catchment upstream of the recent survey sites. Given findings of the recent surveys, flow characteristics and the history of modification of watercourse the Darling River snail (<i>Notopala sublineata</i>) is unlikely to occur in the proposal area. No further assessment required.



3.4 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems in which species composition and ecological processes are determined by groundwater (Department of Land and Water Conservation 2002). Ephemeral waterways are likely to be fed by both surface and groundwater, and the associated riparian vegetation is therefore likely to be dependent, at least in some part, on groundwater.

Groundwater sources in the proposal corridor include alluvial sediments in the vicinity of Narromine, associated with the Macquarie River. Alluvial sediments extend to up to 80 metres below ground level and alluvial groundwater associated with the Macquarie River would be recharged by rainfall infiltration and surface flows. Groundwater levels would be expected to rise following periods of above average rainfall and fall following periods of below average rainfall (GHD 2017).

To the south of Narromine, the proposal area is underlain by fractured rock associated with the Lachlan Fold Belt. The groundwater assessment (GHD 2017) identified that the fractured siltstone and sandstone rock aquifer occurs deeper than 70 metres below ground level. Groundwater in the fractured rock aquifer is not expected to be present in the vicinity of the ground surface (GHD 2017).

Shallow alluvial sediments of depth of less than 10 to 20 metres below ground level may be intercepted along creek lines by the proposal. These perched shallow groundwater sources would be recharged by rainfall infiltration with groundwater levels expected to rise following rainfall events (GHD 2017).

A review of the online Atlas of GDEs identified potential GDEs occurring within the proposal area:

- moderate potential for GDEs along Burrill Creek and Tomingley Creek where they are crossed by the existing rail corridor
- moderate potential for GDEs in Wallaby Creek a tributary of Backwater Cowal, upstream of the existing rail corridor, and for Boggy Cowal /Backwater Cowal downstream of The McGrane Way
- low potential for GDEs along the Bogan River downstream of Peak Hill.

The River Red Gum Forest along Burrill Creek is likely to be a GDE under the NSW State Groundwater Dependent Ecosystems Policy (Department of Land and Water Conservation 2002). However given that this community will not be disturbed as part of the proposal and that works to culverts and bridges is not expected to significantly change local flow regimes or require extraction of groundwater, no impacts are predicted and no further assessment of this GDE is required in this report.

The Belah Woodland on alluvial plains and low rises and derived grassland community was assessed as being in moderate to good condition and occurs primarily on the clay soils associated with Tomingley Creek (Umwelt 2016a). It is dominated by belah (*Casuarina cristata*) with bimble box (*Eucalyptus populnea* subsp. *bimbil*) occurring as a sub-dominant species in some patches (Umwelt 2016a). The woodland community is mapped as occurring upstream and downstream of the rail corridor encroaching into the edges of the rail corridor (**Figure A17**).

One TEC listed under the *Threatened Species Conservation Act 1995* (TSC Act) that is predicted to occur in the proposal area is the *Artesian Springs Ecological Community in the Great Artesian Basin*. This ecosystem is listed as Critically Endangered under the TSC Act and Endangered under the EPBC Act and is a GDE. The listing under the EPBC Act is described as *the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin*. This community is naturally restricted to artesian springs at the edges of the Great Artesian Basin that are the natural surface discharge points of aquifers in the Triassic, Jurassic and Cretaceous sedimentary sequence of the Great Artesian Basin but not including those



springs arising from Tertiary sediments and basalts (TSSC 2001). These springs occur predominantly in Queensland and South Australia with a few locations the Mulga Lands, Darling Riverine Plains and Cobar Peneplain Bioregions in north-western NSW. The EPBC listed species profile and threats database (SPRAT) identifies that the community is associated with spring supergroups in discharge areas including two in NSW:

- Bogan River supergroup generally located north-west of Walgett, north-east of Coolabah and west of Carinda
- Bourke supergroup generally located north east to north west of Bourke with some springs east of White Cliff.

These springs are not within the proposal area or immediate environs. No further consideration of this TEC is required.



4.0 Impact Assessment

For the purposes of this assessment, the proposal area represents the area within the existing rail corridor, where the corridor overlays mapped watercourses. The proposal is shown on **Figure 1.3**, **Figure 1.4** and the location of all culverts and bridges that are proposed to be upgraded or replaced in shown on **Figures A1** to **A21** in **Appendix A**.

GHD (2017) prepared a hydrology and flooding assessment for the project. The ARTC Inland Rail – Parkes to Narromine Hydrology and Flooding Assessment (GHD 2017) identified the potential impacts and associated management and mitigation measures with respect to anticipated hydrological and flooding impacts. The impacts identified in GHD (2017) considered relevant to this aquatic assessment are listed below:

- modified surface flow volume or rate downstream of the rail corridor during the construction period
- · changed surface flow paths across the rail corridor
- restricted water passage along irrigation drains or constructed channels
- modified groundwater flow volume or rate downstream of the rail corridor during the construction period
- modified surface flow volume or rate downstream of the rail corridor during rail line operation
- restricted water passage along irrigation drains or constructed channels
- modified groundwater flow volume or rate downstream of the rail corridor during rail line operation.

This aquatic ecology assessment has considered the impacts identified above. For a detailed analysis of specific hydrology and flooding impacts related to the proposal refer to GHD (2017).

4.1 Impacts on Aquatic Ecology

Impacts associated with construction of the proposal include:

- removal of riparian vegetation on the banks of the watercourse may be required for some of the
 watercourse structures. Given that the existing rail corridor has been cleared the total extent of
 clearance of native vegetation, where present, may be minimised or avoided at the detailed design
 stage
- removal of in-stream vegetation predominantly non-native grasses and weed species though some small beds of sedges/reeds were noted in watercourses
- temporary obstruction of fish passage when constructing access tracks associated with either filling or removal of material from the watercourse – this is generally upstream of the watercourse structure along the alignment of the existing access track
- potential for increased sediment load downstream of the proposal area
- risk of spills and pollution associated with construction equipment working in the watercourse.



The majority of watercourses have been mapped as cleared/non-native vegetation (refer to **Table 3.1**). The proposal will impact eight vegetation communities occurring within a 25 metre buffer of mapped watercourses. The vegetation communities impacted within the riparian zone is shown in **Table 4.1**.

Table 4.1 Area of clearance of vegetation associated with watercourses in the proposal area

Vegetation Communities Occurring within 25m buffer of Watercourse	Area of Permanent Impact (ha)
PCT-26 Weeping Myall Open Woodland	0.01
PCT-201 Fuzzy Box Woodland	0.14
PCT-267 White Box - White Cypress Pine - Western Grey Box Woodland	0.17
PCT-276 Yellow Box Grassy Tall Woodland	0.81
PCT-36 River Red Gum Tall to very Tall Open Forest / Woodland	0.59
PCT-55 Belah Woodland	0.46
PCT-76 Western Grey Box Tall Grassy Woodland	1.03
TOTAL	3.21

The impact of the proposal on riparian communities has been assessed in the BAR, in accordance with the Framework for Biodiversity Assessment. Further assessment of the loss of riparian communities is therefore not required in this report.

While minimal fish habitat exists, at the time of construction there may be semi-permanent pools in the impact footprint that may support fish. Draining and/or filling of these pools may kill any fish present, however, any such impacts are considered unlikely to significantly impact local fish populations.

There are minimal impacts on aquatic ecological systems associated with operation of the proposal including consideration for the potential for spills from trains and/or maintenance vehicles using the access track.



4.2 Threatened Species, Endangered Populations and TECs Assessed Under the FM Act 1994

Searches of available databases and literature review have identified a number of threatened species, endangered populations and TECs as listed under the FM Act 1994. As identified in **Table 3.4** none of the threatened species or endangered populations are assessed as likely to occur within aquatic habitats in the watercourses in the proposal area. Therefore no impacts on these species are predicted and no further assessment of the impact of the proposal on these species is required.

The existing rail corridor intersects with the two aquatic ecological communities listed as endangered under the FM Act:

- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River
- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River.

An assessment of significance for the two aquatic ecological communities is provided in **Table 4.2**.



Table 4.2 Seven Part Tests of Significance for Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River and the Darling Catchment

Se	Seven Part Test of Significance	Assessment
а)	in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;	Not applicable
(q	in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	Not applicable
(2)	in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed; i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; and ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;	The proposal intersects watercourses that are part of the natural drainage system of the lowland catchment of the Darling River and Lachlan River. All of the watercourses are at the upper extent of the catchment of the two ecological communities and have been modified by in-stream structures, clearance of remnant vegetation and potentially altered by deposition of sediment from land practices in their catchments. The proposal would require localised disturbance of the watercourse to replace existing watercourse crossing structures and may include clearance of adjoining riparian vegetation. The existing watercourse structures would be replaced by structures that are designed to avoid blockage of fish passage, minimise disturbance of remnant vegetation upstream and downstream of the work area, and minimise changes to the morphology of the watercourse. The proposal is unlikely to: • have an adverse effect on extent of these ecological communities such that its local occurrence is likely to be place ad risk of extinction; or • substantially and adversely modify the composition of the community.

Seven Part Test of Significance	Assessment
d) in relation to the habitat of a threatened species, population or ecological community; i. the extent to which habitat is likely to be removed or modified as a result of the action proposed; ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;	The proposal would require localised disturbance of the watercourse to replace existing watercourse crossing structures and may include clearance of adjoining riparian vegetation. The maximum extent of disturbance to riparian vegetation in the proposal area is 3.21 hectares as outlined in Table 4.1. Disturbance is limited to 50m upstream and downstream of the watercourse. This represents a minimal to negligible area of both of the ecological communities. The watercourse structures would be designed to avoid blockage of fish passage and minimise disturbance of remnant vegetation upstream and downstream of the work area. The proposal intersects the <i>Aquatic Ecological Community in the Natural Drainage System of the determination</i> , downstream from Peak Hill (32°50′5, 148°00°E). Tributaries of Bogan River downstream from Peak Hill (13°20′5, 148°00°E). Tributaries of Bogan River downstream of Peak Hill include Barrabadeen Creek, Bulldog Creek, Gundong Creek, Tomingley Creek, Bradys Cowal, Yellow Creek and Backwater Cowal. These watercourses have minimal to unlikely fish habitat and have been assessed as Type 3 minimal sensitivity key fish habitat (Table 3.2). None of these watercourses are important to the long-term survival of the ecological community in the Natural Drainage System of the Lowland Catchment of the Lachlan River at a number of third order and below streams that are tributaries of Ridgey Creek, that is itself a tributary of Goobang Creek. These watercourses have all been assessed as unlikely fish habitat and Type 3 minimal sensitivity key fish habitat (Table 3.2). None of these watercourses are important to the long-term survival of the ecological community in the locality.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);	No critical habitat has been identified in the proposal area.

Seven Part Test of Significance	nificance	Assessment
f) whether the action objectives or action	whether the action proposed is consistent with the objectives or actions of a recovery plan or threat	Priority action statements for Lowland Darling River and Lowland Lachlan River include following recovery actions:
abatement plan; and	pu	 provide advice to consent and determining authorities and management authorities regarding habitat protection
		 community and stakeholder liaison, awareness and education
		 implement and enforce relevant fishing regulations
		 review regulatory and voluntary incentive based mechanisms to enhance habitat protection
		 pest eradication and control
		• stocking/translocation
		 habitat rehabilitation including: management of environmental flows; improved fish passage at major regulating structures; protection and rehabilitation of aquatic habitat and riparian vegetation; and mitigate impacts of cold water pollution.
		The proposal would replace some of the existing watercourse structures designed and constructed in accordance with the national guidelines Why do fish need to cross the road? Fish passage requirements for waterway crossings (Fairfull and Witheridge 2003). This is in keeping with recovery actions.

Seve	Seven Part Test of Significance	Assessment
g)		The proposal may contribute to the following key threatening processes:
- +-	key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	 installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
		 degradation of native riparian vegetation
		 removal of large woody debris.
		The proposal may require removal of large woody debris in the proposal area though none was noted during the survey efforts. Any large woody debris in the proposal area would be relocated upstream or downstream.
		Through appropriate design of the watercourse crossing structures and avoiding/minimising disturbance of riparian vegetation the proposal would minimise the above threatening processes.

umwelt



4.3 Matters of National Significance Assessed Under the Commonwealth EPBC Act

Under the EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). Aquatic MNES predicted to occur within the proposal area and a 10 kilometre buffer are identified in **Table 3.3** and discussed in **Section 3.3**.

No nationally listed threatened aquatic species, endangered populations, TECs or aquatic migratory species are expected to occur in the watercourses within the proposal area and therefore no impacts are predicted. Accordingly an assessment of the impact of the proposal on matters of national significance is not required.



5.0 Impact Avoidance and Mitigation Measures

5.1 Construction Phase Impact Mitigation

A range of general mitigation measures are recommended be employed across the proposal area during the construction phase to minimise impacts to aquatic ecological values, including:

- employee education and training including inductions for staff, contractors and visitors to the site to
 inform relevant personnel of the aquatic ecological issues present at the site and so they know their
 role and responsibilities in relation to the protection and/or minimisation of impacts and
- areas of ecological value outside the proposal area would be fenced or signposted, where appropriate, to prevent the unnecessary disturbance during the construction phase.

To minimise impacts on water quality, erosion and sedimentation associated with spills and/or construction activities in the watercourse, works within or adjacent to the watercourse would be undertaken in accordance with the soil and water management sub-plan prepared as part of the Construction Environmental Management Plan (CEMP). The soil and water management sub-plan will be prepared in accordance with guidelines from *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volumes 2A, 2C, 2D and 2E* (DECC 2008) (the Blue Book), including:

- works within the riparian zone would maximise, where possible, the preservation of any existing vegetation and minimise disturbance
- designs for works within or near watercourses would provide for the retention of natural functions and maintenance of fish passage in accordance with Why do fish need to cross the road? Fish passage requirements for waterway crossings (Fairfull and Witheridge 2003)
- planned works would, where possible, be scheduled for forecasted dry weather periods
- management of sediment that has accumulated upstream to avoid sediment mobilisation
- spoil material removed would be disposed appropriately.

Watercourse crossings can act as a barrier to fish passage. To avoid the creation of barriers to fish passage it has been assumed that all in-stream watercourse structures would be designed to the minimum required (see **Table 4.2**) for the watercourse classification as provided in **Table 3.2**. Guidelines for the design and construction of watercourse structures to minimise impact on fish passage and aquatic habitats are provided in *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge 2003).



Table 4.1 Preferred Watercourse Crossing Type in Relation to Watercourse Classification (DPI 2013)

Watercourse Classification	Minimum Recommended Crossing Type	Additional Design Information
Class 1 Major Key Fish Habitat	Bridge, arch structure or tunnel.	Bridges are preferred to arch structures
Class 2 Moderate Key Fish Habitat	Bridge, arch structure, high flow design culvert or tunnel.	Bridges are preferred to arch structures, box culverts and fords
Class 3 Minimal Key Fish Habitat	Culvert or ford	Box culverts are preferred to fords and pipe culverts.
Class 4 Unlikely Key Fish Habitat	Culvert, causeway or ford	Culverts and fords are preferred to causeways

To avoid clearance of established trees and native vegetation on the banks of watercourses and in-stream vegetation upstream and downstream of the rail corridor it is recommended that the following patches of vegetation be demarcated prior to clearing:

- Zone 14 Yellow Box Grassy Tall Woodland at KP 452.721 (Figure A2)
- Zone 15 Yellow Box Grassy Tall Woodland Derived Native Grassland at KP 456.992 (Figure A3)
- Zone 8 Western Grey Box Tall Grassy Woodland Derived Native Grassland at KP 461.157 (Figure A4)
- Native vegetation (unmapped) upstream of KP 478.262 (Figure A9)
- Zone 2 River Red Gum Tall to Very Tall Open Forest Woodland at KP 479.346 (Figure A9)
- Zone 11 Fuzzy Box Woodland downstream and upstream at KP 490.605 (Figure A12)
- Zone 12 White Box-White Cypress Pine-Western Grey Box woodland at KP 493.7 (Figure A13)
- Zone 5 Belah Woodland-Derived Native Grassland at KP 518.55 and KP 519.224 (Figure A17)
- Zone 7 Western Grey Box Tall Grassy Woodland at KP 546.542 (Figure A20)
- Zone 9 Poplar Box Grassy Woodland at KP 552.631 (Figure A21).

The proposal may require removal of large woody debris in the proposal area though none was noted in the rail corridor assessments. Any large woody debris in the proposal area would be relocated upstream or downstream where practicable.

To minimise loss of fish within any semi-permanent pools in the impact zone, it is recommended that a dewatering procedure be developed and included in the biodiversity management sub-plan in the CEMP. The dewatering procedure would outline methods for collection and relocation of protected fish and euthanasia of pest species.



5.2 Operational Phase Mitigation

A range of strategies are recommended to mitigate adverse impacts during the operational phase of the proposal. This includes specific measures to minimise the potential impacts on the biodiversity and aquatic ecological values of the proposal area and the locality, including:

- continuation of general mitigation measures for maintenance staff to inform relevant personnel of aquatic ecological values, roles and responsibilities in relation to the protection of watercourses and riparian vegetation
- · ongoing weed management
- regular inspection and maintenance of structures to ensure functionality and minimise blockage of fish passage
- management of spills.



6.0 Summary and Conclusion

The aquatic ecological assessment for the proposed upgrading of the existing rail corridor between Parkes and Narromine has been prepared based on a combination of field investigations and a review of available aerial photographs, topographic maps, databases, literature, policies and guidelines. The proposal crosses 29 watercourses in the catchment of the Lachlan or Bogan Rivers. While the watercourses range from first order streams to fifth order streams the catchments are characterised by variable and unpredictable patterns of flow and water levels exacerbated by heavily cleared catchments and prevalence of agricultural land use.

The majority of watercourses along the existing rail corridor between Parkes and Narromine are first order streams with intermittent flow following rain events, little or poorly defined channels with no aquatic flora species. The watercourses have been modified by crossing structures for rail, road and agricultural land practices with minimal native vegetation retained along the banks of the watercourses. Accordingly these watercourses have been classified as under DPI Fisheries guidelines as Class 4 unlikely key fish habitats that are considered to be Type 3 minimally sensitive fish habitat.

Third order tributaries of Burrill Creek, Barrabadeen Creek, Bulldog Creek, Tomingley Creek, Bradys Cowal, Yellow Creek and Backwater Cowal have all been assessed as being Class 3 minimal key fish habitat with semi-permanent pools evident upstream or downstream of the existing rail corridor. All of these watercourses have still been assessed as type 3 minimally sensitive habitats as they are ephemeral with little to no native aquatic vegetation evident in the immediate environs of the existing rail corridor. Burrill Creek was the only watercourse in the proposal area that was assessed as moderately sensitive habitat and class 2 moderate fish habitat.

A number of state and Commonwealth listed threatened fish species, endangered populations and TECs are recorded or predicted to occur in major watercourses within the Parkes and Narromine LGAs. None of the threatened species or endangered populations are likely to occur in the watercourses within the proposal area due to the lack of preferred habitat. The proposal intersects watercourses associated with the Bogan River that may be part of the FM Act Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River downstream of Peak Hill and tributaries of Ridgey Creek that may be part of the FM Act Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River. An assessment of significance of impact of the proposal on these two TECs has identified that the proposal is unlikely to have an adverse impact on either of these communities, with the adoption of appropriately designed fish friendly crossing structures and other mitigation measures proposed to further reduce impacts..

The assessment has considered the impact of the proposal on MNES as listed under the EPBC Act. No nationally listed threatened aquatic species, endangered populations, TECs or aquatic migratory species are expected to occur in the watercourses within the proposal area.

Potential GDEs in the proposal area are associated with River Red Gum Forest along Burrill Creek and the Belah woodland associated with Tomingley Creek. Given that the works to culverts and bridges are not expected to significantly change local surface water flow regimes nor will the works require extraction of groundwater, the proposal is not expected to adversely impact on GDEs.



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	Stream Order:	a — 1st Order	—— 2nd Order	—— 3rd Order	a —— 4th Order	5th Order	6th Order
pu:	— Proposal Area	☐ Local Government Area	Culvert	Bridge	Native Vegetation Area	Plot/Transect	Ranid Assessment
Legend			•	•			

/egetation:

I Native Vegetation Area

I Cleared/Non-native Vegetation

| Zone 1-PCT26-BVTCW205, LA212-Weeping Myall Open Woodland-Moderate/Good

Zone 2-PCT36-BVTCW183, LA193-River Red Gum Tall to very Tall Open Forest / Woodland-Moderate/Good

Zone 3-PCT36-BVTCW183, LA193-River Red Gum Tall to very Tall Open Forest / Woodland-Low - Regeneration

Zone 4-PCT55-BVTCW104, LA105-Belah Woodland-Moderate/Good

Zone 5-PCT55-BVTCW104, LA105-Belah Woodland-Moderate/Good - Derived Native Grassland

Zone 6-PCT70-BVTCW220, LA223-White Cypress Pine Woodland-Moderate/Good

Zone 7-PCT76-BVTCW145, LA154-Western Grey Box Tall Grassy Woodland-Moderate/Good

Zone 8-PCT76-BVTCW145, LA154-Western Grey Box Tall Grassy Woodland-Moderate/Good - Derived Native Grassland

Zone 9-PCT105-BVTCW171, LA177-Poplar Box Grassy Woodland-Moderate/Good

Zone 10-PCT105-BVTCW171, LA177-Poplar Box Grassy Woodland-Moderate/Good - Derived Native Grassland

Zone 11-PCT201-BVTCW138, LA145-Fuzzy Box Woodland-Moderate/Good

Zone 12-PCT267-BVTCW213, LA218-White Box - White Cypress Pine - Western Grey Box Woodland-Moderate/Good

Zone 13-PCT267-BVTCW213, LA218-White Box - White Cypress Pine - Western Grey Box Woodland-Moderate/Good - Derived Native Grassland

Zone 14-PCT276-BVTCW226, LA226-Yellow Box Grassy Tall Woodland-Moderate/Good

Zone 15-PCT276-BVTCW226, LA226-Yellow Box Grassy Tall Woodland-Moderate/Good - Derived Native Grassland



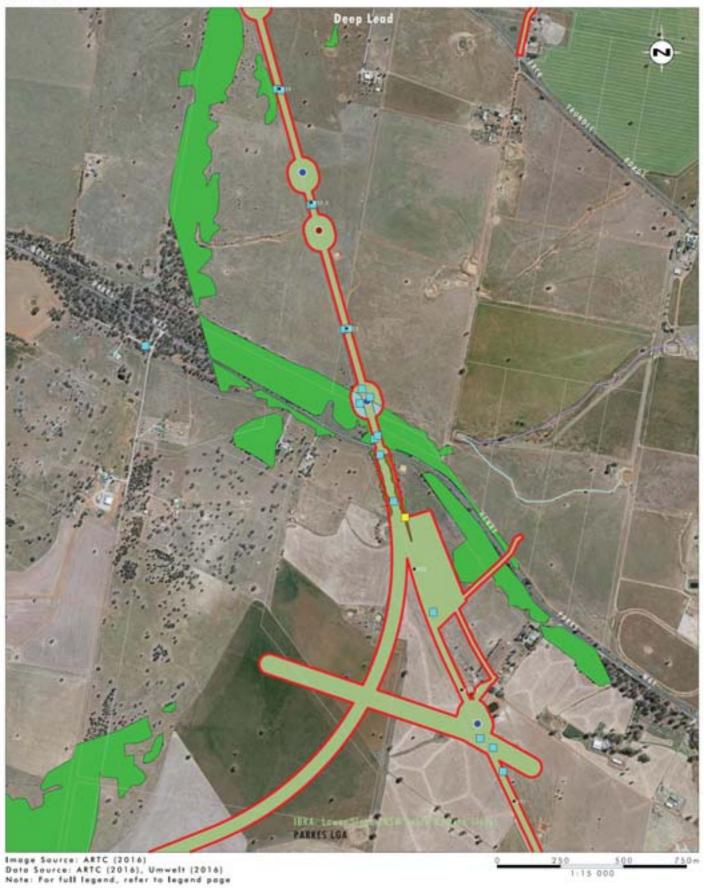


- Frogosof Area

. Raif Line Kilometerage

FIGURE AT





Proposal Area
Rail Line Kilometerage

FIGURE A2

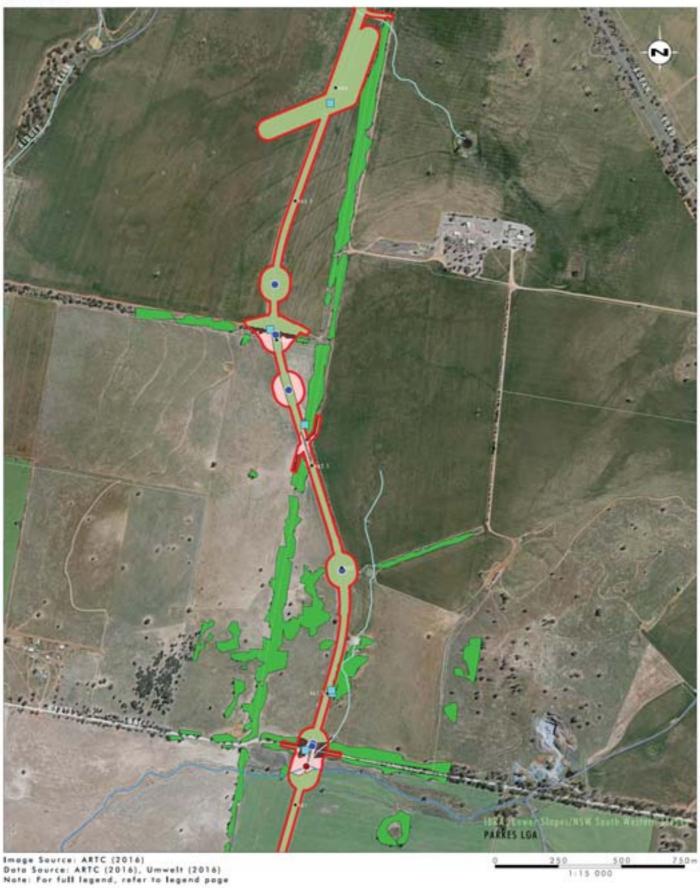




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FIGURE A3

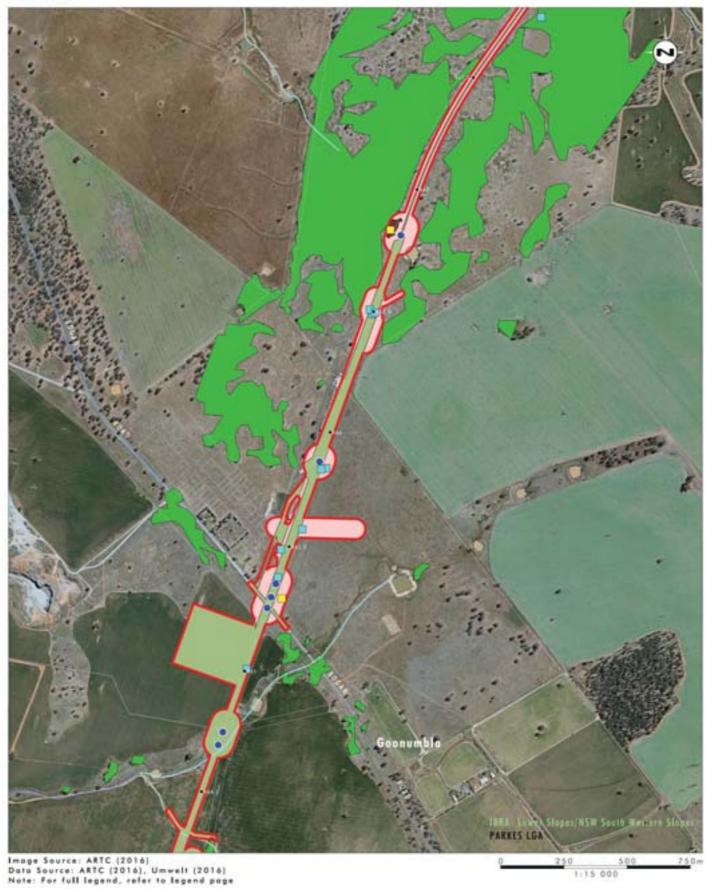




Proposal Area
Rail Line Kilometerage

FIGURE A4





- Frogosof Area . Raif Line Kilometerage

FIGURE A5





Proposal Area
Rail Line Kilometerage

FIGURE A6





Freposal Area . Raif Line Kilometerage

FIGURE A7





Proposal Area
Rail Line Kilometerage

FIGURE A8

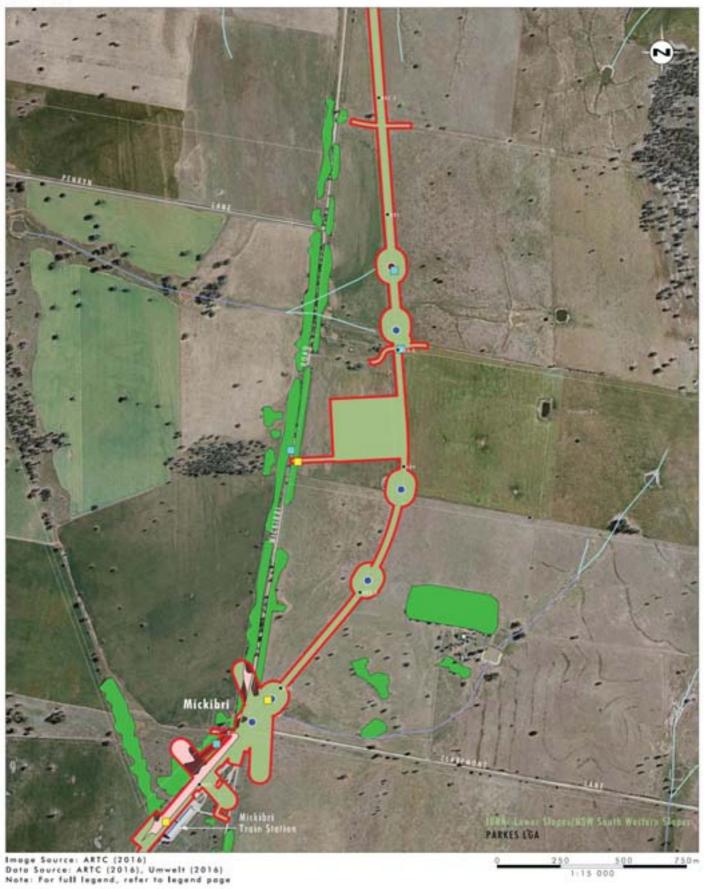




• Reif Line Kilometerage

FIGURE A9





Proposal Area
Rail Line Kilometerage

FIGURE A10

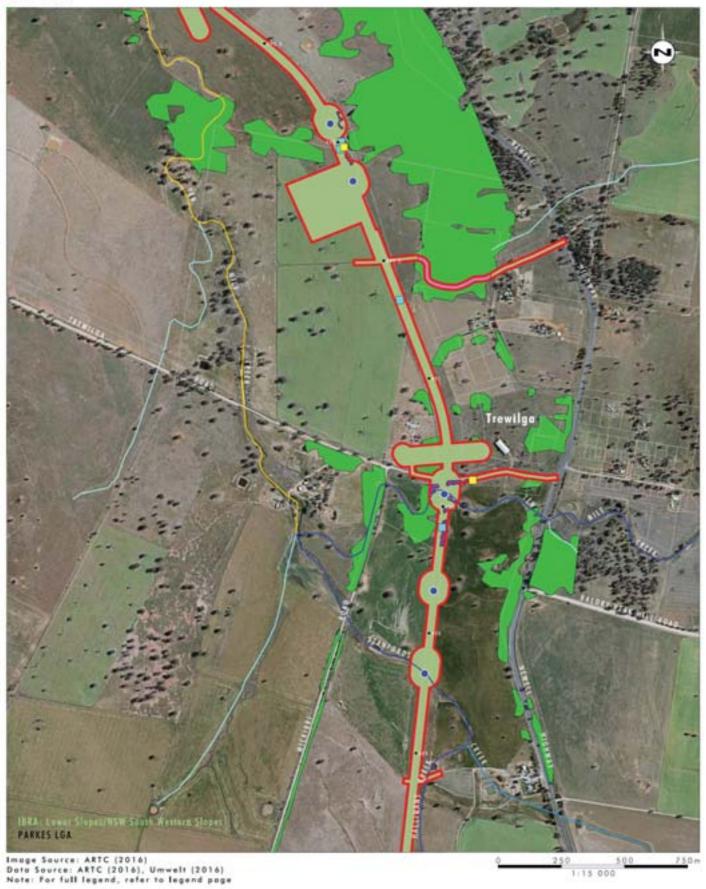




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FIGURE A11





Proposal Area
Rail Line Kilometerage

FIGURE A12

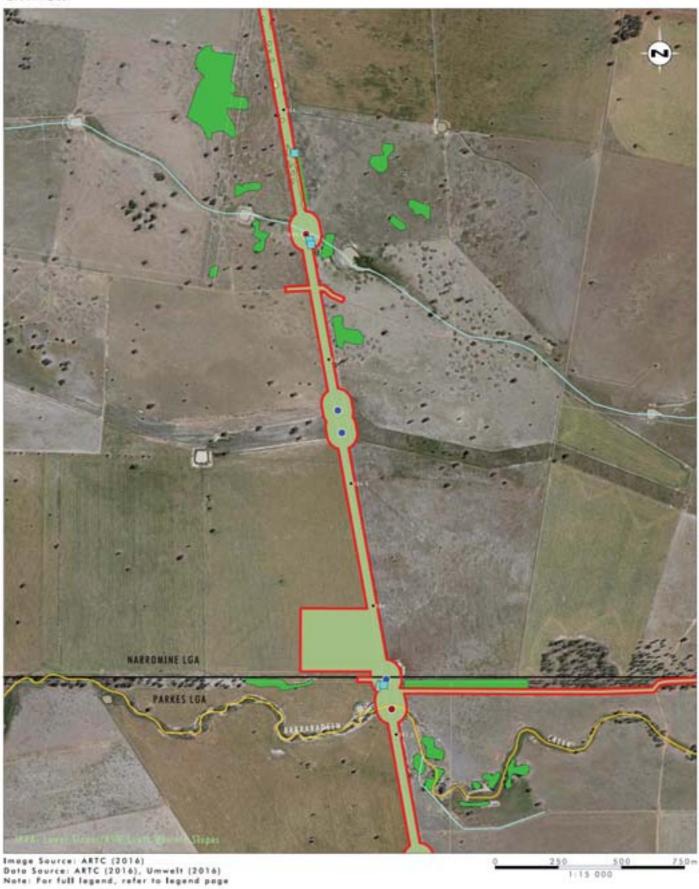




• Reif Line Kilometerage

FIGURE A13





Proposal Area
Lacal Government Area . Rail Line Kilometerage

FIGURE A14





Frogosof Area
 Raif Line Kilometerage

FIGURE A15





Proposal Area
Rail Line Kilometerage

FIGURE A16





• Reif Line Kilometerage

FIGURE A17





Proposal Area
Rail Line Kilometerage

FIGURE A18





• Reif Line Kilometerage

FIGURE A19

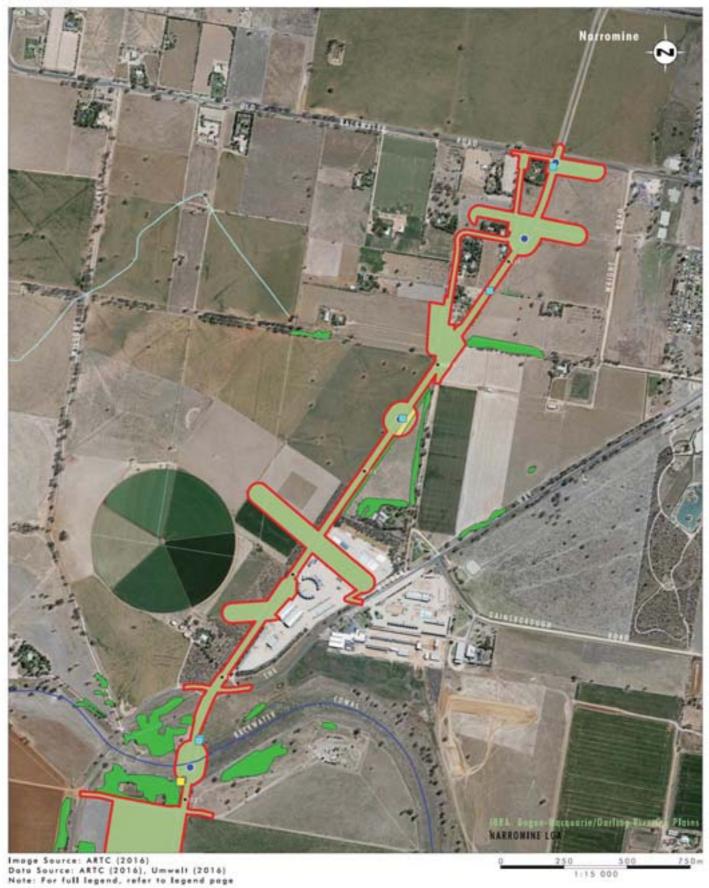




Proposal Area
Rail Line Kilometerage

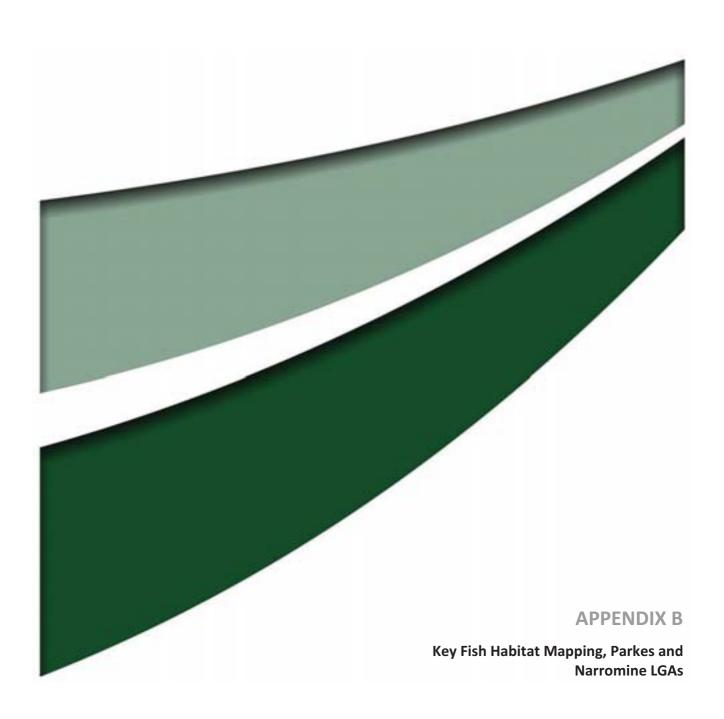
FIGURE A20





- Frogosof Area . Raif Line Kilometerage

FIGURE A21



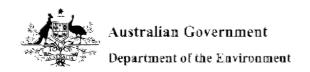


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Image Source: Department of Primary Industry, NSW File Name (A4): R10/3606_078.dgn





EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

Report created: 01/04/16 15:53:44

Summary

Details

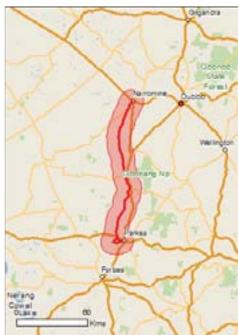
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Other Matters Protected by the EPBC Act

Extra Information

Caveat

Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the <u>Administrative Guidelines on Significance</u>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	5
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	19
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A <u>permit</u> may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	700 - 800km upstream
Hattah-kulkyne lakes	500 - 600km upstream
Riverland	600 - 700km upstream
The coorong, and lakes alexandrina and albert wetland	800 - 900km upstream
The macquarie marshes	100 - 150km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

produce indicative distribution maps.		
Name	Status	Type of Presence
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area
Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Grantiella picta		
Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Polytelis swainsonii	Visingrahia	Onsains ar angains haltitat
Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Rostratula australis	Status	Type of Fresence
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Maccullochella macquariensis Trout Cod [26171]	Endangered	Species or species habitat may occur within area
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Mammals		
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	NSW and the ACT) Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Plants		
Austrostipa metatoris [66704]	Vulnerable	Species or species habitat may occur within area
Austrostipa wakoolica [66623]	Endangered	Species or species habitat likely to occur within area
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species	the EDDC Ast. Three starrey	[Resource Information]
* Species is listed under a different scientific name on Name	the EPBC Act - Threatened Threatened	d Species list. Type of Presence
Migratory Marine Birds	modonod	1 3 00 01 1 10001106
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area

Merops ornatus

Rainbow Bee-eater [670] Species or species

Name Threatened Type of Presence

habitat may occur within

Motacilla flava

Yellow Wagtail [644] Species or species habitat

may occur within area

Myiagra cyanoleuca

Satin Flycatcher [612] Species or species habitat

known to occur within area

Migratory Wetlands Species

Ardea alba

Great Egret, White Egret [59541] Species or species habitat

known to occur within area

Ardea ibis

Cattle Egret [59542] Species or species habitat

may occur within area

Gallinago hardwickii

Latham's Snipe, Japanese Snipe [863] Species or species habitat

may occur within area

Pandion haliaetus

Osprey [952] Species or species habitat

known to occur within area

Tringa stagnatilis

Marsh Sandpiper, Little Greenshank [833] Species or species habitat

likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name

Commonwealth Land -

Commonwealth Land - Australian Postal Commission

Commonwealth Land - Australian Telecommunications Commission Commonwealth Land - Australian Telecommunications Corporation

Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation

Commonwealth Land - Commonwealth Trading Bank of Australia Defence - PARKES TRAINING DEPOT; PARKES ACS LAND

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Threatened Name Type of Presence

Birds

Apus pacificus

Fork-tailed Swift [678] Species or species habitat

likely to occur within area

Ardea alba

Great Egret, White Egret [59541] Species or species habitat

known to occur within area

Ardea ibis

Cattle Egret [59542] Species or species habitat

may occur within area

Gallinago hardwickii

Latham's Snipe, Japanese Snipe [863] Species or species habitat

may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
<u>Lathamus discolor</u> Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Alauda arvensis		
Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia		,,
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula		
Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus		
Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer		
Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis		
Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides		

Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]

Species or species habitat likely to occur

Name	Status	Type of Presence
Cytisus scoparius		within area
Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana		0
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat
Amoun boxulom, boxulom [19200]		likely to occur within area
Nassella trichotoma		
Serrated Tussock, Yass River Tussock, Yass Tussock Nassella Tussock (NZ) [18884]	ς,	Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat
FILCHLY FEATS [02/30]		likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species habitat
Pine [20780]		may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x	reichardtii	
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		Species or species hebitat
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle,		Species or species habitat likely to occur within area
Trompillo [12323]		

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

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Acknowledgements

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- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Parks and Wildlife Commission NT, Northern Territory Government
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Atherton and Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence

Forestry Corporation, NSW

- -Geoscience Australia
- -CSIRO
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

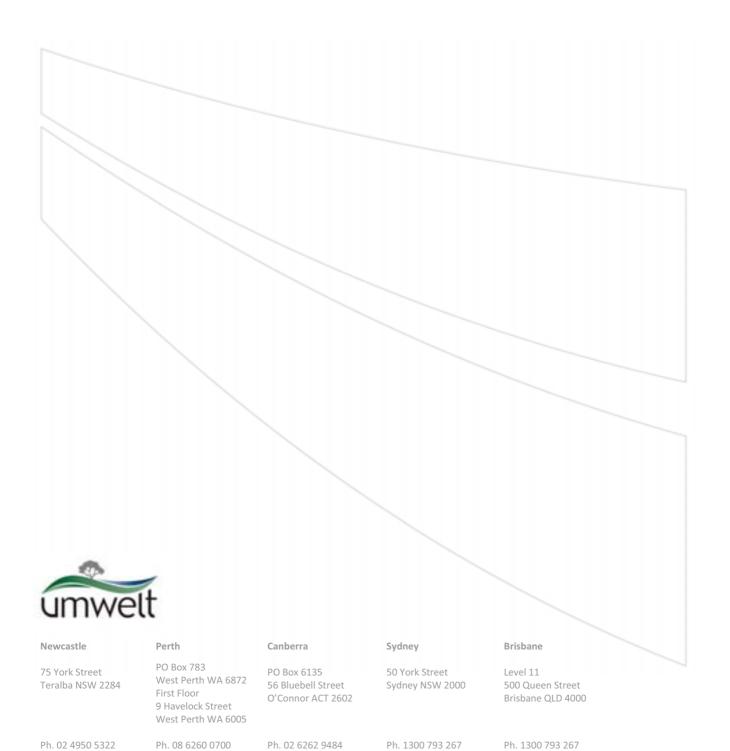
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