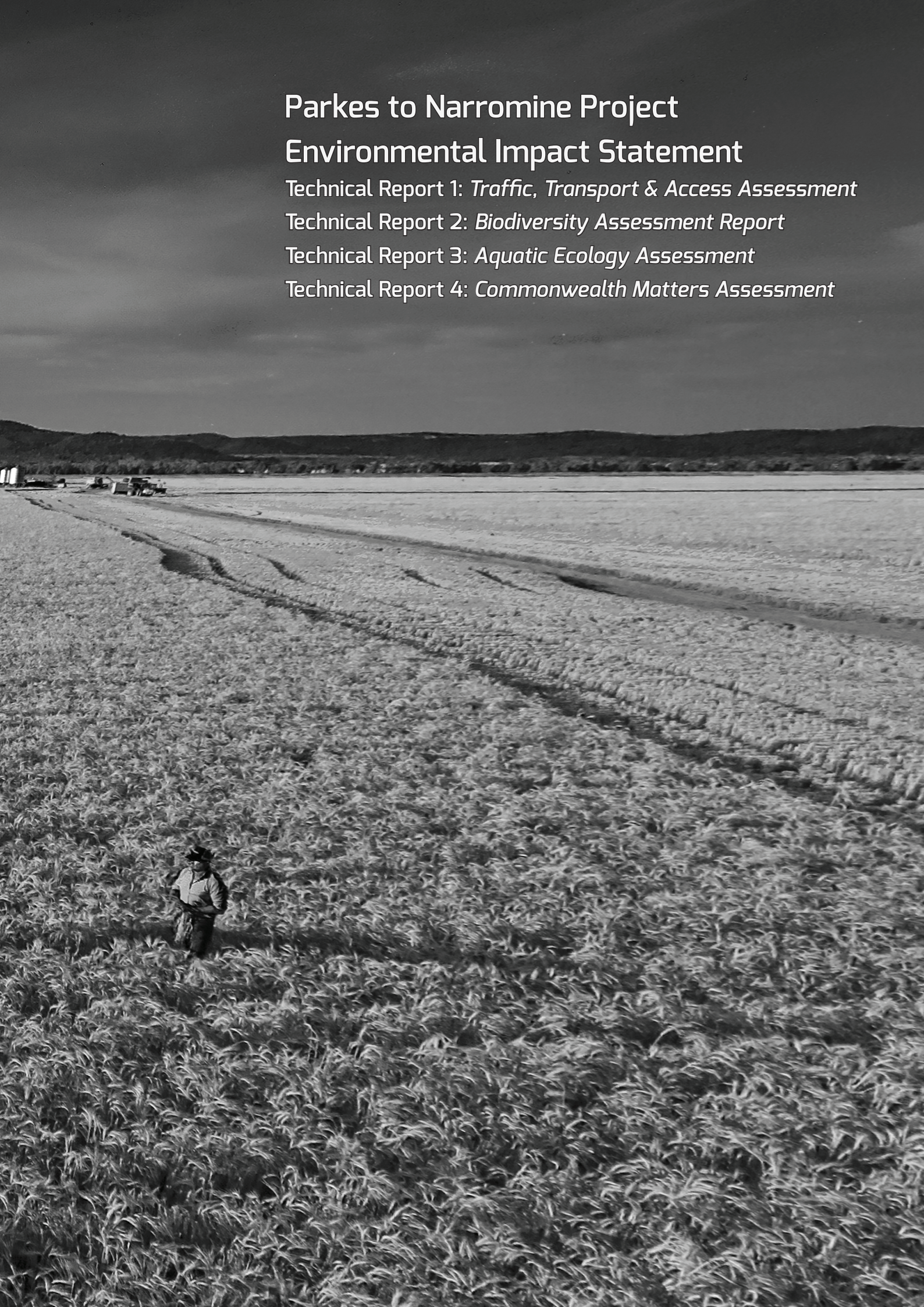
Parkes to Narromine Project
Environmental Impact Statement

Technical Report 1: *Traffic, Transport & Access Assessment*

Technical Report 2: *Biodiversity Assessment Report*

Technical Report 3: *Aquatic Ecology Assessment*

Technical Report 4: *Commonwealth Matters Assessment*



TECHNICAL REPORT 1:
Traffic, Transport & Access Assessment

Australian Rail Track Corporation

Inland Rail - Parkes to Narromine

Traffic, Transport and Access Assessment

June 2017

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Executive summary

This report details an assessment of the traffic, transport and access impacts of the Parkes to Narromine section of Inland Rail ('the proposal').

The proposal would involve upgrading the existing rail line between Parkes and Narromine, including new passing loops, some track realignment and replacement of culverts. The proposal also includes a new north to west connection between Inland Rail and the Broken Hill line (Parkes north west connection). Ancillary works will include upgrading, closing or consolidating level crossings, upgrading signalling and communications, establishing new fencing or upgrading existing fencing along the rail corridor, and relocating/protecting services and utilities.

There are 71 existing level crossings, which are crossed by the proposal, including 38 of which are on private roads. The preferred approach to level crossings consists of a mix of retaining, upgrading and investigating the potential consolidation of level crossings.

Construction

The proposal will be constructed in three stages, working from south to north.

For the majority of the construction period, the workforce would average about 150 people, who would be transported to the work site each day by bus or car. Delivery of materials would be made by truck. Total additional activity associated with construction is some 400 vehicles movements per day. A peak hourly volume of 100 vehicles (one-way) is expected. With this additional traffic, all roads used for construction access, including the Newell Highway and Henry Parkes Way, are expected to operate at Level of Service B or better. Localised traffic management would be put in place to manage traffic movement around any works that interact with the road network, including access to construction areas.

Operation

During operation of the proposal minimal traffic generation is expected. Where there is the potential for public roads to be closed, detours are available, and in most situations the number of road users who will be affected is low.

The key traffic impacts of the proposal relate to more frequent train activity at level crossings, although the proposal will allow faster train speeds which will slight reduce delays associated with individual trains. Traffic activity at most level crossings in the study area is low, and the volume of traffic likely to be delayed by train activity is not substantial. There is capacity at each level crossing for delayed traffic to queue clear of adjacent intersections.

Recommendations

It is recommended that the following measures be implemented to mitigate the potential traffic, transport and access impacts of the proposal:

- During construction
  - Preparation of a Construction Traffic Management Plan to guide the interaction of construction activities with the public road network. The Construction Traffic Management Plan should be developed in consultation with Parkes Shire Council, Narromine Shire Council and Roads and Maritime Services, and be subject to periodic review and update as agreed between the stakeholders.

- During operation
  - Provision of signage and other controls at level crossings in accordance with ARTC policy.
  - Regular review of traffic behaviour and infrastructure at level crossings to confirm that the provided level of protection continues to be appropriate.

1. Introduction

1.1 Overview

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 GHD Pty Ltd (GHD) 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.

1.2 The proposal

1.2.1 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.

1.2.2 Key features

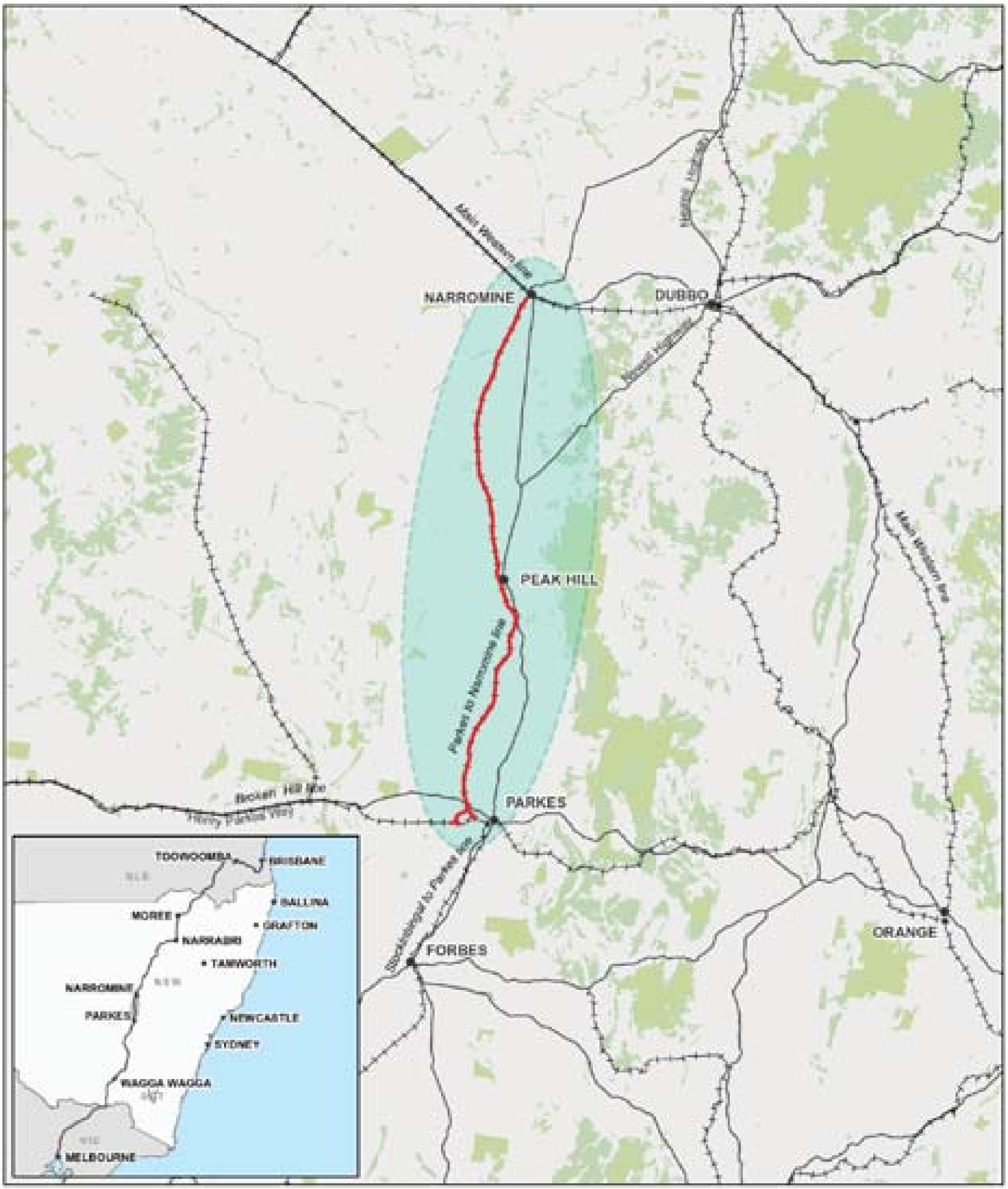
The key features of the proposal involve:

- 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.

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.



LEGEND

Proposal site

Proposal location

Rail lines

Main roads

Paper Size A4

0 5 10 20 30

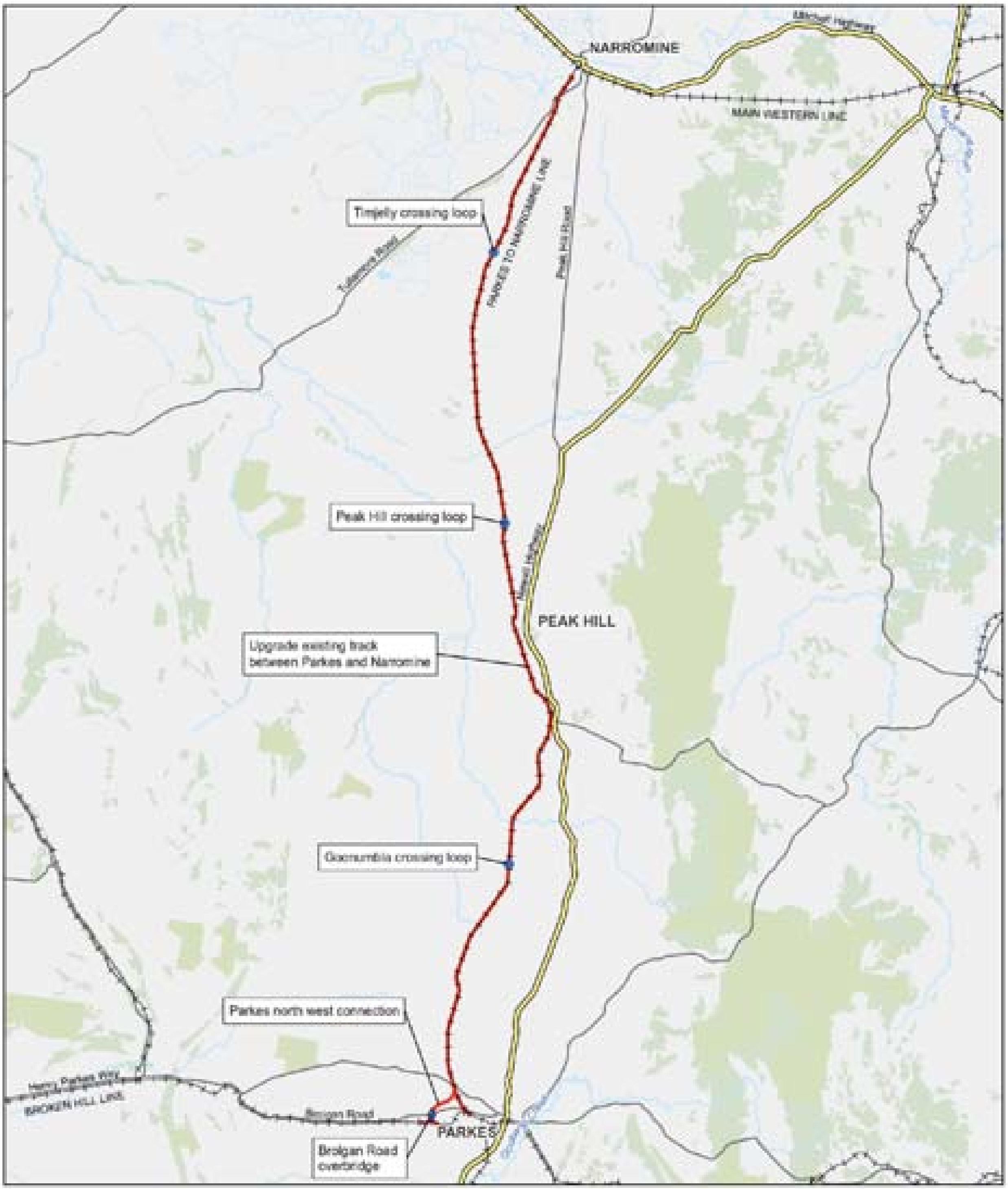
Kilometers

Australian Rail Track Corporation
Inland Rail Track Alignment

Job Number 2217516
Revision 0
Date 30 Nov 2016

Location of the proposal

Figure 1-1



LEGEND

- New bridge
- Crossing loop
- The proposal
- Railway
- Highway
- Road

Paper Size A4

0 2.5 5 10 15

Kilometers

Map Projection: Transverse Mercator

Australian Rail Track Corporation
Inland Rail Track Alignment

Job Number 2217516
Revision 0
Date 19 Jun 2017

Key features of the proposal — **Figure 1-2**

Data source: Commonwealth of Australia (Geoscience Australia), 2006 Topographic Data Series 3, 2006

1.2.3 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.

1.2.4 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.

1.3 Purpose and scope of this report

This report provides the results of the traffic and transport impact assessment of the proposal. It addresses the traffic and transport specific requirements of the SEARs, which are listed in Table 1-1. It also addresses the requirements of Roads and Maritime Services (Roads and Maritime), which are listed in Table 1-2. This report:

- Considers the impact of construction by determining the likely traffic generation, access and egress routes, and parking requirements, in the context of the surrounding road network.
- Determines the existing and future delays (total closure time) at level crossings based on train lengths, travel speeds, and pre and post-train closure times.
- Assesses impacts on travel time due to the proposal.
- Assesses impacts on the wider transport network, including impacts to access, cyclists, pedestrians, and public transport.
- Recommends measures to mitigate the impacts identified.

Table 1-1 Relevant SEARs

Requirements	Where addressed in this report
Traffic and Transport (item 17)	
1. The Proponent must assess construction transport and traffic (vehicle, pedestrian, bus services, train operation and cyclists) impacts, including, but not necessarily limited to:	
a. A considered approach to route identification and scheduling of transport movements.	Section 5.3.2
b. The number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements and track machines).	Section 5.3.1
c. Construction worker parking.	Section 5.3.6
d. The nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements) and assessment of traffic impacts on these routes including identifying traffic management measures to mitigate any issues.	Section 3.3 Section 5.3.1 Section 6.2

Requirements	Where addressed in this report
e. Provisions proposed to ensure safe access and egress to/from the classified road network.	Section 5.3.4
f. The nature of any train paths (types and number of movements) and potential impact to these train paths due to additional track possession requirements.	Section 5.3.5
g. The need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project.	Section 5.3.7
2. The Proponent must assess (and model) the operational transport impacts of the project for both road and rail, including:	
a. Existing and forecast travel demand and traffic volumes for the project (road and rail).	Section 5.4.1
b. Travel time analysis (road and rail).	Section 5.4.1
c. Performance of key interchanges and intersections by undertaking a level of service analysis at key locations.	Section 5.4.2 Section 5.4.3
d. Assessment of impacts on the operation of bus services and public transport infrastructure.	Section 5.4.9
e. Wider transport interactions (local and regional roads, cycling, public and freight transport and the broader NSW rail network).	Section 5.4.7
f. Identification of traffic and transport measures to mitigate any impacts.	Section 6.2
3. The proponent must assess the feasibility of level crossings (existing and planned) and take into account:	
a. Safety assessments.	Section 3.5
b. Consistency with any Interface Agreements and related Safety Management Plans, including draft Interface Agreements and draft Safety Management Plans.	Section 4.1
c. Operation of level crossings with regard to road and rail travel speeds, vehicle types, train lengths, train numbers, road and rail traffic volumes and sight distance.	Section 5.4.3
Health and Safety (item 9)	
1. The Proponent must assess the likely risks of the project to public safety, paying particular attention to pedestrian safety, subsidence risks, bushfire risks and the handling and use of dangerous goods.	Section 5.3.8 Section 5.4.3 Section 5.4.8 Non traffic and transport risks assessed in other reports.

Table 1-2 Roads and Maritime requirements

Requirements	Where addressed in this report
A traffic impact study prepared in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments 2002 and including:	
• Hours and days of construction.	Section 5.3.1
• Schedule for phasing/staging of the project.	Section 5.3.1
• Road and rail traffic volumes including: – Existing background traffic. – Project-related for each stage including construction and operation. – Projected future traffic volumes, including background and project related.	Section 3.3 Section 5.3.2 Section 5.4.2
• Traffic volumes are to also include a description of: – Ratio of light vehicles to heavy vehicles. – Peak times for existing road and rail traffic. – Peak times for project-related road and rail traffic.	Section 3.3 Section 5.3.1 Section 5.4.1
• The origin, destination and routes for construction traffic including: – Employee and contractor light traffic – Heavy traffic – Oversize and over mass traffic.	Section 5.3.2
Details of intermodal hubs required to service the project, their locations, uses and projected traffic impacts on the public road network generated by such development.	Section 5.4.1
Details of access requirements and an analysis of affected intersections are to be provided to determine their suitability. In particular, access requirements and locations to/from the classified road network, that is the Newell Highway (HW17), Henry Parkes Way (MR61), McGrane Way (MR354) and Mitchell Highway (HW7), are to be identified and provisions proposed to ensure safe access and egress.	Section 5.3.4
A description of all oversize and over mass vehicles and the materials to be transported. The shortest and least trafficked route is to be given priority for the movement of materials and machinery to minimise the risk and impact to other motorists, so far as is reasonably practicable.	Section 5.3.1
The impact of generated traffic and measures employed to ensure efficiency and safety on the public road network during construction and operation of the project.	Section 5.3.2 Section 5.4.2 Section 6.2
The level crossing feasibility study is to include a safety assessment for each level crossing. The safety assessment should be consistent with any Interface Agreements and related Safety Management Plans, including draft Interface Agreements and draft Safety Management Plans.	Section 3.5 Section 4.1 Section 5.4.3
Consideration should also be given to the operation of level crossings with regard to road and rail travel speeds, vehicle types, train lengths, road and rail traffic volumes and sight distance.	Section 5.4.3

Requirements	Where addressed in this report
The distance between rail lines and road intersections is to be measured to identify storage capacity and any short stacking risks for road traffic giving way to rail traffic. Improvements to the road network, including upgrades to rail crossings, road widening and intersection treatments, to cater for and to mitigate the impact of project-related traffic are to be identified and provided in the study.	Section 5.4.3
Vibration assessments and studies are to include the impact of construction and rail traffic on nearby road infrastructure including roads, bridges, culverts and road side furnishings.	Refer separate assessment
Proposed road facilities, access and intersection treatments, including road-rail interfaces are to be identified and be in accordance with Austroads Guide to Road Design and Roads and Maritime supplements.	Section 6.2.1
Local climate conditions that may affect road safety for vehicles used during construction and operation of the project (e.g. fog, wet weather, etc).	Section 6.2.1
A Traffic Management Plan is to be developed in consultation with Parkes Shire Council, Narromine Shire Council and Roads and Maritime prior the commencement of haulage and/or construction operations.	Section 6.2.1
Details of existing or required rail encroachments into adjoining road reserves.	Section 5.3.4

1.4 Structure of this report

The report is structured as follows.

- Section 1 – provides an introduction to the report and assessment
- Section 2 – describes the methodology for the assessment
- Section 3 – describes the existing conditions on the road and rail network
- Section 4 – outlines relevant details of the proposal
- Section 5 – outlines the impacts of construction and operation of the proposal
- Section 6 – provides mitigation measures for the impacts identified
- Section 7 – conclusion

2. Assessment approach and methodology

2.1 Methodology

The methodology for undertaking this traffic and transport impact assessment was as follows:

- Review concept design for the proposal.
- Determine the likely traffic generation of the construction activities associated with the proposal.
- Make an assessment of the traffic impacts of construction, including pedestrians, cyclists and public transport.
- Obtain traffic volume data for the road network surrounding the site and key level crossings.
- Determine the existing and future delays (total closure time) at level crossings based on train lengths, travel speeds and pre- and post-train closure times:
  - It was assumed that at active crossings the boom gates close 45 seconds prior to a train arriving and open five seconds after the end of train has passed. Actual times vary on a site by site basis, with the assumed values representing a worst-case scenario.
- Assess impacts on travel time of road users.
- Assess impacts on wider transport network, including impacts to cyclists, pedestrians and public transport.
- Determine mitigation measures for any impacts identified in the assessment.

2.2 Legislative and policy context

The following documents are referenced in SEARs for this proposal:

- Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads, 2007)
- Guide to Traffic Generating Developments Version 2.2 (RTA, 2002)
- Cycling Aspects of Austroads Guides (Austroads, 2014)
- NSW Bicycle Guidelines v 1.2 (RTA, 2005)
- Planning Guidelines for Walking and Cycling (DIPNR, 2004)
- NSW Sustainable Design Guidelines Version 3.0 (TfNSW, 2013)
- Central West Regional Transport Plan (TfNSW 2013)
- Western Regional Transport Plan (TfNSW 2013)
- Construction of New Level Crossing Policy (TfNSW)
- NSW Freight and Port Strategy (TfNSW 2013)
- ONRSR Railway Crossing Policy (2016)

2.3 Outcomes sought in relation to traffic and transport

The proposal will provide for more efficient and productive rail operations, while minimising impacts on the operation of the road network around the proposal. This includes managing any short-term impacts during construction, and ongoing issues once the proposal is complete and is operational.

3. Existing environment

3.1 Key roads in the study area

The road network within the study area consists mainly of local roads and private rural roads. The major roads within the study area include the Newell Highway, part of the National Highway, and Henry Parkes Way, a State Road under the management of Roads and Maritime Services.

3.1.1 Newell Highway

The Newell Highway runs generally north-south, and connects between the Goulburn Valley Highway near the Victoria/New South Wales border, and Leichardt Highway near the Queensland/New South Wales border. Within the study area, the Newell Highway runs to the east of the rail line between Parkes and Tomingley, passing through Peak Hill.

Outside of built-up areas the Newell Highway has a posted speed limit of 110 kilometres per hour, and generally comprises a single lane of travel in each direction on a single carriageway, with sealed shoulders. Overtaking lanes are provided in some locations.

3.1.2 Henry Parkes Way

Henry Parkes Way (part of Main Road 61) is an arterial road connecting Parkes and Condobolin. It is a state owned road. The proposal site crosses Henry Parkes Way about six kilometres north west of Parkes. At this location, Henry Parkes Way comprises a single lane of travel in each direction on a single carriageway, with a posted speed limit of 100 kilometres per hour.

3.1.3 Other roads

The proposal crosses a number of local roads, which are listed in Table 3-1. Local roads are managed by the relevant local government. State roads and the National Highway are managed by Roads and Maritime Services. Regional roads are managed jointly by Roads and Maritime and local government.

Table 3-1 Roads crossed by the proposal[1]

Road name	Road management	Surface type	Shoulders	Linemarking
Dandaloo Road	Local - Narromine	Sealed	No	Yes
Old Backwater Road	Local - Narromine	Sealed	No	No
Wingfield Road	Local - Narromine	Unsealed	No	No
McGrane Road (Tullamore to Narromine Road)	Regional	Sealed	No	Yes
Craigie Lea Lane	Local - Narromine	Unsealed	No	No
Narwonah Road	Local - Narromine	Sealed	No	No
Haberworth Lane	Local - Narromine	Unsealed	No	No

[1] Excluding private roads and some unnamed local roads

Road name	Road management	Surface type	Shoulders	Linemarking
Fairview Road	Local - Narromine	Unsealed	No	No
Wyanga Road	Local - Narromine	Unsealed	No	No
Tinks Lane	Local - Narromine	Unsealed	No	No
Tomingley West Road	Local - Narromine	Sealed	No	No
Kitto's Bridge Road	Local - Narromine	Unsealed	No	No
Bulgandramine Road	Local – Narromine / Parkes	Sealed	No	No
Tullamore Road (Ingalba Street)	Regional	Sealed	No	Yes
Mingelo Street	Local - Parkes	Sealed	No	No
Whitton Park Road (Attwells Lane)	Local - Parkes	Sealed	No	No
Trewilga Road	Local - Parkes	Unsealed	No	No
Mickibri Road	Local - Parkes	Unsealed	No	No
Barber Lane	Local - Parkes	Unsealed	No	No
Alectown West Road	Local - Parkes	Unsealed	No	No
Bogan Road	Local - Parkes	Sealed	No	Yes
Wyatts Lane	Local - Parkes	Unsealed	No	No
Nanardine Lane	Local - Parkes	Unsealed	No	No
Back Trundle Road	Local - Parkes	Sealed	No	Yes
Henry Parkes Way	State	Sealed	Yes	Yes
Millers Lookout Road	Local - Parkes	Unsealed	No	No
Brolgan Road	Local - Parkes	Sealed	Yes	Yes
Coopers Road	Local - Parkes	Unsealed	No	No

Also relevant to the assessment are a number of roads which run parallel to the proposal, and may be used for construction access. These are listed in Table 3-2.

Table 3-2 Roads parallel to the proposal

Road name	Road management	Surface type	Shoulders	Linemarking
Peak Hill Railway Road	Local - Narromine	Sealed	No	No
McGrane Road	Regional	Sealed	No	Yes
Tomingley Road	Regional	Sealed	Yes	Yes
Bulgandramine Road	Local – Narromine / Parkes	Sealed	No	No
Newell Highway	National Highway	Sealed	Yes	Yes
Railway Parade	Local - Parkes	Unsealed	No	No
Mickibri Road	Local - Parkes	Unsealed	No	No
Plowman Lane	Local - Parkes	Unsealed	No	No

3.2 Existing rail movements

The Parkes to Narromine line forms a cross-country link between the Main Western and the Broken Hill lines. Parkes is located on the Broken Hill line and Narromine located on the Main Western line.

3.2.1 Passenger services

The Parkes to Narromine line was closed to passenger services in the early 1970s.

The Indian Pacific, which travels between Sydney and Perth on the Main Western Line, stops at Parkes twice a week. The Broken Hill Outback Xplorer service, run by NSW TrainLink, travels to Broken Hill on Mondays and Sydney on Tuesdays.

3.2.2 Freight services

The Parkes to Narromine line is used by grain and general freight trains at an average rate of 3.8 trains per day (two way) with up to 10 trains on a peak day.

Trains using the line have a maximum length of 1,800 metres. Train speeds are limited to a maximum of 90 to 100 kilometres per hour, with local speed restrictions due to limitations associated with the existing track.

3.3 Existing traffic volumes around the proposal site and on construction access routes

Given the length of the proposal site, the access routes will vary depending on the origin of construction vehicles and the particular location of the work site. Limited traffic volume data is available for most roads in and around the study area, although based on road function, location and surrounding land use volumes are expected to range between 50 vehicles per day for lower order roads, up to 2,000 vehicles per day on some of the more significant roads connecting to Parkes. The busiest road to be affected is the Newell Highway, which is discussed below.

3.3.1 Newell Highway

Traffic volumes along the Newell Highway vary within the study area. Traffic counts (sourced from the Roads and Maritime Services Traffic Volume Viewer, www.rms.nsw.gov.au) indicate Annual Average Daily Traffic (AADT) volumes as shown in Figure 3-1, Figure 3-2 and Figure 3-3.

Tomingley

- 2,800 vehicles per day in 2015
  - 33 percent heavy vehicles
  - Peak volumes of around 220 vehicles per hour (two-way), with traffic volumes relatively consistent between 9:00 am and 5:00 pm

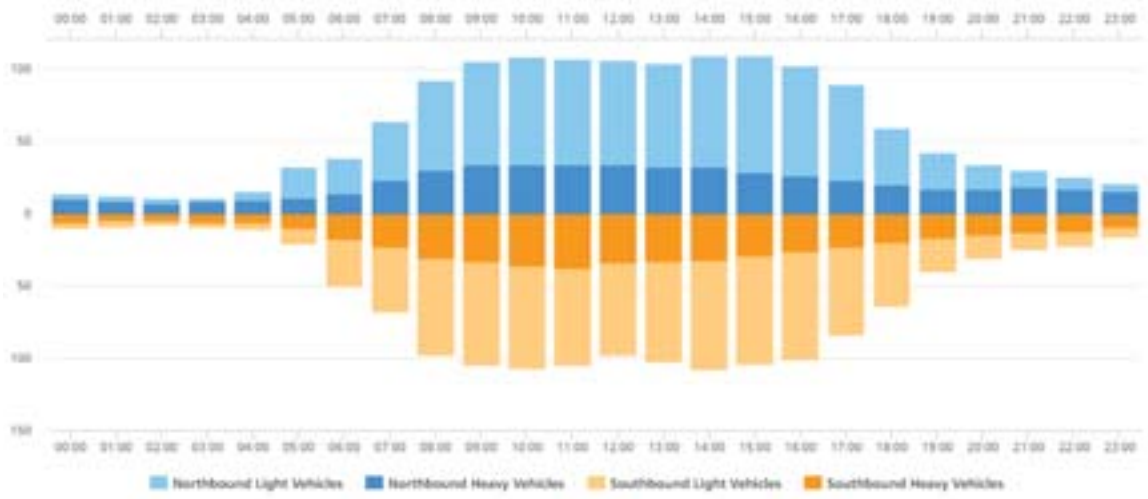


Figure 3-1 Newell Highway daily traffic profile at Tomingley 2015

Peak Hill (Caswell Street)

- 6,100 vehicles per day in 2009
  - Peak volumes of 240 vehicles per hour, in the peak direction, highest in the mid-morning

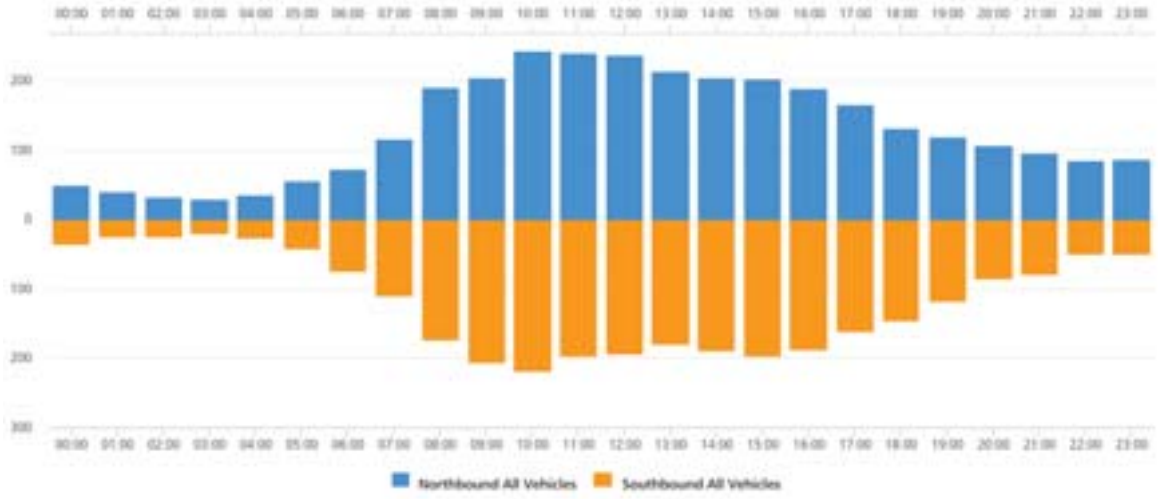


Figure 3-2 Newell Highway daily traffic profile at Peak Hill 2009

Parkes (South of Bogan Road)

- 2,800 vehicles per day in 2009
  - 31 percent heavy vehicles
  - Peak volumes of around 220 vehicles per hour (two-way), relatively consistent across the middle of the day

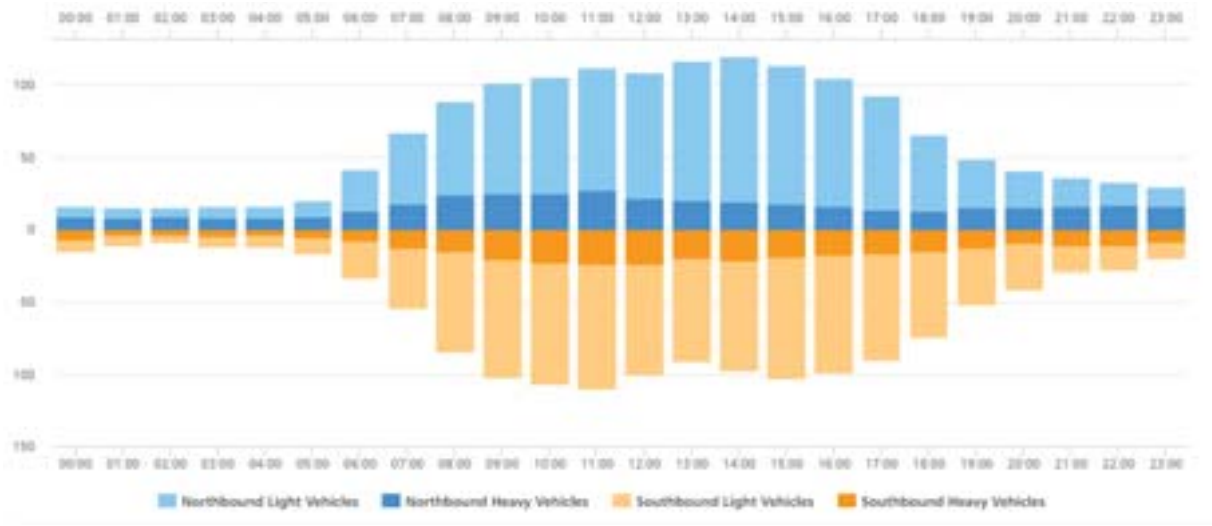


Figure 3-3 Newell Highway daily traffic profile at Parkes 2009

Level of Service

A Level of Service assessment was undertaken for the Newell Highway, using the methodology outlined in the Austroads Guide to Traffic Management for two-lane, two-way roads. For the busiest of the above segments, at Peak Hill with a peak direction volume of 260 vehicles per hour (allowing for 1.2 percent per annum growth in the peak hour volume since the 2009 count), the Newell Highway currently operates at Level of Service B.

Approximate volume thresholds have been identified for each Level of Service band, for key road types in the study area, as an indication of the volume of traffic each road type is able to accommodate. These are shown in Table 3-3.

Table 3-3 Indicative maximum one-way volumes for Level of Service bands (vehicles/hour)

Level of Service band	Newell Highway	Henry Parkes Way	Local roads
Road Description	2-lane, wide sealed shoulders	2-lane, narrow sealed shoulders	No centre line, no shoulders
A	250	150	150
B	500	500	900
C	900	900	1450
D	1500	1500	2000

Note that the method of calculating Level of Service is different for local roads than for the other road types. For highway-type roads, Level of Service is determined by a combination of average speed and percent time spent following (unable to overtake). For local roads, the average speed relative to the free flow speed is the determinant of Level of Service.

Seasonal variation

Based on the dominant rural/agricultural land uses of the study area, traffic volumes on the road network are likely to increase during harvesting season. Harvest of winter crops in the study area can begin in late October and continue through until January in higher rainfall areas (Australian Grain Magazine, July 2016). Key winter crops in the study area include wheat, barley, oats and cereal rye. During this season, heavy vehicle usage on local and main roads in the study area increases as trucks transport grain and tractors and harvesters move between properties. Farming machinery is generally much larger and slower than other vehicles using the roads, and may result in localised delays.

A sensitivity assessment for seasonal variation in potential traffic impacts has been undertaken, detailed in Section 5.3.2.

3.4 Key intersection performance

A number of intersections are located on local roads near the proposal site. These are all priority controlled intersections (with give-way or stop signs), with very low traffic volumes on the side roads, and relatively low volumes on through movements. Intersections near the proposal site within the main towns and villages are listed in Table 3-4. The performance of these intersections was not quantified as part of the assessment. However, as a result of the low traffic volumes, it is expected that there would be little to no delay.

Table 3-4 Key intersections located near the proposal site

Locality	Intersecting road	Intersecting road
Narromine	Peak Hill Railway Road	The McGrane Way
Narromine	Wingfield Road	The McGrane Way
Narromine	Wilsons Lane	The McGrane Way
Narromine	Dandalloo Road	Dandaloo Street
Tomingley	Tomingley West Road	Peak Hill Railway Road
Peak Hill	Tullamore Road	Bulgandramine Road
Peak Hill	Whitton Park Road	Railway Parade
Peak Hill	Whitton Park Road	Newell Highway
Peak Hill	Newell Highway	Trewilga Road
Peak Hill	Trewilga Road	Mickbiri Road
Alectown	Alectown west Road	Plowman Lane
Alectown	Alectown west Road	Mickbiri Road
Parkes	Henry Parkes Way	Brolgan Road
Parkes	Henry Parkes Way	Millers Lookout Road
Parkes	Brolgan Road	Harigan Avene/Westlime Road
Parkes	Brolgan Road	Coopers Road

3.5 Level crossings

There are 71 level crossings (33 public and 38 private) along the proposal. A number of the crossings categorised as public roads are crown roads which provide access to single landholdings. Five of the crossings are controlled by active warning systems (warnings by flashing lights, sounds and/or barriers) and the remaining 66 crossings are controlled by passive systems (warnings provided through signs and line markings). The active crossings are located at:

- Brolgan Road
- Henry Parkes Way
- Bogan Road
- Ingalba Street
- Tullamore-Narromine Road

A summary of existing level crossing protection types between Parkes and Narromine is provided in Table 3-5.

Table 3-5 Existing level crossing protection

Level crossing protection type	Number
No protection	0
Passive: Give way signage ('RX-1')	0
Passive: Stop signage ('RX-2')	66
Active: Lights and bells ('RX-5')	5
Active: Lights, bells and booms ('RX-5 + booms')	0
Active: Lights, bells and advanced warning ('RX-11')	0
Total	**71**

The duration of any delay at a level crossing is related to factors including the train length (up to the 1800 metre maximum length currently allowed on the line) and the train speed. At active crossings, ARTC Engineering (Signalling) Standard ESD-03-01 requires a minimum pre-train warning time of 30 seconds, and a minimum 3 seconds once the train has passed. However in some locations the pre-warning time is 45 seconds, with 5 seconds once the train has passed, and this conservative assumption has been applied to the assessment of all level crossings in the study area.

Further detail on the level crossing strategy is located in Chapters 5 & 6 of the Environmental Impact Statement.

3.6 Parking

There is no formal on-street or off-street parking provided along or near the proposal site.

Rest areas are provided along the Newell Highway. Between Parkes and Tomingley, there are four rest areas designated for heavy and light vehicle access, and a further five suitable for light vehicles only.

3.7 Public transport

In addition to the passenger trains servicing Parkes as outlined in Section 3.2.1, there are a number of coach services providing links to and within the study area. Parkes is serviced four to five times per day by a coach network including services to Dubbo and Orange. Narromine is serviced by a coach between Dubbo and Bourke or Broken Hill with four services most days. These regional services operate on the Newell Highway.

There are also local buses including school services around Parkes, Peak Hill and Narromine. School buses cross the study area on various routes both before and after school including:

- Dandaloo Road
- Kitto's Bridge Road
- Tullamore Road
- Trewilga Road
- Bogan Road
- Henry Parkes Way

3.8 Pedestrians and cyclists

There are no pedestrian or cyclist paths which cross the proposal site. Given the remote nature of the proposal site, there is very low pedestrian and cyclist activity. Cycling is catered for on road shoulders, where provided.

3.9 Road safety

The five-year crash history (2009-2013) for the various roads in the study area was obtained from the Transport for NSW Centre for Road Safety. This is summarised in Table 3-6.

The most crashes occurred on the Newell Highway, which is to be expected given the higher volumes of traffic compared to other roads. The high proportion of serious and moderate injury crashes is also noted, most likely a factor of higher vehicle speeds on rural roads.

Table 3-6 Crash history 2009-2013

	Fatal	Serious	Moderate	Minor	Total
Newell Highway[2]					
Dubbo - Tomingley	3	10	6	0	**19**
Tomingley - Peak Hill	0	4	3	0	**7**
Peak Hill (town)	1	1			**2**
Peak Hill - Alectown	1	3	1	3	**8**
Alectown - Parkes	0	3	2	5	**10**
Newell Highway Total	***5***	***21***	***12***	***8***	**46**
Other roads					
Old Backwater Road	0	1	0	0	**1**
Tomingley Road	0	2	1	1	**4**
Plowman Lane	0	1	0	0	**1**
Bogan Road	0	0	2	0	**2**
Henry Parkes Way	0	2	2	0	**4**
Brolgan Road	0	1	1	1	**3**

[2] Excludes urban areas in Dubbo and Parkes

4. The proposal

The proposal is generally located in the existing rail corridor between the towns of Parkes and Narromine, via Peak Hill (as shown in Figure 1-1).

The proposal would involve upgrading the existing rail line between Parkes and Narromine, including:

- Upgrading the existing track and track formation.
- Providing a new five kilometre long section of rail line near Parkes to provide a new north to west connection between inland rail and the Broken Hill line (Parkes north west connection), including three connections between the rail lines, and a new road bridge over the rail corridor at Brolgan Road (see further detail in Section 4.2).
- Providing three new crossing loops within the rail corridor at Goonumbla, Peak Hill, and Timjelly.
- Realigning the track within the existing rail corridor to minimise the radius of tight curves.
- Replacing bridges/culverts where the rail corridor crosses watercourses.

The following ancillary works would also be undertaken:

- Upgrading, closing or consolidating level crossings
- Upgrading signalling and communications
- Establishing new fencing or upgrading existing fencing along the rail corridor
- Relocating/protecting services and utilities.

4.1 Level crossing upgrades

There are 71 existing level crossings which are crossed by the proposal, including 38 of which are on private roads. The preferred approach to level crossings consists of a mix of retaining, upgrading and investigating the potential consolidation of level crossings, as summarised in Table 4-1. Upgrades of the type of protection to boom barrier controls has been proposed at 11 public crossings. 19 level crossings, primarily on private roads have been identified as requiring further investigation in relation to crossing consolidation. Any crossing consolidation will not be finalised unless there is a legal alternative means of access and the local Council, Roads and Maritime or landowner (in the case of a private crossing) have consented to the proposed consolidation.

Table 4-1 Quantity and type of level crossing changes

Action	Number of public crossings affected	Number of private crossings affected	Total
Consider crossing consolidation based on the outcomes of further investigation and stakeholder endorsement	2	17	19
Retain existing passive protection (stop sign)	20	19	39
Retain existing active protection (railway crossing flashing signal and boom)	0	0	0
Upgrade from flashing lights to flashing lights and boom barriers	5	0	5

Action	Number of public crossings affected	Number of private crossings affected	Total
Upgrade from stop signs to flashing lights and boom barriers	6	0	6
Gated crossing with administrative controls such as the requirement to phone train control prior to use	0	2	2
Totals	**33**	**38**	**71**

4.2 Parkes north west connection

4.2.1 Brolgan Road overbridge

An overbridge is proposed to enable Brolgan Road to cross the Parkes north west connection with sufficient clearance for double stacked Inland Rail trains to pass beneath. To enable access along Brolgan Road to be maintained during construction, the overbridge would be constructed 'offline' and to the north of Brolgan Road. The new overbridge would consist of 1,040 metres of new two-lane road with a design speed of 80 kilometres per hour, and would include a bridge structure and two tie-ins to the existing Broken Hill line.

4.2.2 Cooper Road

Coopers Road is an unsealed local road that intersects with Brolgan Road to the north, London Road about midway along, and Watts Lane to the south. Brolgan Road and London Road provide access to Parkes, and Watts Lane connects to the Newell Highway. The eastern branch line of the Parkes north west connection would cross Coopers Road about 110 metres to the north of the existing level crossing on the Broken Hill railway line, 845 metres to the south of Coopers Road's intersection with Brolgan Road, and 2.8 kilometres to the north of its intersection with London Road. Any road realignment as a result of Parkes north west connection would be determined during the detailed design phase where further investigations and consultation with stakeholder will be undertaken.

4.2.3 Millers Lookout Road

The northern section of Millers Lookout Road is an unsealed local road that intersects with Henry Parkes Way. The southern section is a narrow unsealed track that intersects with Brolgan Road via an access gate near Brolgan Road.

The Parkes north west connection would cross Millers Lookout Road about 675 metres to the north of Brolgan Road, and 2.3 kilometres to the south of its intersection with Henry Parkes Way.

Any road realignment as a result of Parkes north west connection would be determined during the detailed design phase where further investigations and consultation with stakeholders will be undertaken.

5. Impact assessment

5.1 Risk assessment

The risk assessment process involved consideration of the consequence and likelihood of the risks associated with each issue identified. The criterion upon which this assessment was based is given in Table 5-1. A consequence and likelihood were selected from Table 5-1 that best represented the likely outcome if the potential hazard actually did occur. For each consequence, the likelihood was considered in terms of the most likely outcome and not the "absolute worst case". Using this information, the risks were then rated using the matrix in Table 5-2 that gave a result in terms of high, significant, moderate or low risk.

Table 5-1 Risk assessment

Consequence		Qualitative measures of consequence or impact	OH&S risk classification
A	Extreme	• Unacceptable impact to the performance of the network • Intersection performance operates at a Level of Service (LoS) of F • Total property damage	• Permanent and severe disablement • One or more fatalities
B	Major	• Major impact to the performance of the network. • Intersection performance operates at a Level of Service (LoS) of E • Major property damage	• Significant injuries • Hospitalisation required
C	Moderate	• Moderate impact to the performance of the network • Intersection performance operates at a Level of Service (LoS) of D • Moderate property damage	• Medical treatment required • Lost time injury
D	Minor	• Minor impact to the performance of the network • Intersection performance operates at a Level of Service (LoS) of C • Minor property damage	• Minor medical treatment required • Not a lost time injury
E	Not significant	• No impact to the performance of the network. • Affected intersection leg operates at a Level of Service (LoS) of A or B • No property damage	• Minor first aid treatment required • Immediate return to work
Likelihood		Description	
1	Almost Certain	An event or situation that is happening more or less all the time, including continuous situations	
2	Likely	An event or situation that occurs or is likely to occur about 10 times or more per year	
3	Possible	An event or situation that occurs or is likely to occur about once per year	
4	Unlikely	An event or situation or event that occurs or is likely to occur about once every 10 years	
5	Rare	An event or situation that occurs or is likely to occur less frequently than once every 10 years.	

Table 5-2 Risk rating

Risk Assessment Matrix	Consequence				
Likelihood	Not significant	Minor	Moderate	Major	Extreme
Almost Certain	Medium	Medium	High	Very high	Very high
Likely	Low	Medium	High	High	Very high
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	High

Table 5-3 summarises this risk assessment for both construction and operation phases of the proposal.

Table 5-3 Risk assessment

Risk	Likelihood	Consequence	Risk Rating
Construction			
Delays on road network • Due to increased construction traffic	Unlikely	Minor	Low
Safety • Crashes between construction traffic and general traffic	Unlikely	Major	Medium
Operation			
Increased delays at level crossings • Due to increased train activity	Likely	Moderate	High
Safety • Crashes between vehicles and trains at level crossings	Possible	Extreme	High

5.2 How potential impacts have been avoided

To most road users, with the proposal in place there will be little obvious changes that would affect their behaviour, or interpretation of a situation. That is, level crossings would continue to operate as normal, with warning devices and other controls installed as per ARTC policy. Interactions between vehicles on the road network would continue to be defined by road rules and the physical configuration of the road, which in most cases will not change from existing conditions.

In most cases construction activities will be located clear of the existing road network. Any short-term impacts associated with construction vehicle access or works at particular sites will be governed by specific traffic management arrangements.

5.3 Construction impacts

5.3.1 Vehicle movements

Construction activity will generate additional vehicle movements including light and heavy vehicles. Light vehicles will generally be construction workers moving to and from specific construction activity areas. Heavy vehicle movements will generally be trucks delivering materials; including fill, ballast, sleepers and culverts, and removing spoil. It is expected that some material, particularly sections of rail, will be delivered by train.

Timing and Staging

An indicative construction program is shown in Figure 5-1. Construction along the existing rail corridor would be undertaken in three stages. For each stage, rail traffic would be diverted as described in Table 5-4. The Parkes to Narromine line is used on an average rate of three to four trains per day (both directions), with up to 10 trains on a peak day.

Construction of the Parkes north west connection and the Brolgan Road overbridge would be undertaken in parallel with stages one and two along the existing rail corridor.

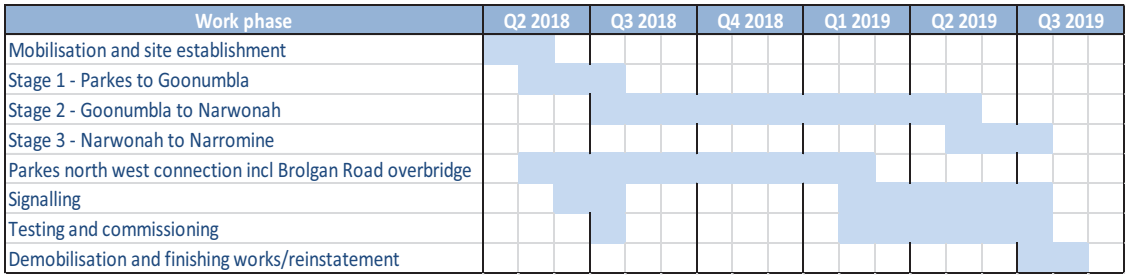


Figure 5-1 Indicative construction program

Table 5-4 Construction staging for work in the existing rail corridor

Stage	Location	Distance (km)	Rail traffic
1 – Parkes to Goonumbla	Located between the southern end of the proposal site (described in section 2.2 and including the Parkes north west connection) and the Goonumbla siding, which is located about 17 km north of the southern end of the proposal side, just north of Bogan Road	17	Redirected north through Narromine via the Main Western line
2 – Goonumbla to Narwonah	Located between the Goonumbla siding, and the Narwonah grain siding, which is located about 5 km south of Narromine	85	Redirected south from Goonumbla and north from Narwonah
3 – Narwonah to Narromine	Located between the Narwonah grain siding and the northern end of the proposal site (described in section 2.2)	5	Redirected south from Narwonah

Working Hours

Construction work would be undertaken during the following hours:

- Monday to Friday: 6 am to 6 pm
- Saturday: 6 am to 6 pm
- Sundays and public holidays: 6 am to 6 pm.
- 24 hours during possessions

Work during possessions

Some minor works may also be undertaken during scheduled rail corridor possession periods (that is, the times that the movement of trains along the rail corridor are stopped for maintenance). This could include, for example, the connection of the tracks at either end of each stage, and some finishing works. During possessions, works may need to be undertaken on a 24 hour basis.

Workforce

For the majority of the construction period, the workforce would average about 150 people. For some limited items of work an additional short-term workforce may be required.

Workers would travel to the site each day in either one of three 25-seat buses or for local workers their own vehicles. Materials would be delivered to the site by a mixture of small and large trucks. Typical total traffic generation is summarised in Table 5-5.

Table 5-5 Construction traffic generation

Vehicle type	Movements per day	Indicative peak hour (one-way)
Light vehicles (cars and utes)	170	75
Light trucks and buses	30	11
Haulage and delivery trucks	200	28
Total heavy vehicles	***230***	***39***
Total vehicles	**400**	**114**

Any movement of oversize or over-mass vehicles will, if required, be subject to specific route planning and road authority approvals. Such movements may be required to utilise the local road network in preference to the Newell Highway and other major roads, in order to minimise traffic impacts. The timing of oversize vehicle movements may also be restricted to minimise impacts.

5.3.2 Access Routes

For the works along the existing rail corridor, the general approach to construction would be to delineate the proposal site into a number of discrete construction work areas, each about 4.5 to five kilometres in length. Each 4.5 to five kilometre section would take about eight to 10 weeks to construct.

Potential access routes to each part of the proposal are identified in Table 5-6. Note that generally access to the southern areas (lower chainages) will be from Parkes, and the northern areas will be accessed from Narromine or Dubbo. Some locations will have two access points, and some will have alternative routes available, depending on the origin.

Note that the route between Dubbo and Narromine has been excluded from this table, for clarity.

Table 5-6 Potential construction access routes

Chainage	Primary route	Secondary route	Tertiary route
Parkes north west connection	Dalton Street	Middleton Street	Brolgan Road
449.2-453km	Dalton Street	Middleton Street	Brolgan Road
	Dalton Street → Henry Parkes Way		
453-457.5km	Dalton Street → Henry Parkes Way	Moulten Street	Back Trundle Road
457.5-462km	Dalton Street → Henry Parkes Way	Moulten Street	Back Trundle Road → Nanardine Lane
	Newell Highway	Bogan Road	Wyatts Lane
462-466.5km	Newell Highway	Bogan Road	
466.5-471km	Newell Highway	Bogan Road	Plowman Lane → Access Track
471-175.5km	Newell Highway	Alectown West Road	
	Newell Highway	Bogan Road	Plowman Lane
475.5-480km	Newell Highway	Alectown West Road	
	Newell Highway	Alectown West Road	Mickibri Road → Barber Lane
480-484.5km	Newell Highway	Alectown West Road	Mickibri Road
	Newell Highway	Claremont Lane	
484.5-489km	Newell Highway	Claremont Lane	Mickibri Road
489-493.5km	Newell Highway	Trewilga Road	
	Newell Highway	Access Track	
498.5-498km	Newell Highway	Access Track	
	Newell Highway	Whitton Park Road	
498-502.5km	Newell Highway	Whitton Park Road	Access Track
	Newell Highway	Kitto's Bridge Road	
502.5-507km	Newell Highway*	Access Track	
507-511.5km	Newell Highway*	Sharah's Access Road	
511.5-516km	Newell Highway*	Tomingley West Road	Back Tomingley West Road → Access Track
	Newell Highway*	Tomingley West Road	
516-520.5km	Newell Highway*	Tomingley West Road	Peak Hill Railway Road
520.5-525km	The McGrane Way	Peak Hill Railway Road	
	Newell Highway	Tomingley West Road	Peak Hill Railway Road
525-529.5km	The McGrane Way	Peak Hill Railway Road	
	Newell Highway	Tomingley Road	Wyanga Road
529.5-534km	The McGrane Way	Peak Hill Railway Road	
	Newell Highway	Tomingley Road	Wyanga Road → Peak Hill Railway Road
534-538.5km	The McGrane Way	Peak Hill Railway Road	

Chainage	Primary route	Secondary route	Tertiary route
	Newell Highway	Tomingley Road	Wyanga Road → Peak Hill Railway Road
538.5-543km	The McGrane Way	Peak Hill Railway Road	
	Newell Highway	Tomingley Road	Wyanga Road → Peak Hill Railway Road
543-547.5km	The McGrane Way	Peak Hill Railway Road	
	Newell Highway	Tomingley Road	Narwonah Road
547.5-552km	The McGrane Way	Access Road	
552-556.5km	The McGrane Way	Access Road	
	Dandaloo Street	Old Backwater Road	

* From Narromine, access to the Newell Highway would be via Tomingley Road

5.3.3 Traffic impacts

Construction of the proposal would result in temporary impacts to traffic and access within the study area, and an increase in both heavy and light vehicle movements on the local road network. The extent of impacts will depend on the location of the works, and the origin of material and/or workers. A worst-case assessment is detailed below.

Daily traffic generation associated with construction is some 400 individual vehicle movements, including 230 heavy vehicle movements. The peak hour for traffic generation would occur at the beginning and end of each shift, with up to 114 vehicle movements (one way), including some 39 heavy vehicles.

The Newell Highway is the busiest of the roads likely to be used for construction access, and as described in Section 3.3 has a peak hourly volume of approximately 260 vehicles in one direction. An additional 100 vehicles per hour (a 38 percent increase, noting that trucks have a disproportionate impact compared to light vehicles), even if they were added to the peak hour, would bring the total volume to around 360 vehicles per hour. This is well within the threshold for Level of Service B, as listed in Table 3-3. The anticipated maximum hourly volume on all of the roads expected to be used for access is within the threshold for Level of Service B.

Even if the peak hourly volume were to be increased by 50 percent, for example due to seasonal variation, Level of Service B would be maintained.

Proposed works on level crossings may also result in disruptions to local traffic and temporary access restrictions to private property. Where this occurs, alternative access arrangements would be provided and/or appropriate traffic controls implemented. These will be detailed in a Construction Traffic Management Plan (see further discussion in Section 6).

5.3.4 Access and egress

Construction vehicle access to the proposal site would be via the existing road network and access tracks within the rail corridor. Access points from the public road network must be chosen such that adequate sight distance and a safe access/egress path is available. Further investigation of access locations is required once further detail around the construction methodology is known. All construction site access points will be designed in accordance with Australian Standards with adequate sight lines to ensure they operate in a safe and efficient manner. In addition, where possible access will be provided from secondary roads to minimise the potential disruptions to the nearby arterial road network.

At all site access points traffic on the existing road network will have priority, with construction traffic required to give way before turning. This will minimise any delays to general traffic associated with these intersections.

Encroachment of construction works into existing road reserves is not anticipated.

5.3.5 Impacts to train paths

Construction activities will result in temporary impacts on existing rail operations. During each construction stage, rail operations would be altered as outlined in Table 5-4. It is possible that on some parts of the rail network there would be additional train activity, either in terms of train length or frequency. This may increase the frequency of delays at some level crossings. However the maximum length of trains would still be restricted according to ARTC operational restrictions for each line, and therefore the length of delays at crossings are not likely to increase significantly (assuming train speeds are not lower).

5.3.6 Parking impacts

Where required, parking for construction workers will be generally within the construction compounds and therefore not impact on surrounding roads. Adequate parking will be provided on site to accommodate the peak demands associated with the construction phases of the proposal, including parking for buses where necessary. Based on the worker numbers detailed in Section 5.3.1, parking may be required for up to eight buses per lot. If buses are not used, car parking demand may be up to 150-180 vehicles.

5.3.7 Road network impacts

The greater road network is not expected to be significantly impacted by the construction activities. This is because the roads have sufficient capacity to absorb the increased traffic, and delays or closure at crossings will have localised affect only due to the low volumes on affected roads. During the peak construction activity, Level of Service B is expected to be achieved on all affected roads.

Although the volume of construction activity may be relatively high across the day, it is expected that construction vehicle movements will be spread out across the day, particularly delivery trucks. This will also assist in minimising any additional delays for vehicles turning from side roads at intersections along the construction access routes.

Construction of the Brolgan Road overbridge over the Parkes north west connection may have localised impacts on Brolgan Road traffic, including access to Coopers Road, although the new bridge will be primarily constructed on a separate alignment which will minimise disruption. Specific traffic control arrangements will be developed, and the necessary road and rail authority approvals will be obtained.

5.3.8 Pedestrian and cyclist impacts

Given the low volume of pedestrian and cyclist activity in the study area, there is not expected to be any significant impacts to pedestrian and cyclists. Localised management measures will be implemented where necessary around construction sites and access points.

5.3.9 Public transport impacts

Coaches between Parkes and Condobolin will cross the Henry Parkes Way level crossing. While construction works are occurring in this area, there may be some short-term delays to some services.

As with other traffic, public buses may be impacted by the increase in traffic on the road network. However, given the relatively small number of services in the area, it is expected to be a minor impact.

More detailed measures to minimise impacts to public transport, including school buses, will be incorporated into the Construction Traffic Management Plan.

5.4 Operation impacts

5.4.1 Existing and forecast travel demands

Road

During operation, there will be some maintenance/operational traffic generated, however this will be minimal and is not expected to create an adverse impact on the operation of the road network.

Increase in the road freight task that may be required to service the additional freight demand at Parkes and Narromine has not been considered in this assessment.

Rail

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. It is estimated that, once operational, Inland Rail would be trafficked by an average of 8.5 trains per day in 2025, increasing to the estimated maximum of 15 trains per day in 2040. This traffic would be in addition to the existing rail traffic using the Parkes to Narromine line (average four trains per day).

5.4.2 Traffic and intersection impacts

As described in Section 5.4.1, there is expected to be minimal increase in traffic volumes as a result of the proposal, with no material impact on operation of the network.

5.4.3 Level crossings

The key traffic impact of the proposal will be impacts on travel time as a result of increased train activity at level crossings. The duration of delays will in some cases be reduced due to increased train speeds that will be possible. Table 5-7 lists the outputs of a model of level crossing delay, where the maximum delay under existing conditions is 122 seconds. By 2040, with an increase in line speed, this delay would be reduced to 109 seconds per train.

Table 5-7 Level crossing delays per train

Scenario	Maximum delay at crossing (sec)
Existing with 1800 m maximum train length	122
Year 2040 with 1800 m maximum train length	109

The modelled delays detailed in Table 5-7 are based on an existing train speed of 90 km/hr, increasing to 110 km/hr by 2040. In all cases, at level crossings with active controls a 45 second pre-train warning has been assumed, along with a 5 seconds after the train has passed, where road traffic is prohibited from proceeding. These values are longer than the absolute minimum (refer Section 3.5), producing a conservative assessment of potential level crossing delays.

The frequency of trains, and therefore likelihood of being delayed, will also be increased over time as the freight task grows. Given the local nature of most affected roads, this impact is expected to affect a small volume of cars and have localised impact only. The potential for queued vehicles to impact on adjacent intersections is considered to be very low, even allowing for the additional length of road trains and other heavy vehicles that may use some of the affected roads.

On the busier roads crossed by the proposal, such as Henry Parkes Way, there is sufficient room for traffic to queue without obstructing any major junctions.

The proposal also includes upgrade of several level crossings along the site, as referenced in Section 4.1.

5.4.4 Access and egress

During operation, minimal impacts to access are anticipated as access to the rail line, if required, would be via existing corridor access points.

5.4.5 Impacts to train paths

The upgrades will not have any negative impacts to train paths when in operation.

Proposed freight train speeds would vary according to axle loads, and range from 80 kilometres per hour (30 tonne) to 115 kilometres per hour (21 tonne). This is an improvement on existing train speeds that are limited to a maximum of 90 to 100 kilometres per hour, with local speed restrictions due to existing track condition.

5.4.6 Parking impacts

Given that there is no existing parking provision, and no expected increase in parking demands as a result of the freight trains, there is not expected to be any impacts on parking as a result of the proposal.

5.4.7 Road network impacts

As discussed in Section 5.4.1, there is expected to be minimal increase in traffic on the road network as a result of the proposal. The increased delay at level crossings is expected to have a localised impact only, and in particular through movements on the Newell Highway will not be affected.

Overall, the proposal is expected to have a positive impact on the road network by relocating some of the road freight task to rail, thereby reducing the heavy vehicle freight traffic on roads within the study area.

Brolgan Road Overbridge

The alignment of the Brolgan Road overbridge would leave a short section of Brolgan Road about 1.1 kilometres long to the south of the overbridge. This section of road would be retained for local access purposes, and to provide access to Coopers Road. The configuration of the connection between the old Brolgan Road alignment (including connection to Coopers Road) and the new alignment is yet to be finalised.

Coopers Road

If access across the rail line is not available, traffic currently using Coopers Road will be able to use the alternative route via Brolgan Road or London Road. The existing travel distance to Parkes is approximately the same via London Road or Brolgan Road at a location approximately 2.1 kilometres south of the Broken Hill line. That is, for any trips starting south of this point, the route via London Road, which is not affected by the proposal, is already shorter than the alternative via Brolgan Road. Based on a review of aerial photography and mapping, there are only 1-2 properties whose distance to access Parkes may increase, up to 2.1 kilometres longer than under existing conditions. This increase is not considered a significant impact, in the context of the number of people who will be affected, and the distances involved in travel in rural areas such as this.

Millers Lookout Road

The section of Millers Lookout Road that would be crossed by the Parkes north west connection is effectively a farm access track, with a locked gate at the Brolgan Road end indicating minimal traffic activity. If access across the rail line is not available, an alternative route is available via Henry Parkes Way. Based on a review of aerial photography and mapping, the majority of traffic activity in Millers Lookout Road is north of the rail line, where access to Parkes via Henry Parkes Way is currently shorter than via Brolgan Road.

5.4.8 Pedestrian and cyclist impacts

Given the low volume of pedestrian and cyclist activity in the study area, there is not expected to be any significant impacts to pedestrians and cyclists as a result of the proposal. An increase in the number of trains will result in an increase in the potential for a pedestrian or cyclist to encounter a train, however the likelihood of adverse impact remains very low.

5.4.9 Public transport impacts

Coaches between Parkes and Condobolin will cross the Henry Parkes Way level crossing. Due to the increased number of trains, there is a greater chance that these services will be stopped at a level crossing and experience some delay, up to three minutes. This is a minor delay for coach services travelling long distances (about 100 kilometres between Parkes and Condobolin) and is therefore expected to have minimal impact on overall travel time.

School bus services which use level crossings along the proposal will be similarly affected, resulting in the potential for a minor delay to these services.

5.5 Cumulative impacts

The assessment detailed above has taken into account growth in traffic volumes into the future, with forecast traffic volumes on roads in the study area within capacity. There are no further anticipated developments that would impact on the proposal.

6. Mitigation and management

6.1 Options for impact mitigation

The options for reducing the potential for increased delays to road traffic as a result of the proposal include:

- Maintaining current maximum train lengths:
  - With no change in train speeds, the duration of delays at level crossings would be similar to existing.
  - With improved train speeds, the duration of delays would be less than existing.
- Grade separation of the rail line at road crossings:
  - Delays to road vehicles would be removed entirely, and the safety risks associated with train/vehicle conflict eliminated.
  - This will require a significant variation to the proposal, and would have additional impacts in terms of construction footprint, costs and environmental issues.
  - Due to the small volume of vehicles that cross the rail line, grade separation is not likely to be feasible at most level crossing locations.

During construction, options for mitigation will depend on the specific activity being undertaken, and the location where it is occurring.

6.2 Recommended mitigation measures

6.2.1 During construction

It is recommended that a construction traffic management plan be developed as part of the construction environmental management plan, to guide the interaction of construction activities with the public road network. It should cover such aspects as:

- Access routes
- Driver behaviour/codes of conduct
- Traffic control procedures:
  - Development and implementation of traffic control plans
  - Temporary speed limit requirements
  - Temporary road closures and detours
- Construction site access:
  - Upgrades to be designed in accordance with Austroads Guide to Road Design and Roads and Maritime Supplements, and local council requirements where appropriate
- Road pavement condition
- Management of traffic under varying weather conditions
- Worker car parking
- Movement of oversize vehicles (if required)
- Management of public transport impacts (including school buses)
- Management of pedestrian and cyclist impacts

The construction traffic management plan should be developed in consultation with Parkes Shire Council, Narromine Shire Council and Roads and Maritime Services, and be subject to periodic review and update as agreed between the stakeholders.

6.2.2 During operation

It is not considered feasible to avoid any increase in potential delays to road users at level crossings as a result of the proposal. However, it is recommended that measures be put in place to manage any localised safety implications that may occur due to increased queueing. Recommended measures are as follows:

- Provision of all necessary and appropriate warning signage, line marking and other traffic controls at level crossings, in accordance with ARTC and Australian Standards. It is critical that controls at level crossings be consistently applied throughout the proposal.
- Review of traffic behaviour at level crossings once the proposed works are complete, to confirm that the available infrastructure is appropriate for the prevailing traffic conditions.
- Transport for New South Wales fund an ongoing program of ALCAM assessments in NSW in order to maintain the relevance of the ALCAM data.

7. Conclusion

The proposal will ultimately allow for faster and more frequent freight train services between Parkes and Narromine. The proposal is largely remote from the existing road network, except at level crossings. The majority of level crossings are of local roads, including private access ways.

The proposal will have different impacts during construction and during operation.

During construction, the main traffic and transport impacts will be related to the movement of construction vehicles to and from the construction site. Additional traffic associated with construction of the proposal will be up to 400 vehicle movements per day, with a peak one-way volume of 114 vehicles per hour. In the peak hour Level of Service B or better will be maintained on all affected roads. Access to construction sites and compounds will be subject to specific planning and traffic management arrangements. Accesses will need to be constructed in accordance with Austroads standards, and other requirements that may be set down by Roads and Maritime and/or Council. Access via the local road network is preferred over direct access from an arterial road, where this is possible.

Once the proposal is operational, minimal traffic generating activity is anticipated. The primary traffic impacts relate to more frequent train activity at level crossings, although the proposal will allow faster train speeds which will slightly reduce delays associated with individual trains. Road traffic activity at most level crossings in the study area is low, and the volume of traffic likely to be delayed by train activity is not substantial. There is capacity at each level crossing for delayed traffic to queue clear of adjacent intersections.

8. References

Roads and Maritime Services traffic volume data, obtained from *http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=10&lat=-32.651295430365316&lon=148.2410363046874*

Roads and Maritime Services rest area maps, obtained from *http://www.rms.nsw.gov.au/roads/using-roads/trip-information/rest-areas/restareasmap/index.html*

Transport for NSW Centre for Road Safety crash statistics http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/nsw.html?tabnsw=3

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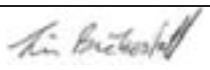
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	M.Kluver-Jones	T.Bickerstaff		S.Page		21.06.2017

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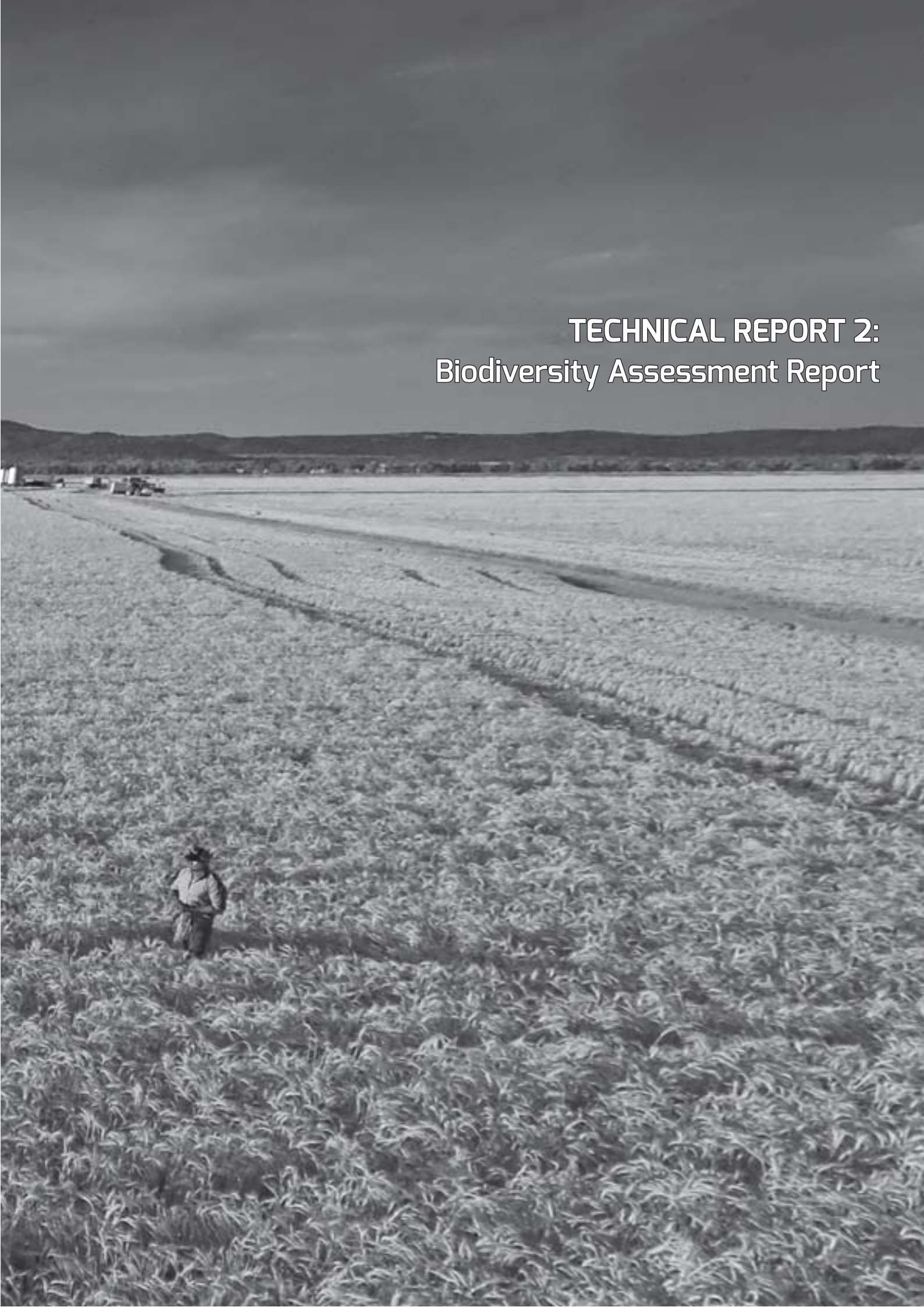

TECHNICAL REPORT 2:
Biodiversity Assessment Report

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INLAND RAIL – PARKES TO NARROMINE

Biodiversity Assessment Report

FINAL

June 2017

INLAND RAIL – PARKES TO NARROMINE

Biodiversity Assessment Report

FINAL

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

Project Director:	John Merrell
Project Manager:	Lachlan Sweeney
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Report No.	3606/R06/V10/Final
Date:	June 2017

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

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 proposal will involve upgrading the existing rail line 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 Biodiversity Assessment Report (BAR) has been prepared on behalf of the Australian Rail Track Corporation (ARTC) to assess the potential ecological impacts of the proposal in accordance with the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (FBA)*.

The BioBanking Credit Calculator (BBCC) was applied following extensive literature reviews, the identification of relevant landscape features and detailed flora and fauna field surveys undertaken in October 2014, July and December 2015 and January, May and June 2016 of the Development Site, in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014a).

Following the application of appropriate avoidance and mitigation measures, the BioBanking Assessment identified the following biodiversity credits required to offset the impacts of the proposal:

- 2,561 ecosystem credits for nine plant community types occurring within the Development Site including impacts on seven threatened ecological communities (TECs)
- 491 species credits for koala (*Phascolarctos cinereus*).

An offset strategy will be developed for the proposal in accordance with the FBA to satisfy these credit requirements.

Glossary

BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator
Buffer Area	550 metre buffer established along each side of the centre line of a linear shaped development footprint.
BVT	Biometric Vegetation Type
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority Area
DECC	NSW Department of Environment and Climate Change (now OEH)
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
Development Site	The total impact zone associated with the proposal which incorporates both permanent and temporary disturbance.
Development Footprint	The area of permanent impact within the Development Site.
DNG	Derived Native Grassland
DoE	Commonwealth Department of the Environment (now DoEE)
DoEE	Commonwealth Department of the Environment and Energy (formerly DoE)
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (now DoEE)
Ecosystem credit	a measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site.
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* (NSW)
GIS	Geographical Information System
Greenfield	Previously undeveloped sites for commercial development or exploitation
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
LGA	Local Government Area
LPI	Land and Property Information
IR	Inland Rail
KMA	Koala Management Area
KP	Kilometre point (rail line kilometerage)

MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
SAT	Spot Assessment Technique
Species credit	the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Species Profile Database.
SSI	State Significant Infrastructure
Strahler Stream Order	Classification system that gives a waterway an 'order' according to the number of tributaries associated with it.
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
TSPD	Threatened Species Profile Database
VIS	Vegetation Information System
WoNS	Weed of National Significance

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Figures

Tables

Appendices

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) is seeking approval to construct and operate the Parkes to Narromine section of Inland Rail ('the proposal'), which consists of 106 kilometres of upgraded rail track and associated facilities.

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). The proposal is also a controlled action under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act), and requires approval from the Australian Minister for the Environment and Energy.

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 addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 8 November 2016.

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**.

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. The proposal is expected to be operational in 2020. Inland Rail as a whole is expected to be operational 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.

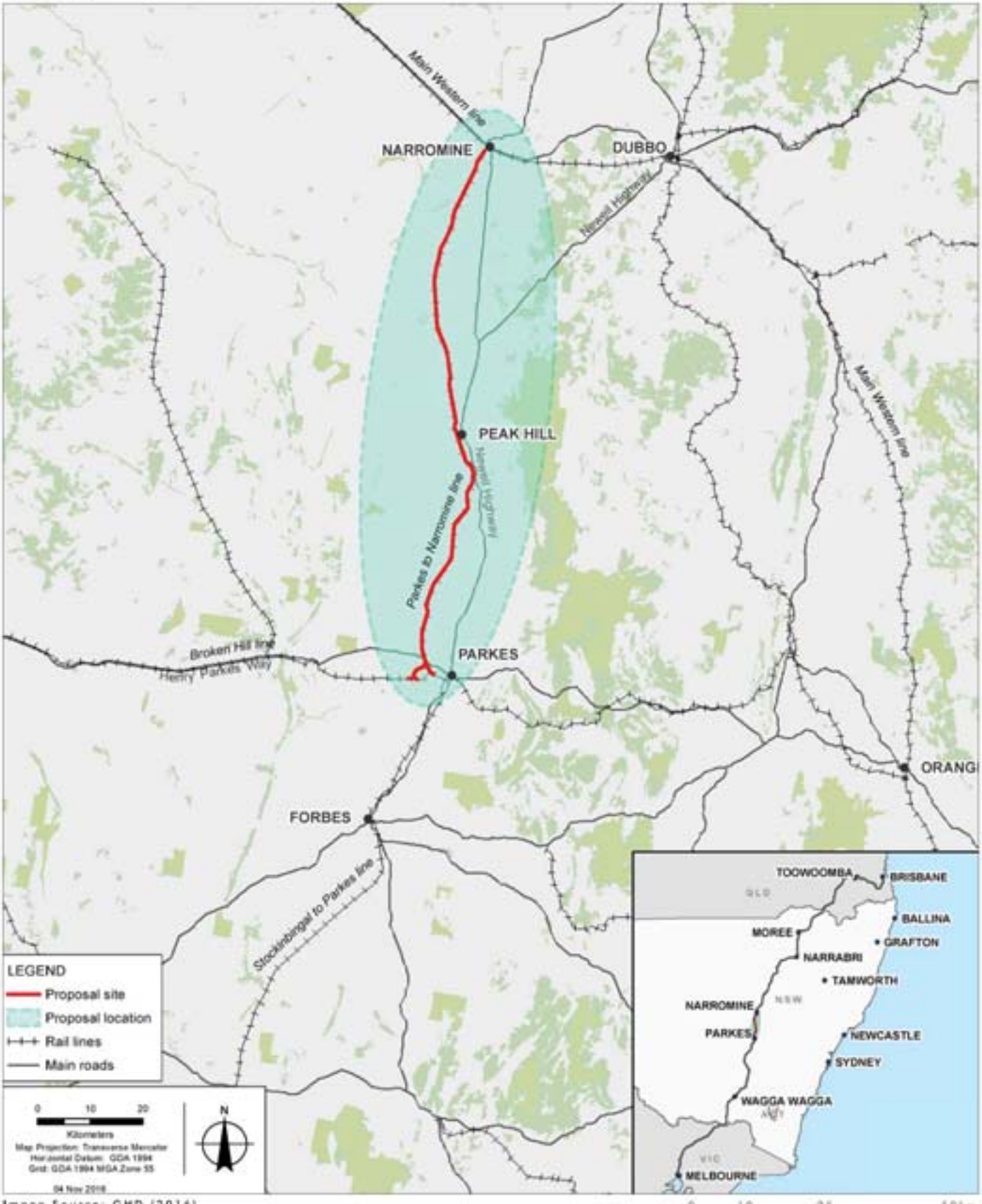
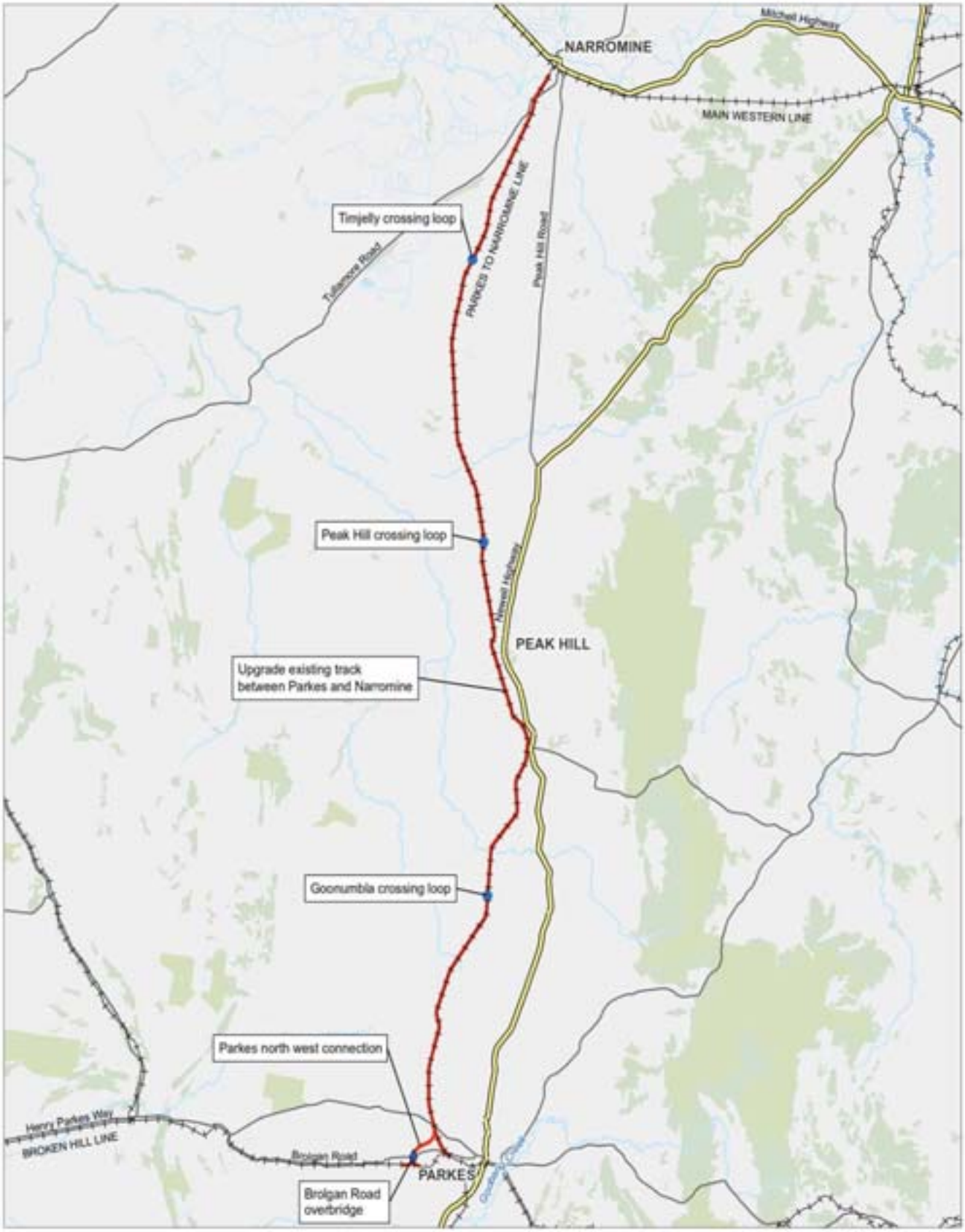


Image Source: GHD (2016)

FIGURE 1.1

Location of the Proposal



LEGEND

- New bridge
- Crossing loop
- The proposal
- Railway
- Highway
- Road

0 2.5 5 10 15
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

FIGURE 1.2

Key Features of the Proposal

Image Source: GHD (2017)

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1.2 Purpose and Scope of this Report

This report provides the findings of the Biodiversity Assessment of the proposal. It addresses the Biodiversity Assessment Report (BAR) specific requirements of the SEARs and the submission from OEH in relation to biodiversity impacts that informed the preparation of the SEARs (refer to **Table 1.1**).

The BAR has been prepared in accordance with the NSW Framework for Biodiversity Assessment (FBA) (OEH 2014a) which applies to all State Significant Infrastructure (SSI).

Table 1.1 SEARs Related to Biodiversity Assessment Report and OEH Submission on SEARs

Requirements for Biodiversity	Where addressed in this report
SEARs	
1. The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA).	Throughout this BAR
2. The Proponent must assess any impacts on biodiversity values not covered by the FBA as specified in s2.3	Section 5.7
3. The Proponent must assess impacts on the EECs, threatened species and/or populations as listed in Attachment B and provided the information specified in s9.2 of the FBA.	Section 5.4
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 *Threatened Species Conservation Action 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).	Section 5.5
OEH Submission	
1. Biodiversity impacts related to the proposed project are to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s142B(1)(c) of the *Threatened Species Conservation Act 1995*.	Throughout this BAR and Section 1.6
2. Impacts on the species and ecological communities listed in Attachment B will require further consideration and provision of the information specified in s9.2 of the Framework for Biodiversity Assessment.	Section 5.4

Requirements for Biodiversity	Where addressed in this report
Attachment B – Species/Populations/Ecological Communities which require further consideration. • *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions* EEC under the TSC Act • *White Box Yellow Box Blakely's Red Gum Woodland* EEC under the TSC Act and CEEC under the EPBC Act • *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* EEC under the TSC and EPBC Acts • a speargrass (*Austrostipa wakoolica*), endangered under the TSC and EPBC Acts • spiny peppercress (*Lepidium aschersonii*), vulnerable under the TSC and EPBC Acts • small purple-pea (*Swainsona recta*), endangered under the TSC and EPBC Acts • silky Swainson-pea (*Swainsona sericea*), vulnerable under the TSC Act.	Section 5.4

Specifically this assessment:

- describes the existing terrestrial environment of the Development Site in terms of its ecological values, including type and condition of vegetation communities and terrestrial habitats
- identifies flora and fauna species and ecological communities within the Development Site that have the potential to be impacted by the proposal
- determines the presence or likelihood of occurrence of threatened flora and fauna species and populations and Threatened Ecological Communities (TECs) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- calculates the offset credit requirements for ecosystem credits and species credits generated as a result of the permanent impacts of the proposal in accordance with the FBA (OEH 2014a).

The FBA process requires the calculation of biodiversity credits using a NSW Government credit calculator. The credits calculated and presented in this report have been prepared based on a proposal site as shown on the Figures in **Appendix A**. It is noted that since this time, a range of alterations to the proposal were made following completion of further technical assessments and engineering design of the proposal which result in some changes to the proposal site. For this reason the proposal site used in this assessment, whilst substantially similar to the final proposal site, is different to that described in the remainder of the EIS. It is expected that the final credit generation for the proposal will be confirmed as an outcome of the detailed design process and that biodiversity offsetting for the proposal will be based on the final credit calculations.

The FBA requires specific terminology to be used to describe the site and impact area being assessed in an FBA report. For this reason the terminology in this report which is FBA specific differs from that used in the EIS. To avoid any doubt, **Table 1.2** below compares the terminology.

Table 1.2 Comparison of BAR and EIS Terminology

FBA Terminology	EIS Terminology
Development Site	Proposal site and the additional assessment area
Development Footprint	Proposal site

It is noted that the SEARs specifically relating to Commonwealth Matters of National Environmetnal Significance (MNES) are addressed in the *ARTC Inland Rail – Parkes to Narromine Commonwealth Matters Assessment* (Umwelt 2017a).

1.3 Development Site Information

The Development Site will be subjected to a range of permanent and temporary disturbances as outlined in **Sections 4.3** and **4.4**. The Development Footprint comprises the portion of the Development Site that will be subject to permanent impact and for which ecosystem and threatened species credits have been calculated in accordance with the FBA. The Development Site is shown on the figures in **Appendix A**.

1.3.1 Location

The proposal will generally be located within the rail corridor between Parkes and Narromine (refer to **Figure 1.3**). The rail corridor commences on the northern side of Parkes, passes through Peak Hill on the existing corridor and ends on the southern side of Narromine in NSW. The Parkes north west connection is also proposed at the southern end of the Development Site near Parkes.

The rail corridor is 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 or wider where site compounds are proposed. The Development Footprint varies along the length of the proposal depending on the construction activities that are proposed in any given area.

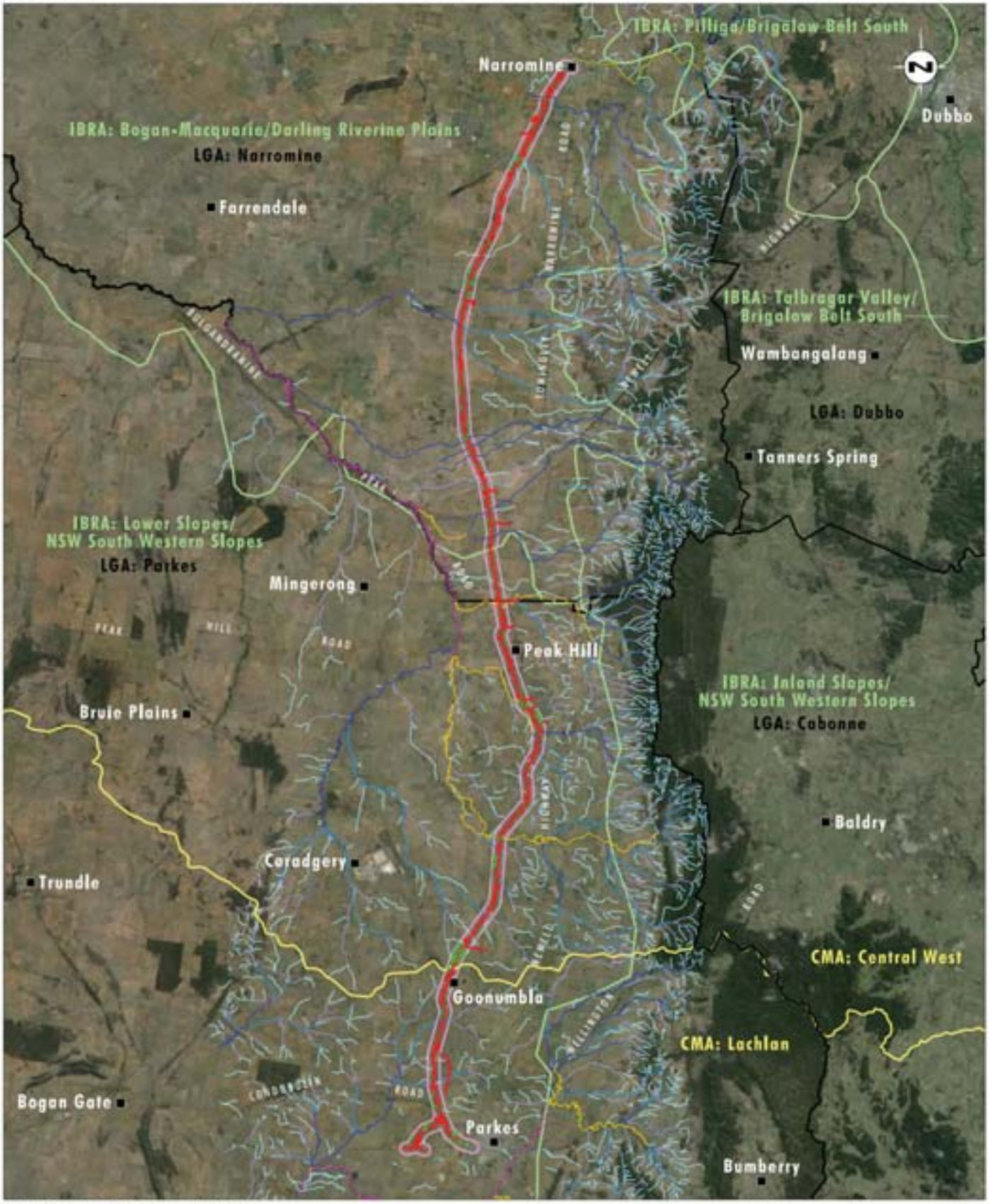

Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

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Legend

- Development Site
- 550m Buffer Area
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Native Vegetation Area
- Town Location

Stream Order:
- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order

FIGURE 1.3

Parkes to Narromine Section of Inland Rail

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Table 1.3 Development Site Location in the Landscape

Parkes to Narromine	
IBRA Bioregions	NSW South Western Slopes Darling Riverine Plains
IBRA Subregions	Lower Slopes Bogan Macquarie
Major Catchment Areas	Lachlan Central West
Mitchell Landscapes	Bimbi Plains Bogan Alluvial Plains Boggy Cowal Alluvial Plains Boggy Cowal Channels and Floodplains Goonumbla Hills Narromine Hills
LGAs	Parkes Narromine

1.3.2 Size

The Development Site covers approximately 923 hectares.

1.3.3 Topography and Natural Features

The Development Site is typical of the South Western Slopes and Darling Riverine Plains Bioregions. The southern extent of the proposal (at Parkes) is situated in the Lachlan River basin and north of the Lachlan River, with the nearest named watercourse being Goobang Creek. The northern extent of the proposal is situated in the Macquarie River floodplain. The proposal crosses 29 waterways including major creeks (such as Burrill Creek, Stanfords Creek, Barrabadeen Creek, Tomingley Creek and Yellow Creek) and other watercourses, most of which are ephemeral.

The Development Site 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 existing rail corridor (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). Given the distance of the existing rail corridor from the coast and the elevation of the areas (>10 metres Australian Height Datum (AHD)), no acid sulfate soils are expected or known to occur (GHD 2014).

Patches of native vegetation exist sporadically within the Development Site which are typically connected to small woodland patches in adjacent agricultural land. These patches generally comprise 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 Development Site.

The majority of the Development Site has been heavily modified by past and ongoing disturbances associated with the rail corridor and surrounding agricultural activities. Clearance and maintenance of the rail corridor has resulted in the fragmentation and subsequent high level of disturbance and degradation of vegetation communities within the rail corridor.

1.4 Key Resources, Policies and Documents

The following key resources, policies and documents were used to prepare the Biodiversity Assessment Report for the proposal:

- Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a)
- Credit Calculator for Major Projects and BioBanking Operational Manual (OEH 2016a)
- BioBanking Assessment Methodology 2014 (OEH 2014b)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004)
- BioBanking Credit Calculator (Major Project Assessment Type) (BBCC 2016), accessed in July 2016
- OEH Threatened Species Profile Database (TSPD) (OEH 2016b), assessed between April and July 2016
- Vegetation Information System (VIS) Classification Database (OEH 2016c), accessed between April and July 2016
- BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016d), accessed in April 2016
- Department of the Environment (DoE) (now the Department of the Environment and Energy) Protected Matters Database (DoE 2016a), accessed in April 2016.
- NSW Guide to Surveying Threatened Plants (OEH 2016e)

1.5 Report Preparation

This Biodiversity Assessment Report (BAR) was prepared by Ryan Parsons (Senior Ecologist) and Kate Connolly (Senior Ecologist), with review and technical direction from Allison Riley (Principal Ecologist). Field surveys were led by Ryan Parsons and Amy Nelson (Ecologist). Each BAR contributor is accredited under the TSC Act as BioBanking and BioCertification Assessors.

1.5.1 Structure of the Report

The structure of the report is outlined below:

- Section 1 – provides the introduction to the report
- Section 2 – outlines the methods used in the assessment
- Section 3 - outlines the results of the field surveys and BioBanking credit calculator application
- Section 4 – describes the avoidance measures implemented and minimisation of impacts as part of the proposal
- Section 5 – provides a summary of impacts in accordance with the FBA
- Section 6 – summarises the biodiversity offsetting options for the proposal
- Section 7 – provides a list of references used throughout the report and assessment.

2.0 Methods

2.1 Assessment Approach

The long linear nature of the Development Site meant that multiple regions within the landscape were crossed. The FBA methodology and credit calculator is based on assessing a Development Site within specific regions. Overall the Development Site crosses the following regions:

- **Catchment Management Authority (CMA) boundaries**
    - Central West
    - Lachlan
- **Local Government Areas (LGA)**
    - Parkes
    - Narromine
- **Interim Biogeographic Regionalisation of Australia (IBRA)**
    - NSW South Western Slopes
    - Darling River Plains
- **IBRA Subregions**
    - Lower Slopes
    - Bogan-Macquarie
- **Mitchell Landscapes**
    - Bimbi Plains
    - Bogan Alluvial Plains
    - Boggy Cowal Alluvial Plains
    - Boggy Cowal Channels and Floodplains
    - Goonumbla Hills
    - Narromine Hills

OEH BioBanking expert John Seidel was consulted regarding the most appropriate assessment approach where multiple regions are intersected by a linear Development Site. It was recommended that for each combination of the CMA and IBRA subregion a separate FBA assessment should be undertaken as these are the most important regions to consider according to the FBA Methodology. In order to enter the vegetation communities into the BBCC a Biometric Vegetation Type (BVT) needs to be assigned which is based on the CMA area. The IBRA subregion is used to filter the species-credit species which are required to be surveyed and assessed. As a result each combination of the CMA and IBRA subregion require a separate assessment, comprising the following:

- Assessment 1 – Lachlan CMA/Lower Slopes IBRA Subregion
- Assessment 2 – Central West CMA/Lower Slopes IBRA Subregion
- Assessment 3 – Central West CMA/Bogan Macquarie IBRA Subregion.

In addition, it was recommended by OEH that the landscape value assessment be completed for the whole Development Site rather than for each individual assessment area. The six Mitchell landscapes intersected by the Development Site are assessed in the landscape value assessment by entering the largest patch size for each Mitchell Landscape. The other regions including LGA and IBRA region are not relevant in an FBA Assessment and are not included in the BBCC.

It was also confirmed by OEH that plot/transect data collected from within the Development Site across the range of CMA and IBRA subregions could be used to undertake each of the three separate assessments described above, irrespective of where in the Development Site the data was collected. This approach allows plot/transect data collected for each vegetation zone delineated within the Development Site to be used in each of the adjacent BBCC assessments, with additional replicate sampling in accordance with the minimum plot/transects (refer to **Table 2.1**) per vegetation zone not required.

Refer to **Figure 2.1** which illustrates the three assessment areas.

2.2 Landscape Features

2.2.1 Identifying Landscape Features

Landscape features within the Development Site and the 550 metre buffer area were determined through reviewing aerial photography and relevant GIS layers. For linear developments, the FBA (OEH 2014a) requires a 550 metre buffer area of the Development Site located from the centre line of the linear development (refer to Figures A1-A36 in **Appendix A**). Landscape features that were reviewed included:

- IBRA bioregions and IBRA subregions
- Mitchell landscapes
- rivers, streams and estuaries (using the Strahler (1952) ordering system) at 1:50,000 scale
- wetlands
- native vegetation extent, and
- State and/or regional biodiversity links.

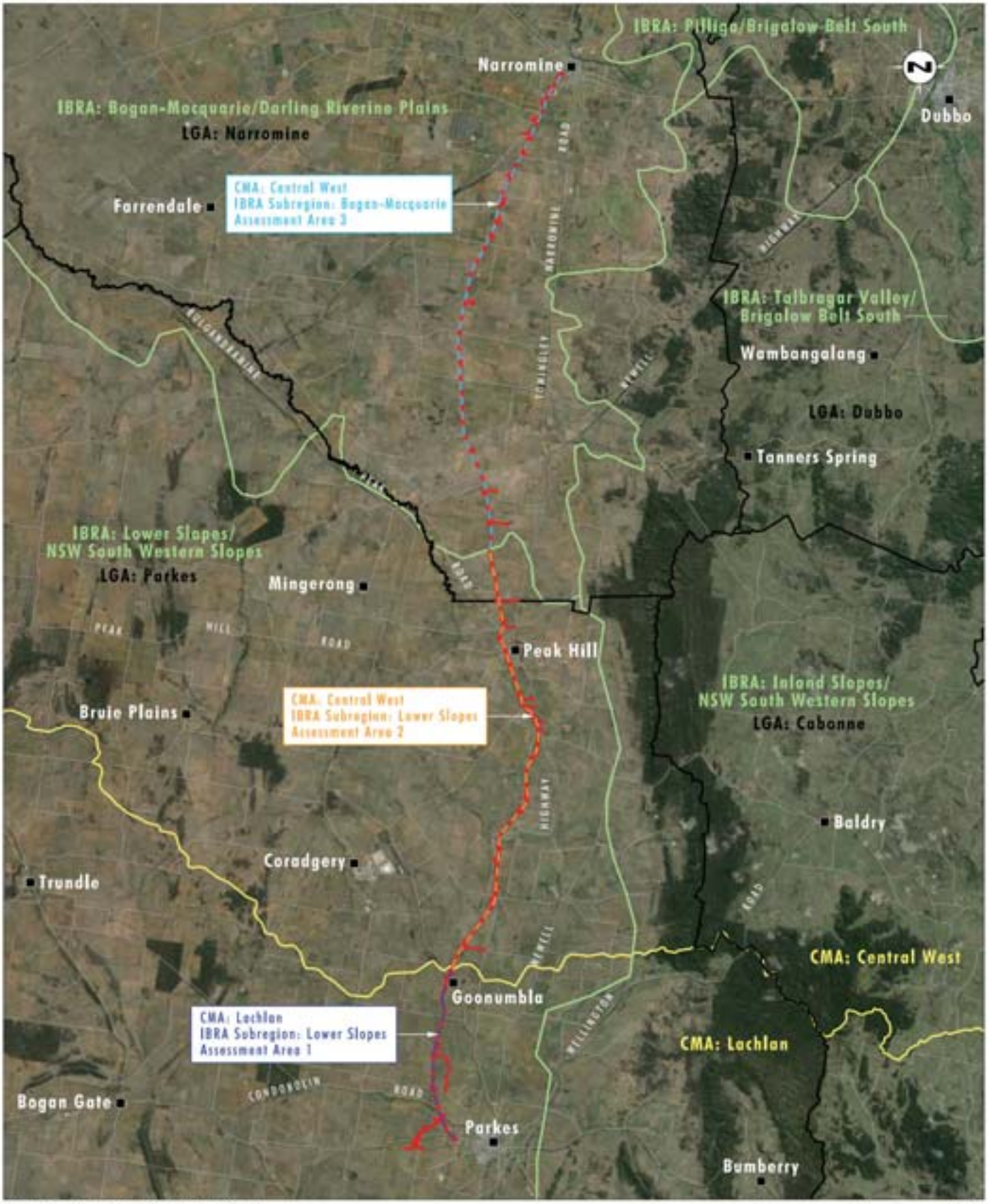

Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

0 5 10 20km
1:500 000

Legend

- Development Site
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Town Location

FIGURE 2.1

Assessments Undertaken in the Biodiversity Assessment Report (BAR)

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2.2.2 Determining Landscape Value

Determining the 'Landscape Value' of the Development Site (linear-based developments) is calculated by assessing the following landscape attributes:

- current and future per cent native vegetation cover
- connectivity value
- patch size
- change in area to perimeter ratio.

For this proposal, and in accordance with Appendix 5 of the FBA (OEH 2014a), the buffer area was established 550 metres either side of the centre of the rail line for the proposal.

2.2.2.1 Per cent Native Vegetation Cover

'Per cent Native Vegetation Cover' is determined by the current per cent native vegetation cover and the future per cent native vegetation cover within the buffer area. This was determined using digital aerial photography interpretation using the Manifold GIS software package. Aerial photographs captured during 2014-2015 were used to digitise all native vegetation within the buffer area. Further refinement of these areas was undertaken following field surveys of the Development Site.

2.2.2.2 Connectivity Value

To determine the connectivity value, the Development Site was assessed for the presence of native vegetation connecting links, and state, regional or local biodiversity links as required by the FBA (OEH 2014a).

Connecting links are present when an area of native vegetation in a Development Site adjoins native vegetation surrounding the Development Site and it is:

- in moderate to good condition, and
- has a patch size of > 1 hectare, and
- is separated by a distance of < 100 metres (or ≤ 30 metres for non-woody ecosystems), and
- is not separated by a large waterbody, dual carriageway, wider highway or similar hostile link.

Connectivity value scores are determined based on the following connecting links, as defined in Table 17 of Appendix 5 of the FBA (OEH 2014a):

- State significant biodiversity link
- regionally significant biodiversity link
- very large area biodiversity link
- large area biodiversity link, and
- local area biodiversity link.

2.2.2.3 Patch Size

A 'Patch' is an area of native vegetation that:

- occurs on the Development Site, and
- is in moderate to good condition, and
- includes native vegetation that has a gap of less than 100 metres from the next area of moderate to good condition native vegetation (or ≤ 30 metres for non-woody vegetation).

For linear-based developments, the patch size is calculated for each Mitchell Landscape occurring within the Development Footprint. The patch may extend onto adjoining land that is not part of the Development Site. An assessment of the patch size class and the patch size score was then determined using Table 18 of the FBA (OEH 2014a).

2.2.2.4 Change in Area to Perimeter Ratio

The change in area to perimeter ratio was calculated by selecting all patches of native woody vegetation greater than 1 hectare in size within the 550 metre buffer zone which would be impacted by the Development Site. The total area in metres squared was divided by the total perimeter in metres before development. This was then completed again for the post development scenario and entered into the Credit Calculator.

2.3 Native Vegetation Assessment

2.3.1 Literature and Database Review

A review of previous documents and reports relevant to the proposal was undertaken. This included regional and sub-regional vegetation mapping reports, site-specific monitoring surveys, ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EPs) and Threatened Ecological Communities (TECs). Relevant documents included:

- Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006)
- Travelling Stock Reserve Conservation Values spatial layer (Rural Lands Protection Board 2010)
- Melbourne Brisbane Inland Railway Parkes to Narromine and Narrabri to North Star – Ecological Investigations (Umwelt 2014)
- VIS Classification Database (OEH 2016c), accessed between April and July 2016
- OEH Threatened Species Profile Database for known/predicted Threatened Ecological Communities (TECs) in the Lower Slopes and Bogan Macquarie IBRA subregion, accessed between April and July 2016
- DoEE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed April 2016.

2.3.2 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Site was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping of the Development Site.

Vegetation communities in the Development Site were mapped on-screen overlaying the 2014-2015 high resolution aerial photographs provided by ARTC. Mapping was undertaken using the Manifold System 8.0 Enterprise Edition GIS in a 32 bit mode. Use of GIS allowed zooming to a relatively large scale, generally at a scale between 1:2000 and 1:4000.

Generally the minimum mapping unit for a vegetation zone was 0.1 hectare, however mapping was completed at a finer scale in order to map the small stands of weeping myall woodland, narrow bands of vegetation as well as smaller patches connected to larger areas of remnant vegetation outside the Development Site. A 3 to 1 crown separation ratio was generally applied for mapping areas of remnant woodland.

2.3.3 Systematic Plot/Transect Surveys

A total of 48 systematic plots/transect surveys were conducted across the Development Site during the surveys undertaken for this assessment (refer to Figures A1-A36 in **Appendix A**). These surveys were undertaken over 17 days and three survey periods, being:

- 11 – 21 January 2016
- 2 – 5 May 2016
- 1 – 2 June 2016.

Furthermore, rapid vegetation assessments were undertaken over three days between 16 and 18 September 2014 as part of the ecological constraints analysis undertaken by Umwelt (2014) (refer to **Section 2.3.4**).

2.3.3.1 Plot/Transect Selection and Stratification of the Development Site

Designing an appropriate survey requires consideration of both survey methods and effort. Reference was made to the VIS Classification Database to identify Plant Community Types (PCTs), as well as reviews of other regional and local vegetation mapping and reporting (refer to **Section 2.3.1**) when designing the field survey. The Development Site PCTs were further stratified into Vegetation Zones (condition states) following the initial field survey of the site to determine the appropriate number of transect/plots required in accordance with the FBA (OEH 2014a) as outlined in **Table 2.1**.

Table 2.1 Minimum Number of Plots/Transects Required per Zone Area (OEH 2014a)

Vegetation Zone Area (ha)	Minimum Number of Plot/Transect
0-4	1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition
>4-20	3 transects/plots or 2 transects/plots if vegetation is in low condition
>20-50	4 transects/plots or 3 transects/plots if vegetation is in low condition

Vegetation Zone Area (ha)	Minimum Number of Plot/Transect
>50-100	5 transects/plots or 3 transects/plots if vegetation is in low condition
>100-250	6 transects/plots or 4 transects/plots if vegetation is in low condition
>250-1000	7 transects/plots or 5 transects/plots if vegetation is in low condition (More transects/plots may be needed if the condition of the vegetation is variable across the zone)
>1000	8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division (More transects/plots may be needed if the condition of the vegetation is variable across the zone)

Table 2.2 below outlines the adequacy of the plot/transect flora survey with respect to the FBA Methodology (OEH 2014a) pertinent to the Development Site.

Table 2.2 Adequacy of Vegetation Survey in the Development Site

Veg Zone	PCT ID (BVT IDs) and PCT Name *Condition Class*	Area in the Development Site (ha)	Number of Biometric Plots/Transects	
			Required (FBA 2014)	Undertaken During Survey
1	PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	3.47	2	3
2	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	0.87	1	1
3	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	0.62	1	1
4	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	1.12	1	1

Veg Zone	PCT ID (BVT IDs) and PCT Name *Condition Class*	Area in the Development Site (ha)	Number of Biometric Plots/Transects	
			Required (FBA 2014)	Undertaken During Survey
5	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	7.12	3	3
6	PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	1.95	1	1
7	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	10.13	3	7
8	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	32.06	4	4
9	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	3.38	2	7
10	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	14.45	3	3
11	PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	1.88	1	2
12	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.24	2	2

Veg Zone	PCT ID (BVT IDs) and PCT Name *Condition Class*	Area in the Development Site (ha)	Number of Biometric Plots/Transects	
			Required (FBA 2014)	Undertaken During Survey
13	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	0.57	1	1
14	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	7.16	3	3
15	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	13.96	3	3
-	Cleared/Non-native vegetation	820.76	0	6
Total		**922.74**	**31**	**48**

2.3.3.2 Plot/Transect Data Collected

At each plot/transect data was recorded according to Section 5 of the FBA (OEH 2014a). 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 44 plots/transects undertaken within the Development Site is shown in Figures A1-A36 in **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.

For each flora species recorded in the plot, the following data was collected in accordance with Table 1 of the FBA (OEH 2014a):

- stratum/layer in which the species occurs
- growth form
- scientific name and common name

- cover
- abundance.

At each standard flora plot, 10 points along a 50 metre transect were assessed for:

- percentage native overstorey cover
- percentage native mid-storey cover.

In addition, 50 points along a 50 metre transect were assessed for:

- percentage native groundcover (grass)
- percentage native groundcover (shrubs)
- percentage native ground cover (other)
- percentage exotic plant cover.

Additional details were also recorded in each quadrat, including soil texture, drainage and depth; site disturbances; physiography (position in the landscape); and vegetation structure (strata percentage covers, heights and dominant species). Photographic records were also taken at each site.

2.3.4 Semi-quantitative Rapid Sampling

A total of 218 rapid vegetation assessments were completed within the Development Site (refer to Figures A1-A36 in **Appendix A**) during the floristic surveys and as part of the ecological constraints analysis undertaken by Umwelt (2014). Assessment areas were not fixed area-based, but were generally confined to an area similar to a plot. The railway corridor was often defined by fences located approximately 20 metres either side of the tracks, however in sections where fences were not present surveys were extended out to approximately 30 to 40 metres.

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.

2.3.5 Meandering Transects

Meandering transects were undertaken through vegetation units across much of the Development Site, particularly for the delineation and refinement of vegetation mapping and searching for threatened and otherwise significant species, endangered populations and TECs. Meandering transects enabled floristic sampling across a much larger area than systematic plots, allowing the survey to achieve a combination of detailed observation and broader appreciation. Records along transects supplemented floristic sampling carried out as part of plot survey, however, the data collected was in the form of presence records. Where meandering transects revealed significant variation within a vegetation unit, or a potential new vegetation community, additional plot survey was undertaken.

Meandering transects provided invaluable information on spatial patterns of vegetation that informed vegetation community mapping of the Development Site.

2.3.6 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Royal Botanic Gardens Sydney 2016).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

2.3.7 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Site. 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 Central West and Lachlan Catchment (DEC 2006)
- predicting the distribution of particular vegetation communities based on understanding the distribution of Biometric vegetation types (OEH 2016c) and plant communities
- preparation of a draft vegetation community map based on interpretation of digital airborne imagery and preliminary delineation of vegetation community floristics
- ground-truthing of the vegetation map based on survey effort documented in **Section 2.3**
- revision of vegetation community floristic delineations based on plot data, and
- 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 VIS Classification Database (OEH 2016c).

2.3.8 Threatened Ecological Community Delineation Techniques

Vegetation communities identified in the Development Site were compared to TECs listed under the Commonwealth EPBC Act and NSW TSC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice. The following approach was used:

- full-floristic quadrat assessment, rapid assessments and meandering survey to determine floristic composition and structure of each ecological community

- comparison with published species lists, including lists of 'important species' as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee

- comparison with habitat descriptions and distributions for listed TECs

- assessment using guidelines and recovery plans published by the Commonwealth DoEE and the NSW OEH

- comparison with other assessments of TECs in the region.

2.3.9 Plant Community Type (PCT)/Biometric Vegetation Type (BVT) Allocation

Each of the vegetation communities described within the Development Site were aligned with an equivalent PCT/BVT as detailed in the VIS Classification Database (OEH 2016c). For each vegetation community described in the Development Site, the dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs/BVTs was generated. The profiles for each of the possible PCT/BVT were then interrogated and the most appropriate match assigned based on floristic, structure, soil, landform and distribution details.

2.4 Threatened Species

2.4.1 Literature and Database Review

A review of previous documents and reports relevant to the proposal was undertaken. This included reports, previous ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents and resources included:

- OEH Threatened Species Profile Database for known/predicted threatened species in the Bogan-Macquarie and Lower Slopes IBRA subregions, accessed between April and July 2016

- OEH BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016d), accessed in April 2016

- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Parkes and Narromine LGAs, accessed July 2016

- DoEE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed April 2016

- Melbourne to Brisbane Inland Rail Alignment Study – Appendix H Preliminary Environmental Assessment (Parsons Brinckerhoff et al. 2010)

- Environmental Assessment Northparkes Step Change Project (Umwelt 2013).

A preliminary assessment using the TSPD was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of the database searches, literature review and TSPD review were used to design the survey requirements for species-credit species so that adequate surveys were undertaken.

Note: Ecosystem-credit species are predicted by the landscape attributes and are not required to be specifically targeted during field surveys.

The *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DEC 2004) and Commonwealth Threatened Species Survey and Assessment Guidelines were considered when undertaking the threatened species surveys in the Development Site.

2.4.2 Species-credit Flora Surveys

Species-credit flora surveys were undertaken over 21 days and four survey periods, being:

- 15 – 16 October 2014
- 11 – 21 January 2016
- 2 – 5 May 2016
- 1 – 2 June 2016.

A preliminary list of species-credit flora species with potential to occur in the Development Site was generated during the literature review, completion of database searches, review of the Attachment B of the SEARs (refer to **Section 1.3**) and the TSPD. Searches of the TSPD were undertaken by the applicable IBRA subregions (Lower Slopes and Bogan-Macquarie) and CMA regions (Lachlan and Central West).

Table 2.3 identifies the species-credit flora species that were determined to potentially occur in the Development Site and therefore require targeted and seasonal surveys.

Targeted surveys were undertaken for the species listed in **Table 2.3** and included targeted on-ground searches in suitable habitat throughout the Development Site. Searches for these species were undertaken in suitable habitat along numerous walking meandering transects and within the plot/transect surveys. These generally involved walking suitable habitat areas and searching for the targeted species between the rail tracks and the fences marking the edge of the corridor. Where there were no fences, surveys were undertaken up to 30 metres either side of the tracks, or wider where required by the Development Footprint. The seasonal survey requirements for all species-credit flora species with the potential to occur within the Development Site were met during the October 2014, January 2016 and May 2016 survey periods.

Table 2.3 Species-credit Flora Species Requiring Targeted Survey

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
Austrostipa wakoolica	E	E	✓	✓	×	September - December	Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
Austrostipa metatoris	V	V	✓	×	×	All year	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
bluegrass *Dichanthium setosum*	V	V	×	×	✓	December - May	Targeted threatened flora searches in suitable habitat undertaken in January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
pine donkey orchid *Diuris tricolor*	V	-	✓	✓	✓	September - October	Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
spike-rush *Eleocharis obicis*	V	V	✓	✓	×	All year	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
spiny peppercress *Lepidium aschersonii*	V	V	✓	✓	×	September - May	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
winged peppercress *Lepidium monoplocoides*	E	E	✓	✓	×	November - February	Targeted threatened flora searches in suitable habitat undertaken in January 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
hoary sunray *Leucochrysum albicans* var. *tricolor*	-	E	✓	✓	✓	All year	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
Austral pillwort *Pilularia novae-hollandiae*	E	-	✓	✓	×	All year	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
slender darling-pea *Swainsona murrayana*	V	V	✓	✓	✓	September - February	Targeted threatened flora searches in suitable habitat undertaken in October 2014 and January 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
small purple-pea *Swainsona recta*	E	E	×	×	✓	September – October (Lachlan CMA) September – November (Central West CMA)	Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
silky Swainson-pea *Swainsona sericea*	V	-	✓	×	×	September - December	Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
red darling pea *Swainsona plagiotropis*	V	V	×	×	✓	August - September	While targeted threatened flora searches were undertaken outside the required survey period for the species as per the TSPD, the species is known to flower in September and October with fruiting occurring by late November (Tonkinson and Robertson 2010). Targeted threatened flora searches in suitable habitat were undertaken in October 2014 throughout the Development Site and it is considered that this species would have been detectable at this time. Opportunistic observations were also undertaken throughout all Umwelt survey periods.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
Ausfeld's wattle *Acacia ausfeldii*	V	-	✓	×	×	August-October	Targeted threatened flora searches in suitable habitat undertaken in October 2014 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.
Tylophora linearis	V	E	✓	✓	×	September - May	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods.

^ Months that surveys are required according to the Threatened Species Profile Database for the Lachlan and/or Central West CMA (searched May 2016).

2.4.3 Species-credit Fauna Surveys

Species-credit fauna surveys were undertaken over 13 days and two survey periods, being:

- 27 – 31 July 2015 and
- 28 November – 5 December 2015.

A preliminary list of species-credit fauna species with potential to occur in the Development Site was generated during the literature review, completion of database searches and review of the TSPD. Searches of the TSPD were undertaken by the applicable IBRA subregions (Lower Slopes and Bogan-Macquarie) and CMA regions (Lachlan and Central West).

Table 2.4 identifies the species-credit fauna species that were considered to potentially occur in the Development Site and that required targeted surveys. Further, while the swift parrot is classified as an ecosystem-credit species that does not require targeted survey in accordance with the FBA, targeted surveys for this species were undertaken within the Development Site due to its co-listing as a threatened species under the EPBC Act. Survey techniques, timing and location are as per the description for the regent honeyeater.

Targeted surveys were undertaken for the species listed in **Table 2.4** and included a range of survey techniques including targeted searches, Anabat recorders, call playback and spotlighting. During the survey period, opportunistic sightings and bird calls of targeted species were also noted during walking or travelling through a site in a hi-rail vehicle (i.e. on the rail line). The seasonal survey requirements for all species-credit fauna species with the potential to occur within the Development Site were met during the July, November and December 2015 survey periods. The details of the targeted surveys are discussed in **Sections 2.4.3.1** to **2.4.3.11** below and specific survey locations are shown on Figures A1-A36 of **Appendix A**.

Table 2.4 Species-credit Fauna Species Requiring Targeted Survey

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
pale-headed snake *Hoplocephalus bitorquatus*	V	-	×	×	✓	October – April	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.1** for further detail.
cotton pygmy-goose *Nettapus coromandelianus*	E	-	×	×	✓	All year	Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.2** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
black-necked stork *Ephippiorhynchus asiaticus*	E	-	×	×	✓	All year	Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.2** for further detail.
Australasian bittern *Botaurus poiciloptilus*	E	E	×	×	✓	All year	Opportunistic observations undertaken throughout all Umwelt survey periods. No suitable habitat identified within the Development Site for targeted surveys. Refer to **Section 2.4.3.3** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
black-breasted buzzard *Hamirostra melanosternon*	V	-	×	×	✓	All year	Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7. Opportunistic observations throughout the survey. Refer to **Section 2.4.3.2** for further detail.
red-backed button-quail *Turnix maculosus*	V	-	×	×	✓	All year	Diurnal bird surveys undertaken in November-December 2015 at sites 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.2** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
grey falcon *Falco hypoleucos*	E	-	×	✓	✓	All year	Diurnal bird surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.2** for further detail.
barking owl *Ninox connivens* (breeding habitat only)	V	-	×	✓	✓	September – December	Call playback, spotlighting and stag/hollow watching surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.4** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
superb parrot *Polytelis swainsonii* (breeding habitat only)	V	V	✓	✓	✓	September – December	Diurnal bird surveys undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Tree hollows were recorded on a GPS and hollows that could potentially provide suitable habitat were watched for activity across all survey sites. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.5** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
brush-tailed phascogale *Phascogale tapoatafa*	V	-	×	×	✓	All year	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.6** for further detail.
eastern pygmy possum *Cercartetus nanus*	V	-	×	✓	✓	September – April	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.6** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
squirrel glider *Petaurus norfolcensis*	V	-	×	✓	×	All year	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.6** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
koala *Phascolarctos cinereus*	V	V	✓	✓	✓	All year	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 1, 2, 3, 5, 5a, 6 and 7. Spot Assessment Technique (SAT) surveys in suitable habitat undertaken in November-December 2015 at sites 1, 2, 3, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.7** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
grey-headed flying-fox *Pteropus poliocephalus*			×	✓	✓	September – April	Spotlighting surveys in suitable habitat undertaken in November-December 2015 at sites 3, 4, 5, 5a, 6 and 7. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.8** for further detail.
large-eared pied bat *Chalinolobus dwyeri* (breeding habitat only)	V	V	×	✓	×	September - April	Echolocation surveys using SD1 Anabat Recorders undertaken in November-December 2015 at sites 3, 4 and 5. Refer to **Section 2.4.3.9** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
Sloane's froglet *Crinia sloanei*	V	-	✓	✓	✓	June-August	Targeted diurnal searches in July 2015 in suitable habitat across 51 locations across the Development Site. Spotlighting and call playback surveys undertaken in July 2015 in suitable habitat across 19 locations across the Development Site. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.10** for further detail.

Common Name *Scientific Name*	TSC Status	EPBC Status	Location by CMA/IBRA Subregion and KP			Required Survey Period^	Survey Technique, Timing and Location
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449– 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466– 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5– 555.5		
regent honeyeater *Anthochaera phrygia*	CE	CE	✓	×	×	All year	Targeted call playback and bird surveys in July 2015 at sites 1 and 2. Opportunistic observations undertaken throughout all Umwelt survey periods. Refer to **Section 2.4.3.11** for further detail.

^ Months that surveys are required according to the Threatened Species Profile Database for the Lachlan and/or Central West CMA (searched May 2016).

2.4.3.1 Pale-headed Snake Surveys

The pale-headed snake was targeted by conducting nocturnal spotlighting surveys over two nights for up to 30 minutes or the entire survey site, whichever occurred first, in November and December 2015. Both the ground and trees were searched for the presence of this species focusing on potential suitable habitat in live and dead trees, under loose bark, and fallen timber. Spotlighting was completed using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Spotlighting surveys targeting pale-headed snake were conducted at Sites 3, 4, 5, 5a, 6 and 7 within the Development Site (refer to Figures A8, A12, A17, A26, A34 and A36 **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

2.4.3.2 Diurnal Bird Surveys for the Cotton Pygmy-goose, Black-necked Stork, Black-breasted Buzzard, Red-backed Button-quail and Grey Falcon

Diurnal bird surveys were conducted for cotton pygmy-goose, black-necked stork, black-breasted buzzard and red-backed button-quail and grey falcon on two separate days across each of the survey sites in November and December 2015. Bird surveys were conducted at various times of the day, primarily early to mid-morning and mid to late afternoon. Surveys targeted likely habitat for each species such as aerial observations for birds of prey (grey falcon and black-breasted buzzard) and wetland habitats for waterfowl (cotton pygmy goose, black-necked stork). Each survey consisted of a slow walking transect within the survey site for 20 minutes.

Diurnal bird surveys were undertaken for cotton pygmy-goose, black-necked stork, black-breasted buzzard and red-backed button-quail at Sites 5a, 6 and 7 within the Development Site. Grey falcon surveys were undertaken at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10x. Opportunistic observations were also recorded throughout the survey period.

2.4.3.3 Australasian Bittern Survey

Due to the specific habitat requirements of the Australasian bittern (emergent aquatic vegetation such as *Phragmites*, *Typha*, *Eleocharis* in freshwater and brackish wetlands), only one site was identified from aerial photographic interpretation to be surveyed, being Site 7. However, at the time of the survey in November and December 2015, due to the lack of reedy vegetation present at this site, no potential habit was identified and no targeted survey was conducted.

Opportunistic observations were also recorded throughout the survey period.

2.4.3.4 Barking Owl Breeding Habitat Surveys

The barking owl is a species-credit species for breeding habitat only in the Central West CMA (KP 446 km – 555.5 km). It is an ecosystem-credit species in the Lachlan CMA where the remainder of the Development Site occurs. For the barking owl, breeding habitat includes living or dead trees with hollows of more than 20 cm in diameter that are located more than 4 metres above the ground. This habitat was surveyed by undertaking targeted hollow tree surveys across the Development Site in November and December 2015. Any suitable trees that were located were marked as a GPS waypoint, and the number of hollows and tree species recorded along with a photo of the tree. Selected stag trees were watched at twilight for any owl

activity. Nocturnal spotlighting for owls was conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. In addition, call playback for the barking owl was undertaken for five minutes at each site prior to spotlighting. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Specific barking owl breeding habitat surveys were conducted at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**). Opportunistic observations were also recorded throughout the survey period.

2.4.3.5 Superb Parrot Breeding Habitat Surveys

The superb parrot is a species-credit species for breeding habitat only in both the Lachlan and Central West CMAs. Breeding habitat for the superb parrot includes hollows more than 60 mm in diameter that are located more than 4 metres above ground. This habitat was surveyed by undertaking targeted hollow tree surveys across the Development Site in November and December 2015. Any suitable trees that were located were marked as a GPS waypoint, and the number of hollows and tree species were recorded along with a photo of the tree. Selected suitable habitat trees were watched for at least an hour, in the morning where possible for any superb parrot activity.

Superb parrot breeding habitat surveys were conducted at Sites 1, 2, 3, 4, 5, 5a, 6 and 7 (refer to Figures A4, A6, A8, A12, A17, A26, A34 and A36 in **Appendix A**). Any additional trees that were not located within the survey site but were within the Development Site were also surveyed.

Opportunistic observations were also recorded throughout the survey period.

2.4.3.6 Brush-tailed Phascogale, Eastern Pygmy Possum and Squirrel Glider Surveys

Nocturnal spotlighting searches for brush-tailed phascogale, eastern pygmy possum and squirrel glider were conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first in November and December 2015. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

Spotlighting surveys for the eastern pygmy possum and squirrel glider were conducted at Sites 3, 4, 5, 5a, 6 and 7. While the brush-tailed phascogale was surveyed at Sites 5a, 6 and 7 (refer to Figures A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

2.4.3.7 Koala Surveys

The koala was targeted by undertaking spot assessment technique (SAT) and nocturnal spotlighting in November and December 2015. The koala SAT was undertaken in eucalypt dominated sites only as per the technique outlined in Phillips and Callaghan (2011). If a scat or koala was located a GPS location, photo and sex of the individual was recorded (where applicable). Koala SAT surveys were conducted at all fauna survey sites except Site 4 due to no trees occurring within the Development Site at this site (refer to Figures A4, A6, A8, A17, A26, A34 and A36 in **Appendix A**).

Nocturnal spotlighting searches for the koala were conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night. Spotlighting surveys for koala were conducted at all sites except Site 4 due to no trees occurring within the Development Site boundary at this site (refer to Figures A4, A6, A8, A17, A26, A34 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

2.4.3.8 Grey-headed Flying-fox Survey

The grey-headed flying-fox was targeted using nocturnal spotlighting surveys in November and December 2015. Spotlighting for this species was conducted over two nights for up to 30 minutes or the entire survey site, whichever occurred first. Spotlighting was either completed on foot and/or from the hi-rail vehicle depending on the size of the site using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 9.00 pm and 2.00 am, commencing approximately one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving hi-rail vehicle while travelling between fauna survey locations at night.

The grey-headed flying-fox surveys were conducted at Sites 3, 4, 5, 5a, 6 and 7 (refer to Figures A8, A12, A17, A26 and A36 in **Appendix A**).

Opportunistic observations were also recorded throughout the survey period.

2.4.3.9 Large-eared Pied Bat Breeding Habitat Surveys

The large-eared pied bat is a species-credit species for breeding habitat only in the Central West CMA (KP 446 km – 555.5 km). The species was targeted by undertaking echolocation surveys using Anabat SD1 recorders in November and December 2015. At each site, the Anabat was positioned at an approximate 30 degree angle one metre above the ground in waterproof housing. Each detector was positioned towards potential micro-bat flight paths or over waterbodies to increase the likelihood of detecting micro-bat species. The Anabat was programmed to start recording from one hour before sunset to one hour after sunrise for at least two nights per site. Area searches for potential breeding habitat which comprises sandstone caves was also undertaken within the Development Site.

As part of the ecological constraint investigation, targeted inspections of timber, steel and concrete bridges were undertaken in September 2014 (Umwelt 2014). Inspections included using a head torch to check any cavities and expansion joints for fauna species and an Anabat was used to record the echolocation calls of micro-bats. The Anabat was directed at cavities within the bridges and set to record after lightly knocking the bridge structure to elicit a response from any potential micro-bat species.

All micro-bat species Anabat recordings were identified by Anna McConville of Echo Ecology Pty Limited (a recognised expert in the identification of micro-bat calls). Each call sequence (‘pass’) was assigned to one of five categories, according to the confidence with which an identification could be made, being definite, probable, possible, species group or unknown. For the purposes of this assessment, definite and probable levels of confidence were treated as positive identifications. All species recorded as Possible during call analysis were also considered as probable in accordance with the precautionary principle.

Anabat recorders were set at Sites 3, 4 and 5 (refer to Figures A8, A12 and A17 in **Appendix A**).

2.4.3.10 Sloane's Froglet Surveys

Diurnal searches for Sloane's froglet were conducted in 51 locations across the Development Site in July 2015 targeting land within 50 metres of ephemeral wetlands or periodically inundated areas within grasslands and disturbed environments. During the search, likely micro-habitats were examined including around waterbodies, beneath rocks, around culverts, and areas of inundation. Each survey consisted of approximately 15-30 minutes for one person, depending on the size and complexity of the habitat.

Nocturnal spotlighting surveys, each consisting of 30 minute person hours over one night, were also undertaken in 19 locations across the Development Site. Each survey consisted of a 5 minute period of call playback for the species followed by 25 minutes of spotlighting. Spotlighting was conducted on foot using a head torch. Spotlighting was undertaken generally between 6:00 pm and 1:00 am, commencing approximately one hour after dusk and targeted relevant habitat features identified during the diurnal surveys, such as farm dams, riparian zones, culverts and areas of inundation.

Opportunistic observations were also recorded throughout the survey period.

2.4.3.11 Regent Honeyeater Surveys

Targeted regent honeyeater surveys were undertaken across two days in July 2015. Each survey consisted of a 5 minute period of call playback for the species followed by 20 minutes of searching, which consisted of a slow walking transect within a two hectare area within suitable vegetation types. Surveys were undertaken during early to mid-morning and mid to late afternoon. Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10 x.

Targeted regent honeyeater surveys were undertaken at Sites 1 and 2 (refer to Figures A4 and A6 in **Appendix A**).

Diurnal bird surveys were undertaken at each fauna survey site within the Development Site and searches for the this species were also undertaken, despite the November and December 2015 and January 2016 surveys being outside the period that the species is likely to occur in the Development Site. Diurnal bird surveys were undertaken at sites, 1, 2, 3, 4, 5, 5a, 6 and 7 (refer to Figures A4, A6, A8, A12, A17, A26, A34 and A36 in **Appendix A**).

Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10x. Opportunistic observations were also recorded throughout the survey period.

Opportunistic observations were also recorded throughout the survey period.

3.0 Results

3.1 Landscape Value

As outlined in **Section 2.1**, while the FBA Assessment has been split into three assessments to cover the different CMAs and IBRA subregions, the landscape assessment was undertaken holistically across the entire Development Site as per consultation with OEH.

3.1.1 Landscape Features

The 550 metre buffer area from the centre line of the Development Site contains some prominent landscape features including 5th order streams and a range of Mitchell landscapes. This area also covers multiple IBRA Bioregions, IBRA Subregions and CMAs.

Landscape features that were included in the determination of the connectivity value scores for the Development Site are outlined in **Table 3.1** below.

Table 3.1 Landscape Features in the Development Site

Landscape Feature	Development Site
Mitchell Landscapes	Bimbi Plains Bogan Alluvial Plains Boggy Cowal Alluvial Plains Boggy Cowal Channels and Floodplains Goonumbla Hills Narromine Hills
Rivers, Streams, Estuaries	5th order streams: • Burrill Creek • Ten Mile Creek • Burrabadine Creek 4th order streams: • Bulldog Creek • Gundong Creek • Tomingley Creek • Bradys Cowal • Backwater Cowal
Wetlands	• Bradys Cowal • Backwater Cowal
Native Vegetation (in buffer area)	1002 hectares
Connecting Links	Regionally Significant Biodiversity Link (refer to **Section 3.1.2.3**).

3.1.2 Landscape Value Scores

3.1.2.1 Per cent Native Vegetation Cover

Table 3.2 details the per cent native woody vegetation cover before and after the proposed disturbance in the Development Footprint and the native vegetation per cent class entered into the BioBanking Calculator as per Table 16 of Appendix 5 of the FBA (OEH 2014a).

Table 3.2 Native Vegetation Cover in Buffer Area

	Pre-Development			Post-Development		
	Area of Native Veg (ha)	Native Veg Cover (%)	Native Veg Per cent Class	Area of Native Veg (ha)	Native Veg Cover (%)	Native Veg Per cent Class
Development Site	1002	7.86	6-10	967	7.59	6-10

3.1.2.2 Area to Perimeter Ratio

The area to perimeter ratio for the development site was calculated as 0, in accordance with the FBA methodology (refer to Appendix 5 Assessing Landscape Value for Linear Shaped Developments, or Multiple Fragmentation Impacts).

3.1.2.3 Connectivity Value

Determining the connectivity value score is derived from identifying the highest scoring connecting link to be impacted by the proposal as per Table 17 of Appendix 5 of the FBA (OEH 2014a).

The highest connecting links occurring within the Development Site are three 5th order streams being Burrill Creek, Ten Mile Creek and Burrabadine Creek (in Assessment 2), crossing the Development Site at KP 479.5, 493.5 and 503.5, respectively. A range of 4th order streams also occur in the north of the Development Site (in Assessment 3).

No State significant biodiversity links were identified within a plan approved by the Chief Executive of OEH and no 6th order or higher streams or important wetlands occur within the Development Site. The closest 6th order stream, being the Bogan River, occurs approximately 3.5 kilometres to the west of the Development Site near Peak Hill, outside the buffer area.

Details of the connectivity value scores applicable for entry to the BBCC are shown in bold in **Table 3.3** below.

Table 3.3 Highest Value Connecting Links

Highest Category of Connecting Link	Connectivity Score	Definition	Description
Regionally Significant Biodiversity Link	**10**	An area identified by the assessor as being part of a regionally significant biodiversity link in a plan approved by the Chief Executive of OEH OR	Not identified
		A riparian buffer 20m either side of a 4th or 5th order stream OR	**5th order streams:** • **Burrill Creek** • **Ten Mile Creek** • **Burrabadine Creek** **4th order streams:** • **Bulldog Creek** • **Gundong Creek** • **Tomingley Creek** • **Bradys Cowal** • **Backwater Cowal**
		A riparian buffer 30m around a regionally significant wetland	Not identified
		A riparian buffer 30m around a regionally significant wetland	Not identified

Note: Connectivity score is based on definition in bold text.

3.1.2.4 Patch Size

Table 3.4 below details the parameters that determined the Patch Size score as per Table 18 of Appendix 5 of the FBA (OEH 2014a).

Table 3.4 Patch Size Score Parameters

Mitchell Landscape	Patch Size	Patch Size Score
Bimbi Plains	564.0	12.5
Bogan Alluvial Plains	1001.0	12.5
Boggy Cowal Alluvial Plains	1001.0	12.5
Boggy Cowal Channels and Floodplains	26.0	5.0
Goonumbla Hills	1001.0	12.5
Narromine Hills	1001.0	12.5

3.1.2.5 Landscape Value Score

The landscape value score for the Development Site is 21.20, as calculated by the BBCC.

3.2 Native Vegetation within the Development Site

3.2.1 Biometric Vegetation Types and Vegetation Zones

Surveys of the Development Site identified nine PCTs across 15 condition classes being:

- PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
- PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion
    - *Moderate to Good Condition*
    - *Low_Regeneration Condition*
- PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt
    - *Moderate to Good Condition*
- PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*

- PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*
- PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion
    - *Moderate to Good Condition*
    - *Moderate to Good_DNG Condition*

These PCTs were aligned with types described as part of the VIS Classification Database (OEH 2016c). The PCTs were then categorised into 15 vegetation zones (refer to **Figures A1** to **A36** in **Appendix A**). The composition of these vegetation zones is outlined in **Sections 3.2.1.1** to **3.2.1.15** below and a flora species list for all plots surveyed is included in **Appendix B**.

3.2.1.1 Vegetation Zone 1 – CW205, LA212– Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion – Moderate to Good Condition

PCT Name	**Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion**	
Condition	**Moderate to Good**	
PCT Number	26	
BVT Number	CW205, LA212	
Formation	Semi-arid Woodlands (Grassy sub-formation)	
Class	Riverine Plain Woodlands	
No. Plots/transects	Three (P13, P23 and P32)	
Total Area in Development Site (ha)	3.47	
General Description	This vegetation zone occurs as several small remnant or regenerating patches throughout the Development Site predominantly persisting on red-brown clay soils. There is limited connectivity between patches due to the heavily disturbed nature of the rail corridor due to historic clearing, infrastructure maintenance, mowing and weed spraying regimes as well as adjacent land uses.	
Floristic Description	This community is an open woodland with an upper storey solely dominated by weeping myall (*Acacia pendula*). Some patches also contained mistletoe (*Amyema quandang*), a hemiparasitic native occurring almost exclusively on species of Acacia. The shrub layer is generally absent, except for young suckering weeping myall (*Acacia pendula*) less than 1 metre in height. The understorey is typically sparse and species depauperate, dominated by	

PCT Name	Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion
	native grasses, chenopods and forbs. Native grasses include wallaby grasses (*Rytidosperma fulvum*), fairy grass (*Sporobolus caroli*), native millet (*Panicum decompositum*), ringed wallaby grass (*Austrodanthonia caespitosa*), common wheatgrass (*Elymus scaber*) and curly windmill grass (*Enteropogon acicularis*). Chenopods include small-leaf bluebush (*Maireana microphylla*), creeping saltbush (*Atriplex semibaccata*), ruby saltbush (*Enchylaena tomentosa*) and climbing saltbush (*Einadia nutans*). Native forbs generally include *Vittadinia cervicularis*, caustic weed (*Chamaesyce drummondii*) and quena (*Solanum esuriale*). Non-native species occur sporadically and include bearded oats (*Avena barbata*), urochloa grass (*Urochloa panicoides*), paspalum (*Paspalum dilatatum*) and flaxleaf fleabane (*Conyza bonariensis*).
Structure	Upper – 6-15m/10-40% Midstorey – 1-5m/0-5% Lower – <0.5m/40-60%
TSC Act Status	This vegetation zone is consistent with the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* listed under the TSC Act (refer to **Appendix D**).
EPBC Act Status	A total of 0.99 hectares of this vegetation zone is consistent with *Weeping Myall Woodlands* listed as an EEC under the EPBC Act. The remaining 2.48 hectares of this zone does not meet minimum EPBC listing criteria due to small patch sizes in the Development Site (refer to **Appendix D**).

3.2.1.2 Vegetation Zone 2 – CW183, LA193 River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion– Moderate to Good Condition

PCT Name	River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion	
Condition	**Moderate to Good**	
PCT Number	36	
BVT Number	CW183; LA193	
Formation	Forested Wetlands	
Class	Inland Riverine Forests	
No. Plots/transects	One (P48)	
Total Area in Development Site (ha)	0.87	

PCT Name	River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion
Condition	Moderate to Good
General Description	This vegetation zone occurs as one distinct patch within the Development Site. These patches are bisected by the existing rail and persist in the riparian zone along Burrill Creek near Peak Hill. This community is found on alluvial soils.
Floristic Description	This community is dominated by mature river red gum (*Eucalyptus camaldulensis*). The shrub layer is generally absent, except for very sparse occurrences of green wattle (*Acacia deanei*). Native ground species include couch (*Cynodon dactylon*), red grass (*Bothriochloa macra*), curly windmill grass (*Enteropogon acicularis*), nardoo (*Marsilea* sp.), *Juncus* sp., variable glycine (*Glycine tabacina*), climbing saltbush (*Einadia nutans*) and kidney weed (*Dichondra repens*). Non-native herbs and forbs include paspalum (*Paspalum dilatatum*) and spear thistle (*Cirsium vulgare*). The community is less disturbed than the adjoining regenerating river red gum community.
Structure	Upper – 15m/25% Midstorey – 3m/2% Lower – 0.5m/50%
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.

3.2.1.3 Vegetation Zone 3 – CW183, LA193 River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion – Low Condition (Regeneration)

PCT Name	River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion	
Condition	Low	
PCT Number	36	
BVT Number	CW183; LA193	
Formation	Forested Wetlands	
Class	Inland Riverine Forests	
No. Plots/transects	One (P05)	
Total Area in Development Site (ha)	0.62	
General Description	This vegetation zone occurs as two distinct patches within the Development Site. These patches are bisected by the existing rail and persist in the riparian zone along Burrill Creek near Peak Hill. This community is found on alluvial soils with a heavily disturbed understorey.	

PCT Name	River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion
Condition	Low
Floristic Description	This community is dominated by regenerating river red gum (*Eucalyptus camaldulensis*) with a predominantly sparse, non-native understorey dominated by paspalum (*Paspalum dilatatum*). Native grasses occur sporadically and are limited to early spring grass (*Eriochloa pseudoacrotricha*), windmill grass (*Chloris truncata*), weeping lovegrass (*Eragrostis parviflora*) and couch (*Cynodon dactylon*). Native herbs and forbs include corrugated sida (*Sida corrugata*), lesser joyweed (*Alternanthera denticulata*), quena (*Solanum esuriale*), creeping knotweed (*Persicaria prostrata*) and kidney weed (*Dichondra repens*). Non-native herbs and forbs include red-flowered mallow (*Modiola caroliniana*), slender celery (*Cyclospermum leptophyllum*), purpletop (*Verbena bonariensis*), flaxleaf fleabane (*Conyza bonariensis*), spear thistle (*Cirsium vulgare*) and haresfoot clover (*Trifolium arvense*).
Structure	Upper – not present Midstorey – 0.5-1.5m/0-5% Lower – <1m/30%
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.

3.2.1.4 Vegetation Zone 4 – CW104, LA105– Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions – Moderate to Good Condition

PCT Name	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	
Condition	Moderate to Good	
PCT Number	55	
BVT Number	CW104; LA105	
Formation	Semi-arid Woodlands (Grassy sub-formation)	
Class	North-west Floodplain Woodlands	
No. Plots/transects	One (P26)	
Total Area in Development Site (ha)	1.12	
General Description	This vegetation zone primarily occurs between the KP 518.5 km and 519.5 km on the clay soils associated with Tomingley Creek. The community is well-connected with vegetation beyond the Development Site despite disturbance from adjacent land uses.	

PCT Name	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions
Condition	Moderate to Good
Floristic Description	This open woodland community is dominated by belah (*Casuarina cristata*) with bimble box (*Eucalyptus populnea* subsp. *bimbil*) occurring as a sub-dominant species in some patches. The mid-storey is sparse and species depauperate, limited to regenerating belah (*Casuarina cristata*), wilga (*Geijera parviflora*), *Senna artemisioides* and the Weed of National Significance (WoNS) African boxthorn (*Lycium ferocissimum*). The ground layer is generally dense with leaf litter and is dominated by small clumps of Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), button grass (*Dactyloctenium radulans*), early spring grass (*Eriochloa pseudoacrotricha*), wallaby grass (*Rytidosperma fulva*) and curly windmill grass (*Enteropogon acicularis*). Non-native grasses primarily include Rhodes grass (*Chloris gayana*), bearded oats (*Avena sativa*) and urochloa grass (*Urochloa panicoides*). Native chenopods and forbs include climbing saltbush (*Einadia nutans*), corrugated sida (*Sida corrugata*), tarvine (*Boerhavia dominii*), quena (*Solanum esuriale*) and lesser joyweed (*Alternanthera dentidulata*). Non-native forbs such as cobbler's pegs (*Bidens pilosa*) and flaxleaf fleabane (*Conyza bonariensis*) are also common.
Structure	Upper – 2-8m/5-15% Midstorey – 0.5-2m/1-5% Lower – <1m/20-35%
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.

3.2.1.5 Vegetation Zone 5 – CW104, LA105– Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions – Moderate to Good Condition – Derived Native Grassland

PCT Name	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	
Condition	Moderate to Good	
PCT Number	55	
BVT Number	CW104; LA105	
Formation	Semi-arid Woodlands (Grassy sub-formation)	
Class	North-west Floodplain Woodlands	
No. Plots/transects	Three (P14, P15 and P33)	
Total Area in Development Site (ha)	7.12	

PCT Name	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions
Condition	Moderate to Good
General Description	This vegetation zone primarily occurs between KP 518.5km and 519.5km on the clay soils associated with Tomingley Creek. The community is derived native grassland of vegetation zone 4.
Floristic Description	This community comprises a derived native grassland dominated by Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*). The upper storey is generally absent, limited to regenerating belah (*Casuarina cristata*). Other native species typically occurring include grasses such as curly windmill grass (*Enteropogon acicularis*), fairy grass (*Sporobolus caroli*), yanganbil (*Austrostipa bigeniculata*) and native millet (*Panicum decompositum*). Non-native species include rhodes grass (*Chloris gayana*), flaxleaf fleabane (*Conyza bonariensis*), urochloa grass (*Urochloa panicoides*) and *Hypericum* sp.
Structure	Upper – 15m/0-5% Midstorey – 3-6m/1-5% Lower – <1m/20-35%
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.

3.2.1.6 Vegetation Zone 6 – CW220, LA223– White Cypress Pine woodland on sandy loams in central NSW wheatbelt – Moderate to Good Condition

PCT Name	White Cypress Pine woodland on sandy loams in central NSW wheatbelt	
Condition	Moderate to Good	
PCT Number	70	
BVT Number	CW220, LA223	
Formation	Grassy Woodlands	
Class	Floodplain Transition Woodlands	
No. Plots/transects	One (P38)	
Total Area in Development Site (ha)	1.95	
General Description	This vegetation zone mostly occurs as a linear patch between KP 522km and 524.5km. The community occupies red clay soils and shares similarities with the upper storey characteristics of vegetation zone 9, except that the understorey is more sparse and the	

PCT Name	White Cypress Pine woodland on sandy loams in central NSW wheatbelt
Condition	Moderate to Good
	upper storey is dominated by white cypress pine (*Callitris glaucophylla*) with bimble box (*Eucalyptus populnea* ssp. *bimbil*) occurring sporadically.
Floristic Description	This open woodland is dominated by white cypress pine (*Callitris glaucophylla*) with bimble box (*Eucalyptus populnea* subsp. *bimbil*) occurring sporadically. The midstorey varies from absent to sparse, comprising scattered wilga (*Geijera parviflora*) and green wattle (*Acacia deanei*). The ground layer is sparsely dominated by native grasses such as *Panicum* spp. And red grass (*Bothriochloa macra*), along with the exotic grass species bearded oats (*Avena barbata*), paspalum (*Paspalum dilatatum*) and urochloa grass (*Urochloa panicoides*). Native chenopods and forbs such as wingless bluebush (*Maireana enchylaenoides*), quena (*Solanum esuriale*), swamp dock (*Rumex brownii*) and fuzzweed (*Vittadinia cuneata*) occur sporadically. The most common non-native forbs are coffee senna (*Senna occidentalis*), flaxleaf fleabane (*Conyza bonariensis*) and *Lepidium africanum*.
Structure	Upper – 10m/15-45% Midstorey – 0-5m/0-5% Lower – <0.5m/30-60%
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.

3.2.1.7 Vegetation Zone 7 – CW145, LA154 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions– Moderate to Good Condition

PCT Name	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	
Condition	Moderate to Good	
PCT Number	76	
BVT Number	CW145; LA154	
Formation	Grassy Woodlands	
Class	Floodplain Transition Woodlands	
No. Plots/transects	Seven (P01, P02, P12, P16, P25, P30 and P31)	
Total Area in Development Site (ha)	10.13	

PCT Name	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions
General Description	This vegetation zone occurs as several disturbed remnant patches throughout the Development Site. The largest patch of this community exists in the southern portion of the Development Site near Parkes. The community typically occupies red to brown clay soils.
Floristic Description	This community is a tall open woodland to 25 metres high dominated by western grey box (*Eucalyptus microcarpa*). Some patches of this community contain white cypress pine (*Callitris glaucophylla*), yellow box (*Eucalyptus melliodora*) and/or bimble box (*Eucalyptus populnea* subsp. *bimbil*) subdominant to western grey box (*Eucalyptus microcarpa*). The midstorey is generally absent or sparse, comprising western rosewood (*Alectryon oleifolius*), western boobialla (*Myoporum montanum*), wilga (*Geijera parviflora*), cooba (*Acacia salicina*), green wattle (*Acacia deanei*), dropping wattle (*Acacia difformis*) and sticky hop-bush (*Dodonaea viscosa*). The understorey is characteristically grassy and is dominated by both native and non-native grasses. Dominant native grasses include speargrass (*Austrostipa scabra*), bunch wiregrass (*Aristida behriana*), Yanganbil (*Austrostipa bigeniculata*), wallaby grass (*Rytidosperma fulva*), tall chloris (*Chloris ventricosa*), Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), red grass (*Bothriochloa macra*), paddock lovegrass (*Eragrostis leptostachya*) and knottybutt grass (*Paspalidium constrictum*). Common exotic grasses include bearded oats (*Avena barbata*), urochloa grass (*Urochloa panicoides*), Rhodes grass (*Chloris gayana*) and stinkgrass (*Eragrostis cilianensis*). Native herbs, forbs and chenopods include corrugated sida (*Sida corrugata*), yellow burr-daisy (*Calotis lappulacea*), purble burr-daisy (*Calotis cuneifolia*), rough fuzzweed (*Vittadinia pterochaeta*) and climbing saltbush (*Einadia nutans*).
Structure	Upper – 15-20m/5-20% Midstorey – 0.5-5m/1-5% Lower – <1m/15-70%
TSC Act Status	A total of 7.33 hectares of this vegetation zone in the NSW South Western Slopes bioregion is consistent with *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* listed under the TSC Act. The remaining area of this zone occurs in the Darling Riverine Plains bioregion and does not meet the scientific determination for the TEC (refer to **Appendix D**).
EPBC Act Status	A total of 9.44 hectares of this vegetation zone is consistent with *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* listed under the EPBC Act. The remainder of this zone does not meet minimum EPBC listing criteria due to due to small patch sizes in the Development Site (refer to **Appendix D**).

3.2.1.8 Vegetation Zone 8 – CW145, LA154 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions– Moderate to Good Condition – Derived Native Grassland

PCT Name	**Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions**	
Condition	**Moderate to Good**	
PCT Number	76	
BVT Number	CW145; LA154	
Formation	Grassy Woodlands	
Class	Floodplain Transition Woodlands	
No. Plots/transects	Four (P03, P04, P07 and P36)	
Total Area in Development Site (ha)	32.06	
General Description	This vegetation zone occurs adjacent to Western Grey Box tall Grassy Woodland patches within the Development Site and lacks a canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses.	
Floristic Description	This community comprises a derived native grassland of Zone 7 Western Grey Box tall Grassy Woodland where the upper storey has mostly been cleared. The midstorey is generally absent with a variable understorey dominated by Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), wallaby grass (*Rytidosperma fulva*), windmill grass (*Chloris truncata*), curly windmill grass (*Enteropogon acicularis*), early spring grass (*Eriochloa pseudoacrotricha*) and red grass (*Bothriochloa macra*). Native forbs and herbs are limited and occur sporadically, including corrugated sida (*Sida corrugata*), pink bindweed (*Convolvulus erubescens*) and fuzzweed (*Vittadinia* spp.). Non-native grasses, forbs and herbs commonly include haresfoot clover (*Trifolium arvense*), star thistle (*Centaurea calcitrapa*), spear thistle (*Cirsium vulgare*), potato weed (*Heliotropium europaeum*), Patterson's curse (*Echium plantagineum*) and common peppercress (*Lepidium africanum*).	
Structure	Upper – 0m/0% Midstorey – 0m/0% Lower – <0.5m/30-75%	
TSC Act Status	This entire vegetation zone occurs in the NSW South Western Slopes bioregion and is consistent with *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* listed under the TSC Act. The remaining area of this zone occurs in the Darling Riverine Plains bioregion and therefore does not meet the scientific determination for the TEC (refer to **Appendix D**).	
EPBC Act Status	This vegetation zone is consistent with *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* EEC listed under the EPBC Act (refer to **Appendix D**).	

3.2.1.9 Vegetation Zone 9 – CW172, LA178 – Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) – Moderate to Good Condition

PCT Name	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	
Condition	Moderate to Good	
PCT Number	244	
BVT Number	CW172; LA178	
Formation	Grassy Woodlands	
Class	Floodplain Transition Woodlands	
No. Plots/transects	Seven (P06, P17, P18, P20, P24, P27 and P29)	
Total Area in Development Site (ha)	3.38	
General Description	This vegetation zone occurs as several small remnant or regenerating patches throughout the Development Site on red-brown clay soils. Although widespread across the Development Site, patches are relatively isolated due to historic clearing.	
Floristic Description	This community comprises a sparse woodland dominated by Bimble Box (*Eucalyptus populnea* subsp. *bimbil*). Other tree species include white cypress pine (*Callitris glaucophylla*) and kurrajong (*Brachychiton populneus*). The midstorey is generally very sparse and includes wilga (*Geijera parviflora*) and *Senna artemisioides*. The understorey is heavily disturbed and is dominated by a mix of native and exotic species. Dominant native grasses include Queensland bluegrass (*Dichanthium sericeum* subsp. *sericeum*), speargrass (*Austrostipa scabra*), bunch wiregrass (*Aristida behriana*) and wallaby grass (*Rytidosperma fulva*). Chenopods such as climbing saltbush (*Einadia nutans*), small-leaf bluebush (*Maireana microphylla*), galvinized burr (*Sclerolaena birchii*) and creeping saltbush (*Atriplex semibaccata*) are also present in the understorey along with herbs and forbs such as corrugated sida (*Sida corrugata*) and variable glycine (*Glycine tabacina*). Non-native forbs and herbs include cobblers pegs (*Bidens pilosa*) and flaxleaf fleabane (*Conyza bonariensis*). Common exotic grasses include Rhodes grass (*Chloris gayana*) and bearded oats (*Avena barbata*). African boxthorn (*Lycium ferocissimum*), a WoNS, occurs in this community.	
Structure	Upper – 3-6m/10-40% Midstorey – 0.5-1m/0-5% Lower – <1m/40-50%	
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.	

3.2.1.10 Vegetation Zone 10 – CW171, LA177– Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) –Moderate to Good Condition – Derived Native Grassland

PCT Name	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	
Condition	**Moderate to Good – Derived Native Grassland**	
PCT Number	244	
BVT Number	CW172; LA178	
Formation	Grassy Woodlands	
Class	Floodplain Transition Woodlands	
No. Plots/transects	Three (P28, P43 and P44)	
Total Area in Development Site (ha)	14.45	
General Description	This vegetation zone occurs adjacent to Poplar Box Grassy Woodland patches within the Development Site however typically lacks a significant canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses.	
Floristic Description	This community is a derived native grassland form of Zone 9 Poplar Box Grassy Woodland where the upper storey has mostly been cleared. The midstorey is generally absent, however some patches contain western silver wattle (*Acacia deanei*). The ground layer is typically dominated by kangaroo grass (*Themeda triandra*), *wallaby* grass (*Rytidosperma fulva*), windmill grass (*Chloris truncata*), curly windmill grass (*Enteropogon acicularis*), early spring grass (*Eriochloa pseudoacrotricha*) and red grass (*Bothriochloa macra*). Native forbs and herbs are limited and occur sporadically and typically include corrugated sida (*Sida corrugata*), *Wahlenbergia* sp., common everlasting (*Chrysocephalum apiculatum*) and *Vittadinia* sp. Non-native grasses, forbs and herbs commonly include haresfoot clover (*Trifolium arvense*), star thistle (*Centaurea calcitrapa*), spear thistle (*Cirsium vulgare*), potato weed (*Heliotropium europaeum*), Patterson's curse (*Echium plantagineum*), Rhodes grass (*Chloris gayana*) and common peppercress (*Lepidium africanum*).	
Structure	Upper – 0m/0% Midstorey – 0.5-4m/0-5% Lower – <0.5m/40-70%	
TSC Act Status	This vegetation zone does not conform to a TEC listed under the TSC Act.	
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.	

3.2.1.11 Vegetation Zone 11 – CW138, LA145 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion– Moderate to Good Condition

PCT Name	Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	
Condition	Moderate to Good	
PCT Number	201	
BVT Number	CW138; LA145	
Formation	Grassy Woodlands	
Class	Western Slopes Grassy Woodlands	
No. Plots/transects	Two (P09 and P10)	
Total Area in Development Site (ha)	1.88	
General Description	This vegetation zone occurs as small remnant patches within the Development Site. The community occupies clay soils and persists on slight depressions of the Development Site. Patches of this community within the Development Site occur are isolated likely due to historic clearing.	
Floristic Description	This open woodland community has a sparse upper storey dominated by fuzzy box (*Eucalyptus conica*). In some patches yellow box (*Eucalyptus melliodora*) and/or grey box (*Eucalyptus microcarpa*) may also be present as associate canopy species. The midstorey is generally sparse or absent but when present is dominated by wilga (*Geijera parviflora*). The ground layer is typically dominated by native grasses including wallaby grass (*Rytidosperma fulva*), kangaroo grass (*Themeda triandra*), purple wiregrass (*Aristida ramosa*), slender panic (*Paspalidium gracile*) and common wheatgrass (*Elymus scaber*). Native forbs include corrugated sida (*Sida corrugata*), tarvine (*Boerhavia dominii*), yellow burr-daisy (*Calotis lappulacea*) and emu-foot (*Cullen tenax*). Common exotic species include haresfoot clover (*Trifolium arvense*), skeleton weed (*Chondrilla juncea*) and oats (*Avena sativa*).	
Structure	Upper – 3-6m/10-40% Midstorey – 0.5-1m/0-5% Lower – <1m/40-50%	
TSC Act Status	This vegetation zone is consistent with the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* listed under the TSC Act (refer to **Appendix D**).	
EPBC Act Status	This vegetation zone does not conform to a TEC listed under the EPBC Act.	

3.2.1.12 Vegetation Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition

PCT Name	**White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion**
Condition	**Moderate to Good**
PCT Number	267
BVT Number	CW220; LA223
Formation	Grassy Woodlands
Class	Western Slopes Grassy Woodlands
No. Plots/transects	Two (P11 and P40)
Total Area in Development Site (ha)	3.24

General Description	This vegetation zone occupies the low rises and gentle slopes within the Development Site. The understorey of this community is predominantly native with few non-native species present. Recruitment of white box (*Eucalyptus albens*) is also occurring within this vegetation zone.
Floristic Description	This open woodland is dominated by white box (*Eucalyptus albens*) with a sparse midstorey dominated by wilga (*Geijera parviflora*) and western silver wattle (*Acacia decora*). In some patches grey box (*Eucalyptus* microcarpa) and/or white cypress pine (*Callitris glaucophylla*) is also present. The understorey is mid-dense and dominated by native grasses including speargrass (*Austrostipa scabra*), common wheatgrass (*Elymus scaber*), curly windmill grass (*Enteropogon acicularis*) and slender nineawn (*Enneapogon gracilis*). Other dominant native understorey species include pink tongues (*Rostellularia adscendens*), amulla (*Eremophila debilis*), *Lomandra filiformis*, variable glycine (*Glycine* tabacina), blueberry lily (*Dianella revoluta*) and common everlasting (*Chrysocephalum apiculatum*). Non-native understorey species was limited to white horehound (*Marrubium vulgare*).
Structure	Upper – 10-15m/10-45% Midstorey – 1-8m/5-40% Lower – <1m/30-65%
TSC Act Status	This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**).
EPBC Act Status	A total of 1.1 hectares of this vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**).

3.2.1.13 Vegetation Zone 13 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion– Moderate to Good Condition – Derived Native Grassland

PCT Name	**White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion**	
Condition	**Moderate to Good – Derived Native Grassland**	
PCT Number	267	
BVT Number	CW213; LA218	
Formation	Grassy Woodlands	
Class	Western Slopes Grassy Woodlands	
No. Plots/transects	One (P41)	
Total Area in Development Site (ha)	0.57	
General Description	This vegetation zone occupies the low rise and gentle slopes within the Development Site. This vegetation zone occurs adjacent to Zone 13 White Box - White Cypress Pine - Western Grey Box Woodland within the Development Site and lacks a canopy due to historic clearing. The community is generally heavily disturbed due to surrounding land uses.	
Floristic Description	This community is a derived native grassland form of Zone 13 White Box - White Cypress Pine - Western Grey Box Woodland where the upper storey has mostly been cleared. The midstorey is generally absent except for scattered silver wattle (*Acacia decora*) and wilga (*Geijera parviflora*). The ground layer varies from mid-dense to dense and is dominated by native grasses such as common wheatgrass (*Elymus scaber*) and cup grass (*Eriochloa crebra*). The dominant non-native grasses are confined to bearded oats (*Avena barbata*). Native chenopods and forbs include berry saltbush (*Einadia hastata*), small-leaf bluebush (*Maireana microphylla*), amulla (*Eremophila debilis*), yellow burr-daisy (*Calotis lappulacea*) and *Vittadinia* sp. Non-native species present include stagger weed (*Stachys arvensis*), common verbena (*Verbena officinalis*) and *Verbena incompta*.	
Structure	Upper – 0m/0% Midstorey – 0.5m/<1% Lower – <0.5m/95%	
TSC Act Status	This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**).	
EPBC Act Status	This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**).	

3.2.1.14 Vegetation Zone 14 – CW226, LA226– Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion– Moderate to Good Condition

PCT Name	**Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion**	
Condition	**Moderate to Good**	
PCT Number	276	
BVT Number	CW226; LA226	
Formation	Grassy Woodlands	
Class	Western Slopes Grassy Woodlands	
No. Plots/transects	Three (P34, P39 and P47)	
Total Area in Development Site (ha)	7.16	
General Description	This vegetation zone occupies the alluvial plains and low hills on clay-loam soils within the Development Site. Patches of this community within the Development Site occur as isolated remnants.	
Floristic Description	This open grassy woodland is dominated by yellow box (*Eucalyptus melliodora*), with kurrajong (*Brachychiton populneus*), bimble box (*Eucalyptus populnea* subsp. *bimbil*) and white cypress pine (*Callitris glaucophylla*) occurring in some patches. The midstorey is generally absent however the ground layer is characteristically dense and dominated by native grasses, including red grass (*Bothriochloa macra*), curly windmill grass (*Enteropogon acicularis*) and speargrass (*Austrostipa scabra*). Native chenopods, forbs and herbs occur sporadically and include wingless fissure-weed (*Maireana enchylaenoides*), small-leaf bluebush (*Maireana microphylla*), yellow burr-daisy (*Calotis lappulacea*), blue flax-lily (*Dianella longifolia*), amulla (*Eremophila debilis*) and *Vittadinia* sp. Exotic species include common peppercress (*Lepidium africanum*), mintweed (*Salvia reflexa*), saffron thistle (*Carthamus lanatus*) and the WoNS, African boxthorn (*Lycium ferocissimum*).	
Structure	Upper – 15-20m/15-20% Midstorey – 0m/0% Lower – <0.5m/80-85%	
TSC Act Status	This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**).	
EPBC Act Status	This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**).	

3.2.1.15 Vegetation Zone 15 – CW226, LA226– Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion– Moderate to Good Condition – Derived Native Grassland

PCT Name	Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion	
Condition	**Moderate to Good_DNG**	
PCT Number	276	
BVT Number	CW226, LA226	
Formation	Grassy Woodlands	
Class	Western Slopes Grassy Woodlands	
No. Plots/transects	Three (P35, P37 and P42)	
Total Area in Development Site (ha)	13.96	
General Description	This vegetation zone occupies the alluvial plains and low hills on clay-loam soils within the Development Site adjacent to patches of Zone 14 Yellow Box Grassy Tall Woodland. Patches of this community within the Development Site occur as isolated remnants.	
Floristic Description	This community is a derived native grassland form of Zone 14 Yellow Box Grassy Tall Woodland where the upper storey has mostly been cleared. The midstorey is generally absent except for regenerating yellow box (*Eucalyptus melliodora*). The ground layer is characteristically dense and dominated by native grasses including common wheatgrass (*Elymus scaber*), curly windmill grass (*Enteropogon acicularis*) and wallaby grasses (*Rytidosperma* sp.). Other dominant native ground layer species include *Dysphania pumilio,* amulla (*Eremophila debilis*), small-leaf bluebush *(Maireana microphylla), Vittadinia* sp. and corrugated sida (*Sida corrugata*). Non-native species include common peppercress (*Lepidium africanum*), stagger weed (*Stachys arvensis*), Buchan weed (*Hirschfeldia incana*) and *Verbena* sp.	
Structure	Upper – 0m/0% Midstorey – 0.5m/<1% Lower – <0.5m/70-98%	
TSC Act Status	This vegetation zone is consistent with *White Box Yellow Box Blakely's Red Gum Woodland EEC* listed under the TSC Act (refer to **Appendix D**).	
EPBC Act Status	This vegetation zone is consistent with *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* listed under the EPBC Act (refer to **Appendix D**).	

3.2.1.16 Cleared/Non-native Vegetation

Cleared/non-native vegetation occupies majority of the rail corridor within the Development Site. The community is dominated by non-native species and is frequently subjected to disturbances from surrounding land uses, weed spraying and frequent mowing regimes.

This community is characterised by a predominantly dense understorey of non-native grasses, forbs and herbs. Dominant grasses typically include paspalum (*Paspalum dilatatum*), bearded oats (*Avena barbata*) and urochloa grass (*Urochloa panicoides*). Coffee senna (*Senna occidentalis*) is frequently present in the midstorey. Dominant non-native forbs and herbs include Patterson's curse (*Echium plantagineum*), red-flowered mallow (*Modiola caroliniana*), cobbler's pegs (*Bidens pilosa*), saffron thistle (*Carthamus lanatus*) and flaxleaf fleabane (*Conyza bonariensis*). Native species occur sporadically and occur in low abundances. Native species encountered include rough fuzzweed (*Vittadinia pterochaeta*), pink bindweed (*Convolvulus erubescens*) and quena (*Solanum esuriale*).

Cleared/non-native vegetation in the Development Site does not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003* and therefore could not be aligned with a BVT or vegetation zone and is excluded from further assessment as per Section 9.5 of the FBA (OEH 2014a).

3.2.2 Current Site Value

Table 3.5 below details the current site value scores for each of the vegetation zones in the Development Site. The raw site condition attribute data for each of the vegetation zones is provided in **Appendix C**.

Table 3.5 Vegetation Zone Site Value Scores

Veg Zone	PCT Name	Current Site Value Score		
		Assessment 1 Lachlan CMA/Lower Slopes Subregion	**Assessment 2** Central West CMA/Lower Slopes Subregion	**Assessment 3** Central West CMA/Bogan-Macquarie Subregion
1	PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	Not present	54.67	54.67
2	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	Not present	64.06	Not present
3	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	Not present	30.21	Not present

Veg Zone	PCT Name	Current Site Value Score		
		Assessment 1 Lachlan CMA/Lower Slopes Subregion	Assessment 2 Central West CMA/Lower Slopes Subregion	Assessment 3 Central West CMA/Bogan-Macquarie Subregion
4	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	Not present	Not present	62.00
5	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	Not present	56.67	56.67
6	PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	28.12	28.12	28.12
7	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	66.49	66.49	66.49
8	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	24.48	24.48	Not present
9	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	Not present	67.19	67.19
10	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	Not present	Not present	31.77
11	PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	Not present	55.33	55.33

Veg Zone	PCT Name	Current Site Value Score		
		Assessment 1 Lachlan CMA/Lower Slopes Subregion	Assessment 2 Central West CMA/Lower Slopes Subregion	Assessment 3 Central West CMA/Bogan-Macquarie Subregion
12	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	67.56	56.89	Not present
13	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	39.33	39.33	Not present
14	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	90.67	84	Not present
15	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	38.00	38.00	Not present

3.2.3 Threatened Ecological Communities

Eight of the vegetation zones described above and mapped within the Development Site conform to State and Commonwealth listed TECs, comprising:

- Weeping Myall Woodlands:
    - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* under the TSC Act.
    - *Weeping Myall Woodlands EEC* under the EPBC Act
- Inland Grey Box Woodlands and Derived Native Grasslands:
    - *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act
    - *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act

- Fuzzy Box Woodlands:
    - *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act
- White Box Woodlands and Derived Native Grasslands:
    - *White Box Yellow Box – Blakely's Red Gum Woodland EEC* under the TSC Act
    - *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act.

Analysis of consistency with the scientific determinations for each TEC was undertaken, with consideration of the advice provided by the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the TSC Act and EPBC Act respectively. The vegetation zones described in Section 3.2.1 conform to the listing advice provided for each of the TECs, except where minimum patch sizes are required or when the TEC is excluded on the basis of bioregion. Detailed analysis of the vegetation zones with respect to the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee determinations is provided in **Appendix D**.

3.3 Threatened Species within the Development Site

3.3.1 Ecosystem-credit Species

3.3.1.1 Predicted Species

Table 3.6 below outlines the ecosystem-credit species predicted to occur by the BioBanking Calculator and whether they were recorded within the Development Site during the surveys undertaken for this assessment. The superb parrot was not part of the list generated by the BioBanking Credit Calculator and was therefore not included in Table 3.6. It is noted that as EPBC Act listed species that were predicted could potentially occur in the proposal site on the basis of professional opinion, targeted surveys were undertaken for this species. Consequently, the superb parrot was recorded during surveys and is therefore discussed in **Section 3.3.1.2** as it is an ecosystem-credit species in relation to foraging habitat.

Table 3.6 Predicted Ecosystem-credit Species

Species Name	TSC Act	EPBC Act	Predicted in the BBCC			Threatened Species Offset Multiplier	Recorded within the Development Footprint
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	Assessment 2 Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	Assessment 3 Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
Australian bustard *Ardeotis australis*	E	-	×	✓	×	2.6	No
Australian painted snipe *Rostratula australis*	E	E	×	×	✓	1.3	No
barking owl *Ninox connivens*	V	-	✓	×	×	3.0	No
black-chinned honeyeater *Melithreptus gularis* subsp. *gularis*	V	-	✓	✓	✓	1.3	No
brolga *Grus rubicunda*	V	-	×	✓	✓	1.3	No
brown treecreeper *Climacteris picumnus* subsp. *victoriae*	V	-	✓	✓	✓	2.0	No
bush stone curlew *Burhinus grallarius*	E	-	✓	✓	✓	2.6	No
Corben's long-eared bat *Nyctophilus corbeni*	V	V	✓	✓	✓	2.1	No

Species Name	TSC Act	EPBC Act	Predicted in the BBCC			Threatened Species Offset Multiplier	Recorded within the Development Footprint
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	Assessment 2 Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	Assessment 3 Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
diamond firetail *Stagonopleura guttata*	V	-	✓	✓	✓	1.3	No
flame robin *Petroica phoenicea*	V	-	✓	✓	✓	1.3	No
freckled duck *Stictonetta naevosa*	V	-	×	×	✓	1.3	No
gang-gang cockatoo *Callocephalon fimbriatum*	V	-	✓	×	×	2.0	No
Gilbert's whistler *Pachycephala inornata*	V	-	✓	×	✓	1.3	No
glossy black-cockatoo *Calyptorhynchus lathami*	V	-	×	✓	✓	1.8	No
grey-crowned babbler *Pomatostomus temporalis* subsp. *Temporalis*	V	-	✓	✓	✓	1.3	Yes
hooded robin *Melanodryas cucullata* subsp. *cucullata*	V	-	✓	✓	✓	1.7	No

Species Name	TSC Act	EPBC Act	Predicted in the BBCC			Threatened Species Offset Multiplier	Recorded within the Development Footprint
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
Kultarr *Antechinomys laniger*	E	-	×	✓	×	2.6	No
little eagle *Hieraaetus morphnoides*	V	-	✓	✓	✓	1.4	No
little lorikeet *Glossopsitta pusilla*	V	-	✓	×	×	1.8	No
little pied bat *Chalinolobus picatus*	V	-	✓	✓	✓	2.1	No
magpie goose *Anseranas semipalmata*	V	-	×	×	✓	1.3	No
major Mitchell's cockatoo *Lophochroa leadbeateri*	V	-	✓	✓	✓	1.9	No
masked owl *Tyto novaehollandiae*	V	-	×	✓	✓	3.0	No
painted honeyeater *Grantiella picta*	V	V	✓	✓	✓	1.3	No

Species Name	TSC Act	EPBC Act	Predicted in the BBCC			Threatened Species Offset Multiplier	Recorded within the Development Footprint
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	Assessment 2 Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	Assessment 3 Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
pied honeyeater *Certhionyx variegates*	V	-	×	✓	×	1.3	No
red-tailed black-cockatoo *Calyptorhynchus banksii* subsp. *samueli*	V	-	×	✓	×	1.8	No
scarlet robin *Petroica boodang*	V	-	✓	✓	✓	1.3	No
speckled warbler *Chthonicola sagittata*	V	-	✓	✓	✓	2.6	No
spotted harrier *Circus assimilis*	V	-	✓	✓	✓	1.4	No
spotted-tailed quoll *Dasyurus maculates*	V	E	✓	✓	✓	2.6	No
square-tailed kite *Lophoictinia isura*	V	-	✓	✓	✓	1.4	No
stripe-faced dunnart *Sminthopsis macroura*	V	-	×	✓	✓	2.6	No

Species Name	TSC Act	EPBC Act	Predicted in the BBCC			Threatened Species Offset Multiplier	Recorded within the Development Footprint
			Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
swift parrot *Lathamus discolour*	E	CE	✓	×	×	1.3	No
turquoise parrot *Neophema pulchella*	V	-	✓	✓	✓	1.8	No
varied sittella *Daphoenositta chrysoptera*	V	-	✓	✓	✓	1.3	No
yellow-bellied sheathtail-bat *Saccolaimus flaviventris*	V	-	✓	✓	✓	2.2	No

3.3.1.2 Survey Results

Two ecosystem – credit species were recorded in the Development Site during the surveys undertaken for this assessment. These were the:

- superb parrot (*Polytelis swainsonii*)
- grey-crowned babbler (*Pomatostomus temporalis temporalis*).

As noted in **Section 3.3.1.1,** foraging habitat for the superb parrot was not predicted to occur by the biobanking credit calculator, however surveys targeting this species were undertaken as part of the assessment due to the identification of potential foraging habitat and its co-listing as a threatened species under the EPBC Act.

No other records of ecosystem-credit species are known to occur within the Development Site. A discussion relating to these two species is provided below and a full fauna species list from the surveys undertaken is included in **Appendix E**.

Superb parrot – *Polytelis swainsonii*

The superb parrot is listed as vulnerable under the TSC and EPBC Acts. This species is found in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems; vagrants have also been recorded in southern Queensland.

The superb parrot was recorded on two occasions within the Development Site during the surveys undertaken for this assessment.

- Two individuals were opportunistically recorded flying over rail line while Umwelt ecologists were undertaking targeted flora surveys in October 2014. The species was recorded around KP 495.5 (refer to Figure A18 in **Appendix A**).
- Four individuals were opportunistically recorded flying overhead while Umwelt ecologists were undertaking vegetation surveys in May 2016 at two locations within the Development Site. The species was recorded around KP 497 and 523 (refer to Figures A18 and A26 in **Appendix A**).

The superb parrot is an ecosystem species for habitat other than breeding habitat (i.e. foraging habitat). In the Southwest Slopes Bioregion, the superb parrot forages in box-gum woodlands dominated by white box, yellow box and Blakely's red gum (Webster 1988).

This species is also discussed in the species-credit context in relation to breeding habitat in **Section 3.3.2.3**.

Grey-crowned babbler – *Pomatostomus temporalis temporalis*

The grey-crowned babbler (eastern sub-species) is listed as vulnerable under the TSC Act. This species occurs within Queensland, NSW and Victoria. Within NSW, this species occurs on the western slopes of the Great Dividing Range.

The grey-crowned babbler was recorded on six occasions within the Development Site during the surveys undertaken for this assessment:

- Four individuals were sighted during the targeted threatened flora surveys in October 2014 at approximately KP 524 (refer to Figure A27 in **Appendix A**)

- Three individuals were sighted during the targeted threatened flora surveys in October 2014 at approximately KP 493.5 (refer to Figure A17 in **Appendix A**)
- An unknown number of individuals were heard calling at Site 4 on 30 November 2015 while conducting a bird survey at approximately KP 479.3 (refer to Figure A12 in **Appendix A**)
- Five individuals were sighted during a bird survey at Site 6 conducted on 30 November 2015 at approximately KP 546.7 (refer to Figure A34 in **Appendix A**)
- Five individuals were sighted and heard during a bird survey conducted at Site 3 on 1 December 2015 (refer to Figure A8 in **Appendix A**)
- An unknown number of individuals were heard calling outside the Development Site in proximity to Site 5 on 30 November 2015 after the 20 minute bird survey was completed (refer to Figure A18 in **Appendix A**).

3.3.2 Species-credit Species

3.3.2.1 Geographic and Habitat Features

Eight geographic and habitat features (refer to **Table 3.7**) that match habitats identified during surveys in the Development Site were selected in the BBCC. The remainder of the geographic and habitat features identified by the BBCC do not occur within the Development Site and were filtered out of the subsequent steps of the assessment.

Table 3.7 Geographic and Habitat Features in the Development Site

Geographic/Habitat Feature	Relevant Species-credit Species
land containing a forb-rich grassy groundlayer	small purple-pea (*Swainsona recta*)
on ridges of gilgai clays	spiny peppercress (*Lepidium aschersonii*)
land containing seasonally damp or waterlogged sites	winged peppercress (*Lepidium monoplocoides*)
periodically waterlogged sites (including table drains and farm dams)	spike rush (*Eleocharis obicis*) Austral pilwort (*Pilularia novae-hollandiae*)
land within 100m of riparian woodland on inland rivers containing mature living eucalypts or isolated paddock trees overhanging water or dry watercourses	grey falcon (*Falco hypoleucos*)
land within 40m of riparian woodland on inlands watercourses/waterholes containing dead or dying eucalypts	black-breasted buzzard (*Hamirostra melanosternon*)
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	large-eared pied bat (*Chalinolobus dwyeri*)
land within 500 metres of identified breeding habitat	Sloane's froglet (*Crinia sloanei*)

3.3.2.2 Predicted Species

Table 3.8 below outlines the species-credit species predicted to occur by the BBCC and whether they are considered to occur in the Development Site. **Table 3.8** also includes species not predicted by the BBCC, but specifically surveyed for in accordance with the literature review and methods outlined in **Section 2.0**.

Table 3.8 Predicted Species-credit Species

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
Austrostipa wakoolica (Endangered – TSC and EPBC Acts)	×	✓	×	No	*Austrostipa wakoolica* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 5 km to the east of the Development Site between Parkes and Bogan Gate (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
Austrostipa metatoris (Vulnerable – TSC and EPBC Acts)	✓	×	×	No	*Austrostipa metatoris* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the east of the Development Site at Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
bluegrass *Dichanthium setosum* (Vulnerable – TSC and EPBC Acts)	×	×	×	No	Bluegrass was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 2 km from the northern edge of the Development Site at Narromine (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
Ausfeld's wattle *Acacia ausfeldii* (Vulnerable – TSC Act)	✓	×	×	No	Ausfeld's wattle was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 70 km east of Narromine (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
pine donkey orchid *Diuris tricolor* (Vulnerable – TSC Act)	✓	✓	✓	No	Pine donkey orchid was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 7 km to the west of the Development Site (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
spike-rush *Eleocharis obicis* (Vulnerable – TSC Act)	✓	×	×	No	The spike rush was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the west of the Development Site between Condobolin and Euabalong (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
spiny peppercress *Lepidium aschersonii* (Vulnerable – TSC and EPBC Acts)	✓	×	×	No	Spiny peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 50 km to the north of the Development Site near Eumungerie (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
winged peppercress *Lepidium monoplocoides* (Endangered – TSC and EPBC Acts)	✓	×	×	No	Winged peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 120 km to the west of the Development Site between Condobolin and Euabalong (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
hoary sunray *Leucochrysum albicans* var. *tricolor* (Endangered – EPBC Act)	×	×	×	No	Hoary sunray was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 120 km to the east of the Development Site near Hill End (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
Austral pillwort *Pilularia novae-hollandiae* (Endangered – TSC Act)	✓	×	×	No	Austral pillwort was not recorded within Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the west of the Development Site near Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

Species Name	Predicted in the BBCC			Impacted by the Proposal^	Justification
	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
slender darling pea *Swainsona murrayana* (Vulnerable – TSC and EPBC Acts)	✓	✓	✓	No	Slender darling pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north of the Development Site (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
small purple-pea *Swainsona recta* (Endangered – TSC and EPBC Acts)	×	×	✓	No	Small purple-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north-west of the Development Site near Trangie (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
silky Swainson-pea *Swainsona sericea* (Vulnerable – TSC Act)	×	×	×	No	Silky Swainson-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The two closest records of the species occur approximately 4 km to the south-east of the Development Site at Parkes, and approximately 25 km to the east of the Development Site; these records are from 1970 and 1947, respectively (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
red darling pea *Swainsona plagiotropis* (Vulnerable – TSC and EPBC Acts)	×	×	✓	No	Red darling pea was not recorded within the Development Site despite thorough vegetation surveys undertaken during the known flowering time for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the northwest of the Development Site near Warren (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
Tylophora linearis (Vulnerable – TSC Act and Endangered EPBC Act)	✓	✓	×	No	*Tylophora linearis* was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
pale-headed snake *Hoplocephalus bitorquatus* (Vulnerable – TSC Act)	×	×	×	No	Pale-headed snake was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. Although there were occasional wooded areas within the Development Site, these habitats were isolated and fragmented by agricultural lands. The closest record of the species occurs approximately 200 km to the north-east of the Development Site within Pilliga State Forest (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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cotton pygmy-goose *Nettapus coromandelianus* (Endangered – TSC Act)	×	×	×	No	Cotton pygmy-goose was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 200 km to the north-west of the Development Site within the Macquarie Marshes Nature Reserve (OEH 2016d). The Development Site does not intersect any freshwater lakes or lagoons that provide the required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
black-necked stork *Ephippiorhynchus asiaticus* (Endangered – TSC Act)	×	×	×	No	Black-necked stock was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 50 km to the west of the Development Site along the Bogan River near Dandaloo (OEH 2016d). The Development Site does not intersect any floodplain wetlands that are required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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	Assessment 1 Lachlan CMA Lower Slopes IBRA Subregion KP 449 – 466.5	**Assessment 2** Central West CMA Lower Slopes IBRA Subregion KP 466 – 509	**Assessment 3** Central West CMA Bogan Macquarie IBRA Subregion KP 508.5 – 555.5		
Australasian bittern *Botaurus poiciloptilus* (Endangered – TSC and EPBC Acts)	×	✓	×	No	Australasian bittern was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the north of the Development Site along the Macquarie River north of Narromine (OEH 2016d). The Development Site does not contain any permanent freshwater wetlands with tall, dense fringing vegetation, which is required habitat for the species. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
black-breasted buzzard *Hamirostra melanosternon* (Vulnerable – TSC Act)	×	✓	✓	No	Black-breasted buzzard was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 80 km to the east of the Development Site near Wellington (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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red-backed button-quail *Turnix maculosus* (Vulnerable – TSC Act)	×	×	✓	No	Red-backed button-quail was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 300 km to the south-east of the Development Site within Blue Mountains National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
grey falcon *Falco hypoleucus* (Endangered – TSC Act)	✓	✓	✓	No	Grey falcon was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 80 km to the north-east of the Development Site near Breelong National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
barking owl *Ninox connivens* (breeding habitat only) (Vulnerable – TSC Act)	×	×	×	No	Barking owl was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs within 300 metres to the east of the Development Site near Peak Hill in 1993 (OEH 2016d). Breeding habitat for this species includes living or dead trees with hollows >20 cm diameter that are > 4 m above the ground (OEH 2016b). 20 hollow-bearing trees that match this description were recorded within the Development Site, however no signs of use

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					by owl species (such as white wash and pellets) was recorded at these hollow sites. The habitat within the Development Site is substantially degraded and the most recent record of the species in the local area is greater than 20 years old. This species is not likely to occur in the Development Site and will not be impacted by the proposal.
superb parrot *Polytelis swainsonii* (breeding habitat only) (Vulnerable – TSC and EPBC Acts)	×	×	×	No	Superb parrot was recorded on three occasions within the Development Site during surveys undertaken for this assessment (refer to **Figures A18** and **A26**). Four individuals were recorded within the Development Site 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). Breeding habitat for this species includes hollows more than 60 mm in diameter that are located more than 4 metres above ground (OEH 2016b). The national recovery plan for the species (Baker-Gabb 2011) identifies Blakely's red gum (*Eucalyptus blakelyii*) as the most important tree species for breeding for this species in the south western slopes bioregion, with most breeding events confined to this tree species. Blakely's red gum was not recorded in the Development Site and therefore breeding habitat is not considered likely to occur. Potential breeding habitat for this species is not likely to be impacted by the proposal.

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regent honeyeater *Anthochaera phrygia* (Critically Endangered – TSC and EPBC Acts)	✓	×	×	No	The regent honeyeater was not recorded within the Development Site despite thorough fauna surveys (including targeted winter bird surveys in 2015) undertaken in accordance with the seasonal requirements for this species. The Development Site contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016c)). The closest record of the species occurs approximately 30 km to the east of the Development Site near Dubbo (OEH 2016d). The habitat within the Development Site is substantially degraded and the closest record of the species in the local area is approximately 30 km from the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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brush-tailed phascogale *Phascogale tapoatafa* (Vulnerable – TSC Act)	✓	×	✓	No	Brush-tailed phascogale was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 100 km to the east of the Development Site at Condobolin (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
eastern pygmy-possum *Cercartetus nanus* (Vulnerable – TSC Act)	✓	✓	×	No	Eastern pygmy possum was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.

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squirrel glider *Petaurus norfolcensis* (Vulnerable – TSC Act)	✓	✓	✓	No	Squirrel glider was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the Development Site within Goobang National Park (OEH 2016d). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
koala *Phascolarctos cinereus* (Vulnerable – TSC and EPBC Acts)	✓	✓	✓	Yes	Koala was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The Development Site contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)) for the Western Slopes and Plains Koala Management Area. Four records of the species occur within 10 km of the Development Site (OEH 2016d). One koala was recorded approximately 500 metres from the Development Site as road kill on the Newell Highway. Another was recorded in remnant vegetation approximately 7 km south of the Development Site, while a third was recorded approximately 3.5 km to the east of the Development Site. Another record occurs approximately 8.5 km to the north-east of the Development Site between Narromine and Narromine East. These were all located in remnant vegetation. The Development Site is considered to contain potential habitat for the species in accordance with the TSPD.

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					Further information is provided in **Section 3.3.2.3**.
grey-headed flying-fox *Pteropus poliocephalus* (Vulnerable – TSC and EPBC Acts)	×	×	×	No	Grey-headed flying-fox was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 25 km to the east of the Development Site near Dubbo (OEH 2016d) and no camps have been recorded in the locality (DoE 2016b). This species is not likely to occur in the Development Site and will not be impacted by the proposal.
large-eared pied bat *Chalinolobus dwyeri* (breeding habitat only) (Vulnerable – TSC and EPBC Acts)	×	✓	×	No	Large-eared pied bat was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 50 km to the east of the Development Site near Dubbo (OEH 2016d). Targeted surveys, including Anabat echolocation recording surveys, did not detect the species roosting or moving within the bridges and culverts within the Development Site. Breeding and roosting habitat is not likely to be impacted by the proposal.
Sloane's froglet *Crinia sloanei* (Vulnerable – TSC Act)	✓	✓	✓	No	Sloane's froglet was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 20 km to the east of the Development Site within Goobang National Park (OEH 2016d).

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					The habitat within the Development Site is substantially degraded and the closest record of the species in the local area is greater than 20 km from the Development Site. This species is not likely to occur in the Development Site and will not be impacted by the proposal.

^ As entered into the 'Threatened Species Survey Results' tab in the BBCC.

3.3.2.3 Survey Results

One species-credit species was recorded in the Development Site during the surveys undertaken for this assessment, being the superb parrot (*Polytelis swainsonii*), however the habitat component for this species for which species credits are generated (breeding habitat) was not identified and is not considered likely to occur. Potential habitat for koala (*Phascolarctos cinereus*) was recorded during the surveys undertaken for this assessment and the species has been recorded in proximity to the Development Site on four occasions indicating that the species may utilise the habitat present in the Development Site as part of a broader home range or as part of a movement corridor across the landscape. The koala is discussed further below.

Koala - *Phascolarctos cinereus*

The koala is listed as vulnerable under the TSC and EPBC Acts. This species has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range.

The koala was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The Development Site contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)) for the Western Slopes and Plains Koala Management Area, being:

Primary Food Tree Species

- river red gum (*Eucalyptus camaldulensis*)

Secondary Food Tree Species

- bimble box (*Eucalyptus populnea*)
- fuzzy box (*Eucalyptus conica*)
- western grey box (*Eucalyptus microcarpa*)
- yellow box (*Eucalyptus melliodora*)
- white box (*Eucalyptus albens*)

Four records of the species occur within 10 km of the Development Site (OEH 2016d). One koala was recorded approximately 500 metres from the Development Site as road kill on the Newell Highway in 1992 (OEH 2016d). Another was recorded in remnant vegetation approximately 7 km south of the Development Site, while a third was recorded approximately 3.5 km to the east of the Development Site. Another record occurs approximately 8.5 km to the north-east of the Development Site between Narromine and Narromine East. These were all located in remnant vegetation surrounded by extensive agricultural lands. The Development Site is considered to contain likely habitat for the species in accordance with the TSPD.

The predicted habitat for the koala is based on the extent of primary and secondary koala feed trees occurring within discrete vegetation communities within the Development Site (refer to **Table 3.9**). High quality habitat occurs in those communities that contain primary koala food trees, which are known to occur within riparian areas within the Development Site. Secondary koala food trees were recorded as a dominant canopy species in Western Grey Box Tall Grassy Woodland, Poplar Box Grassy Woodland, Fuzzy Box Woodland, White Box - White Cypress Pine - Western Grey Box Woodland and Yellow Box Grassy Tall

Woodland. Primary and secondary food trees are identified for the central west CMA in the NSW Recovery Plan for the Koala (*Phascolarctos cinereus*) (DECC 2008).

Remnant vegetation associated with rivers and creeks are likely to provide important corridors for the species within the highly modified and fragmented landscape in the western slopes and plains Koala Management Area (KMA). Approximately 0.87 hectares of primary koala habitat occurs within the Development Site and approximately 18.01 hectares of moderate quality habitat for the koala that includes one secondary koala food tree species has been mapped.

Table 3.9 Area of Potential Koala Habitat Mapped within the Development Site

Koala Habitat/Vegetation Zone	Area in Development Footprint (ha)
Vegetation Zone Containing Primary Feed Trees	
PCT-36 River Red Gum Tall to very Tall Open Forest / Woodland_Moderate/Good	0.87
Vegetation Zone Containing Secondary Feed Trees	
PCT-76 Western Grey Box Tall Grassy Woodland_Moderate/Good	8.58
PCT-105 Poplar Box Grassy Woodland_Moderate/Good	1.41
PCT-201 Fuzzy Box Woodland_Moderate/Good	1.50
PCT-267 White Box - White Cypress Pine - Western Grey Box Woodland_Moderate/Good	3.12
PCT-276 Yellow Box Grassy Tall Woodland_Moderate/Good	3.40
Total	**18.88**

3.3.2.4 Species Habitat Polygons

A species habitat polygon has been prepared for the koala which is summarised in **Table 3.10** below.

Table 3.10 Species-credit Species Recorded or Assumed Present at the Development Site

Species	Area of Species Polygons (i.e. area of impact)	Able to Withstand Further Loss (according to the TSPD)	
		Lachlan CMA	Central West CMA
koala *Phascolarctos cinereus*	18.88 ha	N/A	No loss of breeding habitat. No loss of foraging habitat within 500m of breeding habitat. Up to 10% loss of foraging habitat greater than 500m from breeding habitat.

The species polygons were prepared:

- using the unit of measurement identified for those species in the Threatened Species Profile Database
- including the location of the species or areas likely occupied by the species
- containing the specific habitat feature associated with the species at the Development Site.

Due to the large scale of the proposal species polygons have not been presented in **Appendix A** however, the shape files for these polygons will be submitted to OEH.

4.0 Avoidance and Minimisation of Impacts

4.1 Avoidance

4.1.1 Site Selection

ARTC has commissioned a range of studies to guide the site selection for the proposal. Two major studies have been undertaken in relation to the development of an inland rail route between Melbourne and Brisbane. The first study, completed in 2006, considered potential corridors for the rail line to determine which route would deliver the best economic and financial outcome. This study identified that the 'far western corridor' through Parkes would be the best option.

The Melbourne-Brisbane Inland Rail Alignment Study (ARTC 2010) was finalised in 2010 and was prepared to determine the optimum alignment of the entire route in terms of operational, engineering and environmental factors. At each stage the options were analysed in sufficient detail to enable key decisions to be made and finally narrow the rail corridor options down to a single rail alignment. The successive stages of route analysis included:

- Inland rail route options – identification of a range of available route options. Environmental and land use assessments were undertaken along each route section.
- Identification of the route – evaluation of the route options and preliminary analysis of: Melbourne to Parkes; Parkes to Moree; and Moree to Brisbane.
- Analysis of the route – the route was analysed in terms of capital cost, environmental impacts and journey times as well as its preliminary economic and financial viability. Environmental constraints mapping was produced and survey data was obtained to assist with the alignment development.
- Development of the rail alignment – the rail alignment was developed considering environmental and engineering factors. Environmental risks were eliminated or minimised through consideration of local alternatives and moving the alignment to avoid significant constraints where possible.

For the Parkes to Narromine section of the Inland Rail, the proposed works only include upgrades to existing tracks as opposed to the construction of new track or work in greenfield sites. As a result, the overall disturbance footprint of the proposal is reduced through the use of the existing corridor. As the proposed works occur along or adjacent to the existing track, further positioning works to avoid native vegetation and habitat areas would only be possible in some cases. Conversely, these works would be primarily undertaken in the existing rail corridor that is regularly subject to disturbances relating to the rail corridor and surrounding agricultural activities and with relatively few important biodiversity features and habitats.

In light of this proposal utilising an existing corridor, this report identifies that some of the most significant environmental impacts of the proposal were those associated with vegetation removal required for construction of the railway and track upgrades. Identified impacts associated with the removal of vegetation included effects on threatened species, populations and ecological communities, the fragmentation of wildlife areas and habitats, and severance of wildlife (ARTC 2010).

Further information on proposal alternatives and options is outlined in Chapter 6 of the EIS.

4.1.2 Planning Phase

Ecological investigations were also undertaken during the constraints analysis phase to help to determine the potential impacts of the proposal. This facilitated the amendment of the design, where possible, to minimise potential impacts on threatened species, communities and their habitats.

The ecological investigations undertaken by Umwelt (2014) identified a range of key biodiversity constraints between the Parkes to Narromine section of the proposal. These investigations included database and literature reviews and rapid ecological field surveys of the rail corridor that included vegetation assessments, targeted inspections of bridge structures for micro-bats and rapid aquatic assessments. The investigations identified the presence of multiple threatened ecological communities (TECs) under the TSC and EPBC Acts occurring within and adjacent to the rail corridor. Fauna habitats, however, were found to be relatively limited due to the previous and ongoing disturbances within the rail corridor and extensive agricultural lands surrounding the Development Site.

Following these investigations, where works could be relocated outside of native vegetation (such construction compounds) these were to be located in primarily disturbed or exotic landscapes. However, in most cases there was little scope for further avoidance of ecological impacts for the construction of the proposal itself as the location of works is constrained by the location the existing rail line and the existing rail corridor.

Further mitigation measures are described in **Section 4.2** below with the aim of further minimising impacts.

4.1.3 Avoidance Summary

Table 4.1 below outlines a summary of the avoidance measures that have been or will be implemented to minimise the impacts of the proposal.

Table 4.1 Avoidance Measures

Action	Outcome	Timing	Responsibility
The Melbourne-Brisbane Inland Rail Alignment Study	• Identification of a preliminary proposal route • Avoidance of native vegetation and habitat areas, where practicable	Site Selection	ARTC
Ecological constraints investigations	• Identification of areas of high conservation value • Relocation of works outside native vegetation and habitat areas, where practicable • Maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas)	Planning Phase	ARTC
Demarcation of areas approved for clearing, where practicable	• Minimisation of accidental clearing/disturbance of surrounding native vegetation	Construction	Construction contractor

4.2 Mitigation Measures

4.2.1 Construction Phase

It is recommended that a strategy to mitigate adverse biodiversity impacts is implemented during the construction phase of the proposal. This includes specific measures to manage potential impacts on fauna species in the Development Footprint during vegetation clearing and construction of the proposal. Mitigation measures relative to the construction phase are outlined below and should be further detailed in a Construction Environmental Management Plan (CEMP) prepared for the proposal.

4.2.1.1 Management of Arboreal Species and Habitat

A robust pre-clearance survey and tree-felling procedure should be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees and to avoid impacts on koalas. These management measures are designed to minimise impacts to hollow-dependent, roosting fauna and koalas.

The pre-clearance survey and tree-felling procedure are described below and should be documented in the CEMP.

Pre-clearance Surveys

Pre-clearance surveys should be implemented within areas of woody native vegetation that are to be cleared. Pre-clearance surveys should be undertaken by suitably qualified person and involve the following:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing/disturbance of surrounding native vegetation where practicable
- the likely habitat resources and habitat trees should be identified and marked. Habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs and burrows
-
- in areas of koala habitat, visual inspection of trees for koalas prior to clearing.

Tree-felling Supervision

Tree clearing should be completed as close to the completion of pre-clearance surveys as practicable to limit the potential for new issues to arise (such as new active nests being built), with the clearing of habitat resources and habitat trees to be supervised by a suitably qualified person or fauna handler after pre-clearance surveys have identified potential threatened species habitat. The suitably qualified person will be licensed by the relevant field survey and ethics authorities to allow for capture, housing, transport and possibly ethical euthanizing of injured fauna. The tree-felling procedure should include the following:

- The felling of non-habitat trees would be completed prior to the felling of habitat trees. All habitat trees would be vigorously shaken with heavy machinery the day prior to clearing. Note that the clearing of non-habitat trees does not require supervision by an ecologist or fauna handler
- On the day of habitat tree felling, the following is to be undertaken:
    - all habitat trees will be subject to a visual inspection to survey for threatened species

- trees previously identified as containing fauna or fauna habitat (such as hollows or nests) will be shaken and then felled, providing no threatened species are identified
- all reasonable attempts will be made to reduce the impact of felling on all fauna species.
- the lowering of hollow-bearing trees will be done as gently as possible with heavy machinery
- if a native fauna species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include further shaking to encourage the animal to vacate the tree, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
- uninjured animals should be released on the day of capture into nearby suitable adjacent habitat and should not be held for extended periods of time, and
- injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. If required, the suitably qualified person may ethically euthanize fauna.

- Following felling, habitat trees will be inspected for remaining or injured fauna species and to ensure that no hollows are blocked against the ground. This may require the tree to be rolled to ensure adequate access
- All felled habitat trees should remain in place for a least one night to allow any fauna still present to move on, and
- Habitat features identified for translocation or salvage operations should be extracted and stored appropriately.

4.2.1.2 Management of Micro-bat Species and Habitat

Culvert and Bridge Works Pre-clearance Surveys

All culverts and bridges that are proposed to be removed should be subject to a pre-clearance survey to determine if they provide habitat for micro-bats.

Where potential habitat is identified, on the day prior to the disturbance of bridges or culverts with the potential to provide roosting habitat for micro-bats, a suitably qualified and experienced ecologist should undertake an inspection of the bridge to search for potential micro-bat roost sites under and within the culvert or bridge. If roosting bats are identified under and/or within the culvert or bridge, the bats should be left undisturbed until dusk. At dusk roosting bats can be captured and released nearby. Following removal or departure of all roosting bats the culvert or bridge crevices should be removed or blocked off (for example cover the entrance with shade cloth) prior to dawn the following morning.

Pre-clearance surveys should record the:

- roosting species (if identifiable)
- count/estimate of the number of roosting individuals
- location and time of relocation (if applicable) or other actions taken to discourage the roosting of micro-bat species under (or in) the culvert or bridge.

4.2.1.3 Weed Control

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The increased presence of weed species within the Development Site has the potential to decrease the value of retained vegetation to native species.

The following management measures should be undertaken to minimise the potential impacts and spread of weeds during the construction of the proposal:

- vehicles or equipment being brought onto the Development Site to be involved in ground disturbance activities and/or travelling around the site must be inspected and cleaned prior to commencing work to limit the spread of seeds and plant material between sites
- regular inspections will be undertaken in the Development Site to monitor the spread of weed species
- training of environmental personnel on the identification of target weed species.

Any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, and/or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

4.2.1.4 Sediment and Erosion Control

When work is required within or adjacent to watercourses, appropriate erosion and sediment controls will be put in place in accordance with a soil and water management sub-plan (SWMP) to be developed for the proposal as outlined in the *ARTC Inland Rail – Parkes to Narromine Hydrology and Flooding Assessment* (GHD 2017).

There will also be specific erosion and sedimentation control plans developed throughout all stages of construction.

Designs for works within or near water bodies will be designed to provide for the retention of natural functions and maintenance of fish passage in accordance with NSW Fisheries Guidelines (2004) *Fish Friendly Waterway Crossings* and *Why do fish need to cross the road? Fish passage requirements for waterway crossings*

4.2.1.5 General Biodiversity Mitigation Measures

A range of general biodiversity mitigation measures are recommended across the Development Site during the construction phase to minimise impacts to biodiversity values, including:

- employee education and training including inductions for staff, contractors and visitors to the site will be conducted to inform personnel of the biodiversity issues present at the site and so they know their role and responsibilities in relation to the protection and/or minimisation of impacts to native biodiversity

- areas of biodiversity value outside the Development Footprint will be fenced or signposted, where appropriate, to prevent the unnecessary disturbance during the construction phase
- noise, vibration and dust control as per Chapters 11, 12 and 13 of the EIS.

4.2.2 Operational Phase

It is recommended that a strategy to mitigate adverse biodiversity impacts is implemented during the operational phase of the proposal. This includes specific measures to minimise the potential impacts on the biodiversity of the Development Site and the locality.

4.2.2.1 Ongoing Weed Management

As part of regular maintenance of the rail corridor, inspections of the Development Site should be undertaken for weed infestations and to assess the need for control measures in accordance with existing operational management procedures. These inspections will identify any weed infestations, the need for any control measures and the effectiveness of past weed control activities.

As outlined in **Section 4.2.2**, any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Noxious and other undesirable weed species (including WoNS) within the Development Site, such as African boxthorn (*Lycium ferocissimum*), silver-leaved nightshade (*Solanum elaeagnifolium*) and tiger pear (*Opuntia aurantiaca*), will be controlled to an acceptable level, and where possible eliminated. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

4.2.3 Mitigation Measures Summary

Table 4.2 below provides a summary of the mitigation measures that are recommended before, during and after construction to minimise the impacts of the proposal.

Table 4.2 Recommended Mitigation Measures

Action	Outcome	Timing	Responsibility
Demarcation of areas approved for clearing where practicable	• Minimisation of accidental clearing/disturbance of surrounding native vegetation	Construction	Construction contractor
Pre-clearance surveys	• Reduction of impacts to hollow-dependant fauna species • Minimisation of impacts to koala • Minimisation of impacts to micro-bat species • Identification of habitat resources for translocation or salvage	Construction	Construction contractor

Action	Outcome	Timing	Responsibility
Tree-felling and bridge/culvert replacement supervision	• Relocation of captured fauna individuals into nearby suitable secure habitat • Injured fauna individuals taken to a veterinary clinic or wildlife carer • Translocation or salvage of habitat resources	Construction	Construction contractor
Weed control	• Minimisation of the spread of weeds within native vegetation (management of noxious weeds)	Construction Operation	Construction contractor ARTC
Erosion and sedimentation control	• Minimisation of erosion and sediment laden runoff into adjacent watercourses	Construction Operation	Construction contractor
Fencing and impact site delineation	• Prevention of unnecessary disturbance of native vegetation and habitats	Construction	Construction contractor
Employee education and training	• Communication to employees on their role and responsibilities as it relates to biodiversity	Construction Operation	Construction contractor ARTC

4.3 Direct Impacts unable to be Avoided

The construction and operation of the proposal will result in a range of direct impacts on biodiversity values within the Development Site. Direct impacts include the loss of native vegetation and fauna habitats as a result of direct and permanent clearance works and track upgrades and the location and extent of direct (permanent) impacts is shown on **Figure 4.1A** to **4.1E**.

Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 5 10 20km
1:500 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1

Development Site Impact Parkes to Narromine

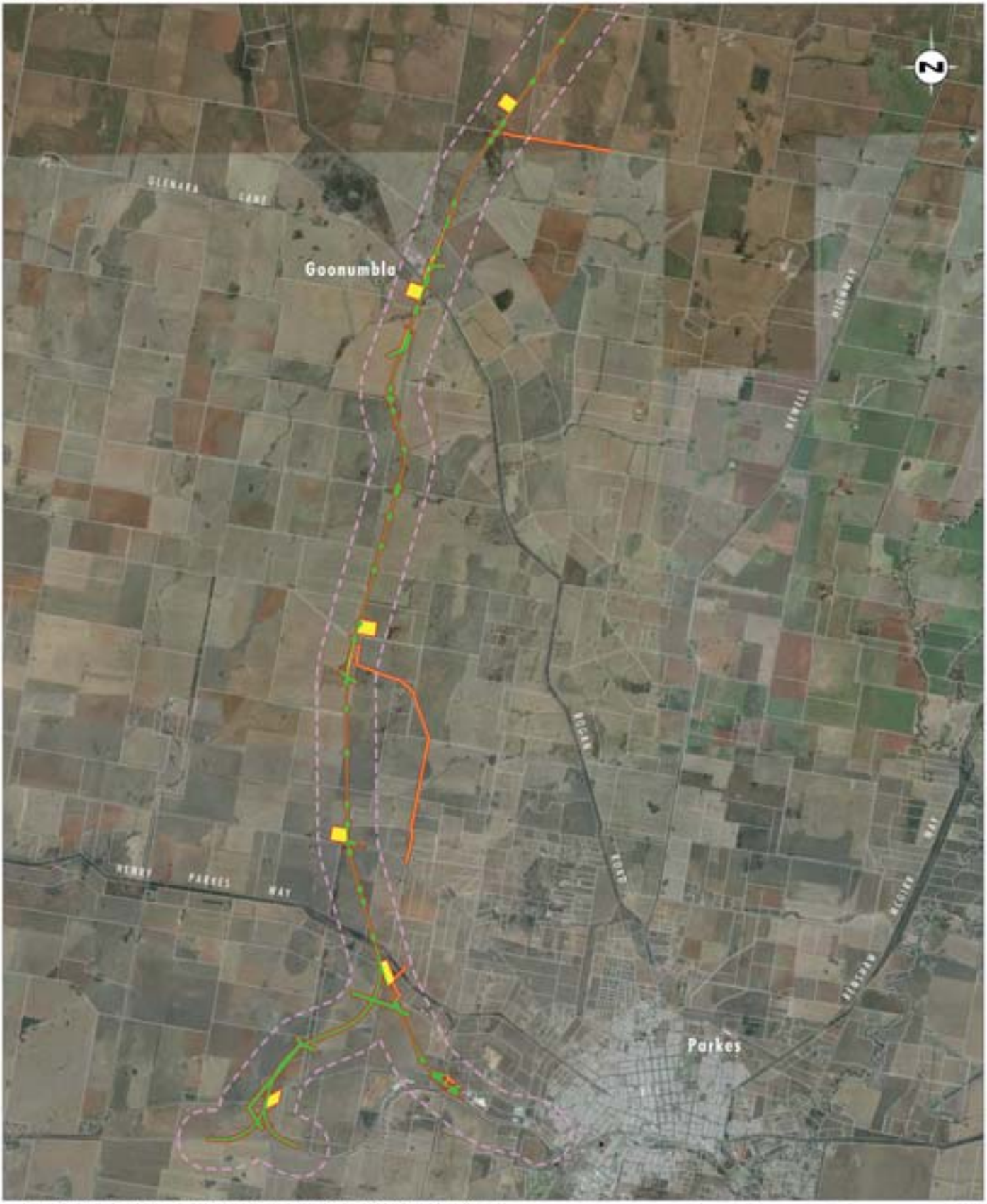

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1A

Development Site Impact Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1B

Development Site Impact
Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1C

Development Site Impact Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1D

Development Site Impact Parkes to Narromine

File Name (A4): R06/3606_071.dgn
20170501 13.44

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 4.1E

Development Site Impact Parkes to Narromine

The proposal would involve upgrading the existing rail line between Parkes and Narromine, including:

- upgrading the existing track and track formation
- replacement of culverts and bridges
- construction of new crossing loops, at Goonumbla, Peak Hill, and Timjelly
- rationalisation and upgrading of level crossings
- curve easing
- constructing the Parkes north west connection.

The following ancillary works would also be undertaken:

- changes to some property access roads and the local road network in some locations as a result of the rationalisation of level crossings
- stormwater drainage works
- upgrading signalling and communications
- establishing or upgrading existing fencing of the rail corridor
- relocation of some services and utilities

Detailed discussion of the works proposed as part of the proposal are included in **Section 1.1**.

Table 4.3 below outlines the impact associated with the proposal as they were entered into the BBCC, which totals 75.78 hectares of direct impacts to native vegetation communities. Direct impacts have been focused, where possible, outside of native vegetation communities, with 579.71 hectares of cleared/non-native vegetation subject to direct impacts.

Avoidance and mitigation measures associated with minimising the impacts of these direct impacts are discussed in **Sections 4.1**and **4.2** above.

Table 4.3 Direct and Permanent Impacts of the Proposal on Native Biodiversity Features

Ecological Feature	Area within the Development Site (ha)
Plant Community Type	
PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion[1] *Moderate to Good*	3.16
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	0.87

Ecological Feature	Area within the Development Site (ha)
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	0.62
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	0.94
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	6.13
PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	1.54
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions[2] *Moderate to Good*	8.58
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions[3] *Moderate to Good_DNG*	23.64
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	1.41
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	1.20
PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion[4] *Moderate to Good*	1.50
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion[5] *Moderate to Good*	3.12
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion[5] *Moderate to Good_DNG*	9.35
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion[5] *Moderate to Good*	3.40

Ecological Feature	Area within the Development Site (ha)
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion[5] *Moderate to Good_DNG*	10.32
Total	**75.78**
Species-credit Species Habitats	
Vegetation containing koala feed trees and vegetation types (as per the TSPD) for koala (*Phascolarctos cinereus*)	18.88 ha

1. 3.47 ha conforms to *Myall Woodland EEC* under the TSC Act and 0.99 ha conforms to *Weeping Myall Woodlands EEC* under the EPBC Act.
2. 7.33 ha conforms to *Inland Grey Box Woodland EEC* under the TSC Act and 9.44 ha conforms to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act.
3. Conforms to *Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act.
4. Conforms to *Fuzzy Box Woodland EEC* under the TSC Act.
5. Conforms to *White Box – Yellow Box- Blakeley's Red Gum Woodland EEC* under the TSC Act and *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act.

4.4 Indirect and Temporary Impacts

4.4.1 Indirect Impacts

The proposal is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the proposal with the proposed controls in place (e.g. erosion and sediment controls, dust controls, noise controls). However, some minor indirect impacts associated with dust, noise, weeds and increased rail movements are likely to occur during the construction and operational phase of the proposal. This is further discussed in the sections below.

4.4.1.1 Dust Impacts

Dust mpacts associated with the proposal are expected to be minor and include dust covering vegetation thereby reducing vegetation health and growth.

Appropriate dust controls would be implemented during the construction phase of the proposal to minimise dust generation and thereby minimise the potential for adverse dust impacts on biodiversity. These would include:

- the minimisation of vegetation clearance where it is not required
- timely rehabilitation of disturbed areas once construction works are complete, and
- dust suppression on access tracks and other construction areas to reduce vehicle generated dust emissions, where required.

With the planned controls in place and considering the nature of the construction program, dust impacts associated with both the consituction and operation phases of the proposal are considered unlikely to result in significant impacts on biodiversity.

4.4.1.2 Noise Impacts

Construction and operational noise impacts have the potential to adversely impact fauna species. Potential impacts include noise disturbing the roosting and foraging behaviour of fauna species and reducing the occupancy of areas of suitable habitat. The proposed increase in rail movement would also increase noise generation along the rail corridor.

The design of the proposal would include measures to minimise the potential for adverse noise impacts. These include:

- the use of physical barriers such as earthen bunds and noise walls, where deemed required to attenuate operational noise, and
- equipment selection and maintenance to manage noise generation.

With the planned controls in place and considering the nature of the likely noise generation of the proposal associated with the consituction and operational phases of the proposal, noise impacts are considered unlikely to result in significant impacts on biodiversity.

4.4.1.3 Increased Train Movements

Increased train movements during the operation of the proposal may result in adverse impacts on locally occurring fauna species, particularly terrestrial mobile species. Grain and freight train numbers are expected to increase from an existing approximate two to three trains per day to up to approximately 17 trains per day by 2040.

The increased train movements have the potential to result in an increase in train strikes on fauna species resulting in injury and death of native fauna. The rail corridor is managed in some places by agricultural fencing, however this is unlikely to impede fauna movement through the Development Site. Furthermore, the inclusion of fauna exclusion fencing to minimise train strike is not desirable due to the likely reduction in fauna movement and connectivity in the broader landscape.

The increase in train movements and train speed as a result of the operation of the proposal is likely to result in greater train strike impacts to terrestrial fauna species. However this impact is considered unlikely to result in the extinction of the local population of any threatened species likely to be affected by the increased train movements.

4.4.1.4 Weed Encroachment

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The presence of weed species within the Development Site has the potential to decrease the value of extant vegetation to native species, particularly threatened species. Mitigation measures outlined in **Sections 4.2.1.3** and **4.2.2.1** will minimise the potential for weed encroachment into surrounding areas around the Development Site.

4.4.2 Temporary Impacts

The construction of the proposal will result in temporary impacts relating to construction impacts associated with construction facilities such as compounds and temporary access tracks. Native vegetation occurring in these areas is not expected to be fully impacted (i.e. will not be cleared) but will be subject to some disturbance and is expected to recover. While the vegetation and habitats in these areas will be impacted in the short term, it is considered that these areas will regenerate following the completion of the construction phase of the proposal. As a result, these temporary impacts have not been included in the BBCC assessment. The location and extent of temporary impacts is shown on **Figure 4.1A** to **4.1E**.

To facilitate the regeneration of temporary impact locations, a rehabilitation strategy will be prepared as part of the CEMP.

Temporary impacts on native vegetation communities are outlined in **Table 4.4** below and total 35.26 hectares. Temporary impacts have been focused, where possible, outside of native vegetation communities, with 231.99 hectares of cleared/non-native vegetation subject to temporary impacts. It should be noted that while some temporary impacts occur in areas outside derived native grassland communities, no trees or shrubs in these areas will be cleared as a result of these impacts. As a result, temporary impacts will not affect any species-credit species habitats.

Table 4.4 Temporary Impacts of the Proposal on Native Vegetation

Biometric Vegetation Type	Area within the Development Site (ha)
PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	0.31
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	0
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	0
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	0.18
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	0.99
PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	0.41

Biometric Vegetation Type	Area within the Development Site (ha)
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	1.55
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	8.59
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	1.97
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	13.25
PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	0.38
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	0.12
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	0.11
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.76
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	3.64
Total	**35.26**

5.0 Impact Summary

5.1 Impacts Not Requiring Further Assessment

Impacts not requiring further assessment under the FBA include areas of land without native vegetation. The Development Site contains 655.49 hectares of cleared land/non-native vegetation that will be removed as a result of the proposal that does not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003*. This impact does not require further assessment under the FBA.

Due to the large scale of the proposal, a map of areas not requiring further assessment has not been presented in the report, however the shape files for these areas will be submitted to OEH.

5.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the FBA include native vegetation that has a site value score of less than 17 and are not identified as an endangered or critically endangered ecological community, and/or associated with threatened species habitat (as represented by ecosystem credits).

Impacts on species and populations not requiring offsets under the FBA include threatened species habitat associated with a PCT that has a site value score of less than 17 or species or populations that are not threatened and do not form part of a EEC or CEEC.

A range of non-threatened flora and fauna species were recorded within the Development Site during the surveys undertaken for this assessment. These species do not require offsets under the FBA. As no PCTs within the Development Footprint have a site value score of less than 17 and are predicted to be habitat for threatened ecosystem species, all will require offsetting as discussed in **Section 5.3**.

5.3 PCTs and Threatened Species Requiring Offset

A range of PCTs, ecosystem-credit species and species-credit species were found to require offsetting as discussed in the sections below.

5.3.1 Ecosystem Credits

Table 5.1 outlines the ecosystem-credit species requiring offset as a result of the proposal. These species are offset through the retirement of ecosystem credits (see Table 5.2) and do not generate individual offsetting requirements. The highest threatened species offset multiplier determines the credit requirements for the vegetation zones these species are predicted to occur in.

Table 5.1 Ecosystem-credit species requiring offset as a result of the proposal

Common Name	Species Name	Threatened Species Offset Multiplier
barking owl	*Ninox connivens*	3.0
masked owl	*Tyto novaehollandiae*	3.0
Australian bustard	*Ardeotis australis*	2.6

Common Name	Species Name	Threatened Species Offset Multiplier
bush stone curlew	*Burhinus grallarius*	2.6
Kultarr	*Antechinomys laniger*	2.6
speckled warbler	*Chthonicola sagittata*	2.6
spotted-tailed quoll	*Dasyurus maculatus*	2.6
stripe-faced dunnart	*Sminthopsis macroura*	2.6
yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	2.2
Corben's long-eared bat	*Nyctophilus corbeni*	2.1
little pied bat	*Chalinolobus picatus*	2.1
brown treecreeper	*Climacteris picumnus* subsp. *Victoriae*	2.0
gang-gang cockatoo	*Callocephalon fimbriatum*	2.0
major Mitchell's cockatoo	*Lophochroa leadbeateri*	1.9
glossy black-cockatoo	*Calyptorhynchus lathami*	1.8
little lorikeet	*Glossopsitta pusilla*	1.8
red-tailed black-cockatoo	*Calyptorhynchus banksii* subsp. *samueli*	1.8
turquoise parrot	*Neophema pulchella*	1.8
hooded robin	*Melanodryas cucullata* subsp. *cucullata*	1.7
little eagle	*Hieraaetus morphnoides*	1.4
spotted harrier	*Circus assimilis*	1.4
square-tailed kite	*Lophoictinia isura*	1.4
Australian painted snipe	*Rostratula australis*	1.3
black-chinned honeyeater	*Melithreptus gularis* subsp. *Gularis*	1.3
brolga	*Grus rubicunda*	1.3
diamond firetail	*Stagonopleura guttata*	1.3
flame robin	*Petroica phoenicea*	1.3
freckled duck	*Stictonetta naevosa*	1.3
Gilbert's whistler	*Pachycephala inornata*	1.3

Common Name	Species Name	Threatened Species Offset Multiplier
grey-crowned babbler	*Pomatostomus temporalis* subsp. *temporalis*	1.3
magpie goose	*Anseranas semipalmata*	1.3
painted honeyeater	*Grantiella picta*	1.3
pied honeyeater	*Certhionyx variegatus*	1.3
scarlet robin	*Petroica boodang*	1.3
swift parrot	*Lathamus discolor*	1.3
varied sittella	*Daphoenositta chrysoptera*	1.3

Table 5.2 below outlines the PCTs to be impacted as a result of the proposal and the ecosystem credits required to offset those impacts. Maps of these PCTs are presented in **Appendix A**. The full Credit Calculator reports are included in **Appendix F**.

Table 5.2 Plant Community Types Requiring Offset and the Total Ecosystem Credits Required

Vegeta -tion Zone	Plant Community Type	Total Area to be Impacted (ha)	Highest Threatened Species Offset Multiplier	Total Ecosystem Credits Required
1	PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	3.16	3.0	146
2	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	0.87	3.0	46
3	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	0.62	3.0	8
4	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	0.94	3.0	49
5	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	6.12	3.0	293
6	PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	1.54	2.6	38
7	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	8.58	3.0	473

Vegeta -tion Zone	Plant Community Type	Total Area to be Impacted (ha)	Highest Threatened Species Offset Multiplier	Total Ecosystem Credits Required
8	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	23.48	3.0	556
9	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	1.41	3.0	79
10	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	1.20	3.0	35
11	PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	1.50	3.0	70
12	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12	3.0	169
13	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	0.46	3.0	16
14	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.40	3.0	235

Vegeta -tion Zone	Plant Community Type	Total Area to be Impacted (ha)	Highest Threatened Species Offset Multiplier	Total Ecosystem Credits Required
15	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	10.32	3.0	348
TOTAL		**66.72**	-	**2,561**

5.3.2 Species Credits

Table 5.3 below outlines the species-credit species to be impacted as a result of the proposal and the species credits required to offset those impacts. A full Credit Calculator report is included in **Appendix F**.

Due to the large scale of the proposal, species polygons have not been presented in **Appendix A**, however the shape files for these polygons will be submitted to OEH.

Table 5.3 Species-credit Species Requiring Offset and the Species Credits Required

Common Name	Species Name	Threatened Species Offset Multiplier	Species Credits Required
koala	*Phascolarctos cinereus*	2.6	491

5.4 Impacts on Biodiversity that Require Further Consideration

Under the FBA, certain impacts on biodiversity values may require further consideration by the consent authority. These are impacts that are considered to be complicated or severe and include:

- impacts on landscape features, being:
    - impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas, or
    - impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state, and
- impacts on native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability, and
- impacts on critical habitat or on threatened species or populations that are likely to cause the extinction of a species or population from an IBRA subregion or significantly reduce its viability.

The proposal will not have an impact on any biodiversity features that would result in one or more of the above severe impacts.

Despite this, a range of threatened species and communities have been identified in OEH's submission of the SEARs that require further consideration. These are outlined in **Sections 5.4.1** and **5.4.2** below.

5.4.1 Impacts on Native Vegetation that Require Further Consideration

The following TECs were specifically identified in the SEARs as requiring further consideration in the BAR:

- *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions* – EEC under the TSC Act.
- *White Box Yellow Box Blakely's Red Gum Woodland* – EEC under the TSC Act and CEEC under the EPBC Act.

- *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* - EEC under the TSC and EPBC Acts.

- *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*- EEC under the TSC and EPBC Acts.

Table 5.4 below provides further information for the threatened ecological communities identified in the SEARs as requiring further consideration as per Section 9.2.4 of the FBA (OEH 2014a).

Table 5.4 Impacts on Native Vegetation that Require Further Consideration as per the SEARs

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
(a) the area and condition of the CEEC or EEC to be impacted directly and indirectly by the proposed development			
• 1.88 hectares (1.50 ha permanent disturbance and 0.38 ha temporary disturbance) to be directly impacted by the proposal. • This EEC occurs in small patches within the Development Site in Moderate to Good condition with a predominately native groundcover with occurrences of some exotic species likely due to existing disturbances in the rail corridor (refer to (refer to **Section 3.2.1.11**).	• 24.93 hectares (17.28 ha permanent disturbance and 7.63 ha temporary disturbance) of *White Box Yellow Box Blakely's Red Gum Woodland EEC* to be directly impacted by the proposal. • 22.79 hectares (15.11 ha permanent disturbance and 7.63 ha temporary disturbance) of *White Box Yellow Box Blakely's Red Gum Woodland CEEC* to be directly impacted by the proposal. • These TECs occur as several remnant patches within the Development Site in woodland and derived native grassland condition. Derived native grassland areas are devoid of canopy species likely due to historic clearing. Both condition classes are predominately native with minimal occurrences of exotic plant species (refer to **Sections 3.2.1.12** to **3.2.1.15**).	• 3.47 hectares (3.16 ha permanent disturbance and 0.31 ha temporary disturbance) of *Myall Woodland EEC* under the TSC Act to be directly impacted by the proposal. • 0.99 hectares (all to be permanently disturbed) of *Weeping Myall Woodlands EEC* under the EPBC Act to be directly impacted by the proposal. • These TECs occur as several small remnant or regenerating patches within the Development Site in Moderate to Good condition. There are varying levels of disturbance in these EECs due to the heavily disturbed rail corridor, historic clearing, infrastructure maintenance, mowing and weed spraying regimes as well as adjacent land uses (refer to **Section 3.2.1.1**).	• 39.39 hectares (30.29 ha permanent disturbance and 9.1 ha temporary disturbance) of *Inland Grey Box Woodland EEC* under the TSC Act to be directly impacted by the proposal. • 41.51 (31.37 ha permanent disturbance and 10.14 ha temporary disturbance) hectares of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act to be directly impacted by the proposal. • These TECs occur as several disturbed patches within the Development Site in woodland and derived native grassland condition. Derived native grassland areas are devoid of canopy species likely due to historic clearing. Both condition types are predominately native with some occurrences of exotic plant species (refer to **Sections 3.2.1.7** and **3.2.1.8**).

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
(b) the extent and overall condition of the CEEC or EEC within an area of 1000 ha and then 10,000 ha surrounding the proposed development footprint.			
According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) no vegetation communities equivalent to this EEC occur within a 1000 ha or 10,000 ha buffer area surrounding the Development Site.	According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) the vegetation communities Yellow Box Woodland and White Box – White Cypress Pine Woodland (both likely equivalent to the EEC/CEEC listings) mapped surrounding the Development Sites, comprising: • 4 ha in 1000 ha buffer area. • 94 hectares in the 10,000 ha buffer area. It is noted that this regional mapping only includes the woodland form of the EEC/CEEC and not the derived native grassland component. The remnant patches of this EEC/CEEC are generally scattered isolated occurrences in a largely agricultural landscape. The small and narrow patch sizes represent remnants with large edge affects and are likely to be in moderately disturbed condition.	According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) no vegetation communities equivalent to these EECs occur within a 1000 ha or 10,000 ha buffer area surrounding the Development Site.	According to the regional vegetation map Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006) the vegetation community Inland Grey Box Woodland which is likely equivalent to these EECs was mapped surrounding the Development Sites, comprising: • 17 ha in 1000 ha buffer area. • 209 ha in the 10,000 ha buffer area. It is noted that this regional mapping only includes the woodland form of these EECs and not the derived native grassland component. The remnant patches of these EECs are generally scattered isolated occurrences in a largely agricultural landscape. The small and narrow patch sizes represent remnants with large edge affects and are likely to be in moderately disturbed condition.
(c) an estimate of the extant area and overall condition of the CEEC or EEC remaining in the IBRA subregion after the impact of the proposed development has been taken into consideration			

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
• Current mapping and literature does not provide an accurate estimate of the extant area of this TEC in the Lower Slopes and Bogan-Macquarie IBRA subregions. • Less than 5% of *Fuzzy Box Woodland EEC* is estimated to remain compared to pre-European times due to past clearing. • It is expected that the overall condition of *Fuzzy Box Woodland EEC* in the Lower Slopes and Bogan-Macquarie IBRA subregions is likely to be fragmented and subject to disturbances such as grazing and weed invasion. • The impact of 1.88 hectares of this TEC represents a negligible reduction of the community across its national extent.	• Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions. • The estimated total current NSW extent of the *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act is approximately 4% of the pre-1750 extent in the South Western Slopes bioregion (DECCW 2010). • The estimated total current national extent of the *White Box Yellow Box Blakely's Red Gum Woodland CEEC* under the EPBC Act is 416 325 hectares (TSSC 2006). • It is expected that the overall condition of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from relatively good to highly degraded, and subject to disturbances such as grazing and weed invasion. • The impact of 22.79 hectares of this community represents a reduction of approximately 0.005% of the community across its national extent.	• Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions. • Both the current and pre-European national extent of the ecological community are poorly known (TSSC 2008). Weeping Myall Woodlands have declined from an original extent in NSW of between 1,900, 000 ha and 3,300,000 ha to a current extent of between 190,000 ha and 330,000 ha. • It is expected that the overall condition of these EECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from small fragmented areas of good condition to highly degraded, and subject to disturbances such as overgrazing, weed invasion and pest outbreaks. • The impact of up to 3.47 hectares of these TECs represents an extremely minor reduction of the community across its NSW extent.	• Current mapping and literature does not provide an accurate estimate of the extant area of these TECs in the Lower Slopes and Bogan-Macquarie IBRA subregions. • A cumulative assessment of regional values in NSW indicates an overall decline of 85% from 1,532 000 ha to 236,000 ha. • It is expected that the overall condition of these EECs in the Lower Slopes and Bogan-Macquarie IBRA subregions would range from relatively good to highly degraded, with remnants often containing an intact canopy but with the shrub and/or groundcovers degraded through grazing and pasture modification. • The impact of up to 39.39 hectares (TSC Act) and 41.51 (EPBC Act) of this community represents a reduction of approximately 0.02% of the community across its NSW extent.

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
(d) the development proposal's impact on: ***(i) abiotic factors critical to the long-term survival of the CEEC or EEC. For example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns?***			
The proposal would be unlikely to adversely modify or destroy abiotic factors necessary for the long-term survival of these TECs in the locality.			
(ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants			
The proposal will result in the removal of areas of *Fuzzy Box Woodland EEC* within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, fuzzy box (*Eucalyptus conica*) and native groundcover species. The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality.	The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and a range of important native groundcover species as per the Species List for the EPBC Act Policy Statement (DEH 2006). The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality.	The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, weeping myall (*Acacia pendula*) and native shrub and groundcover species. The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality.	The proposal will result in the removal of areas of these TECs within the Development Site as described in the sections above. Where this disturbance will occur, the proposal will remove characteristic and functionally important species to the EEC. These include, but are not limited to, grey box (*Eucalyptus microcarpa*) and native groundcover species. The proposal would be unlikely to impact these characteristic and functionally important species for this EEC outside the Development Site in the wider locality.

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
(iii) the quality and integrity of an occurrence of the CEEC or EEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the CEEC or EEC.			
Weed invasion is one of the key mechanisms and indicators of degradation of this EEC. Weeds are known to be common in areas of *Fuzzy Box Woodland EEC* (NSWSC 2004). Although this EEC within the Development Site contains a predominantly native understorey, all sites recorded include some exotic groundcover species. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species. The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of the EEC.	Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. Weeds have invaded most of the remaining areas of the original pre-1750 extent of *Box Yellow Box Blakely's Red Gum Woodland EEC/CEEC*. Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species. The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs.	Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. These TECs are threatened by clearing and fragmentation associated with cropping, overgrazing by feral and domestic animals, pest outbreaks and weed invasion (NSWSC 2005). Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species. The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs.	Weed invasion is one of the key mechanisms and indicators of degradation of these TECs. Weeds have invaded most of the remaining areas of the original pre-1750 extent of *Inland Grey Box Woodland EEC/CEEC*. Although these TECs within the Development Site contain a predominantly native understorey, all sites include some exotic groundcover. The rail corridor is currently subject to the invasion of weed species. There is potential for the proposal to cause edge effects into these TECs surrounding the Development Site and facilitate the spread of invasive weed species. The proposal is not expected to cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of these TECs.

Fuzzy Box Woodland EEC under the TSC Act	*White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act and CEEC under the EPBC Act	*Myall Woodland EEC* under the TSC Act and *Weeping Myall Woodlands EEC* under the EPBC Act	*Inland Grey Box Woodland EEC* under the TSC Act and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and DNG EEC* under the EPBC Act
(e) direct or indirect fragmentation and isolation of an important area of the CEEC or EEC.			
It is not considered that any of these TECs in the Development Site consists of an important area of the EEC as defined by the FBA (OEH 2014a). An important area comprises an area of the CEEC or EEC that is necessary for the entities' long-term persistence and recovery. This may include areas identified in recovery plans, and/or an area large in comparison to other stands of the CEEC or EEC or occurrences of the CEEC or EEC at the limit of the community's range. The occurrence of the EEC within the Development Site is unlikely to be necessary for the EEC's long-term persistence and recovery. These areas occur as already fragmented and disturbed patches within the rail corridor and do not constitute a large area in comparison with other stands of the EEC. While the proposal will result in an increase in the level of fragmentation of this EEC at the local scale, the level of increase is considered negligible given the already highly fragmented nature of this EEC across the Development Site and region.			
(f) the measures proposed to contribute to the recovery of the CEEC or EEC in the IBRA subregion.			
As part of the proposal, a Biodiversity Offset Strategy will be prepared in accordance with the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). This will require the identification of suitable land-based or non-land based offsets as outlined in this Policy. In the case of land-based offsets, these may be located in the same or any adjoining IBRA subregion in which the development occurs. The establishment of a BioBank site, as per BBAM (2014b), will include specific management actions that must be carried out to maintain and improve these communities at the BioBank Site. The proposed offset strategy for the proposal is discussed in **Section 6.0**.			

5.4.2 Impacts on Threatened Species that Require Further Consideration

The following threatened species were specifically identified in the SEARs as requiring further consideration in the BAR:

- *Austrostipa wakoolica* – endangered under the TSC and EPBC Acts.
- spiny peppercress (*Lepidium aschersonii*) - vulnerable under the TSC and EPBC Acts.
- small purple-pea (*Swainsona recta*) - endangered under the TSC and EPBC Acts.
- silky Swainson-pea (*Swainsona sericea*) – vulnerable under the TSC Act.

Table 5.5 below provides further information for the threatened species identified in the SEARs as requiring further consideration as per Section 9.2.5 of the FBA (OEH 2014a).

Table 5.5 Impacts on Threatened Species that Require Further Consideration as per the SEARs

Austrostipa wakoolica	**Spiny peppercress** ***Lepidium aschersonii***	**Small purple-pea** ***Swainsona recta***	**Silky Swainson-pea** ***Swainsona sericea***
(a) the size of the local population directly and indirectly impacted by the development			
Austrostipa wakoolica was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 5 km to the east of the Development Site between Parkes and Bogan Gate (OEH 2016d). No known populations of *Austrostipa wakoolica* occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal.	Spiny peppercress was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 50 km to the north of the Development Site near Eumungerie (OEH 2016d). No known populations of spiny peppercress occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal.	Small purple-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north-west of the Development Site near Trangie (OEH 2016d). No known populations of small purple-pea occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal.	Silky Swainson-pea was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Site are highly disturbed and generally in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The two closest records of the species occur approximately 4 km to the south-east of the Development Site at Parkes, and approximately 25 km to the east of the Development Site; these records are from 1970 and 1947, respectively (OEH 2016d). No known populations of small purple-pea occur within the Development Site and it is considered that the species will not be impacted as a result of the proposal.

Austrostipa wakoolica	**Spiny peppercress** ***Lepidium aschersonii***	**Small purple-pea** ***Swainsona recta***	**Silky Swainson-pea** ***Swainsona sericea***
(b) the likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population, including but not limited to: ***(i) an estimate of the change in habitat available to the local population as a result of the proposed development***			
Austrostipa wakoolica grows in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. The Development Site contains areas near watercourses and open woodlands. No known populations of *Austrostipa wakoolica* occur within the Development Site and no change in known habitat will occur as a result of the proposal.	Spiny peppercress grows on ridges of gilgai clays dominated by brigalow (*Acacia harpophylla*), belah (*Casuarina cristata*), buloke (*Allocasuarina luehmanii*) and grey box (*Eucalyptus microcarpa*). The Development Site contains areas dominated by belah and grey box. No known populations of spiny peppercress occur within the Development Site and no change in known habitat will occur as a result of the proposal.	Small purple-pea occurs in woodlands and open forests dominated by Blakely's red gum (*Eucalyptus blakelyi*), yellow box (*Eucalyptus melliodora*), candlebark gum (*Eucalyptus rubida*) and long-leaf box (*Eucalyptus goniocalyx*). The Development Site contains areas consisting of yellow box and fragmented woodlands. No known populations of small purple-pea occur within the Development Site and no change in known habitat will occur as a result of the proposal.	Silky Swainson-pea occurs in box-gum woodlands in the south western slopes. The Development Site contains areas including box-gum woodlands. No known populations of silky Swainson-pea occur within the Development Site and no change in known habitat will occur as a result of the proposal.

Austrostipa wakoolica	**Spiny peppercress** ***Lepidium aschersonii***	**Small purple-pea** ***Swainsona recta***	**Silky Swainson-pea** ***Swainsona sericea***
(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and			
The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor. No known habitat for *Austrostipa wakoolica* occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species.	The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor. No known habitat for spiny peppercress occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species.	The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor. No known habitat for small purple-pea occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species.	The proposal will remove a range of native vegetation communities within the Development Site including fragmented woodlands and derived native grassland. The majority of impacts will occur in cleared and non-native vegetation associated with the rail corridor. No known habitat for silky Swainson-pea occurs within the Development Site and the proposal will not result in the loss, modification, destruction for isolation of habitat for the species.
(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.			
Austrostipa wakoolica flowers mainly in response to rain. Seed dispersal occurs mainly from wind, rain and flood events. Seeds are buried in the soil and believed to be viable for three to five years. No known habitat for *Austrostipa wakoolica* occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle.	Spiny peppercress flowers from spring to autumn. The species occurs at some sites that are occasionally flooded, and shows some adaptation to the seasonal filling and drying of wetlands. No known habitat for spiny peppercress occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle.	Small purple-pea plants die back in summer, with surviving rootstocks producing new shoots in autumn. The species is generally tolerant of fire, which also enhances germination by breaking the seed coat and reduces competition from other species. No known habitat for small purple-pea occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle.	Silky Swainson-pea regenerates from seed after fire. No known habitat for silky Swainson-pea occurs within the Development Site and the proposal will not result in the modification of habitat important to the species life cycle.

Austrostipa wakoolica	**Spiny peppercress** ***Lepidium aschersonii***	**Small purple-pea** ***Swainsona recta***	**Silky Swainson-pea** ***Swainsona sericea***
(c) the likely impact on the ecology of the local population: ***(ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:*** ***– pollination cycle*** ***– seedbanks*** ***– recruitment, and*** ***– interactions with other species (e.g. pollinators, host species, mycorrhizal associations)***			
No known habitat for *Austrostipa wakoolica* occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal.	No known habitat for spiny peppercress occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal.	No known habitat for small purple-pea occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal.	No known habitat for silky Swainson-pea occurs within the Development Site. The proposal is unlikely to affect the ecology and biology of any residual population in the locality following the development of the proposal.
(d) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development			
Austrostipa wakoolica is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species.	Spiny peppercress is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species.	Small purple-pea is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species.	Silky Swainson-pea is not known to occur within the Development Site and is not expected to be impacted by the proposal. As a result the proposal will not fragment or isolate any known populations of this species.

Austrostipa wakoolica	Spiny peppercress *Lepidium aschersonii*	Small purple-pea *Swainsona recta*	Silky Swainson-pea *Swainsona sericea*
(e) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range			
Local populations of *Austrostipa wakoolica* are known to the south and west of Parkes (OEH 2016d). The Development Site would be at the northern extent of the species known range, however *Austrostipa wakoolica* has not been recorded in the Development Site. Seed dispersal occurs mainly from wind, rain and flood events. It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity.	Populations of spiny peppercress occur approximately 100 kilometres to the southwest of Parkes and 40 kilometres north of Narromine (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site. It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity.	Local populations of small purple-pea occur approximately 80 kilometres to the northeast of Parkes and 30 kilometres northwest of Narromine (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site. It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity.	Historic local populations of silky Swainson-pea are known to occur in Parkes and in a range of locations around the Development Site (OEH 2016d). The Development Site would not be at the limit of the species known range. The species has not been recorded in the Development Site. It is unlikely that the proposal will impede the ability of other populations to interact for dispersal and genetic viability or diversity.

Austrostipa wakoolica	**Spiny peppercress** ***Lepidium aschersonii***	**Small purple-pea** ***Swainsona recta***	**Silky Swainson-pea** ***Swainsona sericea***
(f) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population			
Key threats for *Austrostipa wakoolica* include the invasion of weeds, grazing pressure and habitat reduction through clearing for agriculture and developments. The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for *Austrostipa wakoolica* occurs within the Development Site.	Key threats for spiny peppercress include the invasion of weeds, grazing and loss of habitat through clearing for land development. The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for spiny peppercress occurs within the Development Site.	Key threats for small purple-pea as described in the recovery plan include the invasion of weeds, grazing and loss of habitat through clearing for land development and inappropriate rail reserve maintenance. The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for small purple-pea occurs within the Development Site.	Key threats for silky Swainson-pea include the invasion of weeds and loss of habitat through clearing for agriculture and infrastructure development. The proposal will result in the removal of a range of native vegetation communities and would be likely to exacerbate these threats if it occurred, however, no known habitat for silky Swainson-pea occurs within the Development Site.
(g) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.			
As part of the proposal, ARTC is preparing a Biodiversity Offset Strategy in accordance with the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). This will require the identification of suitable land-based or non-land based offsets as outlined in this Policy. In the case of land-based offsets, these may be located in the same or any adjoining IBRA subregion in which the development occurs. The establishment of a BioBank site, as per BBAM (2014b), will include specific management actions that must be carried out to maintain and improve these communities at the BioBank Site. The proposed offset strategy for the proposal is discussed in **Section 6.0**.			

5.5 Seven Part Tests of Significance

Threatened species impact assessment is an integral part of environmental impact assessment. The objective of s. 5A of the EP&A Act, the *assessment of significance*, is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent.

Although it is understood that the preparation of a BioBanking Assessment under the FBA supersedes the requirement to prepare Seven Part Tests, the Department of Planning and Environment (DPE) has advised that the requirements of Section 5A of the EP&A Act be considered in the BAR. The preparation of a BAR under the FBA addresses the components of the Seven Part Tests by use of the BBCC. A summary of the requirements of the Seven Part Tests of Significance and where they are addressed in the FBA Assessment is outlined in **Table 5.6** below.

Table 5.6 Seven Part Tests of Significance and the FBA

Seven Part Test of Significance	Where Addressed in the FBA Process
a) 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;	Threatened species (ecosystem-credit and species-credit) are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features. Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) identify impacts on critically endangered threatened species, impacts that may cause the extinction of a species in a IBRA subregion and impacts that significantly reduce the viability of a species.
b) 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	Endangered populations are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features. Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) identify impacts that may cause the extinction of an endangered population in a IBRA subregion and impacts that significantly reduce the viability of a population.
c) 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;	Endangered ecological communities are predicted in the BBCC by the plant community types and biometric community types identified from the field surveys and entered into the BBCC. Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014a) are identified as impacts on any critically endangered or endangered ecological community that may cause the extinction of the EEC/CEEC in a IBRA subregion or significantly reduce the viability of an EEC/CEEC.

Seven Part Test of Significance	Where Addressed in the FBA Process
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;	Habitat loss is assessed in the BBCC via the 'Site Values' tab and the loss in site value score entered for each vegetation zone. Fragmentation of habitat is addressed as part of the 'Landscape Value' score including consideration of features before and after the development including per cent native vegetation cover, connectivity value and vegetation condition. The per cent cleared scores for the dominant Mitchell Landscape is also calculated in the 'Landscape Value' score. Important habitat features are identified through determining geographic and habitat features relevant for particular species-credit species and the assessment of landscape features (such as riparian buffers, important wetlands and state or regionally significant biodiversity links). The extent of habitat loss is ultimately determined by the measure of ecosystem credits and species credits calculated in the BBCC.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);	Critical habitat is addressed under impacts that require further consideration by the consent authority (refer to Section 9.2 of the FBA (OEH 2014a)).
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and	Recovery plans are not directly addressed in the FBA. Recovery plans have been prepared for superb parrot (*Polytelis swainsonii*) (Baker-Gabb 2011), koala (*Phascolarctos cinereus*) (DECC 2008) and White Box White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (DECCW 2010). It is likely that the proposal would be inconsistent with any recovery plans prepared for the threatened species and/or communities impacted by the proposal as it relates to impacts on the CEEC and habitat for the species. However the proposal will not impede the implementation of these recovery plans. If supplementary offsetting measures are used (as per Appendix B of the NSW Biodiversity Offset Policy for Major Projects) to offset species or communities impacted by projects, reference can be made to the key objectives and actions in the relevant recovery plans.

Seven Part Test of Significance	Where Addressed in the FBA Process
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	Key threatening processes are not directly assessed under the FBA. In this case, the proposal is likely to contribute to the following key threatening processes through the clearing of vegetation: • Clearing of native vegetation (TSC Act and EPBC Acts) • Loss of hollow-bearing trees (TSC Act) • Removal of dead wood and dead trees (TSC Act) The proposal may to contribute to the following key threatening processes through clearing of vegetation, edge effects and the operation of the proposal: • Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*) (TSC and EPBC Acts) • Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) (TSC and EPBC Acts) • Predation by the European red fox (*Vulpes vulpes*) (TSC and EPBC Acts) • Invasion of native plant communities by exotic perennial grasses (TSC Act). While the proposal is considered likely to contribute to the function of the above key threatening processes, the proposal as a whole, or any component of the proposal would not be classified as a key threatening process.

5.6 Impacts on Matters of National Environmental Significance

Under the Commonwealth 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). These matters are:

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

A Referral to the Commonwealth Environment Minister was prepared and included assessments of significance for applicable MNES in accordance with the *Significant Impact Guidelines 1.1* (DoE 2013). Assessments of significance were undertaken for the following MNES:

- White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC
- Weeping Myall Woodlands EEC
- painted honeyeater (*Grantiella picta*)
- superb parrot (*Polytelis swainsonii*)
- koala (*Phascolarctos cinereus*) (combined population of QLD, NSW and the ACT)
- south-eastern long-eared bat (*Nyctophilus corbeni*).

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 DoEE also determined that the action be assessed in accordance with the Bilateral agreement made under section 45 of the EPBC Act. Supplementary SEARs were issued on 8 November 2016 and a detailed response to each of the matters raised is provided in the *ARTC Inland Rail – Parkes to Narromine Commonwealth Matters Assessment* (Umwelt 2017a).

5.6.1 Summary of Commonwealth Matters Assessment

Based on the direct and permanent impacts associated with the proposal that are summarised in **Table 4.3** and the range of avoidance, mitigation and management measures described in **Section 4.0**, the proposal is not considered likely to result in a residual significant impact on threatened species and communities listed under the EPBC Act and detailed offsetting of the proposal in accordance with the DoEE Environmental Offsets Policy is not required. Despite this, TECs and threatened species habitats impacted by the proposal will be offset in accordance with the NSW FBA, as detailed in **Table 5.7**.

Table 5.7 Summary of the Impacts of the Proposal on Relevant MNES

Matter of National Environmental Significance	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland CEEC	The proposal will result in the permanent loss of 17.3 hectares of the CEEC, of which 6.52 hectares comprises woodland and 10.78 hectares of grassland.	Subject to the revision of credits as part of the detailed design process, 768 ecosystem credits will be retired to offset impacts to this CEEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC	The proposal will result in the permanent loss of 31.53hectares of the EEC, of which 7.89 hectares comprises woodland and 23.64 hectares of derived native grasslands.	Subject to the revision of credits as part of the detailed design process, 1029 ecosystem credits will be retired to offset impacts to this EEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Tylophora linearis	The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. *Tylophora linearis* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal site within Goobang National Park (OEH 2016d). This species distribution is known to overlap with occurrences of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, which occurs in the proposal site and	Subject to the revision of credits as part of the detailed design process, 442 ecosystem credits will be retired to offset impacts to *White Box Yellow Box – Blakely's Red Gum Woodland* CEEC, which provides potential habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

Matter of National Environmental Significance	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
	therefore there is potential for this species to occur (albeit low) in the proposal site. A *population* of the species (as described by the significant impact guidelines) is not expected to occur within the proposal area.	
Superb Parrot	Six superb parrots were recorded flying over the proposal site at two locations during targeted surveys. Four individuals were recorded within the proposal area 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All of the vegetation communities identified in the proposal site are expected to provide potential foraging habitat, however potential breeding habitat is not expected to occur. The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that provide foraging habitat for the species. Blakely's red gum was not recorded in the proposal site and therefore breeding habitat is not likely to be impacted by the proposal.	Subject to the revision of credits as part of the detailed design process, 2,561 ecosystem credits will be retired to offset impacts to the habitat of this threatened species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Regent Honeyeater	The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016c)). The closest record of the species occurs approximately 30 km to the east of the Proposal area near Dubbo (OEH 2016d). The habitat within the proposal site is substantially degraded. This species is considered to have a low likelihood of occurrence within the proposal site, however approximately 15.1 hectares of potential foraging habitat for the species will be directly impacted.	Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

Matter of National Environmental Significance	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
Swift Parrot	The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species undertaken throughout the proposal site. There are no known records of swift parrot within 10km of the proposal site.	Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

5.7 Environmental Values not Assessed under the FBA

As per Section 2.3 of the FBA (OEH 2014a), biodiversity values not considered under the FBA include marine mammals, wandering sea birds and biodiversity that are endemic to Lord Howe Island. None of these biodiversity values occur or have the potential to occur within the Development Site and as such have not been specifically assessed as part of this assessment.

In addition, the FBA does not assess the direct impacts of a proposal that are not associated with clearing of vegetation. Examples of these impacts include, but are not limited to:

- bird and bat strike associated with wind farm developments
- vehicle strike
- subsidence and cliff falls associated with mining developments
- downstream impacts on hydrology and environmental flows on surface vegetation and groundwater dependent ecosystems
- impacts on karst ecosystems.

The proposal will not involve impacts related to wind farms, mining developments or on karst ecosystems. It is likely that vehicle (train) strike will occur along the operational rail corridor. The impacts associated with increased train movements are outlined in **Section 4.4.1.3**. The potential impacts on groundwater dependent ecosystems and downstream impacts on hydrology and environmental flows on vegetation are outlined in the *ARTC Inland Rail – Parkes to Narromine Aquatic Ecology Assessment* (Umwelt, 2017b). As the proposal does not involve substantial excavations that are that likely to interfere significantly with groundwater, the risk of significant impacts to groundwater and groundwater dependent ecosystems is low.

5.8 Impacts on Aquatic Biodiversity

An assessment of the impacts of the proposal on aquatic species and communities has been prepared in the Aquatic Impact Assessment in Volume 3 of the EIS. A summary of the outcomes is provided below.

Twenty-five third order or higher streams occur within the proposal area. Analysis of key fish habitat values and sensitivity typing of the watercourses in combination with a literature review of fish community analysis by NSW DPI identifies that a number of these named watercourses have moderate or higher fish community value. The Mehi River and Gwydir River have both been identified as Class 1 Key Fish Habitat in accordance with DPI (Fisheries) guidelines.

A number of state and Commonwealth listed threatened fish species, endangered populations and TECs have been recorded or are predicted to occur in major watercourses within the Parkes and Narromine LGAs, however none are likely to occur in the watercourses within the proposal area due to a lack of preferred habitat. The proposed corridor intersects watercourses associated with the Bogan River that may be part of the *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 *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River* both listed under the FM Act.

An assessment of significance of impact of the proposal on aquatic communities, threatened species and endangered populations identified that the proposal is unlikely to have an adverse impact, with the adoption of appropriately designed fish friendly crossing structures and other mitigation measures to further reduce impacts.

Potential groundwater dependent ecosystems (GDEs) in the Development Site 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.

Further detail on this assessment is outlined in the Aquatic Impact Assessment in Volume 3 of the EIS.

6.0 Biodiversity Offset Strategy

ARTC is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the proposal under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). Firstly, ARTC has, where possible, altered the proposal to avoid and minimise ecological impacts in the proposal planning stage, and a range of impact mitigation strategies have been included in the proposal to mitigate the impact on ecological values (refer to **Section 4.0**) prior to the consideration of offsetting requirements.

6.1 Biodiversity Credit Report

Full Credit Calculator reports for the proposal are included in **Appendix F**.

Table 6.1 below provides a summary of the ecosystem and species credits that require offsetting as a result of the proposal based on the Development Footprint used for this assessment.

Table 6.1 Ecosystem and Species Credits Generated at the Development Site

Name	Credits Required
Ecosystem Credits	
PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	146
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion	54
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	342
PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt	38
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	1,029
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	114
PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	70
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	185
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion	583
Total	**2,561**
Species Credits	
koala (*Phascolarctos cinereus*)	491
Total	**491**

As detailed in **Table 6.1**, a total of 2,561 ecosystem credits and 491 species credits are required to offset the direct impacts of the proposal. The final credit generation for the proposal will be confirmed as an outcome of the detailed design process and the biodiversity offsetting for the proposal will be based on the final credit calculations. ARTC commits to the retirement of credits in accordance with the FBA and is developing a strategy to address the above offset requirement.

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APPENDIX A

Landscape, Survey and Results Figures

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A1

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A2

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A3

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_007.dgn
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Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

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1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A4

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_008.dgn
20160719 15.30

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A5

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_009.dgn
20160719 15.31

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A6

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

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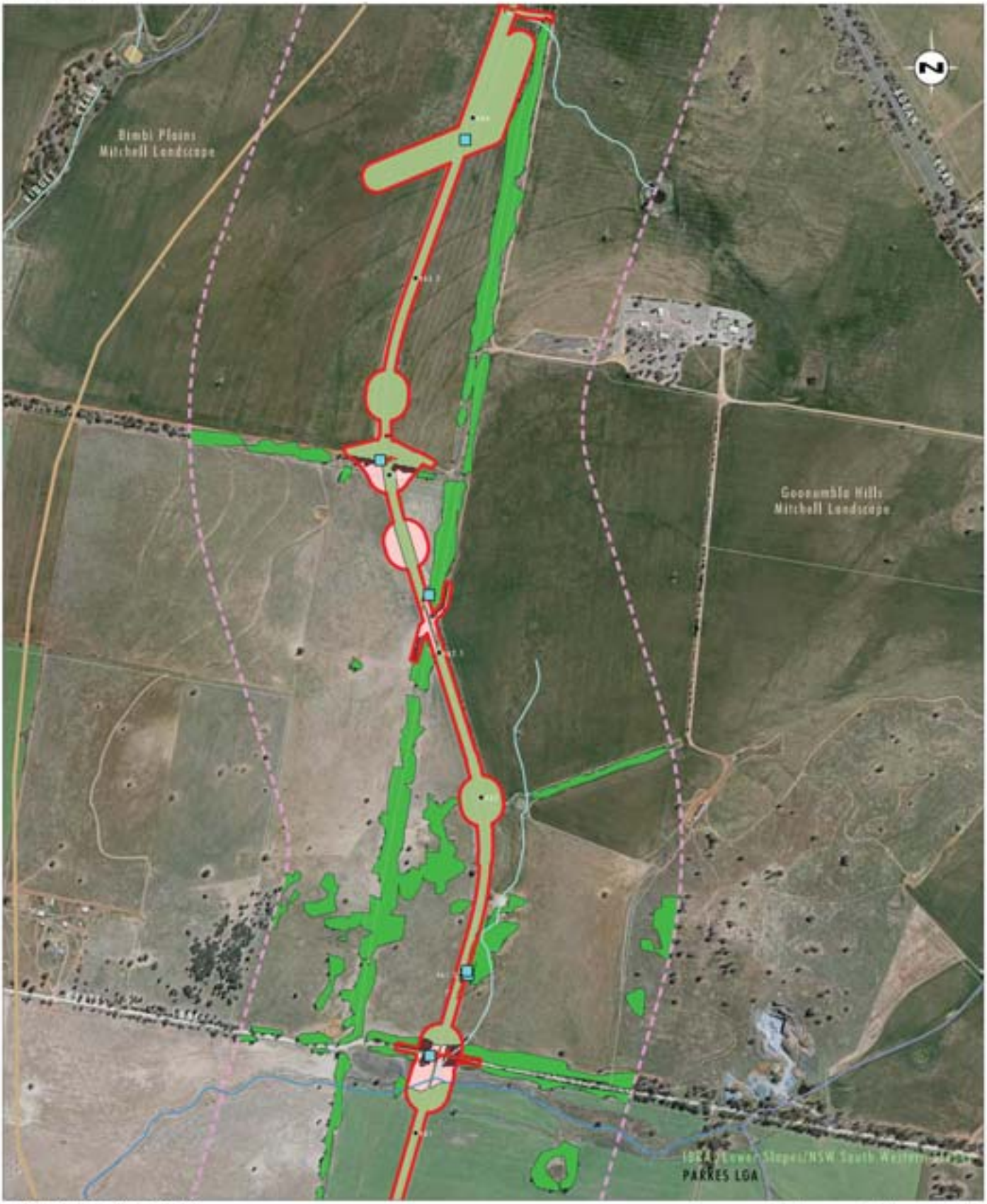

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A7

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_011.dgn
20160922 13.57

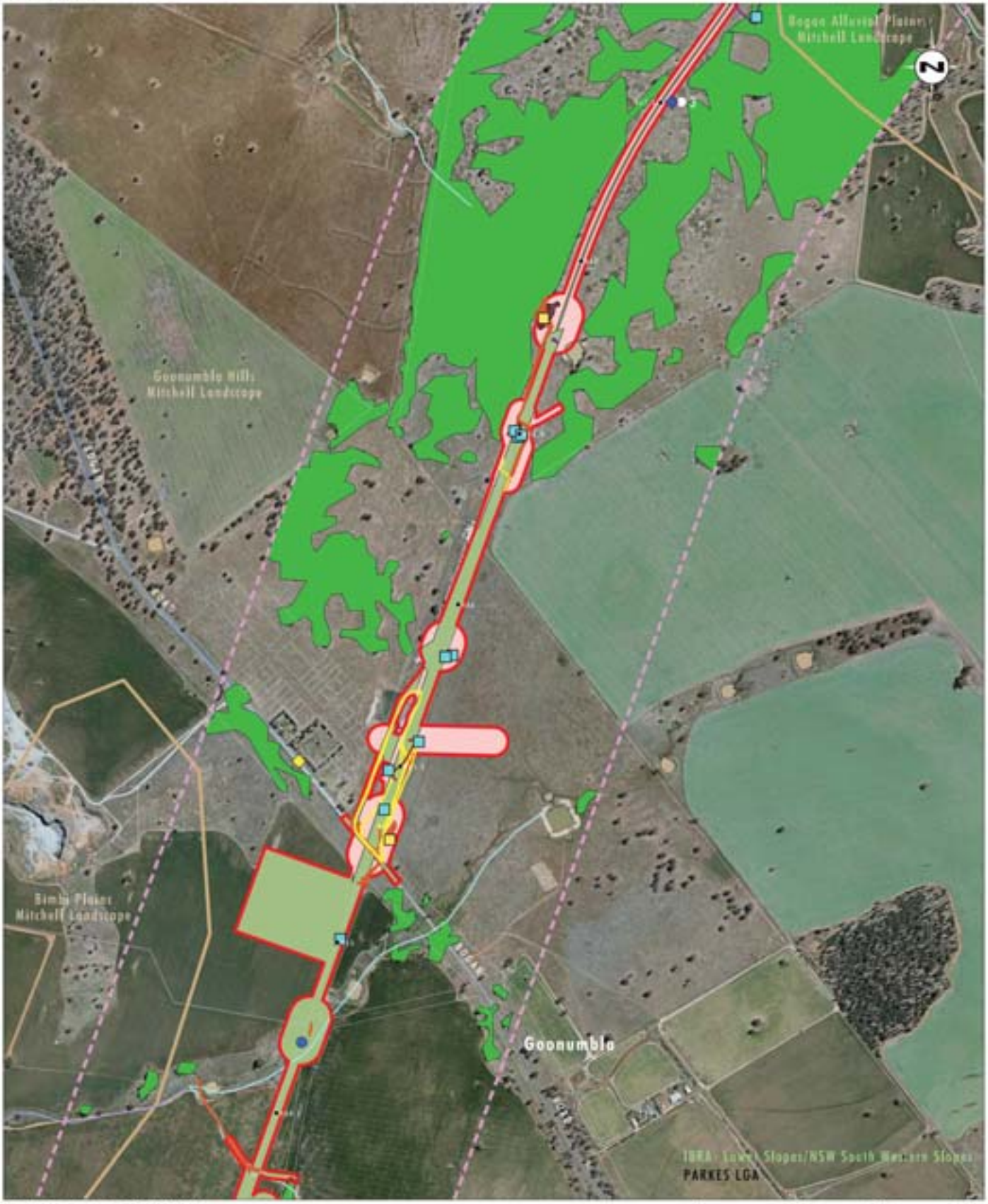

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A8

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_012.dgn
20160922 14.27

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A9

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A10

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A11

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_015.dgn
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Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A12

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_016.dgn
20160922 14.30

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A13

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

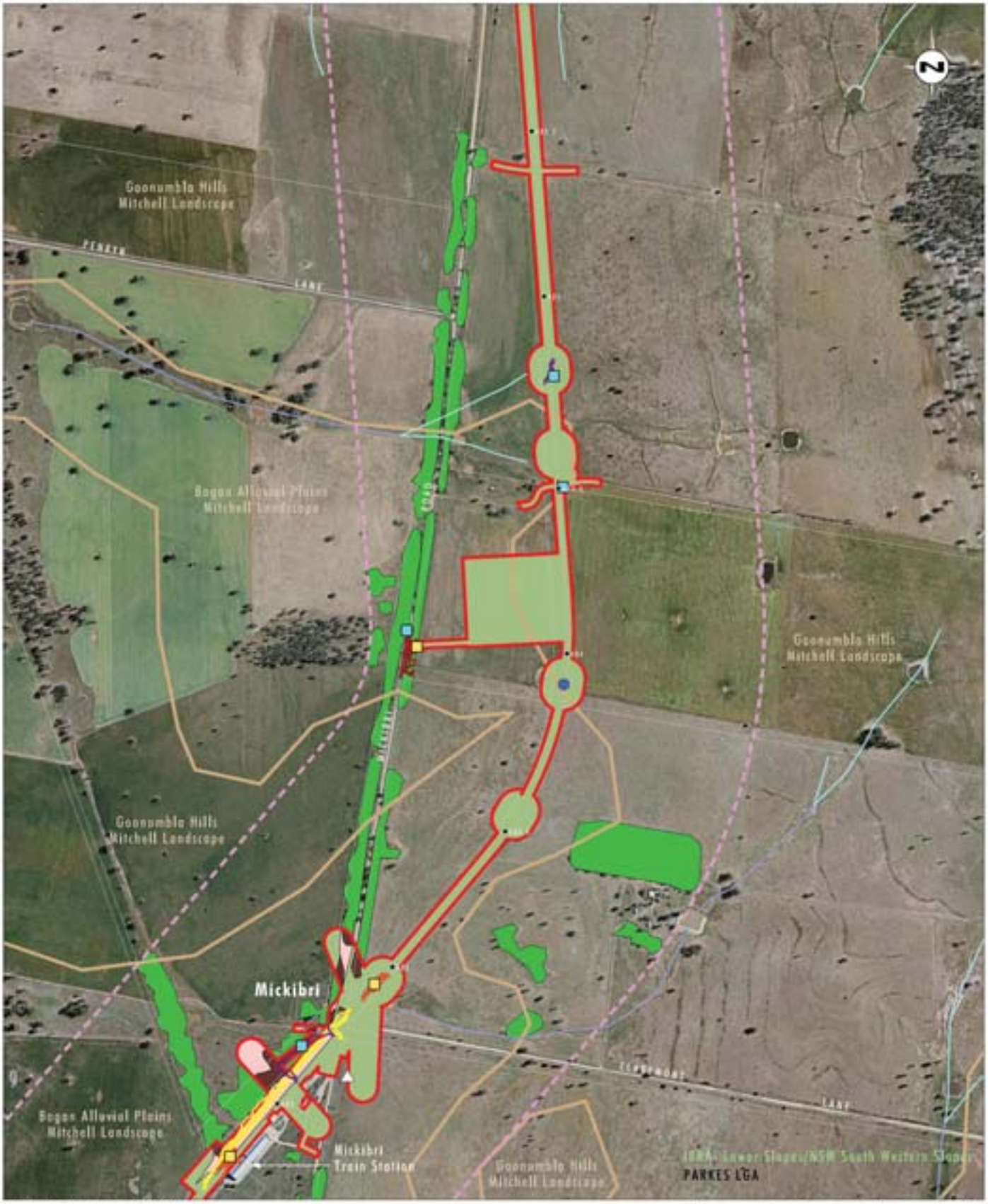


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A14

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_018.dgn
20160922 14:28

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A15

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_019.dgn
20160922 14:27

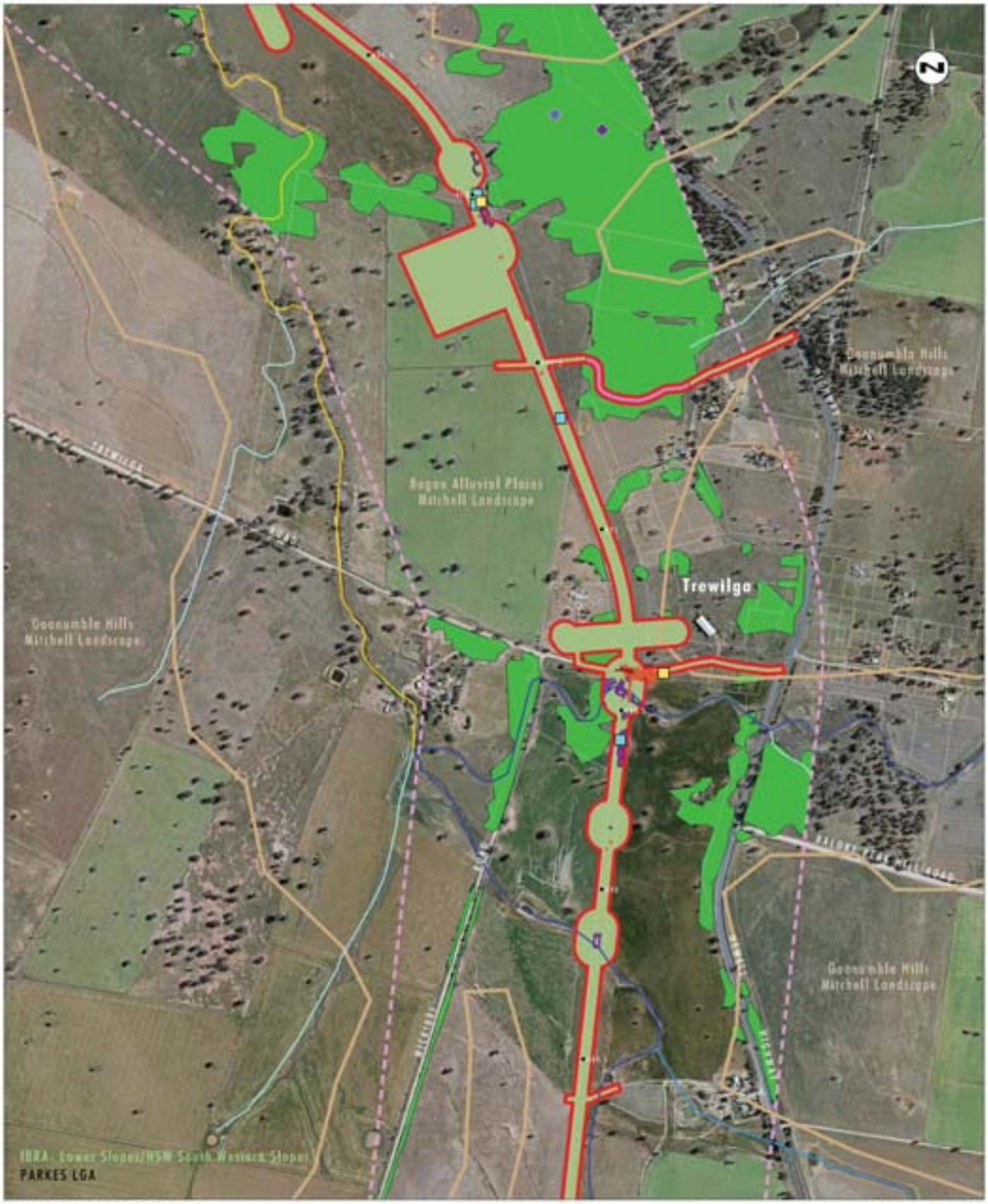


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A16

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A17

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A18

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_022.dgn
20160922 14.25

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

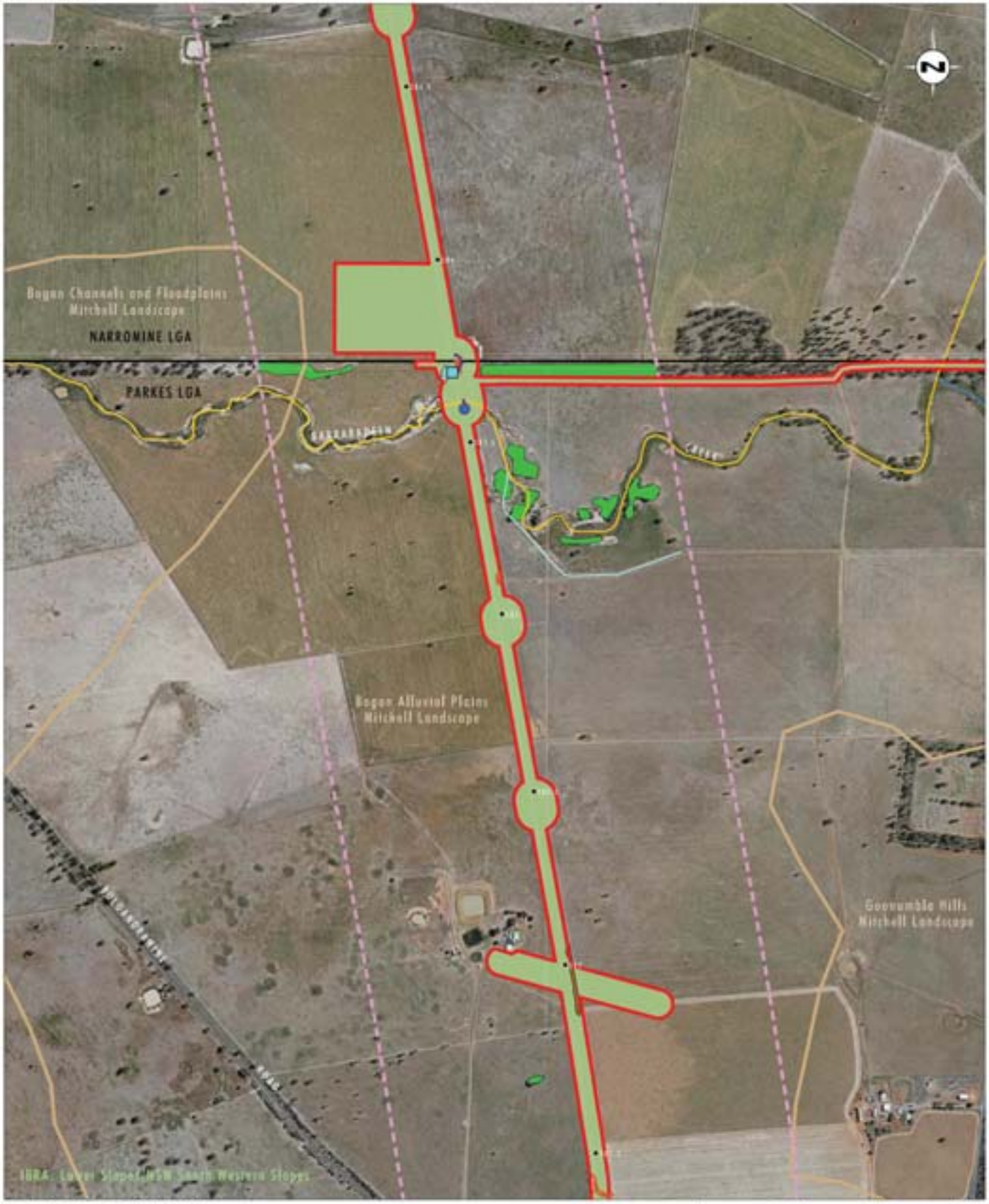
0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A19

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment



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Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Local Government Area
- Rail Line Kilometerage

FIGURE A20

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_024.dgn
20160922 14.17

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

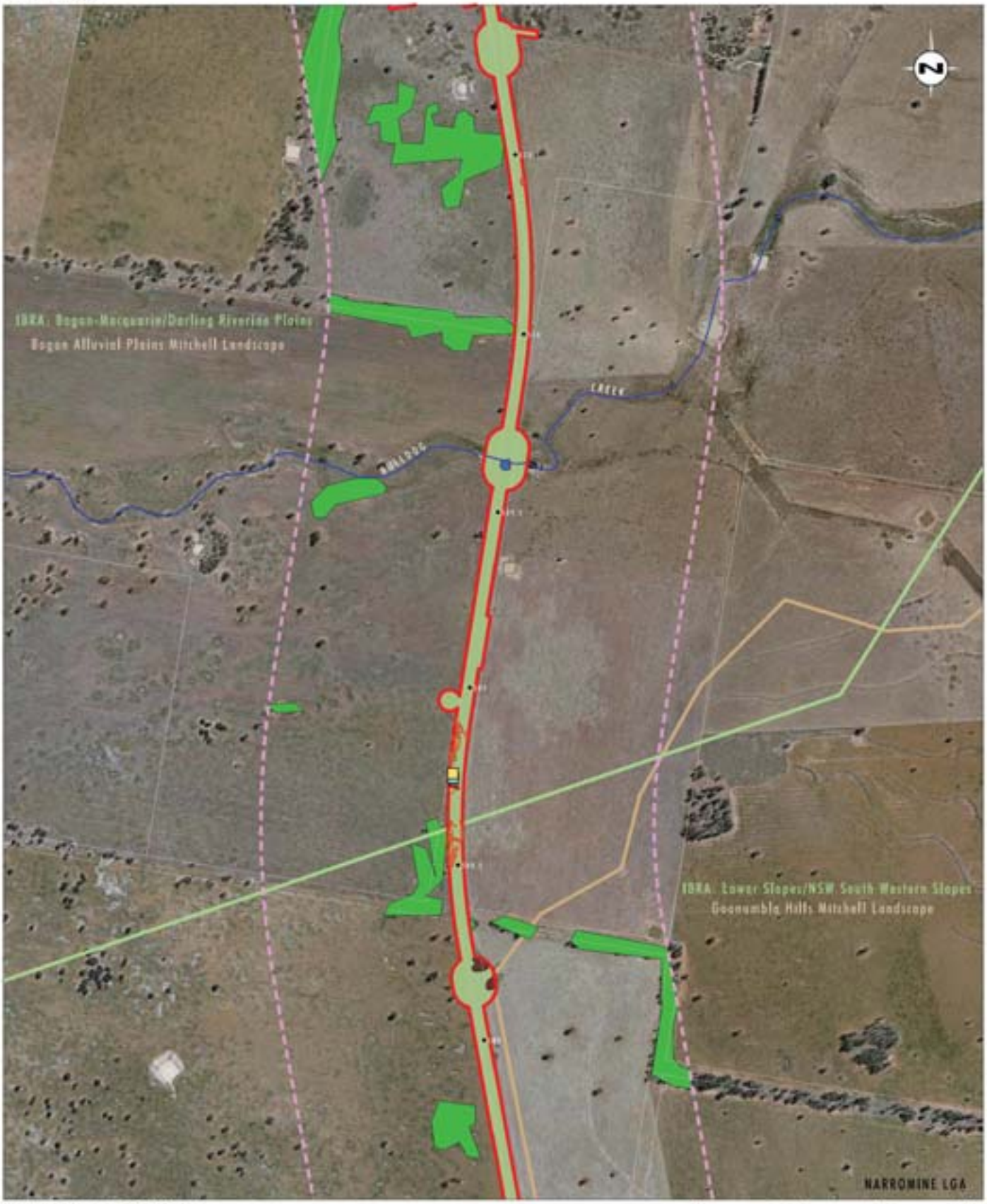
0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A21

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment



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Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- IBRA Regions and Subregion Area
- Rail Line Kilometerage

FIGURE A22

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_026.dgn
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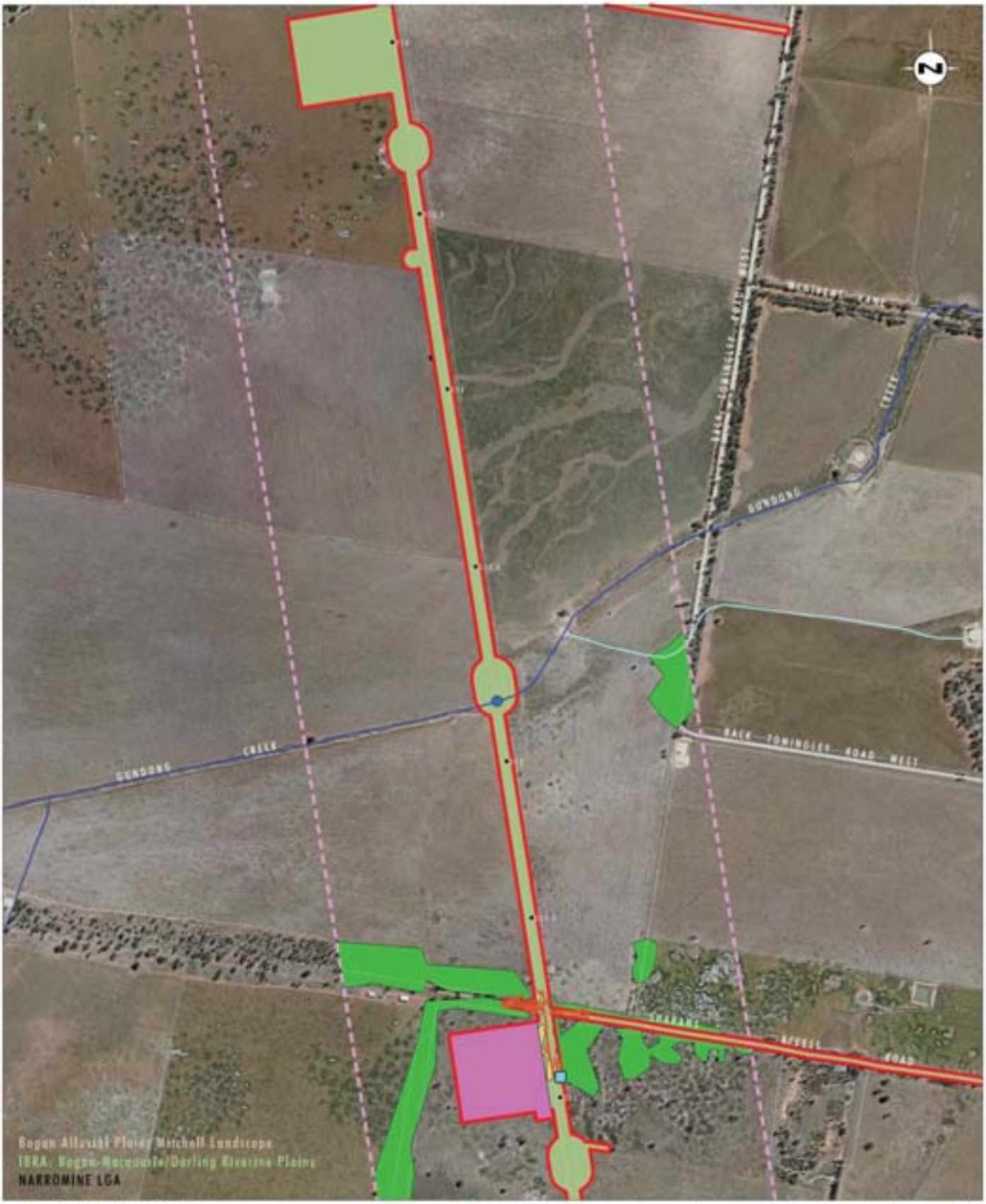

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Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A23

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_027.dgn
20160922 14:12

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A24

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_028.dgn
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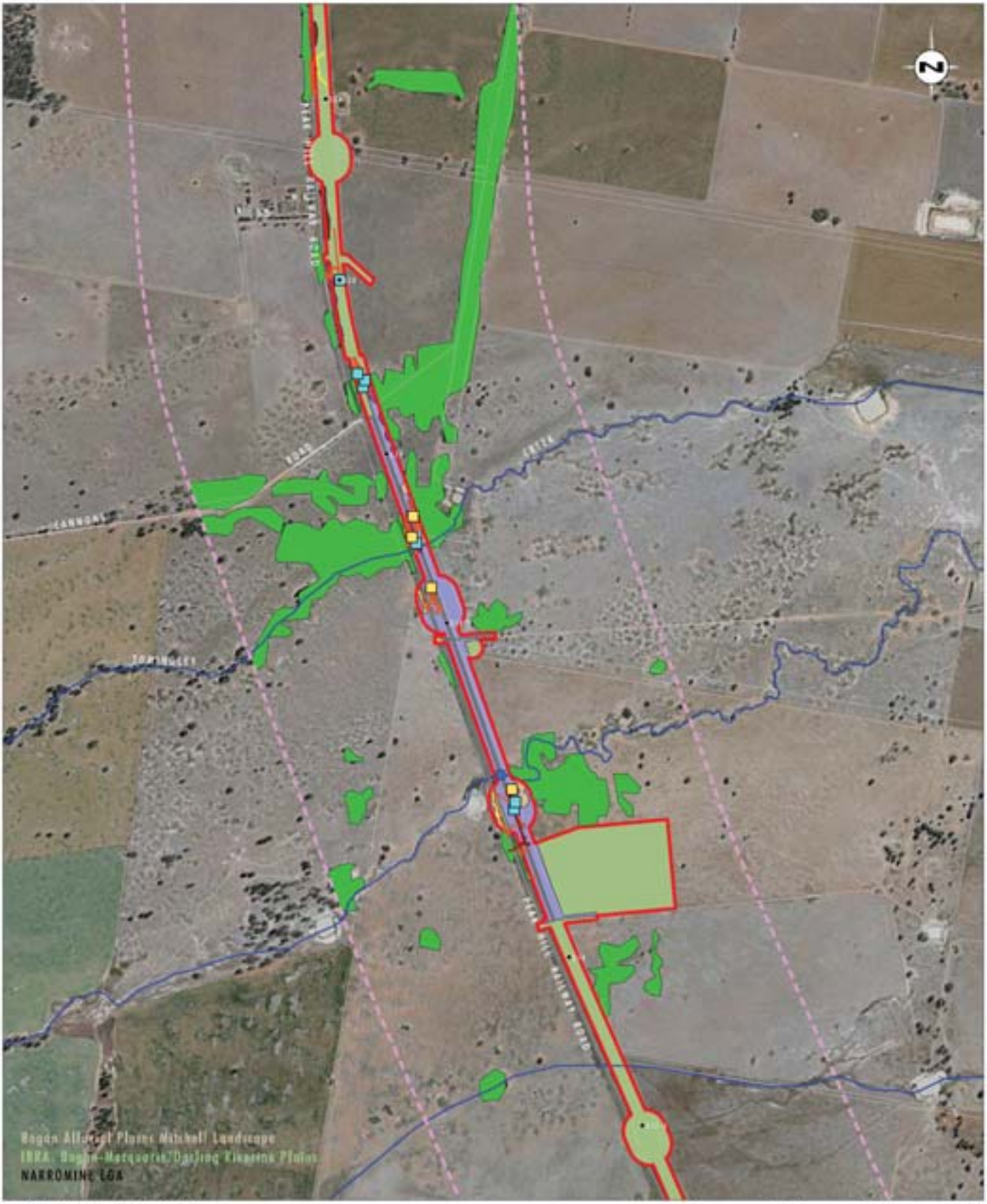

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A25

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A26

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

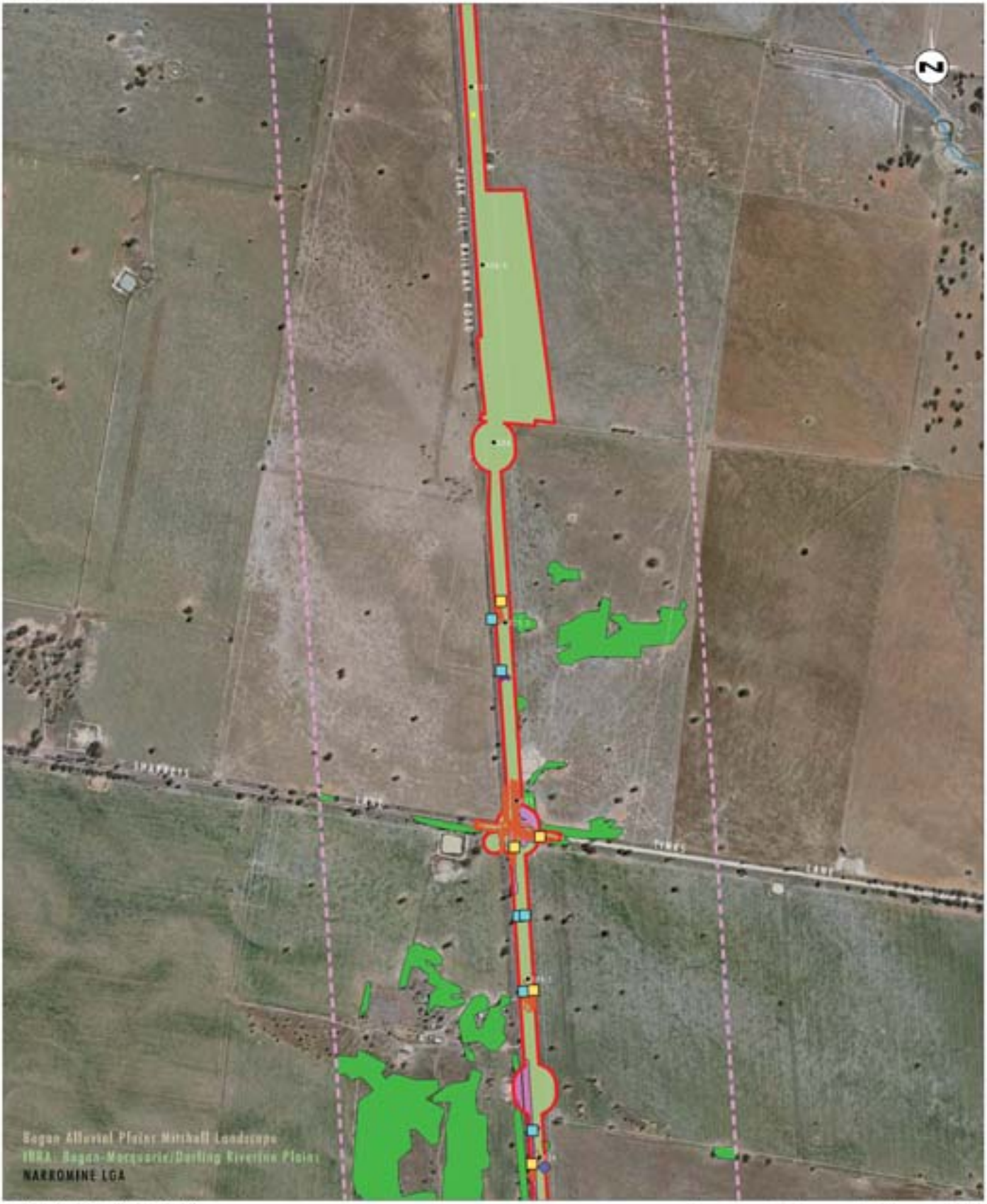

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A27

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

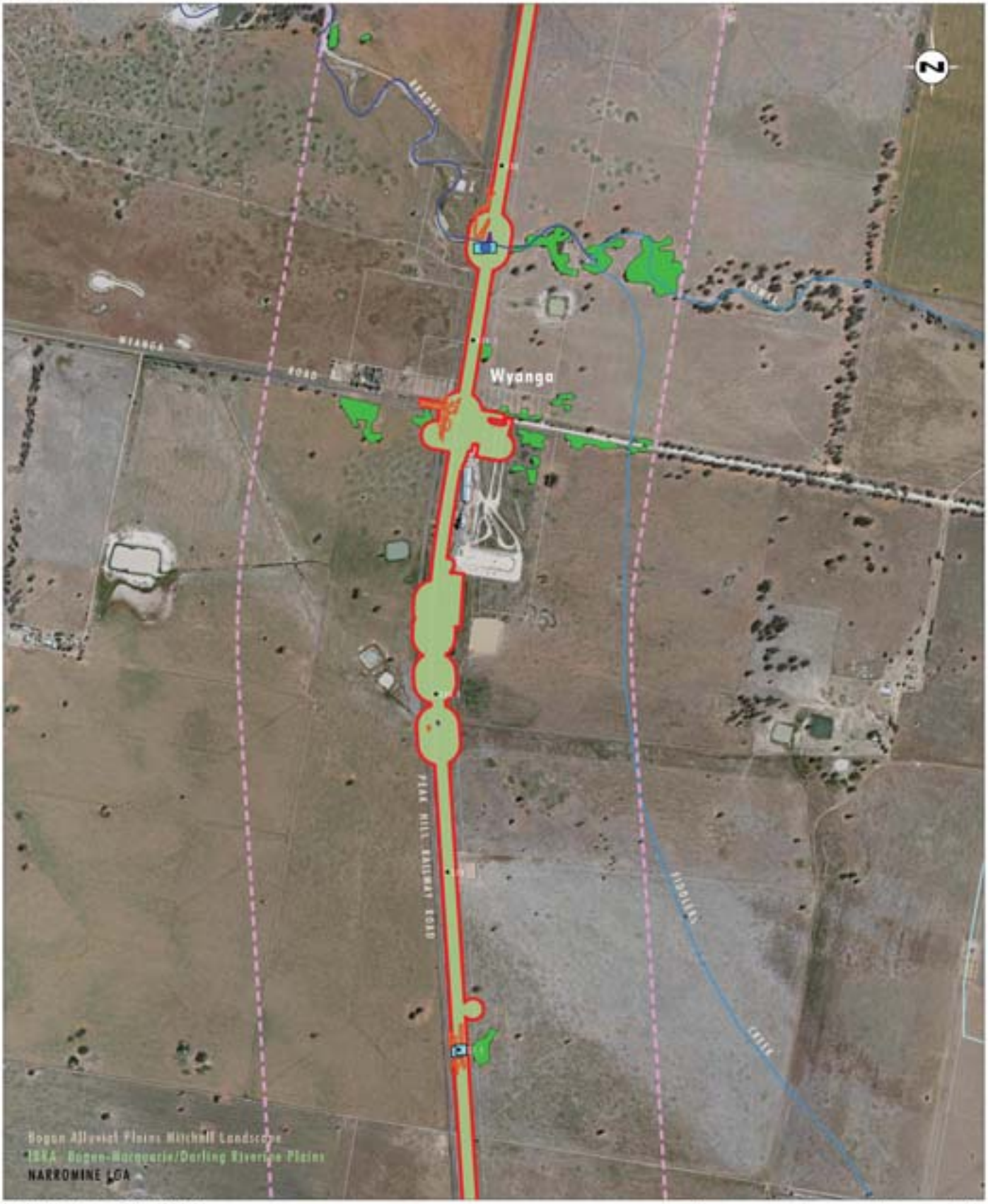

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A28

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_032.dgn
20160922 14.01

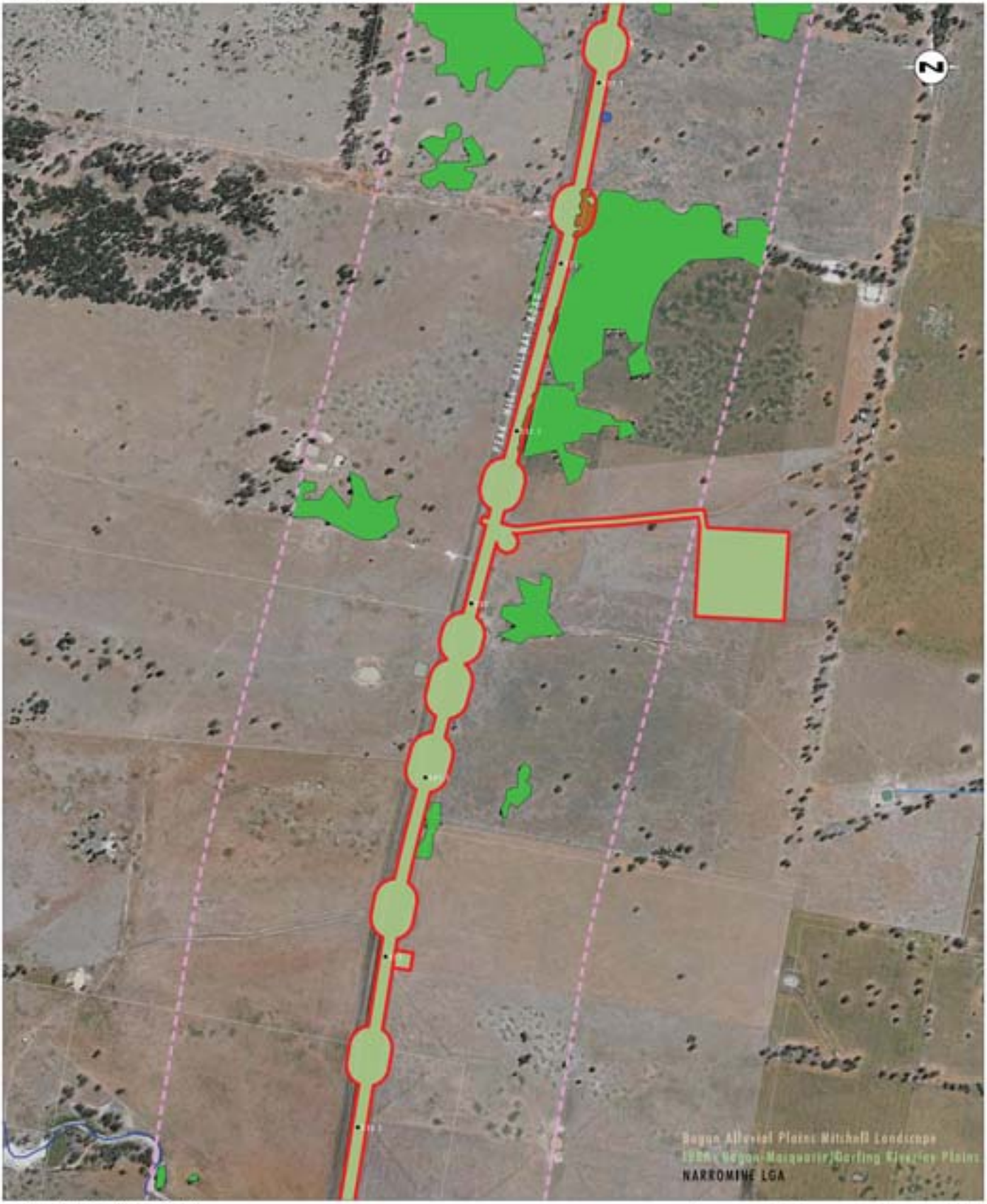

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A29

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

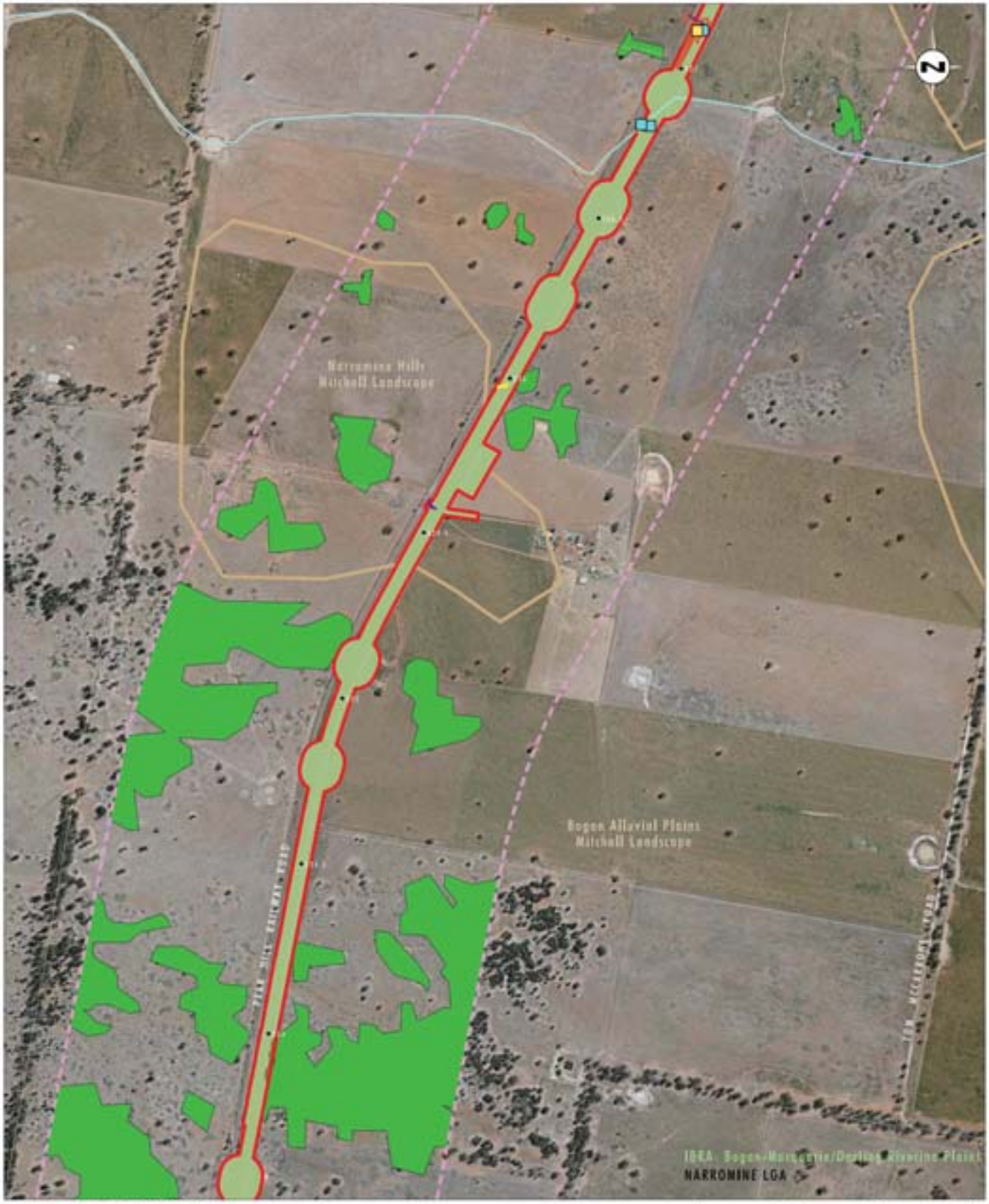

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A30

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A31

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_035.dgn
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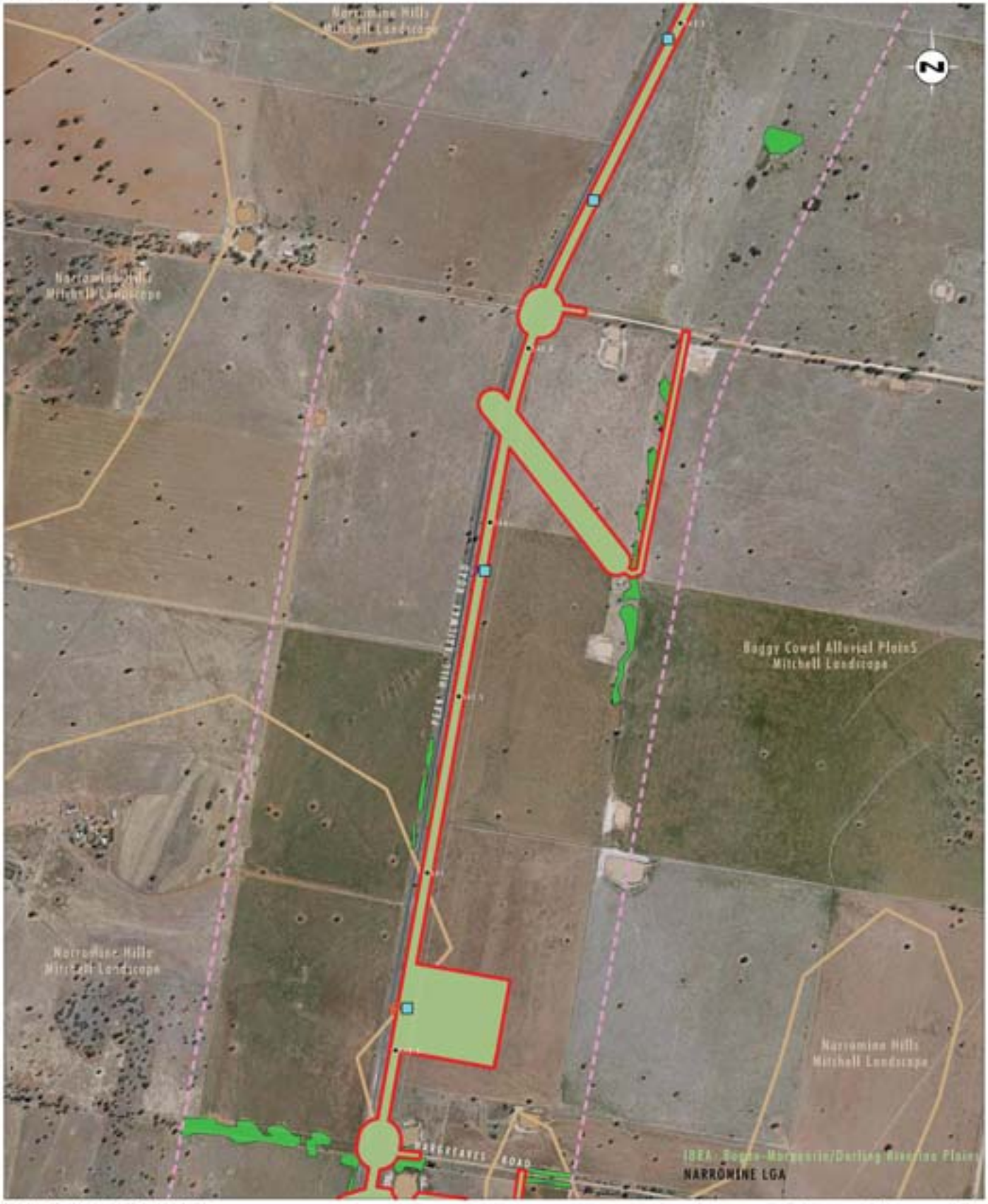


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A32

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_036.dgn
20160922 13.56

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A33

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_037.dgn
20160922 13:55

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Rail Line Kilometerage

FIGURE A34

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A35

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): 806/3606_039.dgn
20160922 13:54

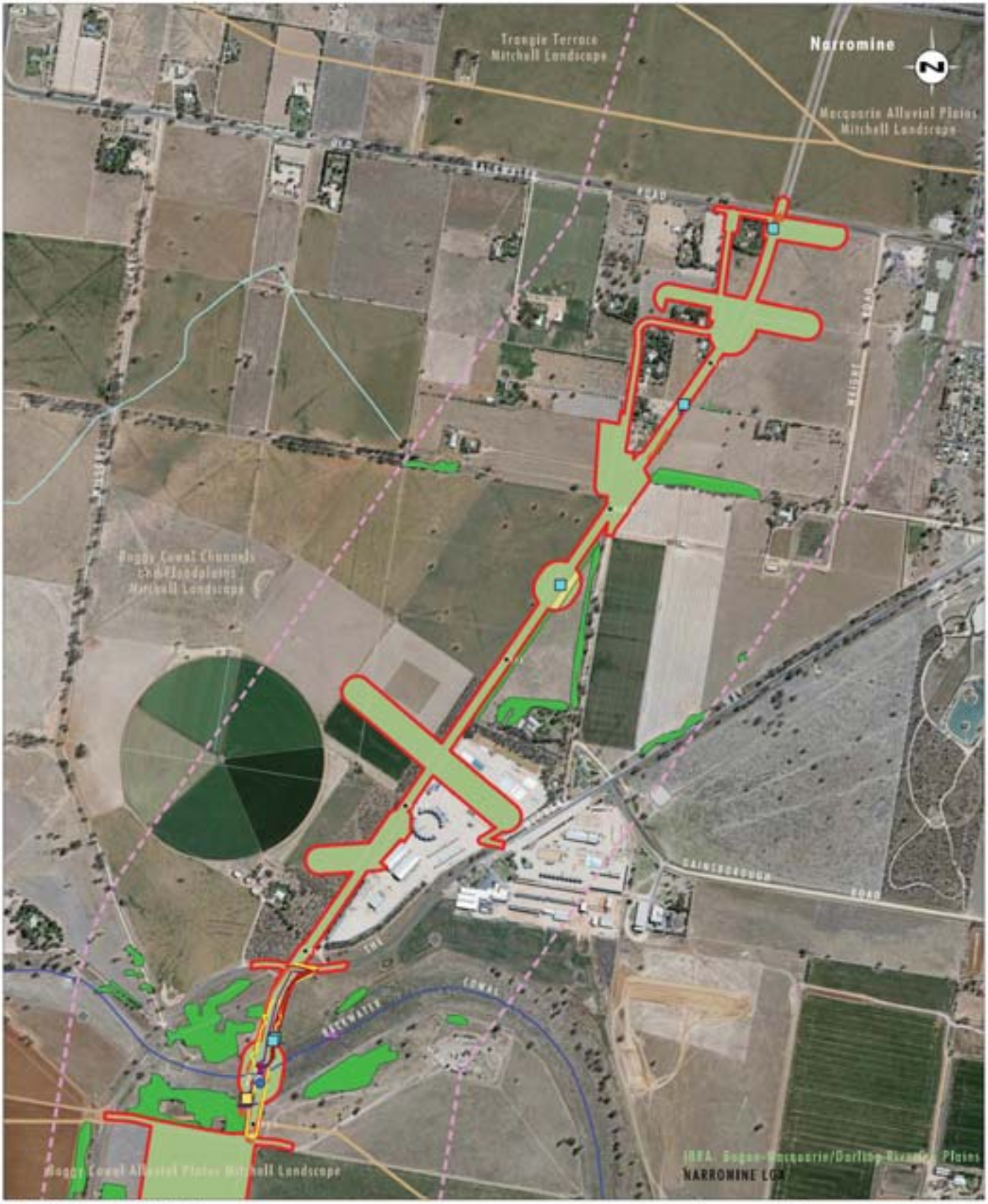


Image Source: ARTC (2016)
Data Source: ARTC (2016), BioNet Atlas of NSW Wildlife (OEH 2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

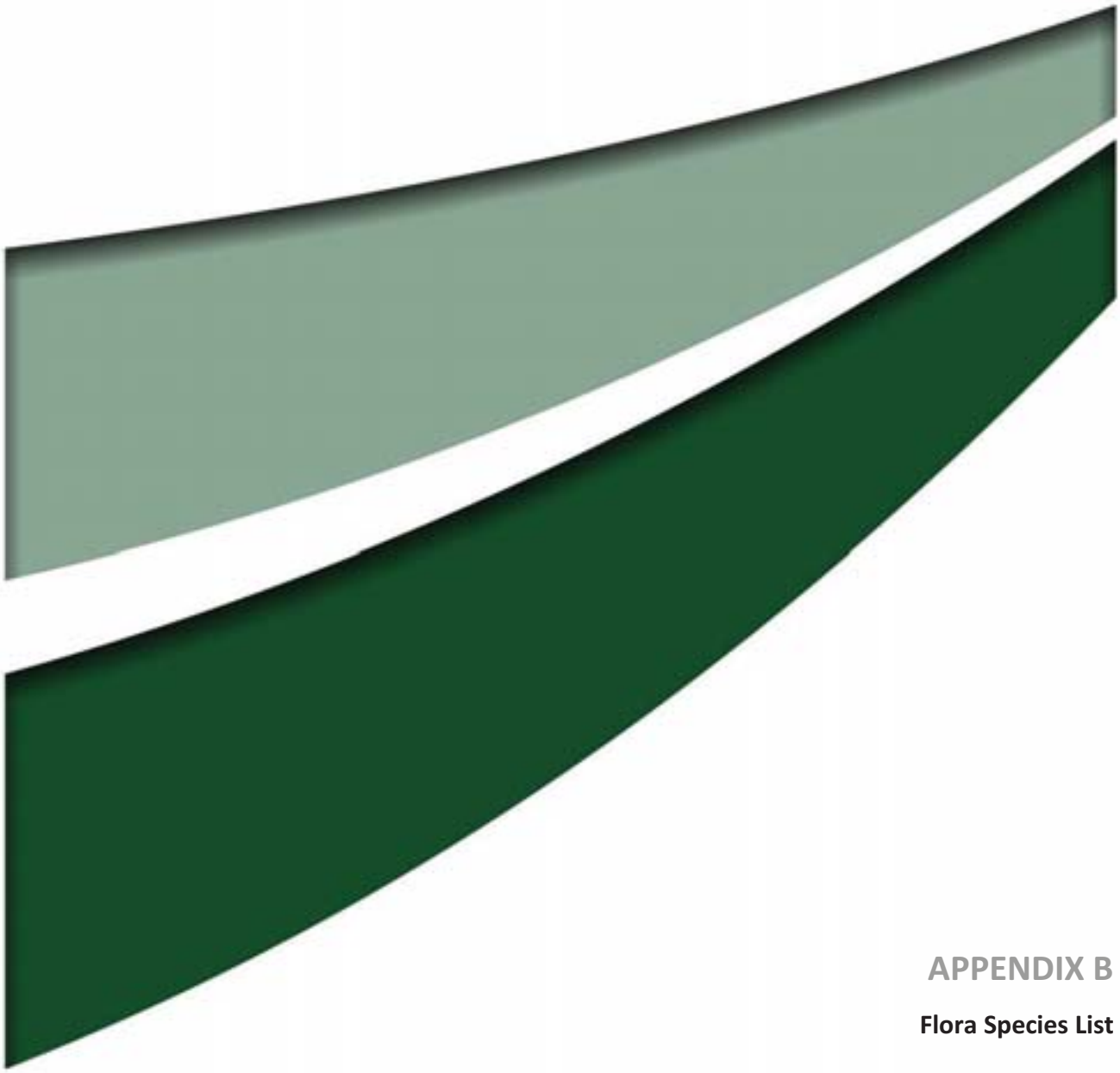
Legend

- Development Site
- 550m Buffer Area
- Mitchell Landscape Area
- Rail Line Kilometerage

FIGURE A36

Survey Effort, Vegetation Map, Threatened Species Locations and Landscape Assessment

File Name (A4): R06/3606_040.dgn
20160719 15.58



APPENDIX B

Flora Species List

Appendix B - Flora Species List

The following list was developed from surveys of the Development Site by Umwelt in January and May 2016. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

asterisk (*)	denotes species non-native species
double asterisk (**)	denotes a Weed of National Significance (WoNS)
subsp.	subspecies and
var.	variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2016), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family	Scientific Name	Common Name	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44	P45	P46	P47	P48
Coniferopsida (Conifers)																																																			
Cupressaceae	*Callitris glaucophylla*	white cypress pine	✓				✓	✓									✓		✓	✓									✓			✓	✓						✓	✓	✓		✓	✓	✓					
Filicopsida (Ferns)																																									✓									
Adiantaceae	*Cheilanthes distans*	bristly cloak fern						✓			✓								✓				✓																			✓	✓	✓	✓	✓	✓			✓	
Adiantaceae	*Cheilanthes sieberi*	rock fern																																															
Marsileaceae	*Marsilea drummondii*	common nardoo													✓	✓	✓								✓	✓		✓						✓				✓										
Marsileaceae	*Marsilea hirsuta*	short-fruited nardoo																										✓																				
Marsileaceae	*Marsilea* sp.																																															✓
Magnoliopsida (Flowering Plants) - Liliidae (Monocots)																																																
Anthericaceae	*Arthropodium milleflorum*	pale vanilla-lily									✓																																						
Asphodelaceae	**Asphodelus fistulosus*	onion weed																	✓																														
Cyperaceae	*Carex inversa*	knob sedge					✓	✓	✓							✓									✓	✓		✓																				
Cyperaceae	*Cyperus gracilis*	slender flat-sedge																								✓																						
Cyperaceae	*Cyperus* sp.									✓																																						✓
Juncaceae	*Juncus* sp.	a rush																																	✓													✓
Juncaceae	**Juncus cognatus*					✓																																									
Lomandraceae	*Lomandra filiformis*	wattle matt-rush											✓															✓						✓			✓						✓				✓	
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush																																✓														
Lomandraceae	*Lomandra* sp.	mat-rush					✓												✓																													
Phormiaceae	*Dianella longifolia*	blueberry lily																															✓		✓	✓										✓	
Phormiaceae	*Dianella revoluta*	blueberry lily						✓					✓									✓				✓		✓																			
Poaceae	*Aristida behriana*	bunch wiregrass	✓					✓			✓							✓		✓		✓								✓					✓									✓				
Poaceae	*Aristida benthamii*	three-awned spear grass																												✓																	
Poaceae	*Aristida calycina* var. *calycina*		✓																																													
Poaceae	*Aristida jerichoensis* var. *subspinulifera*	Jericho wiregrass																											✓																		✓	
Poaceae	*Aristida ramosa*	purple wiregrass			✓			✓								✓			✓							✓																						
Poaceae	*Aristida* sp.	a wiregrass		✓																✓																			✓				✓			✓	✓	✓			✓	
Poaceae	*Aristida vagans*	threeawn speargrass											✓																																				
Poaceae	*Austrostipa aristiglumis*	plains grass														✓						✓		✓	✓													✓			✓								
Poaceae	*Austrostipa bigeniculata*	Yanganbil	✓	✓	✓											✓												✓							✓	✓		✓				✓						

Family	Scientific Name	Common Name	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44	P45	P46	P47	P48
Poaceae	*Austrostipa scabra*	speargrass	✓	✓				✓	✓		✓	✓	✓					✓	✓	✓						✓		✓		✓	✓	✓	✓		✓	✓	✓	✓		✓						✓	✓	
Poaceae	*Austrostipa* sp.	speargrass																											✓																	✓	✓		
Poaceae	*Austrostipa stuposa*																																✓																
Poaceae	*Austrostipa verticillata*	slender bamboo grass				✓					✓															✓																								
Poaceae	**Avena barbata*	bearded oats												✓					✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓						✓			✓		✓	✓				
Poaceae	**Avena sativa*	oats						✓	✓	✓		✓																																						
Poaceae	**Avena* sp.	oats	✓		✓		✓				✓				✓																																			
Poaceae	*Bothriochloa macra*	red grass				✓													✓							✓	✓			✓					✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓
Poaceae	**Bromus catharticus*	prairie grass																				✓																											
Poaceae	**Bromus hordeaceus*	soft brome				✓						✓																																					
Poaceae	**Bromus* sp.	a brome						✓								✓	✓							✓	✓	✓										✓												
Poaceae	**Chloris gayana*	Rhodes grass															✓	✓		✓		✓	✓	✓		✓		✓	✓		✓				✓								✓	✓				
Poaceae	*Chloris truncata*	windmill grass		✓		✓	✓		✓	✓							✓																						✓			✓						
Poaceae	*Chloris ventricosa*	tall chloris				✓						✓		✓				✓				✓					✓	✓																				
Poaceae	*Chloris* sp.			✓																✓																												
Poaceae	*Cynodon dactylon*	common couch					✓		✓	✓				✓		✓					✓		✓														✓	✓	✓			✓	✓						
Poaceae	*Dactyloctenium radulans*	button grass														✓	✓																															
Poaceae	*Dichanthium sericeum subsp.*	Queensland bluegrass	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓		✓		✓		✓		✓	✓		✓	✓	✓												
Poaceae	*Digitaria brownii*	cotton panic grass	✓							✓									✓										✓															✓	✓				
Poaceae	*Digitaria* sp.	a finger grass																					✓																									
Poaceae	*Echinochloa colona*	awnless barnyard grass														✓																															
Poaceae	*Elymus scaber*	common wheatgrass			✓			✓			✓	✓	✓						✓	✓		✓			✓		✓			✓	✓	✓			✓					✓	✓	✓					✓	
Poaceae	*Elymus* sp.			✓																																				✓								
Poaceae	*Enneapogon gracilis*	slender nineawn	✓										✓							✓									✓															✓	✓			✓	✓
Poaceae	*Enneapogon nigricans*	niggerheads																	✓																										✓	✓				
Poaceae	*Enteropogon acicularis*	curly windmill grass	✓		✓				✓				✓							✓					✓			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓
Poaceae	*Eragrostis brownii*	brown's lovegrass					✓																						✓																				
Poaceae	**Eragrostis cilianensis*	stinkgrass								✓				✓			✓		✓		✓		✓															✓					✓		✓	✓				
Poaceae	*Eragrostis leptostachya*	paddock lovegrass																✓																						✓	✓	✓				✓	✓				

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Poaceae	*Eragrostis parviflora*	weeping lovegrass				✓	✓							✓															✓	✓	✓																			
Poaceae	*Eragrostis* sp.																																													✓	✓	✓	
Poaceae	*Eriochloa crebra*	cup grass; tall cupgrass																																									✓	✓						
Poaceae	*Eriochloa pseudoacrotricha*	early spring grass				✓	✓		✓	✓		✓		✓			✓			✓		✓		✓				✓																						
Poaceae	**Lolium* sp.	a ryegrass												✓									✓																												
Poaceae	*Panicum buncei*	native panic										✓		✓	✓																																				
Poaceae	*Panicum decompositum*	native millet	✓						✓								✓				✓				✓										✓																
Poaceae	*Panicum effusum*	hairy panic															✓	✓	✓											✓																				✓	
Poaceae	*Panicum queenslandicum*	Yadbila grass				✓										✓																																		
Poaceae	*Panicum* sp.	panicum		✓		✓	✓	✓			✓	✓	✓						✓	✓		✓	✓			✓	✓		✓		✓											✓	✓	✓					
Poaceae	*Paspalidium aversum*	bent summer grass																✓																																
Poaceae	*Paspalidium caespitosum*	Brigalow grass																								✓																								
Poaceae	*Paspalidium constrictum*	knottybutt grass		✓											✓														✓																					
Poaceae	*Paspalidium distans*									✓																																							
Poaceae	*Paspalidium gracile*	slender panic					✓		✓		✓	✓								✓							✓			✓																				
Poaceae	*Paspalidium* sp.																			✓		✓														✓						✓		✓	✓					
Poaceae	**Paspalum dilatatum*	paspalum					✓		✓										✓						✓	✓			✓							✓	✓			✓									✓
Poaceae	**Paspalum* sp.				✓			✓															✓																	✓								
Poaceae	*Poa* sp.								✓	✓																																							
Poaceae	*Rytidosperma bipartita*	wallaby grass	✓																																													
Poaceae	*Rytidosperma caespitosa*	ringed wallaby grass																							✓																									
Poaceae	*Rytidosperma fulva*	wallaby grass			✓	✓			✓		✓				✓	✓	✓	✓				✓				✓	✓	✓				✓	✓	✓		✓														
Poaceae	*Rytidosperma setacea*	small-flowered wallaby-grass		✓																✓																														
Poaceae	*Rytidosperma* sp.				✓						✓		✓													✓																								
Poaceae	**Setaria parviflora*													✓					✓										✓																				✓	
Poaceae	*Sporobolus caroli*	fairy grass															✓																		✓	✓		✓				✓				✓	✓				
Poaceae	*Sporobolus creber*	slender rat's tail grass				✓					✓			✓					✓									✓															✓			✓	✓				
Poaceae	*Themeda triandra*	Kangaroo grass					✓	✓																			✓			✓																✓	✓				
Poaceae	*Tragus australianus*	small burrgrass															✓																																

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Poaceae	**Triticum aestivum*	wheat				✓	✓								✓								✓																												
Poaceae	**Urochloa panicoides*	urochloa grass												✓	✓	✓			✓	✓	✓		✓	✓				✓						✓	✓				✓					✓	✓				
Poaceae	**Vulpia* sp.	rat's-tail fescue					✓				✓												✓	✓				✓				✓		✓				✓	✓		✓	✓	✓	✓	✓	✓				
Poaceae	*Walwhalleya proluta*														✓																																		
Magnoliopsida (Flowering Plants) - Magnoliidae (Dicots)																																																	
Acanthaceae	*Rostellularia adscendens*	pink tongues						✓					✓																																				✓	
Amaranthaceae	*Alternanthera angustifolia*																					✓			✓																									
Amaranthaceae	*Alternanthera denticulata*	lesser joyweed				✓	✓									✓	✓				✓					✓		✓		✓												✓								
Amaranthaceae	**Alternanthera pungens*	khaki weed										✓																																					
Amaranthaceae	*Alternanthera* sp.	joyweed												✓																																			
Amaranthaceae	*Amaranthus* sp.	amaranth									✓			✓													✓																						
Amaranthaceae	*Ptilotus indivisus*																							✓																									
Amaranthaceae	*Ptilotus* sp.						✓			✓																																							
Apiaceae	**Cyclospermum leptophyllum*	slender celery					✓																																											
Apiaceae	*Eryngium paludosum*	long eryngium														✓												✓																						
Asteraceae	**Bidens pilosa*	cobblers pegs															✓					✓						✓			✓				✓			✓			✓								
Asteraceae	**Bidens subalternans*	greater beggars ticks																			✓																													
Asteraceae	*Brachyscome* sp.			✓																																													
Asteraceae	*Calotis cuneifolia*	purple burr-daisy												✓				✓														✓	✓														✓	
Asteraceae	*Calotis lappulacea*	yellow burr-daisy		✓				✓			✓		✓	✓	✓	✓		✓	✓	✓		✓	✓				✓	✓			✓					✓					✓	✓	✓	✓				✓	
Asteraceae	*Calotis* sp.	a burr-daisy																													✓																	
Asteraceae	*Cassinia* sp.																																															✓	
Asteraceae	**Carthamus lanatus*	saffron thistle	✓									✓										✓		✓	✓	✓	✓			✓							✓	✓	✓	✓					✓	✓		
Asteraceae	**Centaurea calcitrapa*	star thistle			✓				✓																																								
Asteraceae	**Chondrilla juncea*	skeleton weed	✓		✓						✓	✓																																					
Asteraceae	*Chrysocephalum apiculatum*	common everlasting																	✓	✓			✓						✓	✓														✓	✓				
Asteraceae	*Chrysocephalum semipapposum*	clustered everlasting														✓								✓																									
Asteraceae	**Cirsium vulgare*	spear thistle			✓	✓	✓								✓	✓	✓																				✓	✓									✓
Asteraceae	**Conyza bonariensis*	flaxleaf fleabane	✓				✓		✓	✓					✓	✓	✓			✓		✓		✓	✓	✓	✓		✓		✓					✓					✓			✓	✓				

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Asteraceae	*Eclipta platyglossa*	yellow twin-heads															✓											✓																						
Asteraceae	*Euchiton involucratus*	star cudweed													✓																																		
Asteraceae	**Hedypnois rhagadioloides*	cretan weed				✓																																											
Asteraceae	**Hypochaeris glabra*	smooth catsear																																													✓		
Asteraceae	**Hypochaeris radicata*	catsear																																												✓		✓
Asteraceae	**Lactuca serriola*	prickly lettuce					✓																		✓	✓				✓																			
Asteraceae	*Pycnosorus globosus*	drumsticks													✓	✓																																		
Asteraceae	**Schkuhria pinnata* var. *abrotanoides*	dwarf marigold														✓	✓							✓	✓																									
Asteraceae	**Soliva sessilis*	bindyi																																				✓											
Asteraceae	**Sonchus oleraceus*	common sowthistle			✓		✓					✓			✓	✓	✓	✓	✓		✓	✓						✓																					✓
Asteraceae	*Vittadinia cervicularis*							✓	✓			✓			✓										✓																								
Asteraceae	*Vittadinia cervicularis var. cervicularis*	a fuzzweed																								✓																							
Asteraceae	*Vittadinia cuneata*	a fuzzweed		✓	✓															✓	✓															✓			✓									
Asteraceae	*Vittadinia dissecta*																		✓																													
Asteraceae	*Vittadinia muelleri*	a fuzzweed																				✓																										
Asteraceae	*Vittadinia pterochaeta*	rough fuzzweed				✓								✓		✓	✓	✓				✓	✓				✓		✓								✓											
Asteraceae	*Vittadinia* sp.	fuzzweed						✓			✓	✓																																	✓	✓	✓	
Asteraceae	*Vittadinia sulcata*																		✓											✓																		
Asteraceae	*Xerochrysum viscosum*	sticky everlasting						✓			✓							✓	✓	✓			✓						✓															✓				
Boraginaceae	**Echium plantagineum*	Pattersons curse			✓							✓			✓	✓	✓				✓	✓	✓					✓																				
Boraginaceae	**Heliotropium amplexicaule*	blue heliotrope															✓		✓				✓																							✓	✓			
Boraginaceae	**Heliotropium europaeum*	potato weed	✓		✓					✓			✓			✓						✓																											
Brassicaceae	**Hirschfeldia incana*	buchan weed								✓		✓																									✓												
Brassicaceae	**Lepidium africanum*	common peppercress	✓	✓	✓		✓	✓	✓		✓	✓									✓	✓			✓	✓	✓				✓					✓	✓		✓	✓	✓	✓		✓					
Brassicaceae	*Lepidium pseudohyssopifolium*	peppercress															✓																																
Brassicaceae	**Lepidium* sp.	a peppercress			✓	✓	✓				✓	✓				✓									✓	✓																						
Brassicaceae	**Rapistrum rugosum*	turnip weed																						✓													✓											

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Cactaceae	**Cereus uruguayanus*	apple cactus											✓														✓																							
Cactaceae	***Opuntia aurantiaca*	tiger pear																															✓																	
Campanulaceae	*Wahlenbergia communis*	tufted bluebell		✓								✓																										✓				✓	✓						
Campanulaceae	*Wahlenbergia gracilis*	sprawling bluebell																													✓																		
Campanulaceae	*Wahlenbergia littoricola*																													✓																		
Campanulaceae	*Wahlenbergia* sp.	bluebell	✓			✓												✓		✓					✓																									
Capparaceae	*Apophyllum anomalum*	warrior bush																																✓																
Caryophyllaceae	*Spergularia marina*	lesser sea-spurrey		✓																																														
Casuarinaceae	*Casuarina cristata*	belah															✓											✓							✓																
Chenopodiaceae	*Atriplex semibaccata*	creeping saltbush	✓									✓					✓			✓		✓			✓		✓				✓	✓	✓	✓																
Chenopodiaceae	*Atriplex* sp.	a saltbush									✓			✓																																					
Chenopodiaceae	*Chenopodium desertorum*	desert goosefoot																								✓																									
Chenopodiaceae	*Dysphania pumilio*	small crumbweed																																			✓													
Chenopodiaceae	*Einadia hastata*	berry saltbush									✓											✓				✓	✓					✓			✓			✓			✓	✓	✓	✓	✓						
Chenopodiaceae	*Einadia nutans*	climbing saltbush						✓			✓						✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓			✓	✓	✓		✓	✓	✓			✓	✓
Chenopodiaceae	*Einadia polygonoides*	knotweed goosefoot	✓	✓				✓				✓			✓			✓																																
Chenopodiaceae	*Einadia* sp.								✓		✓		✓	✓																																					
Chenopodiaceae	*Einadia trigonos*	fishweed																											✓				✓																
Chenopodiaceae	*Enchylaena tomentosa*	ruby saltbush																	✓										✓				✓	✓			✓				✓								
Chenopodiaceae	*Maireana decalvans*	black cotton bush																						✓	✓									✓															✓	
Chenopodiaceae	*Maireana enchylaenoides*	wingless fissure-weed																													✓					✓				✓				✓				
Chenopodiaceae	*Maireana microphylla*	small-leaf bluebush		✓	✓											✓		✓		✓		✓			✓	✓			✓		✓	✓		✓		✓	✓				✓	✓	✓		✓	✓			
Chenopodiaceae	*Maireana* sp.	cotton bush; bluebush; fissure-weed									✓																																						
Chenopodiaceae	*Rhagodia spinescens*	thorny saltbush																		✓																															
Chenopodiaceae	*Salsola australis*	buckbush;soft rolpoly; saltwort							✓			✓		✓									✓			✓		✓					✓	✓						✓		✓	✓	✓						
Chenopodiaceae	*Sclerolaena birchii*	galvinized burr															✓					✓			✓	✓		✓			✓		✓																

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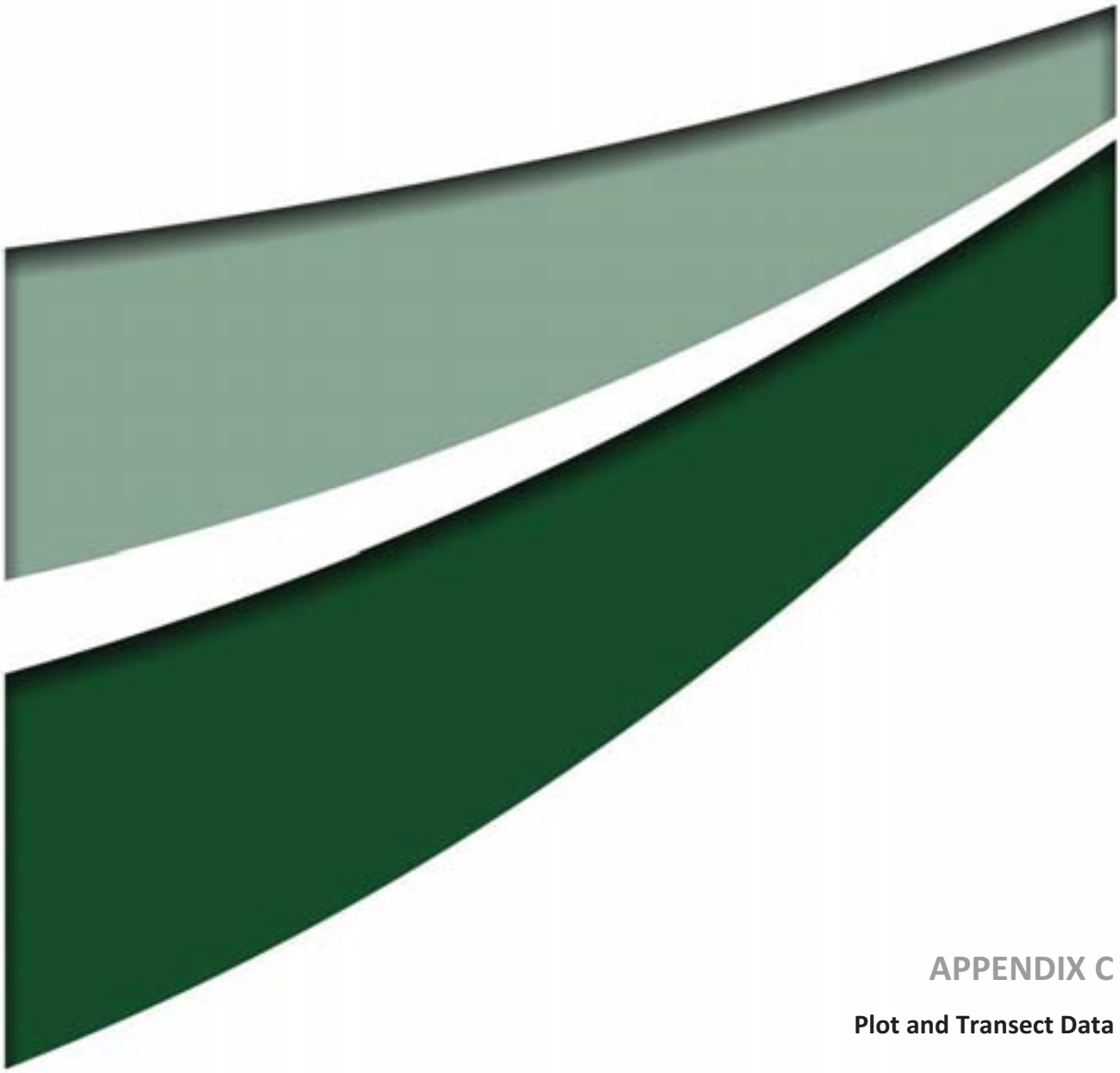
Chenopodiaceae	*Sclerolaena diacantha*	grey copperburr												✓																		✓	✓										✓							
Chenopodiaceae	*Sclerolaena muricata*	black rolypoly		✓					✓			✓													✓		✓							✓		✓	✓				✓			✓						
Chenopodiaceae	*Sclerolaena* sp.	copperburr; poverty-bush						✓				✓							✓	✓											✓		✓				✓	✓	✓	✓	✓	✓	✓	✓						
Clusiaceae	**Hypericum* sp.															✓		✓					✓					✓		✓																					
Convolvulaceae	*Convolvulus angustissimus*		✓			✓														✓	✓																														
Convolvulaceae	*Convolvulus erubescens*	pink bindweed	✓		✓			✓	✓			✓				✓	✓	✓					✓	✓	✓						✓	✓	✓		✓		✓			✓			✓	✓	✓	✓				
Convolvulaceae	*Convolvulus* sp.	a bindweed					✓																							✓																			
Convolvulaceae	*Dichondra repens*	kidney weed		✓		✓	✓					✓											✓				✓	✓	✓							✓						✓	✓					✓	✓
Cucurbitaceae	**Cucumis myriocarpus* subsp. *leptodermis*	paddy melon															✓				✓		✓																					✓	✓				
Cucurbitaceae	**Cucumis* sp.																		✓							✓								✓															
Euphorbiaceae	*Chamaesyce dallachyana*		✓							✓											✓																						✓							
Euphorbiaceae	*Chamaesyce drummondii*	caustic weed							✓						✓	✓	✓		✓				✓		✓			✓		✓	✓			✓															
Euphorbiaceae	*Chamaesyce* sp.			✓																								✓																				
Euphorbiaceae	*Euphorbia* sp.									✓					✓																✓							✓												
Fabaceae (Caesalpinioideae)	*Senna artemisioides group*																			✓		✓						✓			✓									✓						✓		
Fabaceae (Caesalpinioideae)	*Senna clavigera*							✓		✓																																							
Fabaceae (Caesalpinioideae)	**Senna occidentalis*	coffee senna					✓									✓			✓		✓		✓	✓		✓					✓		✓							✓									
Fabaceae (Caesalpinioideae)	*Senna* sp.		✓								✓					✓																																	
Fabaceae (Faboideae)	*Cullen tenax*	emu-foot										✓																																					
Fabaceae (Faboideae)	*Desmodium varians*	slender tick-trefoil									✓																✓									✓						✓							
Fabaceae (Faboideae)	*Glycine canescens*	silky glycine									✓																✓																					
Fabaceae (Faboideae)	*Glycine clandestina*	twining glycine																	✓																								✓						✓	
Fabaceae (Faboideae)	*Glycine* sp.				✓																																					✓							
Fabaceae (Faboideae)	*Glycine tabacina*	variable glycine	✓	✓			✓	✓			✓		✓					✓		✓		✓							✓		✓		✓										✓	✓						✓
Fabaceae (Faboideae)	**Medicago* sp.	a medic				✓		✓											✓	✓								✓																		✓	✓		

Family	Scientific Name	Common Name	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44	P45	P46	P47	P48
Fabaceae (Faboideae)	**Medicago truncatula*	barrel medic															✓																																	
Fabaceae (Faboideae)	**Trifolium arvense*	haresfoot clover	✓		✓	✓	✓		✓		✓	✓							✓											✓							✓													
Fabaceae (Mimosoideae)	*Acacia deanei*	green wattle																✓	✓	✓									✓	✓																				✓
Fabaceae (Mimosoideae)	*Acacia decora*	western silver wattle											✓																															✓	✓	✓	✓			✓	
Fabaceae (Mimosoideae)	*Acacia difformis*	drooping wattle																														✓																	
Fabaceae (Mimosoideae)	*Acacia oswaldii*	Miljee															✓																																	
Fabaceae (Mimosoideae)	*Acacia pendula*	Boree													✓										✓									✓															
Fabaceae (Mimosoideae)	*Acacia salicina*	cooba	✓																																														
Gentianaceae	**Centaurium* sp.																		✓																															
Geraniaceae	*Geranium solanderi*	native geranium							✓																																								
Geraniaceae	*Geranium* sp.															✓																															✓	✓	✓	
Goodeniaceae	*Goodenia hederacea*	ivy goodenia																											✓																				
Goodeniaceae	*Goodenia heterophylla* subsp. *heterophylla*																		✓																															
Goodeniaceae	*Goodenia pinnatifida*																																															✓	
Goodeniaceae	*Goodenia* sp.																			✓																														
Haloragaceae	*Haloragis heterophylla*	variable raspwort			✓																																											
Lamiaceae	**Marrubium vulgare*	white horehound						✓			✓		✓	✓								✓				✓	✓	✓																					
Lamiaceae	*Mentha satureioides*	native pennyroyal			✓																																											
Lamiaceae	**Salvia reflexa*	mintweed																												✓						✓												
Lamiaceae	**Salvia verbenaca*	vervain																																										✓	✓	✓	✓
Lamiaceae	**Stachys arvensis*	stagger weed	✓									✓																			✓		✓			✓	✓	✓			✓		✓		✓	✓				
Lobeliaceae	*Pratia concolor*	poison pratia				✓										✓	✓											✓																				
Lobeliaceae	*Pratia purpurascens*	whiteroot																																	✓												
Lobeliaceae	*Pratia* sp.				✓			✓								✓																															
Loranthaceae	*Amyema quandang*																																	✓													
Malvaceae	**Malvastrum americanum*	spiked malvastrum																																	✓									✓	✓				

Family	Scientific Name	Common Name	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44	P45	P46	P47	P48
Malvaceae	**Modiola caroliniana*	red-flowered mallow			✓		✓			✓											✓																														
Malvaceae	*Sida corrugata*	corrugated sida	✓		✓	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓		✓	✓	✓	✓			✓	
Malvaceae	*Sida cunninghamii*	ridge sida						✓					✓																																					
Malvaceae	*Sida filiformis*			✓												✓				✓							✓						✓	✓	✓		✓	✓	✓		✓	✓							
Malvaceae	**Sida rhombifolia*	Paddy's lucerne																																		✓														
Malvaceae	*Sida* sp.																																															✓	
Myoporaceae	*Eremophila debilis*	amulla	✓		✓			✓				✓	✓					✓									✓		✓				✓			✓							✓	✓				✓	✓
Myoporaceae	*Eremophila mitchellii*	budda																															✓																
Myoporaceae	*Myoporum montanum*	western boobialla																✓		✓							✓		✓				✓																	
Myrtaceae	*Eucalyptus albens*	white box											✓																													✓							
Myrtaceae	*Eucalyptus camaldulensis*	river red gum					✓																																										✓
Myrtaceae	*Eucalyptus conica*	fuzzy box									✓	✓	✓																																				
Myrtaceae	*Eucalyptus melliodora*	yellow box																																		✓			✓		✓								
Myrtaceae	*Eucalyptus microcarpa*	western grey box	✓	✓										✓				✓									✓					✓	✓																
Myrtaceae	*Eucalyptus populnea* subsp. *bimbil*	bimble box						✓									✓			✓		✓				✓		✓		✓																				
Nyctaginaceae	*Boerhavia dominii*	tarvine		✓							✓	✓		✓			✓			✓			✓			✓		✓		✓									✓										✓
Oleaceae	*Notelaea microcarpa*	native olive																															✓	✓															
Oleaceae	**Olea europaea* subsp. *cuspidata*	African olive												✓																																				
Onagraceae	**Oenothera* sp.																				✓																												
Onagraceae	**Oenothera stricta* subsp. *stricta*																		✓																														
Oxalidaceae	*Oxalis perennans*														✓			✓			✓								✓														✓					✓	
Oxalidaceae	*Oxalis* sp.																													✓																		
Phyllanthaceae	*Phyllanthus virgatus*	wiry spurge																✓												✓																				
Plantaginaceae	*Plantago debilis*	shade plantain		✓																																													
Plantaginaceae	**Plantago lanceolata*	lamb's tongues	✓				✓		✓	✓													✓																												
Plantaginaceae	*Plantago turrifera*	small sago-weed				✓																						✓																						
Polygonaceae	*Persicaria prostrata*	creeping knotweed					✓																																											
Polygonaceae	**Polygonum aviculare*	wireweed										✓																																						
Polygonaceae	*Rumex brownii*	swamp dock									✓																																							

Family	Scientific Name	Common Name	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P38	P39	P40	P41	P42	P43	P44	P45	P46	P47	P48
Polygonaceae	**Rumex crispus*	curled dock												✓		✓					✓																													
Polygonaceae	*Rumex* sp.	dock		✓																																													
Portulacaceae	*Portulaca oleracea*	pigweed												✓			✓								✓	✓																								
Rubiaceae	*Asperula conferta*	common woodruff		✓											✓																				✓														
Rubiaceae	**Galium* sp.						✓																																										
Rubiaceae	*Psydrax odorata*	shiny-leaved canthium																																								✓								
Rubiaceae	**Sherardia arvensis*	field madder	✓																																														
Rutaceae	*Geijera parviflora*	wilga						✓			✓	✓	✓				✓	✓	✓	✓		✓					✓	✓	✓		✓			✓									✓			✓	✓			✓	
Sapindaceae	*Alectryon oleifolius*	western rosewood		✓																																													
Sapindaceae	*Dodonaea viscosa*	sticky hop-bush																					✓								✓	✓																		
Scrophulariaceae	**Kickxia elatine*	pointed toadflax								✓																																							
Scrophulariaceae	**Misopates orontium*	lesser snapdragon														✓																																		
Scrophulariaceae	**Verbascum virgatum*	twiggy mullein																					✓																						✓	✓				
Solanaceae	***Lycium ferocissimum*	African boxthorn															✓			✓						✓		✓						✓							✓								
Solanaceae	***Solanum elaeagnifolium*	silver-leaved nightshade							✓	✓																																							
Solanaceae	*Solanum esuriale*	quena	✓		✓		✓					✓		✓		✓	✓				✓	✓	✓	✓	✓	✓			✓					✓					✓	✓	✓	✓	✓	✓	✓					
Solanaceae	**Solanum nigrum*	black-berry nightshade																			✓	✓	✓																											
Solanaceae	*Solanum* sp.								✓																			✓																				
Stackhousiaceae	*Stackhousia muricata*	stackhousia						✓												✓																													
Sterculiaceae	*Brachychiton populneus*	kurrajong	✓																✓	✓		✓						✓		✓		✓																	
Ulmaceae	*Trema tomentosa var. aspera*	native peach												✓																																		
Verbenaceae	**Verbena bonariensis*	purpletop					✓			✓																																						
Verbenaceae	**Verbena incompta*																		✓		✓								✓				✓											✓				
Verbenaceae	**Verbena officinalis*	common verbena															✓																											✓	✓				
Verbenaceae	**Verbena* sp.													✓					✓																													
Zygophyllaceae	*Tribulus micrococcus*	spineless caltrop										✓																															✓						
Zygophyllaceae	*Tribulus* sp.	cat-head; caltrop		✓																																												
Zygophyllaceae	**Tribulus terrestris*	cat-head															✓						✓			✓																							



APPENDIX C

Plot and Transect Data

Appendix C - Plot and Transect Data

The following plot and transect data was collected from surveys of the Development Site. It includes the ten site attributes that are recorded in each Biometric plot and transect as per Table 2 of the FBA (OEH 2014a). This data is assessed against benchmark data for PCTs and then entered into the BioBanking Calculator to assess the site value of each PCT in the Development Site.

The following abbreviations or symbols are used in the list:

NPS	native plant species
NOC	native overstorey cover
NMC	native midstorey cover
NGCG	native ground cover (grasses)
NGCS	native ground cover (shrubs)
NGCO	native ground cover (other)
EPC	exotic plant cover
NTH	number of trees with hollows
OR	overstorey regeneration, and
FL	total length of fallen logs.

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
Zone 1: CW205, LA212_Weeping Myall Open Woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion_Moderate/Good													
P13	17	17.5	0	34	0	6	0	0	1	0	610211.44	6380228.2	55
P21	26	1	0	114	0	32	28	0	1	0	613120.71	6426762.16	55
P32	22	2.5	0	48	34	36	0	1	1	60.5	609202.85	6388281.52	55
Zone 2: CW183, LA193_River Red Gum Tall to very Tall Open Forest/woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion_Moderate/Good													
P48	13	27.5	0	38	0	32	12	2	1	50	610084	6361069	55
Zone 3: CW183, LA193_River Red Gum Tall to very Tall Open Forest/woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion_Low - Regeneration													
P05	26	0	0	54	2	18	46	0	1	4	610099.71	6361049.68	55
Zone 4: CW104, LA105_Belah Woodland on alluvial plain and low rises on the Central NSW wheatbelt to Pilliga and Liverpool Plains regions_Moderate/Good													
P26	32	16	0	39	2	2	2	0	0.5	0	607031.94	6398448.80	55
Zone 5: CW104, LA105_Belah Woodland on Alluvial Plain and Low Rises on the Central NSW Wheatbelt to Pilliga and Liverpool Plains Regions_Moderate/Good – Derived Native Grassland													
P33	12	0	0	86	0	0	0	0	1.0	0	607308.39	6397685.35	55
P14	29	0	0	48	0	20	6	0	1.0	0	607082.21	6398249.80	55
P15	30	14	1	36	2	14	18	1	1.0	0	607028.60	6398390.96	55
Zone 6: CW220, LA223_White Cypress Pine Woodland on Sandy Loams in Central NSW Wheatbelt_Moderate/Good													
P38	19	2.6	0	52	2	8	16	0	0.66	0	604579.72	6335569.98	55
Zone 7: CW145, LA154_Western Grey Box Tall Grassy Woodland on Alluvial Loam and Clay Soils in the NSW South West Slopes and Riverina Bioregions_Moderate/Good													
P01	25	4.5	0	32	0	4	0	1	0.75	10.1	604330.19	6342492.62	55
P02	29	6.7	0	32	0	0	0	3	0.75	17.8	605896.72	6349724.42	55
P12	25	9.5	0	26	0	10	4	1	0.75	2.5	610485.13	6379138.91	55

P16	30	33	4.5	36	4	8	2	0	0.75	0	606686.60	6401007.91	55
P25	28	26.5	0	28	0	14	4	5	0.75	2.75	611299.72	6376679.50	55
P30	20	8.5	0	26	2	8	8	2	0.75	6	605755.07	6333435.03	55
P31	30	32.5	0	50	0	34	0	2	0.75	8	612111.00	6374322.15	55
Zone 8: CW145, LA154_Western Grey Box Tall Grassy Woodland on Alluvial Loam and Clay Soils in the NSW South West Slopes and Riverina Bioregions_Moderate/Good – Derived Native Grassland													
P03	19	0	0	50	0	8	4	0	0.5	0	605468.01	6348264.17	55
P04	21	0	0	60	0	2	0	0	0.5	0	606489.40	6350709.85	55
P07	20	0	0	44	0	10	20	0	0.5	0	611784.53	6363463.94	55
P36	13	0	0	72	0	24	2	0	0.5	11	609507.96	6355576.05	55
Zone 9: CW172, LA178_Poplar Box Grassy Woodland on Alluvial Clay-loam Soils mainly in the Temperate (hot summer) Climate Zone of Central NSW (wheatbelt) _Moderate/Good													
P06	31	11	0	42	0	2	0	0	0.8	0	612225.34	6373804.04	55
P17	32	0	0	6	0	28	88	0	0.8	10.5	606595.94	6402470.85	55
P18	37	4.5	12.5	22	4	18	0	0	0.8	16	606545.32	6403072.77	55
P20	29	31	0	20	0	18	24	0	0.8	0	606568.11	6403988.22	55
P24	23	16.5	0	22	0	10	30	5	0.8	7	614371.93	6430004.82	55
P27	24	14	10	28	6	6	0	0	0.8	12	606568.84	6402281.88	55
P29	18	11.5	0.5	38	2	28	42	0	0.8	0	606496.21	6403959.05	55
Zone 10: CW172, LA178_Poplar Box Grassy Woodland on Alluvial Clay-loam Soils mainly in the Temperate (hot summer) Climate Zone of Central NSW (wheatbelt) _Moderate/Good – Derived Native Grassland													
P28	22	0	0	86	2	22	18	0	0.8	0	606610.02	6402337.32	55
P43	21	0	6	70	24	24	2	0	0.8	14	606633.24	6401906.55	55
P44	22	0	0	70	6	16	8	0	0.8	13	606610.27	6402250.28	55
Zone 11: CW138, LA145_Fuzzy Box Woodland on Alluvial Brown Loam Soils mainly in the NSW South Western Slopes Bioregion_Moderate/Good													

P09	33	15.5	0	66	0	10	0	0	0.33	0	613885.35	6371162.88	55
P10	28	15	0	42	0	4	0	1	0.33	0	613375.60	6372482.45	55
Zone 12: CW213, LA218_White Box – White Cypress Pine – Western Grey Box shrub/grass/forb Woodland in the NSW South Western Slopes Bioregion_Moderate/Good													
P11	22	11	0	52	0	12	0	1	0.75	2.5	612428.98	6373455.90	55
P40	25	1.9	0.6	56	12	20	0	1	0.75	22	612307.31	6364890.94	55
Zone 13: CW213, LA218_White Box – White Cypress Pine – Western Grey Box shrub/grass/forb Woodland in the NSW South Western Slopes Bioregion_Moderate/Good – Derived Native Grassland													
P41	24	0	0	80	0	34	8	0	0.75	2	612363.05	6373506.55	55
Zone 14: CW226, LA226_Yellow Box Grassy Tall Woodland on Alluvium or Parna Loams and Clays on Flats in NSW South Western Slopes Bioregion_Moderate/Good													
P34	24	9.7	0	62	4	24	0	1	0.75	8	609943.10	6359480.46	55
P39	29	4.2	0	66	6	24	4	2	0.75	24	609797.82	6359184.92	55
P47	32	18.5	12.5	56	6	16	1	2	1	5	612200	6373944	55
Zone 15: CW226, LA226_Yellow Box Grassy Tall Woodland on Alluvium or Parna Loams and Clays on Flats in NSW South Western Slopes Bioregion_Moderate/Good – Derived Native Grassland													
P35	18	8	0	82	0	20	2	0	0.75	0	609954.97	6359403.71	55
P37	11	0	0	92	2	2	16	0	0.75	0	609814.04	6359079.40	55
P42	24	1	0	76	4	20	0	0	0.75	3	612261.35	6373947.90	55

APPENDIX D

Threatened Ecological Community Analysis

Threatened Ecological Communities

Eight of the vegetation zones described above and mapped within the Development Site conform to State and Commonwealth listed TECs, comprising:

- Weeping Myall Woodlands:
    - *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC* under the TSC Act.
    - *Weeping Myall Woodlands EEC* under the EPBC Act
- Inland Grey Box Woodlands and Derived Native Grasslands:
    - *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act
    - *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act
- Fuzzy Box Woodlands:
    - *Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act
- White Box Woodlands and Derived Native Grasslands:
    - *White Box Yellow Box – Blakely's Red Gum Woodland EEC* under the TSC Act
    - *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act.

Analysis of consistency with the scientific determinations for each TEC was undertaken, with consideration of the advice provided by the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the TSC Act and EPBC Act respectively. The vegetation zones described in Section 3.2.1 of the BAR conform to the listing advice provided for each of the TECs, except where minimum patch sizes are required or when the TEC is excluded on the basis of bioregion.

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions EEC under the TSC Act

Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions is listed as an EEC under the TSC Act. This ecological community is scattered across the eastern parts of the alluvial plains of the Murray-Darling river system. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. The community is dominated by *Acacia pendula* as one of the dominant species or in some patches the only tree species present. The understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the Final Determination for this community (NSW Scientific Committee 2005).

Constituent Species

The species recorded within *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* EEC in the Development Site comprise species, and/or taxa below species rank, as required by the TSC Act.

This included the presence of weeping myall (*Acacia pendula*) as the dominant and frequently the sole canopy species within the Development Site.

Assemblage of Species

The NSW Scientific Committee (2005) lists 84 species as characterising the assemblage of species for *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC. As part of ecological investigations for the proposal, three systematic 20 metre x 20 metre quadrats were sampled in this community across the Development Site.

Within the Development Site, weeping myall (*Acacia pendula*) was recorded in all three quadrats sampled. A total of 19 species (23 per cent) of the species listed in the Final Determination were present within this community across the Development Site. The assemblage of species recorded in the vegetation community is considered to conform to the EEC final determination.

Particular Area

In relation to the particular area of the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC, the NSW Scientific Committee (2005) states that the community occurs within the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions. Additionally the community occurs within the Parkes and Narromine LGAs.

The area in which this community occurs within the Development Site is situated within the Darling Riverine Plains Bioregion and NSW South Western Slopes Bioregions; and the Parkes and Narromine LGAs (refer to Figures A19-A36 in **Appendix A**).

Supplementary Descriptors

In relation to supplementary descriptors, the NSW Scientific Committee (2005) includes the following key information pertaining to the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC:

- ***occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall***
- ***structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland,***
- ***the tree layer grows up to a height of about 10 metres and invariably includes Acacia pendula as one of the dominant species or the only tree species present, and***
- ***the understorey includes an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs.***

Of the above supplementary descriptors, the *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions EEC* present in the Development Site comprises a upper stratum dominated by weeping myall (*Acacia pendula*). Beneath the canopy, the community identified within the Development Site comprises a number of chenopod shrubs along with several grass and herb species. The community identified within the Development Site is characterised by open woodland through to open shrublands, a likely result of clearing occurring within the existing rail corridor and exposure to a history of disturbance.

Climatically the Development Site has an average annual rainfall of between 526 and 643 millimetres (BOM, 2016) which is slightly higher than the measurements listed in the Final Determination, however in recent years the rainfall has been lower than these averages. Additionally, the soils on which this community occurred on within the Development Site were consistent with the Final Determination.

Summary

The Development Site supports a total of 3.47 hectares of *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South western Slopes bioregions* EEC under the TSC Act within PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition.

Weeping Myall Woodlands EEC under the EPBC Act

Weeping Myall Woodlands is listed as an EEC under the EPBC Act. The community occurs on inland alluvial plains west of the Great Dividing Range in NSW and Queensland. The Listing Advice for the community identifies the community as occurring in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain bioregions (TSSC 2008). The community is characterised by open woodlands and woodlands, generally 4-12 metres high that are dominated by weeping myall (*Acacia pendula*).

A comprehensive analysis of this vegetation community was undertaken to determine the proportion of the community that conformed to the Listing Advice for the Weeping Myall Woodlands EEC (TSSC 2008).

Particular Area

In relation to the particular area of the Weeping Myall Woodlands EEC, the TSSC (2008) states that the community occurs within the Brigalow Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain IBRA Bioregions.

The area in which this community occurs within the Development Site is situated within the Darling Riverine Plains Bioregion and NSW South Western Slopes (refer to **Appendix A**).

Additional Criteria

The published Listing Advice for *Weeping Myall Woodlands EEC* under the EPBC Act (TSSC 2008) and EPBC Policy Statement 3.17 (DEWHA 2009) provides a set of condition classes that patches of vegetation are required to meet in order to conform to the EEC. These are listed below and comparison was made to the Weeping Myall Woodlands identified within the Development Site.

- ***Tree canopy is dominated (at least 50% of trees present) by living, dead or defoliated Weeping Myall trees.***

The tree canopy of *Weeping Myall Woodlands EEC* within the Development Site is dominated by weeping myall (*Acacia pendula*) trees.

- ***Overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha.***

The 0.99 hectares of *Weeping Myall Woodlands EEC* identified in the Development Site has more than 5% tree canopy of weeping myall (*Acacia pendula*).

- ***The area is at least 0.5 hectares in size.***

A total of 3.47 hectares of PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition was identified within the Development Site. Due to the restricted nature of the rail corridor, the majority of patches strictly within corridor were smaller than the required minimum 0.5 hectare patch size. A process was undertaken to identify which patches extended outside the bounds of the Development Site and therefore met the area patch requirements of the EPBC Act community. This process identified five patches of Weeping Myall that were larger than 0.5 hectares, however, only 0.99 hectares occurred within the Development Site.

- ***Patch has either: more than two layers of regeneration of Weeping Myall Present; or the tallest layer of living, dead or defoliated Weeping Myall trees is at least 4 metres tall and of the vegetation cover present, 50% is comprised of native species.***

The 0.99 hectares of *Weeping Myall Woodland EEC* identified in the Development Site either has more than two layers of regeneration of weeping myall (*Acacia pendula*) present or the tallest layer of living, dead or defoliated weeping myall trees is at least 4 metres tall.

Summary

The Development Site supports a total of 0.99 hectares of *Weeping Myall Woodlands EEC* within PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion - Moderate to Good condition. The analysis above identified that the Development Site supports a total of 0.99 hectares of *Weeping Myall Woodlands EEC* under the EPBC Act. The remaining 2.48 hectares within the Development Site did not conform to the EEC due to the community not meeting the minimum patch size requirements in some areas of the site.

Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC under the TSC Act

Inland Grey Box Woodland is listed as an EEC under the TSC Act. This community is known to occur on the fertile soils of the western slopes and plains of NSW in which inland grey box (*Eucalyptus microcarpa*) is the most characteristic species. In NSW, the community largely occurs within the Riverina and South West Slopes Bioregions, but is also found in areas of the Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the listing advice for the EEC (NSW Scientific Committee 2007).

Constituent Species

The species recorded within *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included inland grey box (*Eucalyptus microcarpa*) being the dominant canopy species, while poplar box (*Eucalyptus populnea* subsp. *bimbil*), white cypress-pine (*Callitris glaucophylla*) and kurrajong (*Brachychiton populneus*) were also present as co-dominants or scattered canopy tree species in the woodland component. Trees were absent from the derived native grassland component.

Assemblage of Species

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2007) lists 74 species as characterising the assemblage of species for *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*. As part of ecological investigations for the proposal, 11 systematic 20 metre x 20 metre quadrats were sampled in this community across the Development Site.

Within the Development Site, seven quadrats were used to describe the woodland component of *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* occurring in the Development Site for which a total of 32 (43 per cent) of the species listed in the Final Determination were recorded.

An additional four quadrats were sampled to describe the grassland component for *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* for which a total of 17 (23 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

Particular Area

In relation to the particular area of *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*, the NSW Scientific Committee (2007) states that the community occurs within the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions. The southern half of the Development Site is situated within the NSW South Western Slopes Bioregion, while the northern half occurs in the Darling Riverine Plains Bioregion. As a result only areas of this community that occur within the NSW South Western Slopes Bioregion have been attributed to the EEC.

The listing advice also identifies the EEC as being present in parts of the Parkes and Narromine LGAs, which the Development Site occurs in.

Supplementary Descriptors

In relation to supplementary descriptors, the NSW Scientific Committee (2007) includes the following key information pertaining to *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC*:

- ***has an average rainfall of 375-800 millimetres per annum and a mean maximum annual temperate of 22-26°C;***
- ***occurs on relatively fertile soils;***

- ***shrubs are typically sparse or absent, but can also be locally common and diverse; and***

- ***the community is usually present as an open woodland 15 – 25 metres in height, but in some locations the canopy may be absent as a result of clearing or thinning.***

Of the above supplementary descriptors, the *Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* present in the Development Site occurs on relatively fertile soils. Climatically the development site has an average annual rainfall of between 526 and 643 millimetres (BOM 2016) and average maximum annual temperature of between 23 and 25°C. The overstorey is relatively intact and shrub layer is predominantly absent in the woodland form, whilst canopy trees are absent from the derived native grassland component. The understorey is variable, generally dominated by native grasses and forbs, with occurrences of introduced perennials and annual exotic grasses.

Summary

The Development Site supports a total of 39.39 hectares of *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC* under the TSC Act represented by PCT267 (CW145, LA145) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions - Moderate to Good condition and Moderate to condition – Derived Native Grassland that occurs within the South Western Slopes IBRA Bioregion.

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia is listed as an EEC under the EPBC Act. The community is characterised by a canopy dominated by inland grey box (*Eucalyptus microcarpa*), while several other canopy species are also commonly associated with the EEC. These include, but are not limited to bulloak (*Allocasuarina luehmannii*), kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*).

A comprehensive analysis of this vegetation community was undertaken to determine whether it conformed to the listing advice for the EEC (TSSC 2010).

Particular Area

In relation to the particular area of the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, the TSSC (2010) states that the community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia.

The area in which this community occurs within the Development Site is situated within the lower slopes of central NSW.

Additional Criteria – Key Diagnostic Characteristics

The *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* occupies a transitional landscape zone between semi-arid communities, temperate woodlands and forests of the lower slopes and ranges. Key diagnostic characteristics are provided within the Listing Advice for this EEC (TSSC 2010) as many of the plant species present in the community are widespread or occur is a variety of other vegetation types that adjoin the community. The key diagnostic characteristics are provided and assessed below.

- ***The ecological community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia. Disjunct occurrences are known from near Melbourne and in the Flinders-Lofty Block Bioregion of South Australia.***

The woodland and associated DNG within the Development Site that is considered to conform with the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act occurs on low slopes and plains of central NSW, particularly from Parkes to Narromine, NSW.

- ***The vegetation structure of the ecological community is typically a woodland to open forest.***

The vegetation communities within the Development Site that are considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* are typically a woodland but also occur in the form of Derived Native Grasslands, with the canopy and understorey shrubs absent.

- ***The tree canopy is dominated (≥50% canopy crown cover) by Eucalyptus microcarpa (Grey Box). Other tree species may be present in the canopy and, in certain circumstances, may be co-dominant with Grey Box but are never dominant on their own.***

The woodland within the Development Site that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* comprised a canopy dominated by inland grey box (*Eucalyptus microcarpa*). Other canopy species were recorded but were never dominant. These species included kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*). Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

- ***The mid layer comprises shrubs of variable composition and cover, from absent to moderately dense. The mid layer usually has a crown cover of less than 30% with local patches up to 40% crown cover.***

Shrubs were commonly present in the mid stratum of the woodland within the Development Site being considered as conforming to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, however, they generally comprised a total crown cover of less than 10 per cent.

- ***The ground layer is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Ground layer flora commonly present include one or more of the graminoid genera: Austrodanthonia, Austrostipa, Elymus, Enteropogon, Dianella and Lomandra; and one or more of the chenopod genera: Atriplex, Chenopodium, Einadia, Enchylaena, Maireana, Salsola and Sclerolaena.***

The woodland within the Development Site that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* varied in quality from diverse to species poor. Both woodland and DNG forms of the community recorded comprised at least one of the graminoid genera listed above. Specifically, *Austrodanthonia*, *Austrostipa*, *Atriplex*, *Einadia* and *Sclerolaena* were common.

Derived grasslands are a special state of the ecological community, whereby the canopy and mid layers have been mostly removed to <10 per cent crown cover but the native ground layer remains largely intact, with 50 per cent or more of the total vegetation cover being native.

Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act. These areas of the EEC

within the Development Site are predominantly absent of a remnant canopy, with only scattered trees and shrubs remaining. The cover of native flora species in the ground layer is at least 50 per cent.

Additional Criteria - Condition Thresholds

The condition thresholds identified in the Listing Advice for this EEC (TSSC 2010) have multiple criteria in order for vegetation to form with the EEC under the EPBC Act. There are general criteria as well as a number of additional criteria depending on the size of the patch, and additional criteria for DNG.

General criteria (TSSC 2010) require:

- ***the minimum patch size is 0.5 hectare;***
- ***the canopy contains inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant; and***
- ***the vegetative cover of non-grass weed species is less than 30% in the ground layer at any time of year.***

Due to the nature of the proposal, the patches in the Development Site being assessed as to whether or not they conform to this EEC occur within the railway corridor. This means that many of the patches are small in size and would not, in isolation, meet the size requirements of the general criteria. However these mapped areas within the corridor are part of larger patches adjacent to the corridor and were consequently larger than 0.5 hectares. Woodland patches all comprised inland grey box (*Eucalyptus microcarpa*) as a dominant or co-dominant and the vegetative cover of non-grass weed species was less than 30 per cent throughout the mapped communities.

Additional criteria (TSSC 2010) for patches between 0.5 and 2 hectares require:

- ***at least 50% of the vegetative cover of the ground layer comprises perennial native species at any time of year; and***
- ***8 or more perennial native species are present in the mid and ground layers at any time of year.***

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland within the Development Site predominantly had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances where this was not the case, however the large size of the Development Site and restrictive nature of the corridor resulted in limitations for plot locations. For this reason and based on the data collected, it is considered that the vegetation community meets this additional criterion. All floristic plots comprise at least 8 perennial native species within the mid and ground layers.

Additional criteria (TSSC 2010) for patches where the canopy is less developed or absent include:

- ***The patch is a derived grassland with clear evidence that the site formerly was a woodland with inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant;***
- ***At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of year; and***
- ***The ground layer comprises at least 12 native species at any time of year.***

Only native grasslands surrounding or in the vicinity of existing grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good – Derived Native Grassland within the Development Site predominantly had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances within this community where this was not the case, however the large size of the Development Site and restrictive nature of the rail corridor resulted in limitations for plot locations. Additionally, these plots all comprised at least 12 native species.

Summary

The Development Site supports a total of 41.51 hectares of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland.

Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC under the TSC Act

Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions is listed as an EEC under the TSC Act. This community primarily occurs in the Dubbo - Narromine - Parkes - Forbes area. It occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on the undulating plains or flats of the western slopes of the Great Dividing Range and is characterised by the presence of fuzzy box (*Eucalyptus conica*), which often grows with inland grey box (*Eucalyptus microcarpa*), yellow box (*Eucalyptus melliodora*) or kurrajong (*Brachychiton populneus*).

A comprehensive analysis of this vegetation community was undertaken to determine if it conforms to the Final Determination for this community (NSW Scientific Committee 2004).

Constituent Species

The species recorded within *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included a canopy dominated by fuzzy box (*Eucalyptus conica*). In some patches yellow box (*Eucalyptus melliodora*) and/or grey box (*Eucalyptus microcarpa*) was also present as either co-dominant or associate canopy species.

Assemblage of Species

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2004) lists 102 species as characterising the assemblage of species for *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*. As part of ecological investigations for the proposal, two systematic 20 metre x 20 metre quadrats were sampled in *White Box Yellow Box Blakely's Red Gum Woodland* EEC across the Development Site.

Within the Development Site, fuzzy box (*Eucalyptus conica*) was recorded in all quadrats. A total of 23 species (22.5 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

Particular Area

In relation to the particular area of the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*, the NSW Scientific Committee (2004) states that the community found principally in the South Western Slopes Bioregion and also occurs in parts of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion..

The Development Site is situated within the Darling Riverine Plains Bioregion and the South Western Slopes Bioregion (refer to **Appendix A**).

Supplementary Descriptors

In relation to supplementary descriptors, the NSW Scientific Committee (2004) includes the following key information pertaining to the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC*.

- ***occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on the undulating plains or flats of the western slopes of the Great Dividing Range***

- ***often occurs upslope from River Red Gum communities, just above frequently inundated areas on the floodplain.***

Of the above supplementary descriptors, the *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* present in the Development Site occupies the clay loam soils of a slight depression in the floodplain upslope from recorded river red gum communities.

Summary

The Development Site supports a total of 1.88 hectares of *Fuzzy Box Woodland on alluvial soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions EEC* under the TSC Act represented by PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion - Moderate to Good condition.

White Box Yellow Box Blakely's Red Gum Woodland EEC under the TSC Act

White Box Yellow Box – Blakely's Red Gum Woodland is listed as an EEC under the TSC Act. The community is known to occur from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW and is characterised by the presence or prior occurrence of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and/or Blakely's red gum (*Eucalyptus blakelyi*).

A comprehensive analysis of this vegetation community was undertaken to determine if it conforms to the Final Determination for this community (NSW Scientific Committee 2002).

Constituent Species

The species recorded within *White Box Yellow Box Blakely's Red Gum Woodland EEC* in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included the canopy species of yellow box (*Eucalyptus melliodora*) and white box (*Eucalyptus albens*).

Assemblage of Species

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2002) lists 95 species as characterising the assemblage of species for *White Box Yellow Box Blakely's Red Gum Woodland* EEC. As part of ecological investigations for the proposal, eight systematic 20 metre x 50 metre quadrats were sampled in *White Box Yellow Box Blakely's Red Gum Woodland EEC* across the Development Site.

Within the Development Site, either yellow box (*Eucalyptus melliodora*) or white box (*Eucalyptus albens*) was recorded in all quadrats or nearby for the derived native grassland component. A total of 24 species (25.3 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Woodland* EEC, the NSW Scientific Committee (2002) states that the community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions.

The area in which this community occurs within the Development Site is situated within the NSW South Western Slopes Bioregion (refer to **Appendix A**).

Supplementary Descriptors

In relation to supplementary descriptors, the NSW Scientific Committee (2002) includes the following key information pertaining to the *White Box Yellow Box Blakely's Red Gum Woodland EEC*:

- ***occurs on relatively fertile soils, generally between 400 and 800 millimetre isohyets, and at an altitude of circa 170 metres to circa 1200 metres***

- ***the shrub layer is generally sparse or absent, though it may be locally common, and***

- ***condition states may range from relatively good to highly degraded, such as paddock remnants with a weedy understorey and only a few hardy natives left. The tree layer may be absent as a result of past clearing or thinning.***

Of the above supplementary descriptors, the *White Box Yellow Box Blakely's Red Gum Woodland EEC* present in the Development Site occurs on relatively fertile soil. This community was recorded at altitudes of approximately between 281 metres and 321 metres above sea level. The shrub layer is generally absent to sparse, and while some of this may have been as a result of past clearing and grazing management, shrubs were most likely always sparse. While the overstorey is relatively intact in the woodland components and absent in the derived native grasslands forms, the understorey comprises a mix of native grasses and herbs.

Summary

The Development Site supports a total of 24.93 hectares of *White Box Yellow Box Blakely's Red Gum Woodland EEC* under the TSC Act within PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good and Moderate to Good – Derived Native Grassland and PCT276 (CW226, LA226) Yellow Box grassy tall woodland

on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion – Moderate to Good and Moderate to Good – Derived Native Grassland.

White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a CEEC under the EPBC Act. This community occurs in an along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*, the TSSC (2006) states that the community occurs within the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions.

The area in which this community occurs within the Development Site is situated within the NSW South Western Slopes Bioregion (refer to **Appendix A**).

Additional Criteria

Detailed assessment of the vegetation communities described and mapped within the Development Site was undertaken to determine whether the vegetation present met the condition class thresholds identified in the Listing Advice (TSSC 2006). These thresholds have been incorporated into an identification flowchart for the CEEC within the EPBC Act Policy Statement (DEH 2006) for the community which was also utilised during the assessment.

- **Is, or was previously, at least one of the most common overstorey species white box, yellow box or Blakely's red gum?**

All vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria was identified as having or previously having either white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) or Blakely's red gum (*Eucalyptus blakelyi*) as one of the dominant overstorey species.

- **Does the patch have predominantly native understorey?**

A patch of Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the Development Site was assessed as not having a predominantly native understorey. This patch had been heavily grazed and pasture improved. All other patches of vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria had a predominantly native understorey.

- **Is the patch 0.1 hectare or greater in size?**

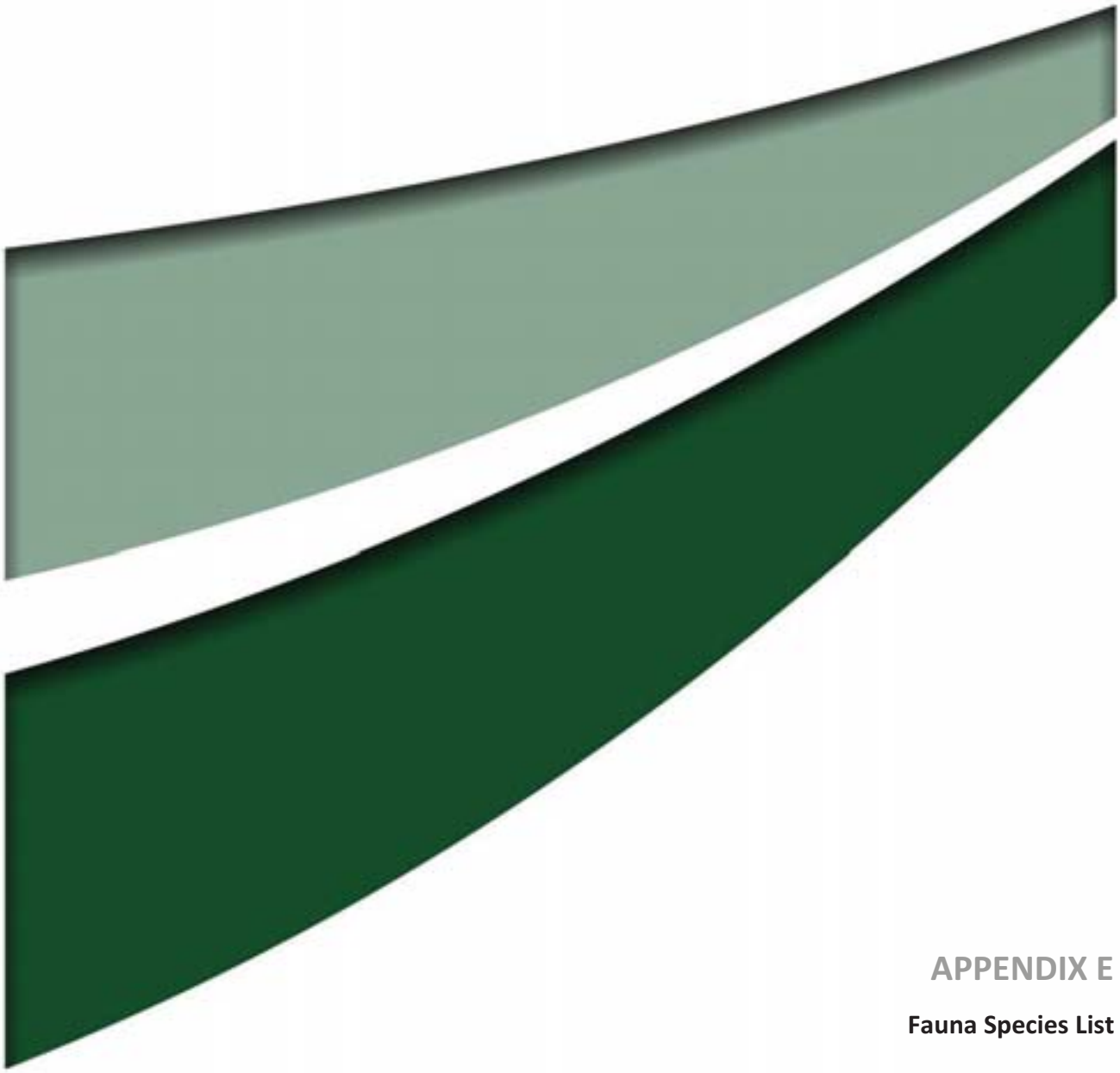
Due to the restricted nature of the Development Site, a majority of patches strictly within the Development Site were smaller than the required 0.1 hectare size. A process was undertaken to identify which patches extended outside the bounds of the Development Site and therefore met the area patch requirements of the EPBC Act community.

- **Are there 12 or more native understorey species present (excluding grasses), of which at least one is deemed an important species.**

A patch of Zone 12 – CW213, LA218– White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the Development Site was assessed as not having 12 native understorey species present (excluding grasses). All other patches of vegetation in the Development Site assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria were identified as containing at least 12 or more native understorey species.

Summary

The Development Site is considered to support 22.79 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* within PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (Moderate to Good – in part and Moderate to Good_DNG condition) and PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion (Moderate to Good and Moderate to Good_DNG condition).



APPENDIX E

Fauna Species List

Appendix E - Fauna Species List

The following fauna list was developed from surveys of the Development Site.

The following abbreviations or symbols are used in the list:

asterisk (*)	Denotes species not indigenous to the Development Site
subsp.	Subspecies
M	Listed migratory species under the EPBC Act
V	Vulnerable under the TSC and/or EPBC Acts

Birds recorded were identified using descriptions in Pizzey and Knight (2012) and the scientific and common name nomenclature of Birdlife Australia (Birdlife International 2015). Reptiles recorded were identified using keys and descriptions in Cogger (2014) and Wilson & Swan (2008) and the scientific and common name nomenclature of Cogger (2014).

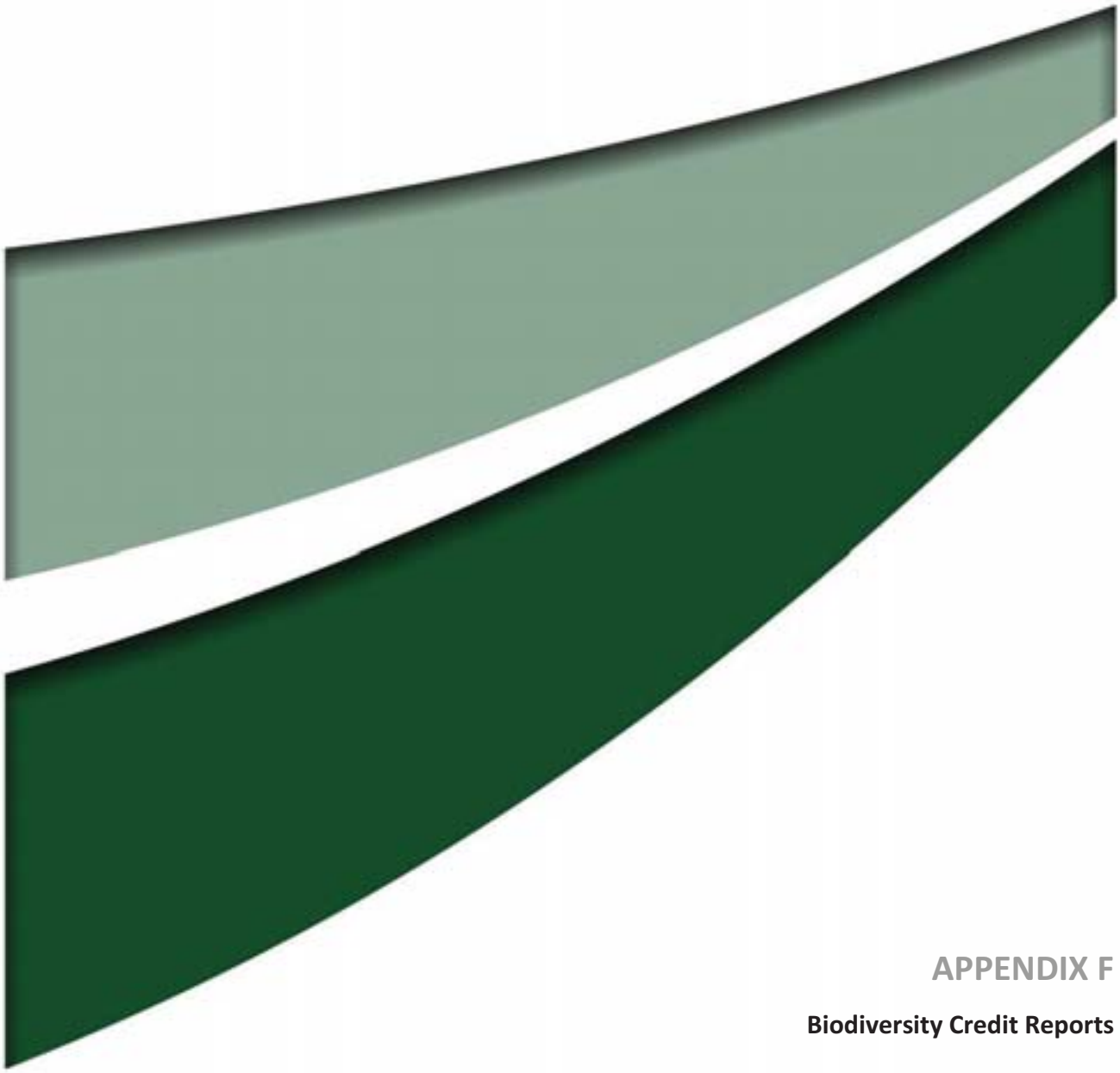
Amphibians recorded were identified using keys and descriptions in Cogger (2014), Robinson (1998), Anstis (2013) and Barker *et al*. (1995) and the scientific and common name nomenclature of Cogger (2014). Mammals recorded were identified using keys and descriptions in Van Dyck and Strahan (2008), and Menkhorst and Knight (2010) and the scientific and common name nomenclature of Van Dyck and Strahan (2008).

Scientific Name	Common Name	TSC Act	EPBC Act
AMPHIBIA			
Myobatrachidae			
Crinia parinsignifera	eastern sign-bearing froglet		
Crinia signifera	common froglet		
Limnodynastes fletcheri	marsh frog		
Limnodynastes tasmaniensis	spotted grass frog		
Hylidae			
Litoria peronii	Peron's tree frog		
AVES			
Podargidae			
Podargus strigoides	tawny frogmouth		
Columbidae			
Ocyphaps lophotes	crested pigeon		
Phaps chalcoptera	common bronzewing		
Alcedinidae			
Dacelo novaeguineae	laughing kookaburra		
Cacatuidae			
Eolophus roseicapillus	galah		

Scientific Name	Common Name	TSC Act	EPBC Act
Nymphicus hollandicus	cockatiel		
Psittacidae			
Barnardius zonarius barnardi	Australian ringneck (barnardi)		
Northiella haematogaster	bluebonnet		
Platycercus eximius	eastern rosella		
Psephotus haematonotus	red-rumped parrot		
Polytelis swainsonii	superb parrot	V	V
Tytonidae			
Tyto alba	eastern barn owl		
Anatidae			
Anas superciliosa	pacific black duck		
Anas gracilis	grey teal		
Ardeidae			
Ardea pacifica	white-necked heron		
Threskiornithidae			
Platalea flavipes	yellow-billed spoonbill		
Plegadis falcinellus	glossy ibis		M
Threskiornis molucca	Australian white ibis		
Threskiornis spinicollis	straw-necked ibis		
Accipitridae			
Milvus migrans	black kite		
Aquila audax	wedge-tailed eagle		
Haliastur sphenurus	whistling kite		
Falconidae			
Falco peregrinus	peregrine falcon		
Falco cenchroides	nankeen kestrel		
Charadriidae			
Erythrogonys cinctus	red-kneed dotterel		
Vanellus miles	masked lapwing		
Recurvirostridae			
Himantopus himantopus	black-winged stilt		
Scolopacidae			
Calidris ruficollis	red-necked stint		M
Tringa stagnatilis	marsh sandpiper		M
Pardalotidae			
Pardalotus striatus	striated pardalote		

Scientific Name	Common Name	TSC Act	EPBC Act
Meliphagidae			
Acanthagenys rufogularis	spiny-cheeked honeyeater		
Lichenostomus penicillatus	white-plumed honeyeater		
Manorina melanocephala	noisy miner		
Philemon corniculatus	noisy friarbird		
Acanthizidae			
Gerygone fusca	western gerygone		
Pomatostomidae			
Pomatostomus superciliosus	white-browed babbler		
Pomatostomus temporalis temporalis	grey-crowned babbler (eastern subsp.)	V	
Artamidae			
Artamus superciliosus	white-browed woodswallow		
Cracticus tibicen	Australian magpie		
Cracticus nigrogularis	pied butcherbird		
Cracticus torquatus	grey butcherbird		
Campephagidae			
Coracina novaehollandiae	black-faced cuckoo-shrike		
Corcoracidae			
Corcorax melanorhamphos	white-winged chough		
Struthidea cinerea	apostlebird		
Corvidae			
Corvus mellori	little raven		
Rhipiduridae			
Rhipidura leucophrys	willie wagtail		
Monarchidae			
Grallina cyanoleuca	magpie-lark		
Maluridae			
Malurus cyaneus	superb fairy-wren		
Megaluridae			
Cincloramphus mathewsi	rufous songlark		
Estrildidae			
Taeniopygia guttata	zebra finch		
Phasianidae			
Coturnix sp.	a quail		

Scientific Name	Common Name	TSC Act	EPBC Act
MAMMALIA			
Macropodidae			
Macropus giganteus	eastern grey kangaroo		
Phalangeridae			
Trichosurus vulpecula	common brushtail possum		
Molossidae			
Mormopterus planiceps	southern freetail-bat		
Vespertilionidae			
Chalinolobus gouldii	Gould's wattled bat		
Chalinolobus morio	chocolate wattled bat		
Scotorepens greyii	little broad-nosed bat		
Vespadelus vulturnus	little forest bat		
Canidae			
**Canis lupus familiaris*	domestic dog		
Leporidae			
**Lepus capensis*	brown hare		
Bovidae			
**Ovis aries*	sheep		



APPENDIX F

Biodiversity Credit Reports

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 21/07/2016 Time: 3:09:04PM Calculator version: v4.0

Major Project details

Proposal ID:	0113/2016/3641MP
Proposal name:	P2N Assessment Area 1 - Lachlan CMA/Lower Slopes IBRA SR
Proposal address:	na Parkes NSW 2870
Proponent name:	ARTC
Proponent address:	
Proponent phone:	na
Assessor name:	Ryan Parsons
Assessor address:	75 York Street TERALBA NSW 2284
Assessor phone:	02 4950 5322
Assessor accreditation:	0113

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	14.74	488.39
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	2.87	152.00
White Cypress Pine woodland on sandy loams in central NSW wheatbelt	0.92	22.00
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion	6.75	255.80
Total	25.28	918

Credit profiles

1. White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218)

Number of ecosystem credits created	152
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA219) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (LA145) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (LA252)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (LA223)

Number of ecosystem credits created	22
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (LA223) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (LA152) Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA153) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (LA162) Mixed Eucalypt woodlands of floodplains in the southern-eastern Cobar Peneplain Bioregion, (LA163) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (LA175) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (LA178) Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194) Yellow Box - River Red Gum tall grassy riverine woodland of NSW South Western Slopes Bioregion and Riverina Bioregion, (LA195)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226)

Number of ecosystem credits created	256
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (LA226) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (LA218) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA219) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (LA145) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (LA252)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154)

Number of ecosystem credits created	488
IBRA sub-region	Lower Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (LA154) Riverine Western Grey Box grassy woodland of the semi-arid (warm) climate zone, (LA194)	Lower Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	18.88	491

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 21/07/2016 Time: 3:11:00PM Calculator version: v4.0

Major Project details

Proposal ID:	0113/2016/3632MP
Proposal name:	P2N Assessment Area 2 - Central West CMA/Lower Slopes IBRA SR
Proposal address:	na Parkes NSW 2870
Proponent name:	ARTC
Proponent address:	
Proponent phone:	na
Assessor name:	Ryan Parsons
Assessor address:	75 York Street TERALBA NSW 2284
Assessor phone:	02 4950 5322
Assessor accreditation:	0113

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	0.23	11.00
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	1.43	67.00
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	0.34	19.00
River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion	1.49	53.97
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	1.54	71.31
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	15.55	443.30
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion	0.70	33.18
White Cypress Pine woodland on sandy loams in central NSW wheatbelt	0.15	3.00
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion	6.97	328.74
Total	28.40	1,031

Credit profiles

1. Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)

Number of ecosystem credits created	67
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112) White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)

Number of ecosystem credits created	443
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)

Number of ecosystem credits created	19
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167) Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213)

Number of ecosystem credits created	33
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138) Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139) White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211) White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226) Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)

Number of ecosystem credits created	3
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172) Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226)

Number of ecosystem credits created	329
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion, (CW226) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138) Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion, (CW139) White Box - Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region, (CW211) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion, (CW213) White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216) Apple Box - Rough-barked Apple terrace flats woodland of the southern Brigalow Belt South Bioregion, (CW231) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)

Number of ecosystem credits created	11
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104) Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion, (CW125) Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains, (CW126)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

8. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)

Number of ecosystem credits created	71
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion, (CW204)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

9. River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)

Number of ecosystem credits created	46
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183) River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (CW181) River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW184) Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in the Brigalow Belt South Bioregion, (CW237) Blakely's Red Gum x Dirty Gum - White Cypress Pine tall riparian woodland, NSW South Western Slopes Bioregion, (CW240)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

10. River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183)

Number of ecosystem credits created	8
IBRA sub-region	Lower Slopes - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Red Gum swampy woodland wetland on cowals (lakes) and associated flood channels in central NSW, (CW181) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion, (CW183) River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW184) Black Tea-tree - River Oak - Wilga riparian low forest/shrubland wetland of rich soil depressions in the Brigalow Belt South Bioregion, (CW237) Blakely's Red Gum x Dirty Gum - White Cypress Pine tall riparian woodland, NSW South Western Slopes Bioregion, (CW240)	Lower Slopes - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 21/07/2016 Time: 3:12:20PM Calculator version: v4.0

Major Project details

Proposal ID:	0113/2016/3640MP
Proposal name:	P2N Assessment Area 3 - Central West CMA/Bogan Macquarie IBRA SR
Proposal address:	na Parkes NSW 2870
Proponent name:	ARTC
Proponent address:	
Proponent phone:	na
Assessor name:	Ryan Parsons
Assessor address:	75 York Street TERALBA NSW 2284
Assessor phone:	02 4950 5322
Assessor accreditation:	0113

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	6.83	331.00
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion	0.07	3.28
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	2.27	95.00
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	1.62	75.01
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	1.77	98.00
White Cypress Pine woodland on sandy loams in central NSW wheatbelt	0.48	13.00
Total	13.04	615

Credit profiles

1. Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138)

Number of ecosystem credits created	3
IBRA sub-region	Bogan-Macquarie - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (CW138) Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (CW112) White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, (CW215) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (CW216) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (CW280)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)

Number of ecosystem credits created	98
IBRA sub-region	Bogan-Macquarie - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172)

Number of ecosystem credits created	95
IBRA sub-region	Bogan-Macquarie - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167) Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220)

Number of ecosystem credits created	13
IBRA sub-region	Bogan-Macquarie - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Cypress Pine woodland on sandy loams in central NSW wheatbelt, (CW220) Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion, (CW144) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions, (CW145) Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW, (CW152) Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW, (CW167) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)., (CW172) Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion, (CW317)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104)

Number of ecosystem credits created	331
IBRA sub-region	Bogan-Macquarie - Central West

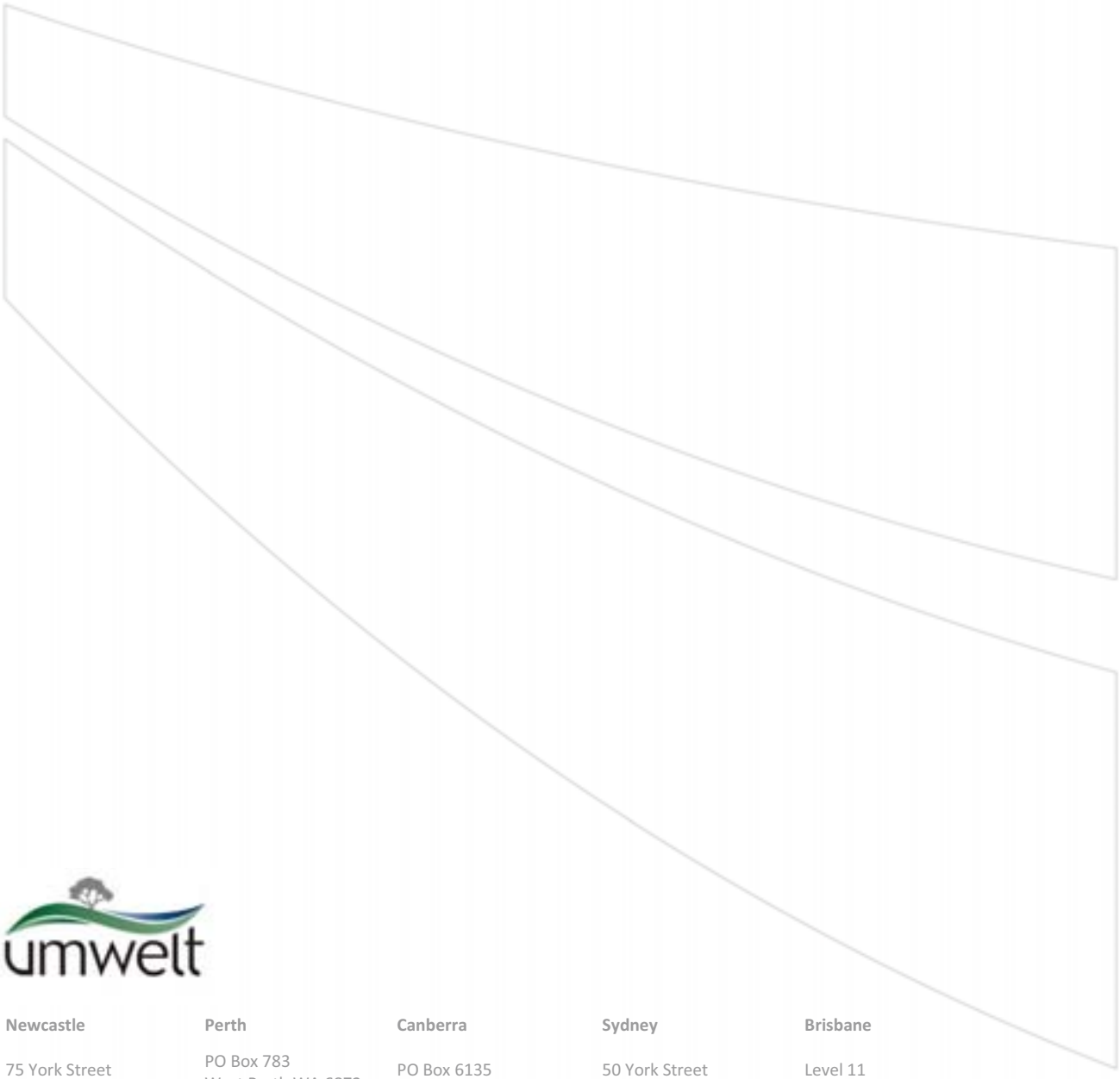
Offset options - Plant Community types	Offset options - IBRA sub-regions
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions, (CW104) Coolabah - River Coobah - Lignum woodland wetland of frequently flooded floodplains mainly in the Darling Riverine Plains Bioregion, (CW125) Coolabah open woodland wetland with chenopod/grassy ground cover on grey and brown clay floodplains, (CW126)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205)

Number of ecosystem credits created	75
IBRA sub-region	Bogan-Macquarie - Central West

Offset options - Plant Community types	Offset options - IBRA sub-regions
Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion, (CW205) Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion, (CW204)	Bogan-Macquarie - Central West and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required



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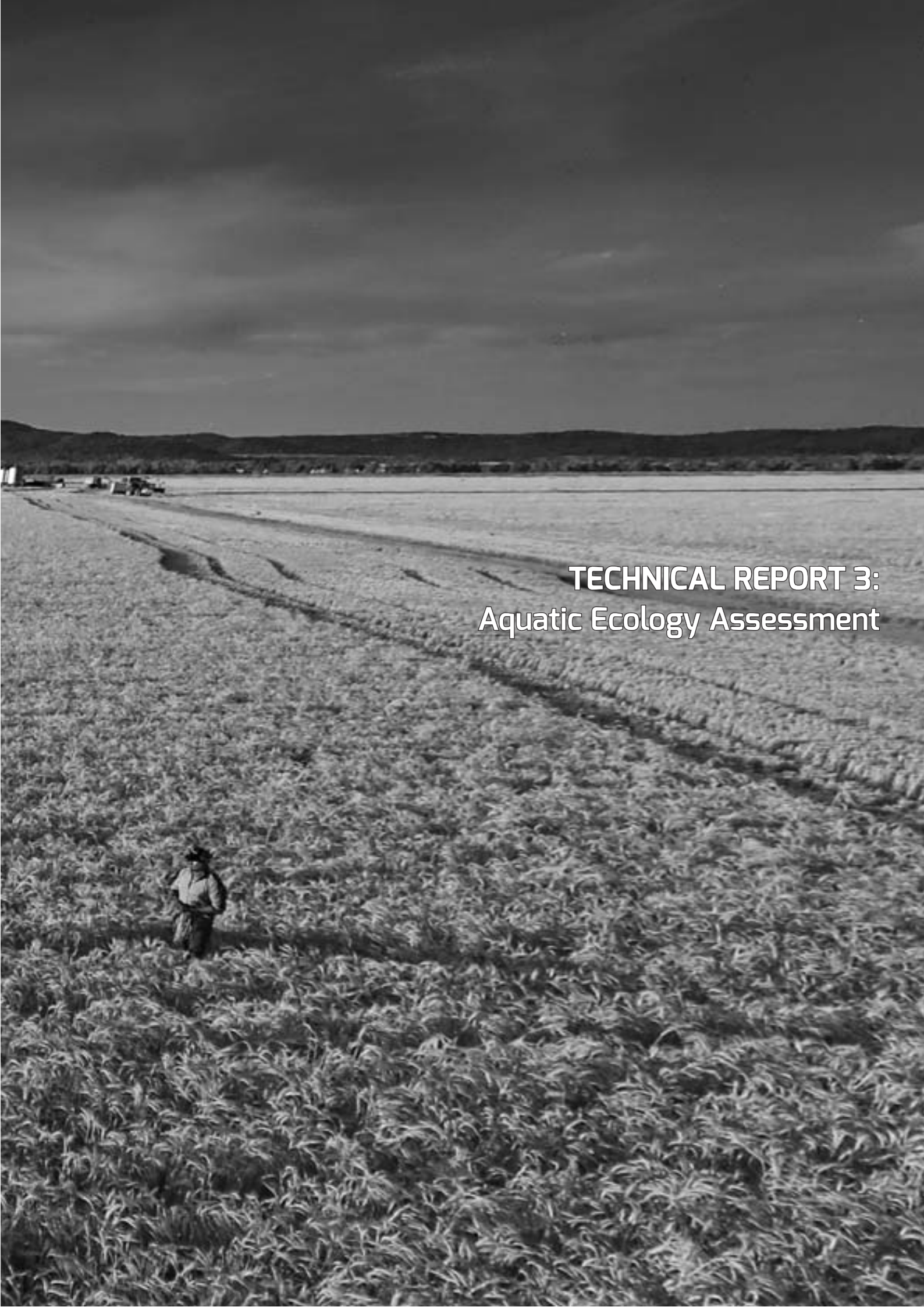

TECHNICAL REPORT 3:
Aquatic Ecology Assessment

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ARTC

INLAND RAIL - PARKES TO NARROMINE

Aquatic Ecology Assessment

June 2017

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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Report No.	3606/R10/V8/Final
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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

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

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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Appendix A	Survey Effort, Vegetation Map and Watercourse
Appendix B	Key Fish Habitat Mapping, Parkes and Narromine LGAs
Appendix C	Protected Matters Search Tool (PMST) report

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**.

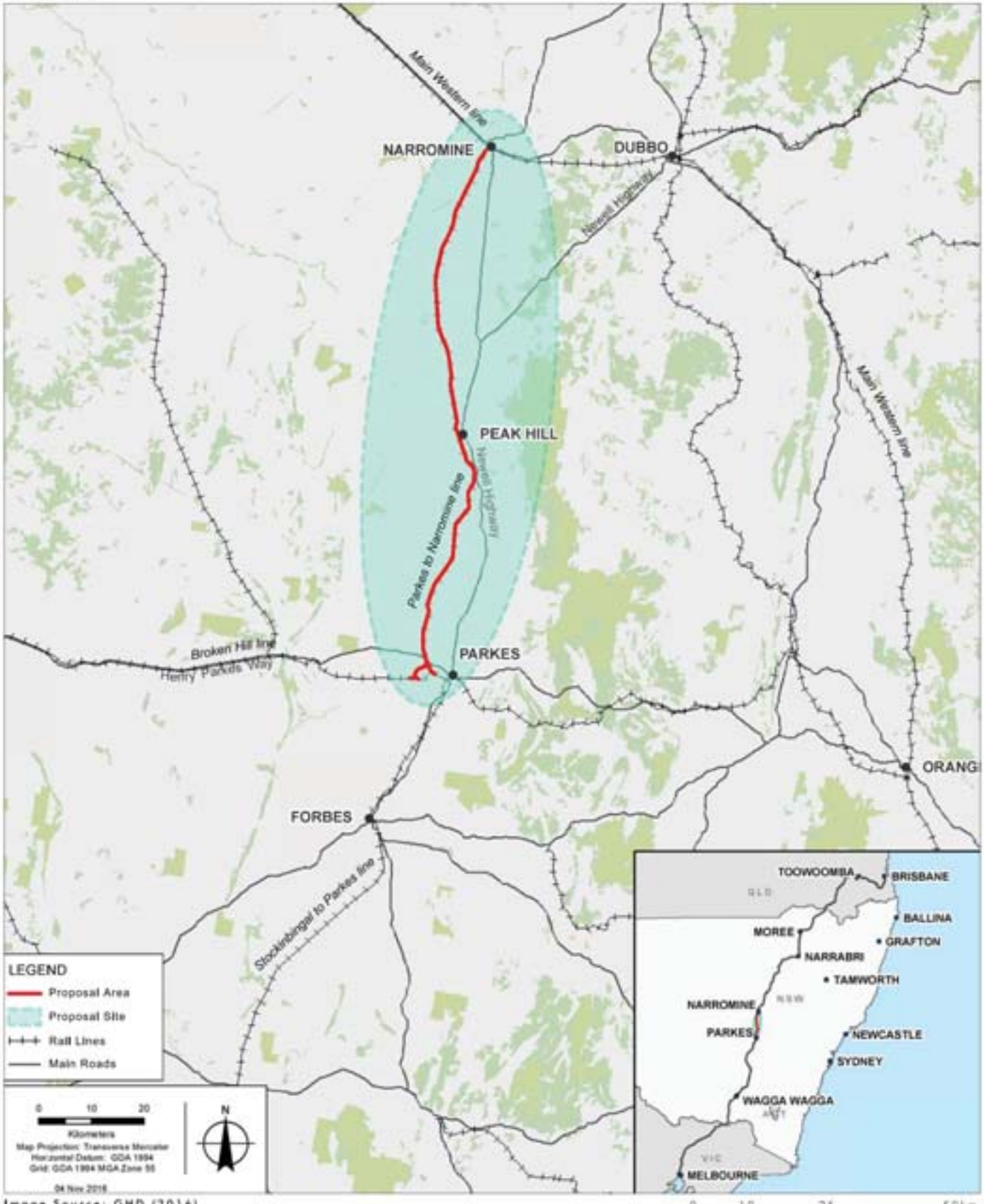

Image Source: GHD (2016)

FIGURE 1.1

Location of the Proposal

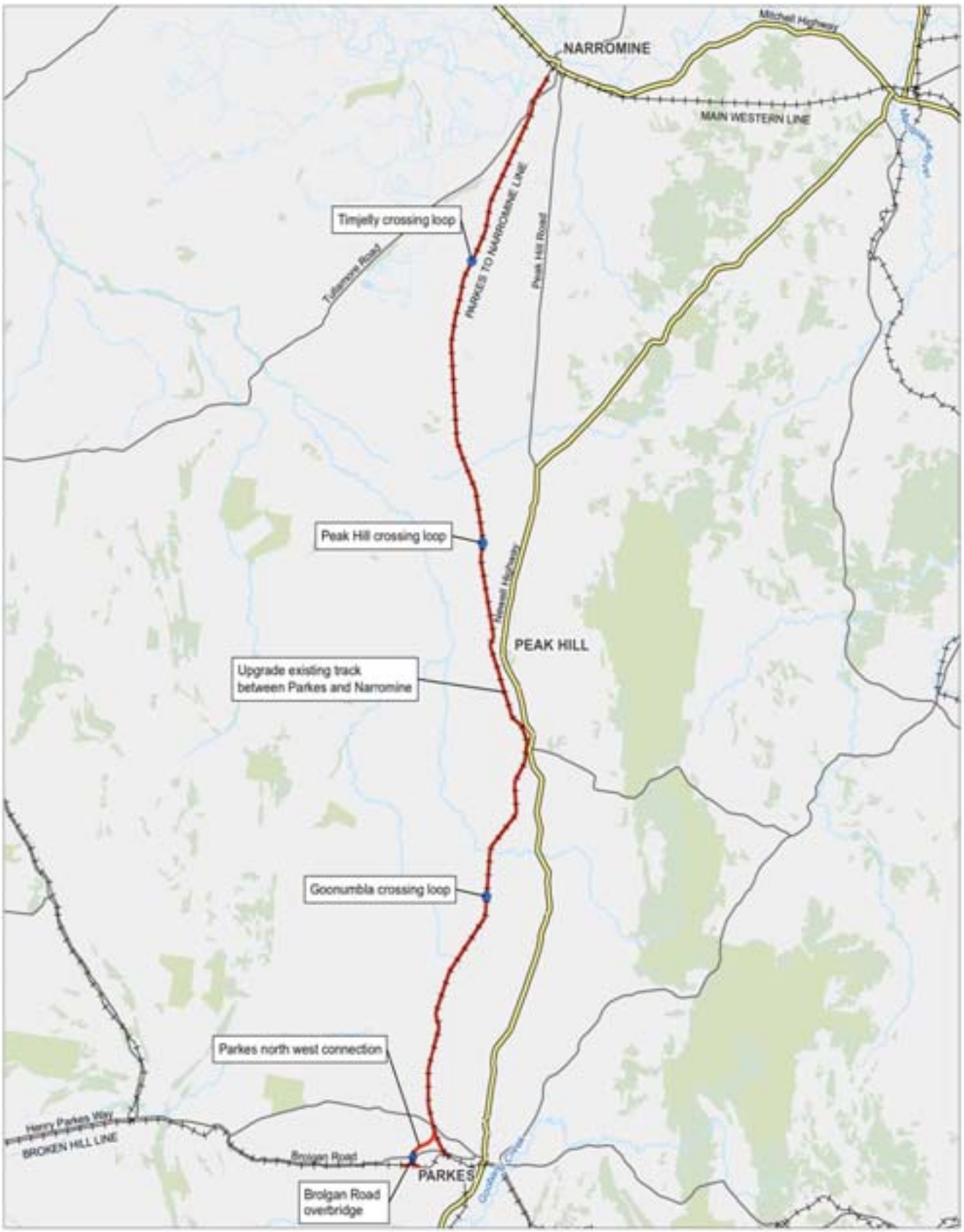

FIGURE 1.2

Key Features of the Proposal

Image Source: GHD (2017)

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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	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.	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 *Threatened Species Conservation Action 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).	Section 4
Guidelines: • 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 • Aquatic Ecology in Environmental Impact Assessment EIA Guideline (Marcus Lincoln Smith 2003).	This report
DPE SEARs – Protected 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 *National Parks and Wildlife Act 1974*; (b) Key Fish Habitat as mapped and defined in accordance with the *Fisheries Management Act 1994* (FM Act); (c) waterfront land as defined in the *Water Management Act 2000*; (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.	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: (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;	Section 4 addresses aspects relevant to aquatic ecology
Guidelines: • Framework for Biodiversity Assessment – Appendix 2 (OEH, 2014) • Risk assessment Guidelines for Groundwater Dependent Ecosystems (Office of Water, 2012).	Section 3 and 4
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

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 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).	This report

Groundwater Dependent Ecosystems
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:
  ○ 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
  ○ the effect on the function of GDEs (habitat, groundwater levels, connectivity).
• Provide safeguard measures for any GDEs.
	Section 3.4

Agency/Key Issue/Requirements for Aquatic Ecology	Where addressed in this report

Watercourses, Wetlands and Riparian Land
 	
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 potentially affected by the Project, including:
 	
• Scaled plans showing the location of:
  ○ wetlands/swamps, watercourses and top of bank;
  ○ riparian corridor widths to be established along the creeks;
  ○ existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  ○ the site boundary, the footprint of the Project in relation to the watercourses and riparian areas; and
  ○ 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.
	Appendix A provides maps of each watercourse.
	
	Descriptions of the watercourse and riparian corridor are provided in **Section 3**.
	
	Impact assessment provided in **Section 4**.

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 **Figure1.1**).

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).

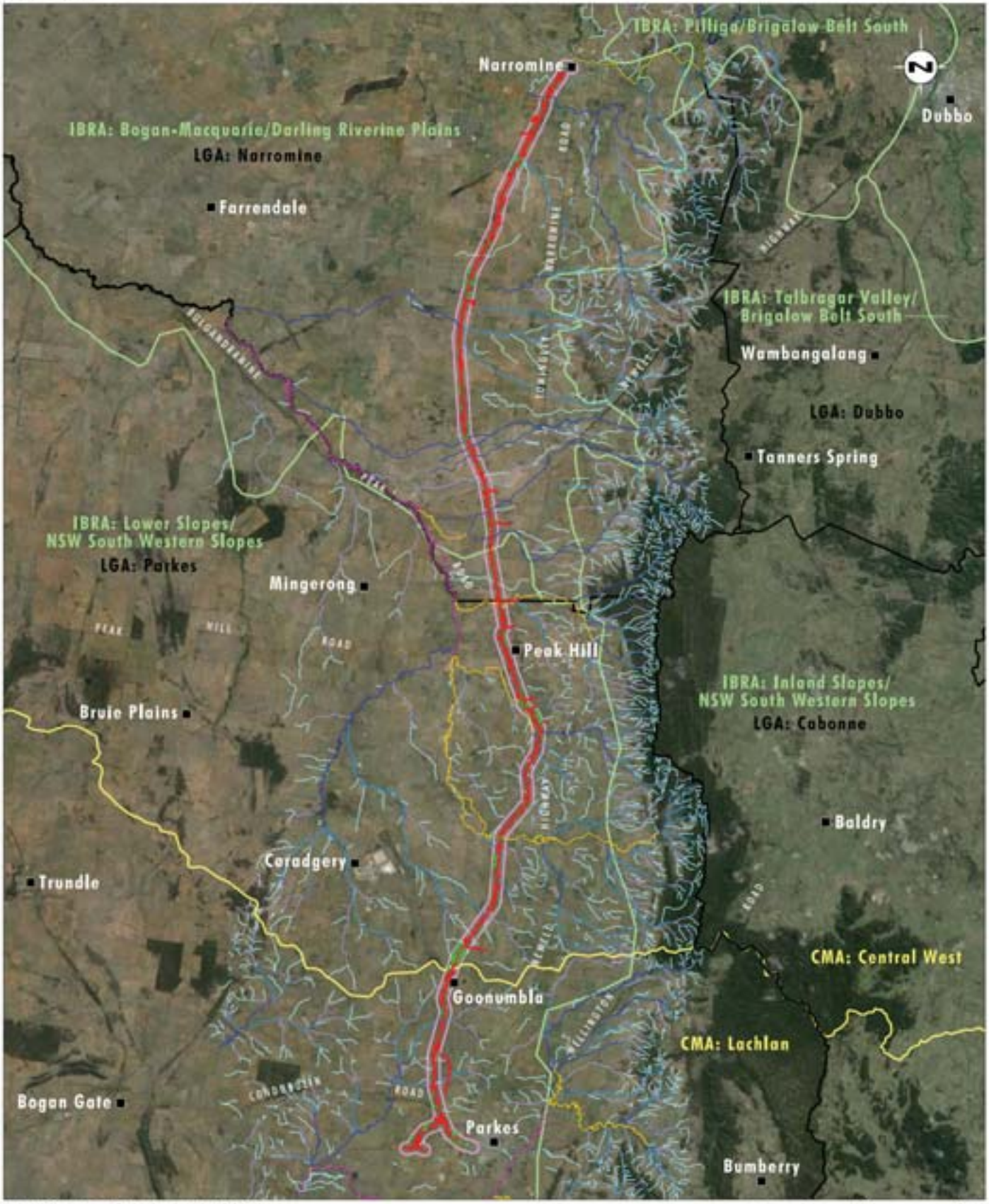

Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

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1:500 000

Legend

- Proposal Area
- 550m Buffer Area
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Native Vegetation Area
- Town Location

Stream Order:
- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order

FIGURE 1.3

Parkes to Narromine Proposal Area

File Name (A4): R10/3606_044.dgn
20170529 11.51

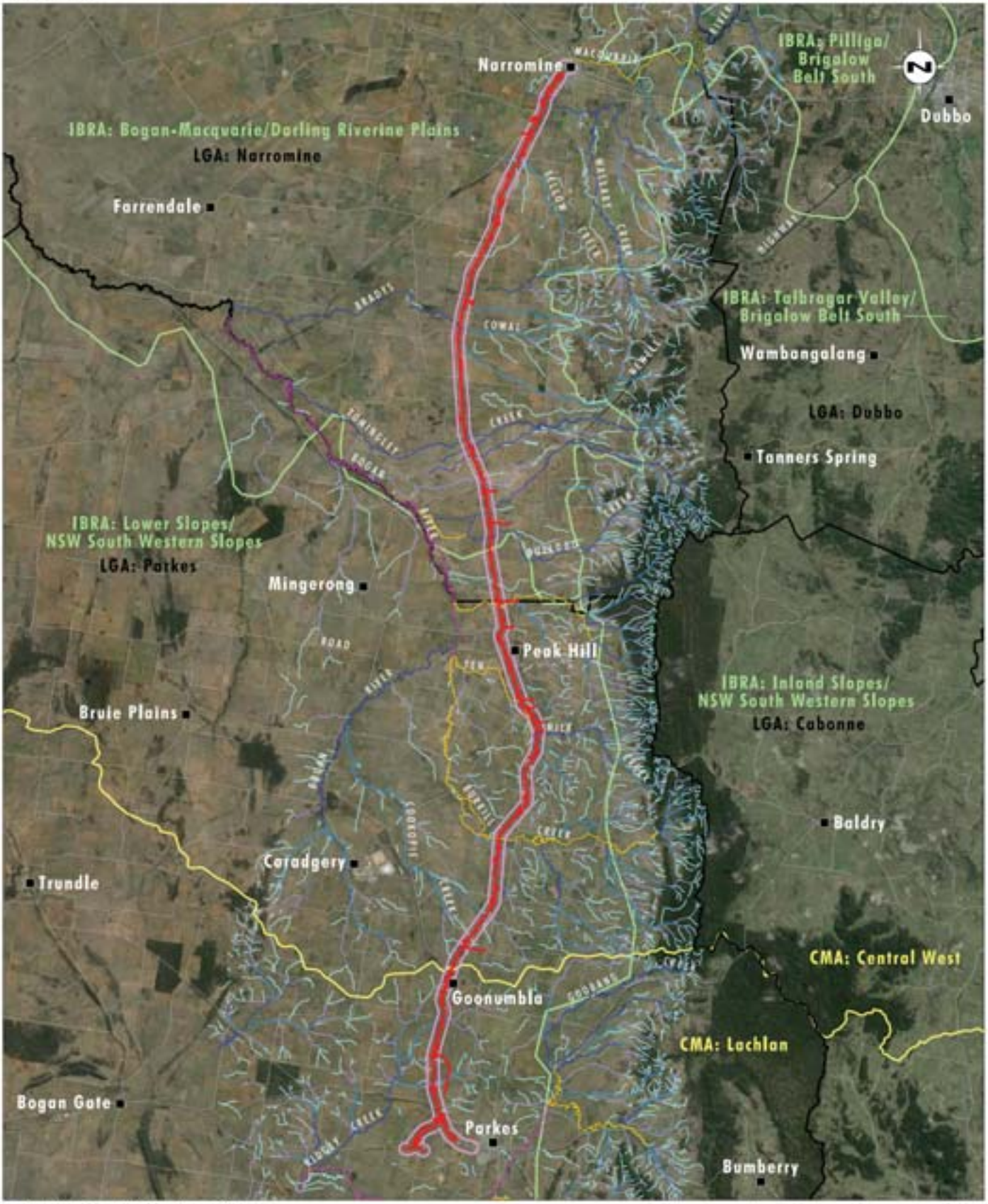

Image Source: Google Earth (2013)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014), Umwelt (2016)

Legend

- Proposal Area
- 550m Buffer Area
- IBRA Regions and Subregion Areas
- Local Government Area
- Catchment Management Authority
- Creek Line
- Town Location

Stream Order:

- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order

FIGURE 1.4

Parkes to Narromine Proposal Area - Watercourses

File Name (A4): R10/3606_045.dgn 20170529 11:52

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

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

KP	Watercourse	Structure	Strahler Order	Catchment Description	Vegetation Mapping in Corridor[1]	Photos
455-455.5	Unnamed	13 corrugated pipes, 24m	Third Order	Flat plain. Tributary of Ridgey Creek. Numerous in-stream dams; agricultural land and cleared land with some scattered trees.	Cleared/Non-native Vegetation, **Figure A3**	
456.992	Unnamed	Pipes	First Order	Flat plain. Tributary of Ridgey Creek. In-stream dams upstream and down; cleared land with some scattered trees upstream.	Cleared/non native vegetation and Zone 15 PCT276 Yellow Box Grassy Tall Woodland – Derived Native Grassland, **Figure A3**.	

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

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

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

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

KP	Watercourse	Structure	Strahler Order	Catchment Description	Vegetation Mapping in Corridor[1]	Photos
479.346	Burrill Creek	Concrete bridge, 40m long	Fifth order	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.	Zone 2 PCT36 River Red Gum Tall to Very Tall Open Forest Woodland, **Figure A9**	Burrill Creek downstream from existing rail corridor   View of crossing structure from upstream.

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

KP	Watercourse	Structure	Strahler Order	Catchment Description	Vegetation Mapping in Corridor[1]	Photos
489.844	Stanfords Creek	20 corrugated pipes over 35m	Fourth order	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.	Cleared/Non-native Vegetation, **Figure A12**	
490.605	Ten Mile Creek	Box culverts, 30m long	Fourth Order	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.	Cleared/Non native vegetation with Zone 11 PCT201 Fuzzy Box Woodland downstream and upstream, **Figure A12**	

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

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

KP	Watercourse	Structure	Strahler Order	Catchment Description	Vegetation Mapping in Corridor[1]	Photos
512.120	Gundong Creek	Corrugated pipes	Fourth order	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.	Cleared/non native vegetation, **Figure A15**	 Erosion evident along Gundong Creek downstream of existing rail corridor
515.011	Unnamed	Timber bridge, 11m long	Second order	Flat plain. In-stream dams upstream and downstream; agricultural land; cleared land.	Cleared/non native vegetation, **Figure A16**	

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

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

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

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

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:
    - freshwater habitats and brackish wetlands, lake and lagoons other than those defined in Type 1 and
    - 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:
    - coastal and freshwater habitats not included in Type 1 or 2
    - 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

KP	Watercourse	Strahler Order	Habitat Sensitivity Type	Classification of Watercourse for Fish Passage	Key Fish Habitat Mapping[1]
Lachlan River 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 River 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

KP	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

Plate 3.2

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

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

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
    - 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		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Threatened Ecological Communities				
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River		EEC	-	*Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River* includes all natural creeks, rivers, streams and 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 (32°50'S; 148°00'E). Tributaries of the 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**).

Scientific Name	Common Name	Legislative Status		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River		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, sandy-muddy 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		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Endangered Populations				
Tandanus tandanus – Eel tailed catfish in the Murray/Darling Basin		E	-	Eel tailed catfish (*Tandanus tandanus*) 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 (*Tandanus tandanus*) 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		E	-	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		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Threatened Fish				
Bidyanus bidyanus	silver perch	V	CE	Silver perch (*Bidyanus bidyanus*) 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 (*Bidyanus bidyanus*)has been recorded in the Macquarie River upstream of Narromine in 2006 (records viewer accessed May 2016). Green *et al* (2011a) note that the silver perch (*Bidyanus bidyanus*) has been the subject of conservation stocking programs in the Macquarie-Bogan catchment. Given habitat preferences, the silver perch (*Bidyanus bidyanus*) is not expected to occur in the watercourses within the proposal area and no further assessment is required.

Scientific Name	Common Name	Legislative Status		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Maccullochella macquariensis	trout cod	E	E	The natural distribution and abundance of trout cod (*Maccullochella macquariensis*) 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 (*Maccullochella macquariensis*) 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 (*Maccullochella macquariensis*) 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	Legislative Status		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Maccullochella peelii	Murray cod	-	V	Murray cod (*Maccullochella peelii*) 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 (*Maccullochella peelii*) 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 (*Maccullochella peelii*) it is not expected to occur in the watercourses within the proposal area. No further assessment required.
Macquaria australasica	Macquarie perch	E	E	Macquarie perch (*Macquaria australasica*) 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		Habitat Requirements and Likelihood to Occur in the Proposal Area
		FM Act	EPBC Act	
Mogurnda adspersa	purple spotted gudgeon	E	-	Purple spotted gudgeon (*Mogurnda adspersa*) 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	CE	-	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 (*Notopala sublineata*) 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

Seven Part Test of Significance	Assessment
a) 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
b) 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
c) 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 *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River* in the Bogan River catchment as defined by the determination, downstream from Peak Hill (32°50'S; 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 locality. The proposal area between Parkes and Goonumbla intersects the *Aquatic 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	Assessment
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and	Priority action statements for Lowland Darling River and Lowland Lachlan River include following recovery actions: • 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.

Seven Part Test of Significance	Assessment
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	The proposal may contribute to the following key threatening processes: • 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.

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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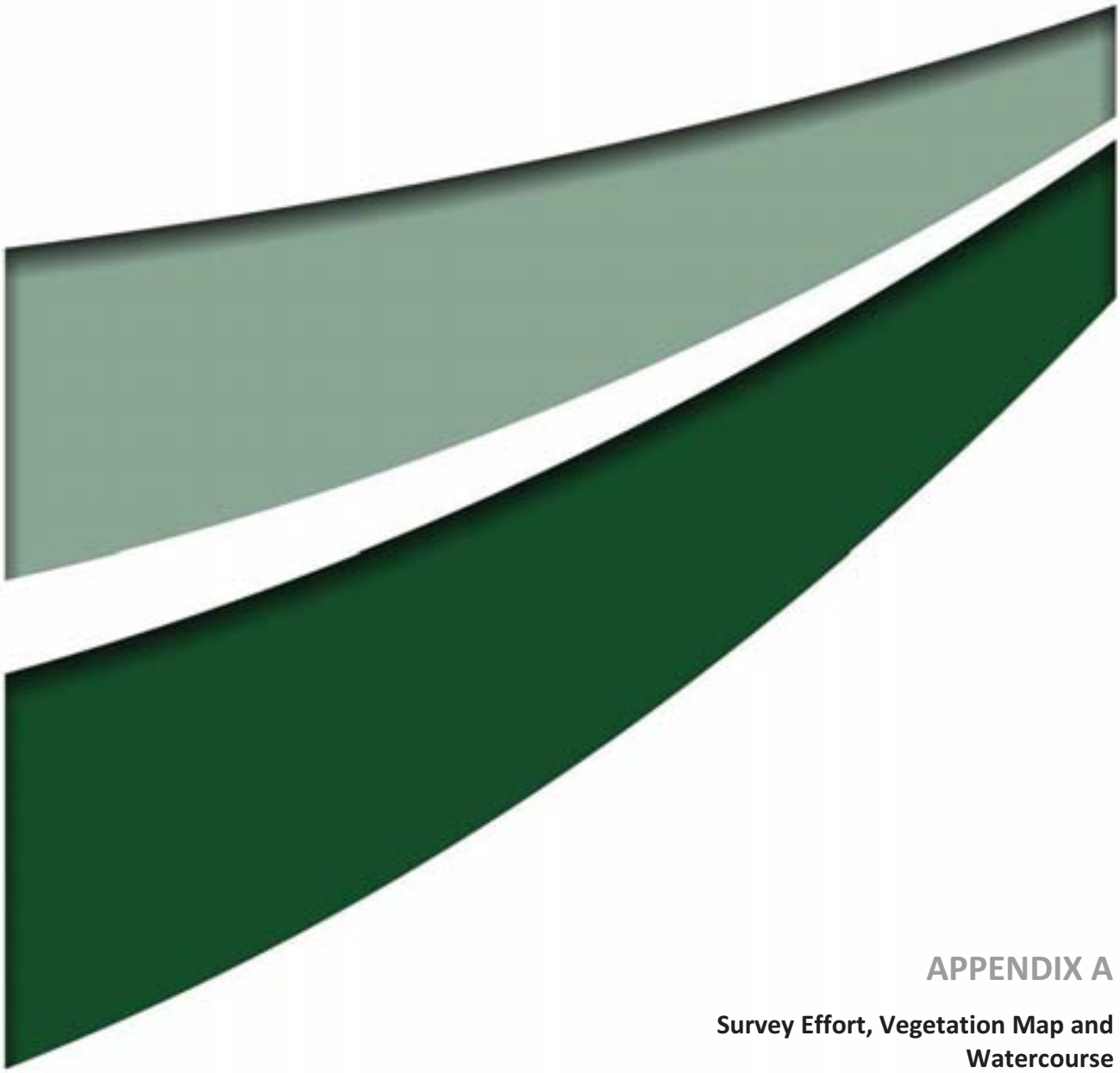

APPENDIX A

Survey Effort, Vegetation Map and Watercourse

Legend

- Proposal Area
- Local Government Area
- Culvert
- Bridge
- Native Vegetation Area
- Plot/Transect
- Rapid Assessment

Stream Order:

- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order

Vegetation:

- Native Vegetation Area
- 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

Appendix A Figures
A1 - A21 Legend

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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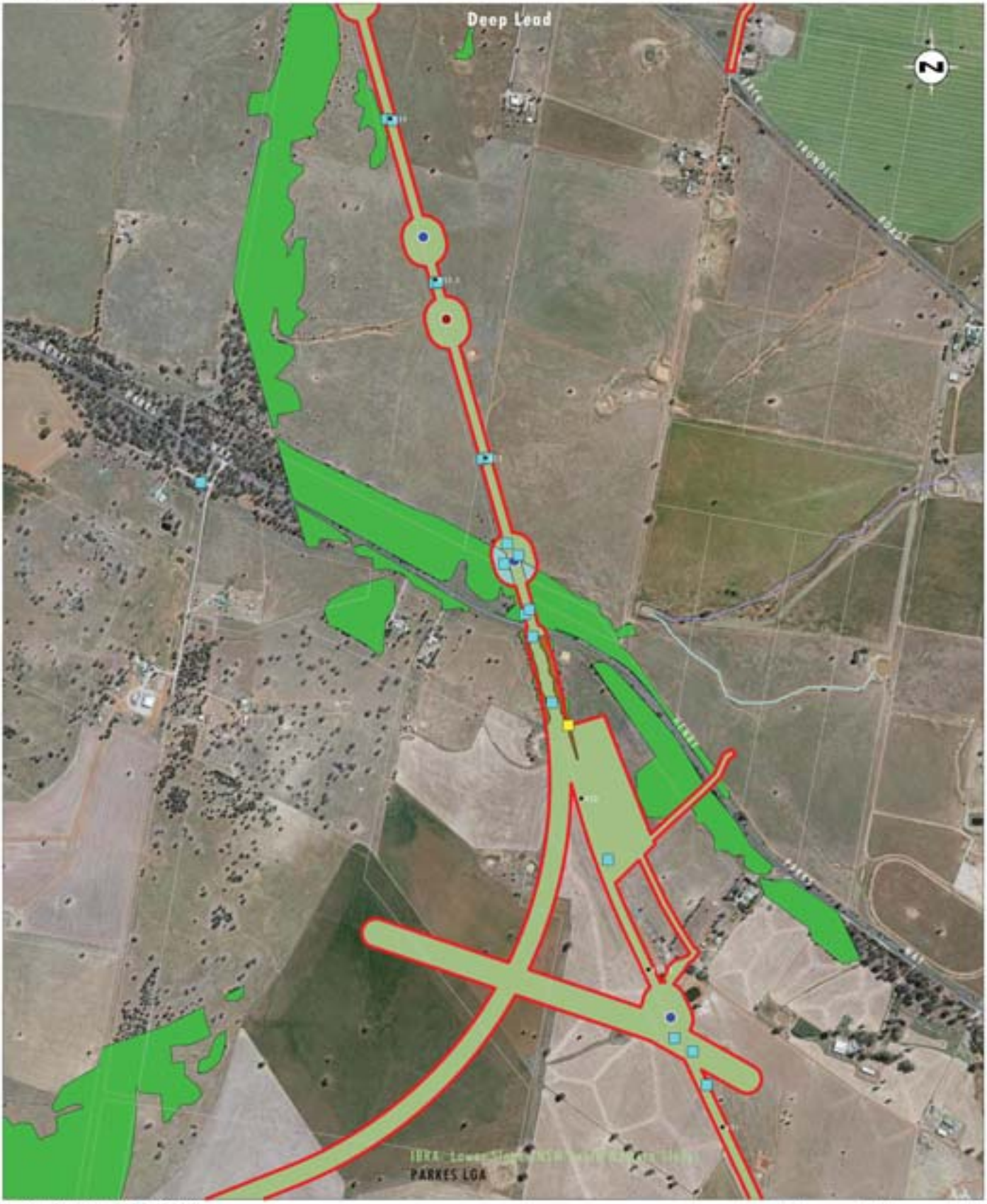
Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A1

Vegetation Map, Landscape Assessment and Watercourses



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Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A2

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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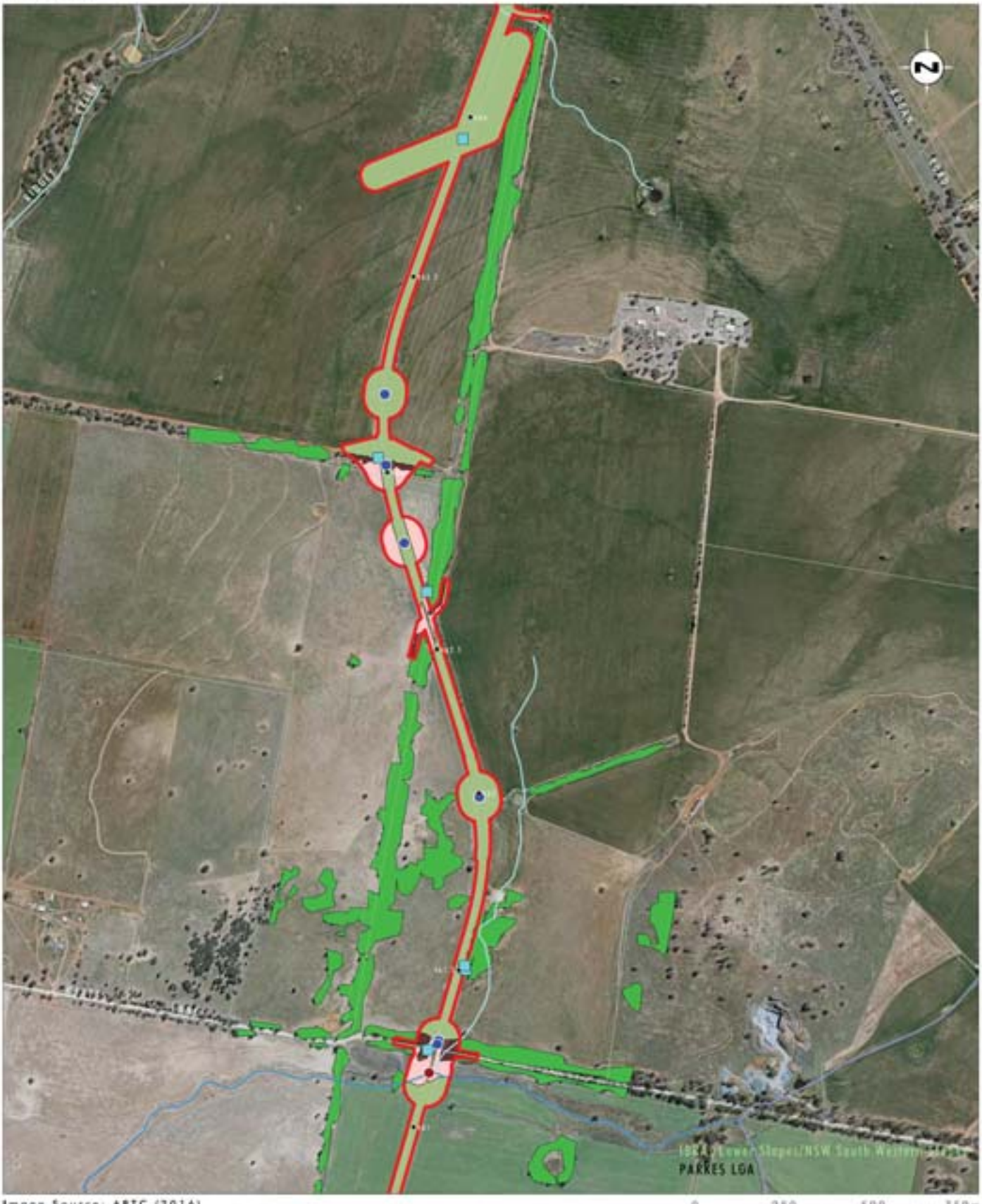
Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A3

Vegetation Map, Landscape Assessment and Watercourses



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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A4

Vegetation Map, Landscape Assessment and Watercourses

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Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A5

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A6

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A7

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A8

Vegetation Map, Landscape Assessment and Watercourses

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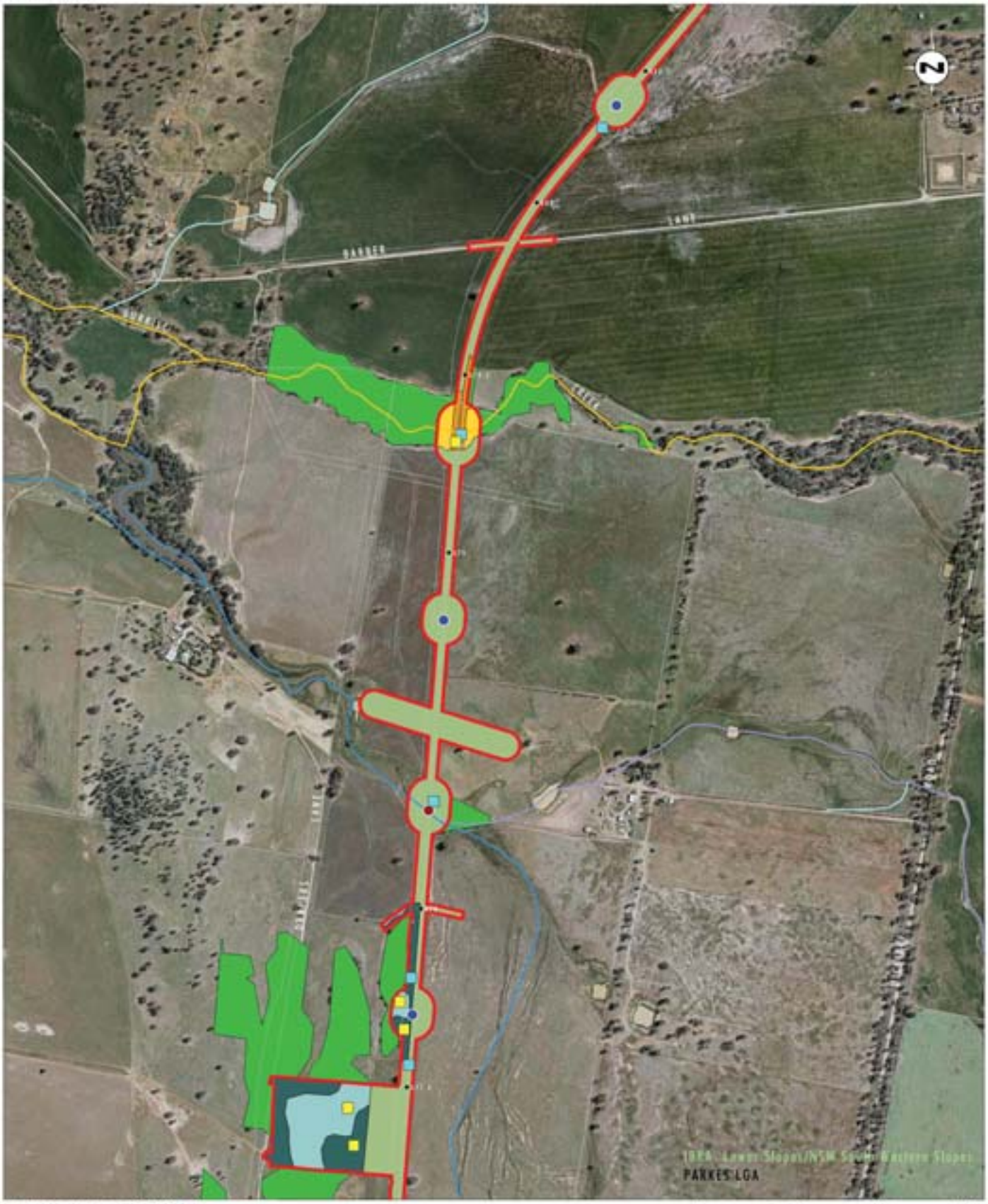

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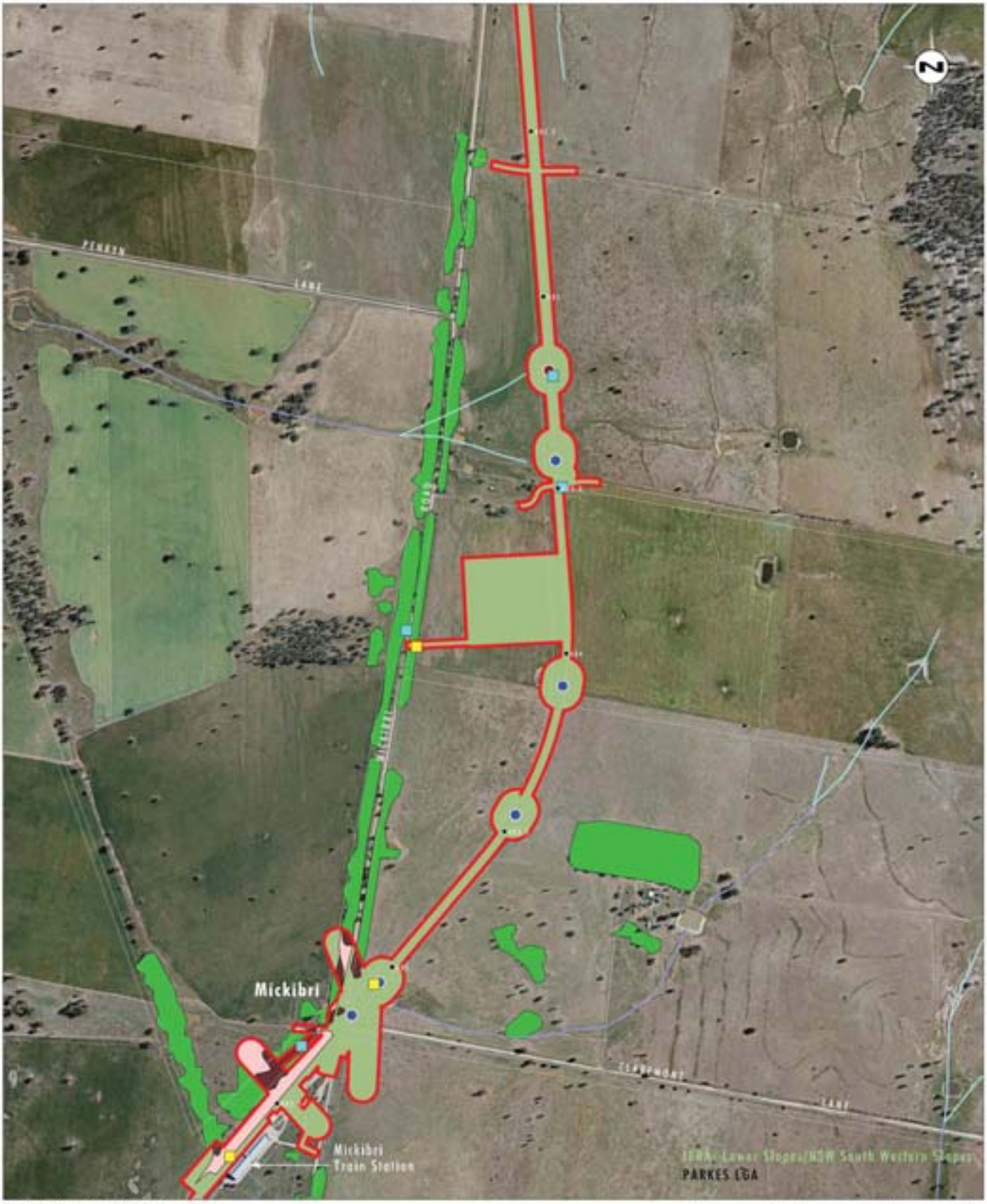
Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A9

Vegetation Map, Landscape Assessment and Watercourses



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Data Source: ARTC (2016), Umwelt (2016)
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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A10

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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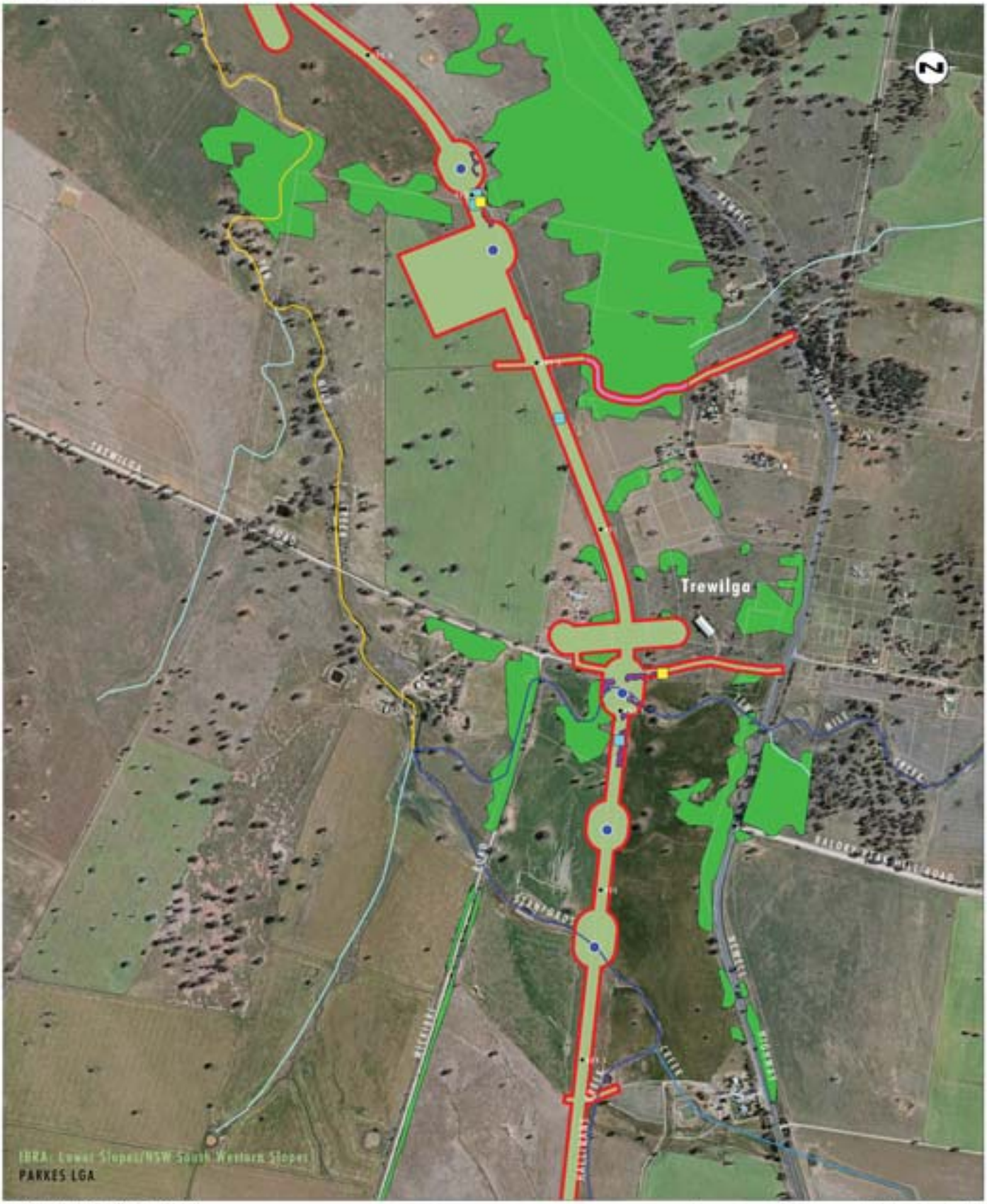
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A11

Vegetation Map, Landscape Assessment and Watercourses



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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A12

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A13

Vegetation Map, Landscape Assessment and Watercourses

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Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

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Legend

- Proposal Area
- Local Government Area
- Rail Line Kilometerage

FIGURE A14

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A15

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A16

Vegetation Map, Landscape Assessment and Watercourses

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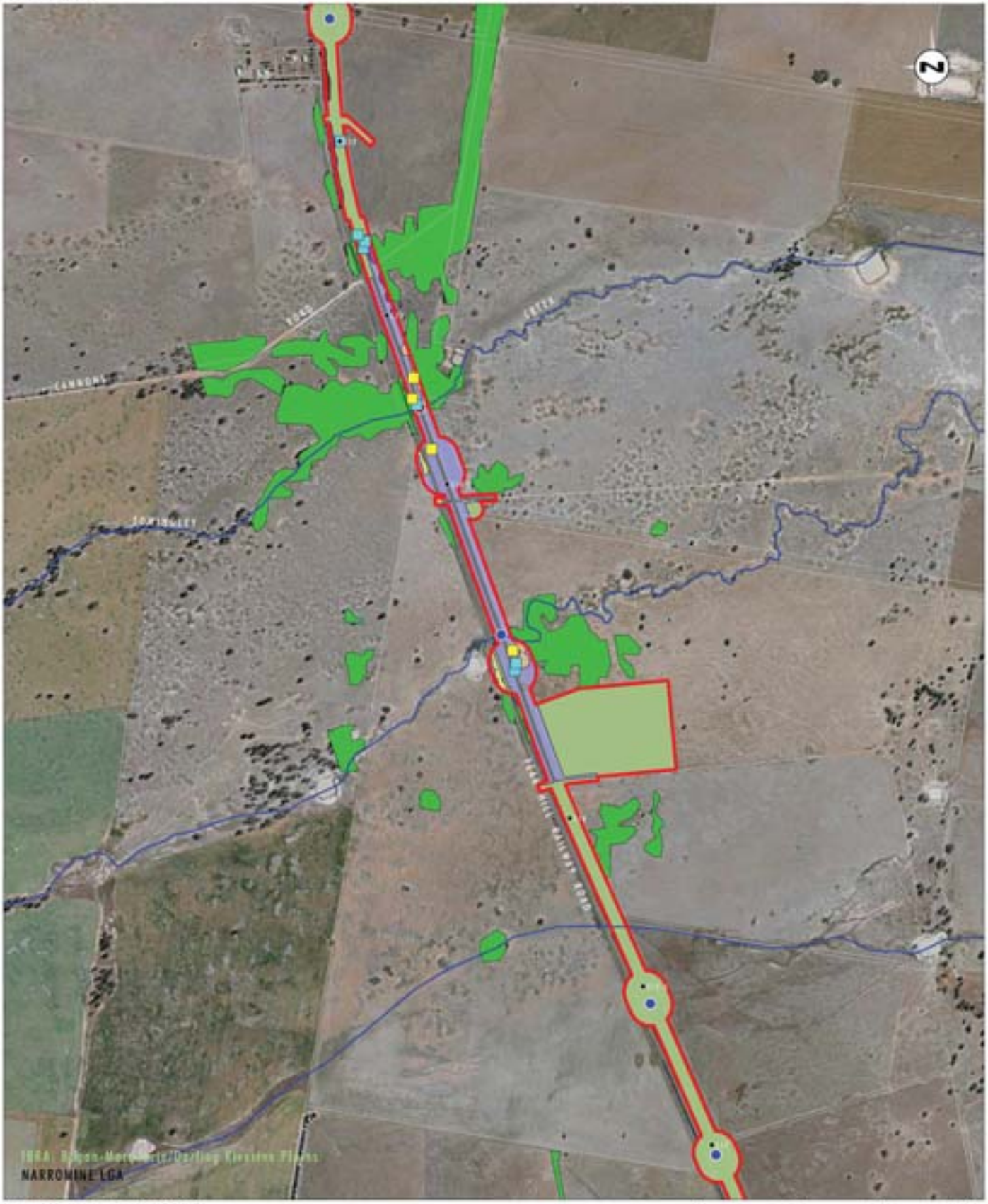


Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A17

Vegetation Map, Landscape Assessment and Watercourses

Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A18

Vegetation Map, Landscape Assessment and Watercourses

File Name (A4): R10/3606_063.dgn
20161122 14:56

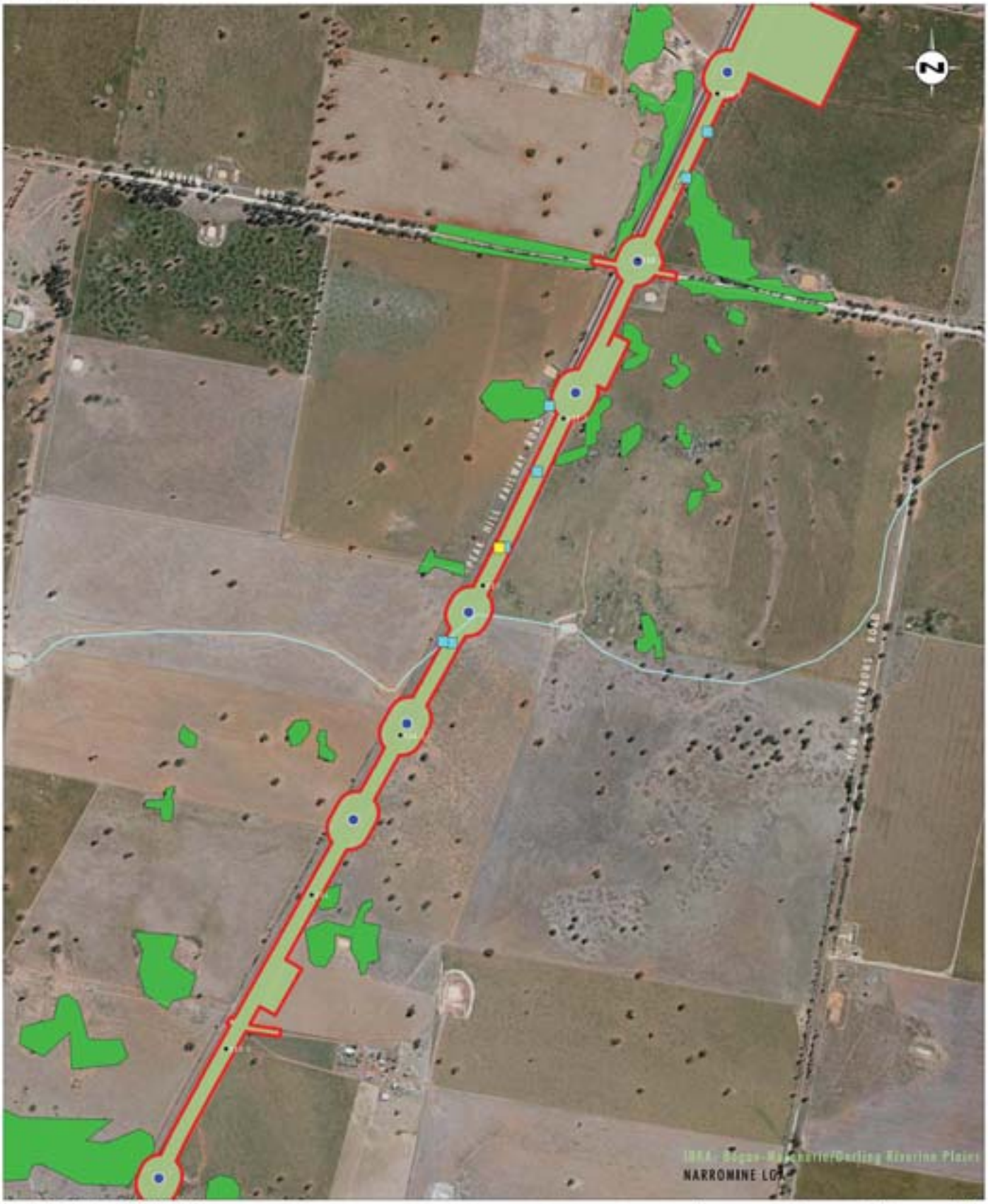


Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A19

Vegetation Map, Landscape Assessment and Watercourses

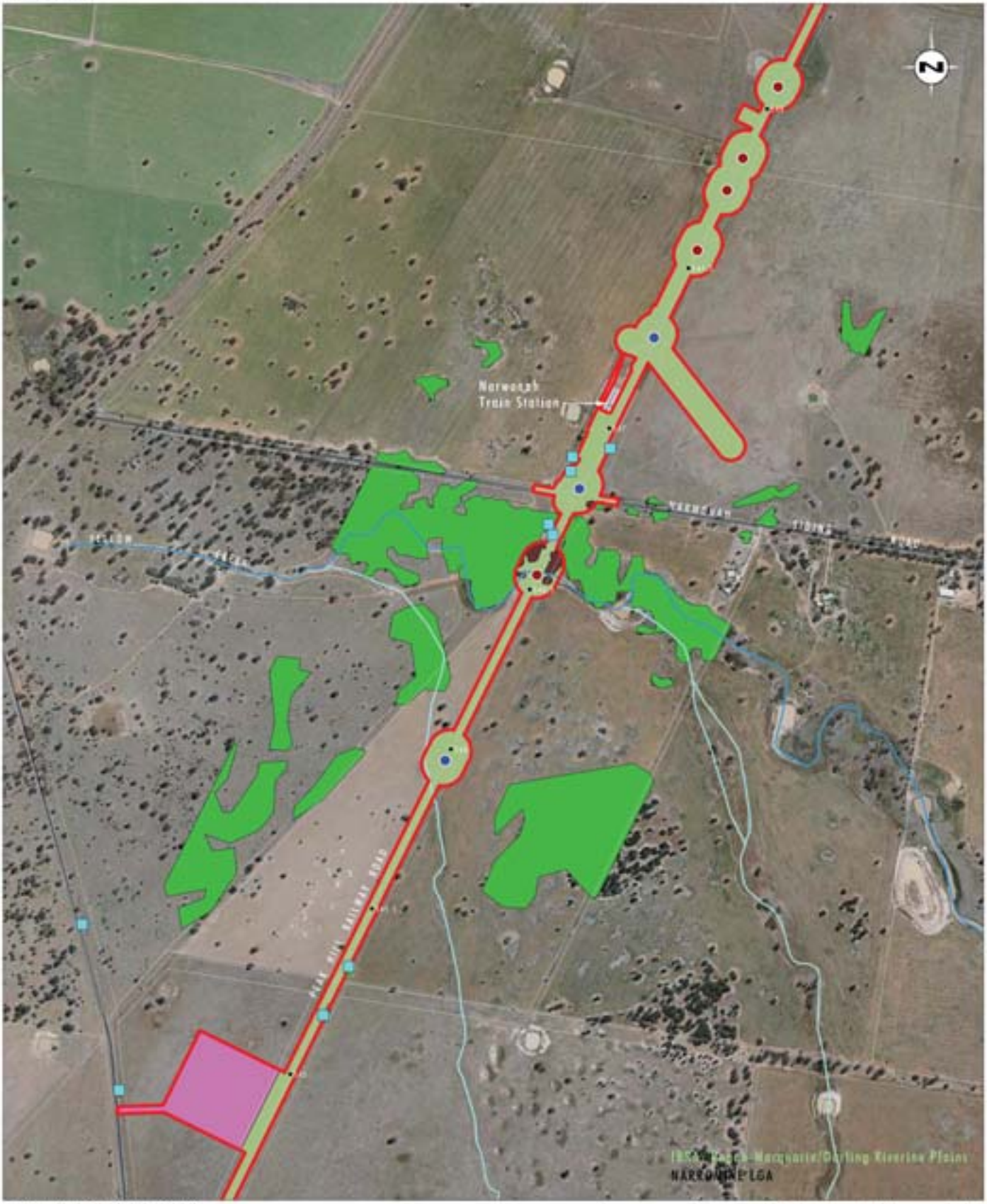


Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

FIGURE A20

Vegetation Map, Landscape Assessment and Watercourses

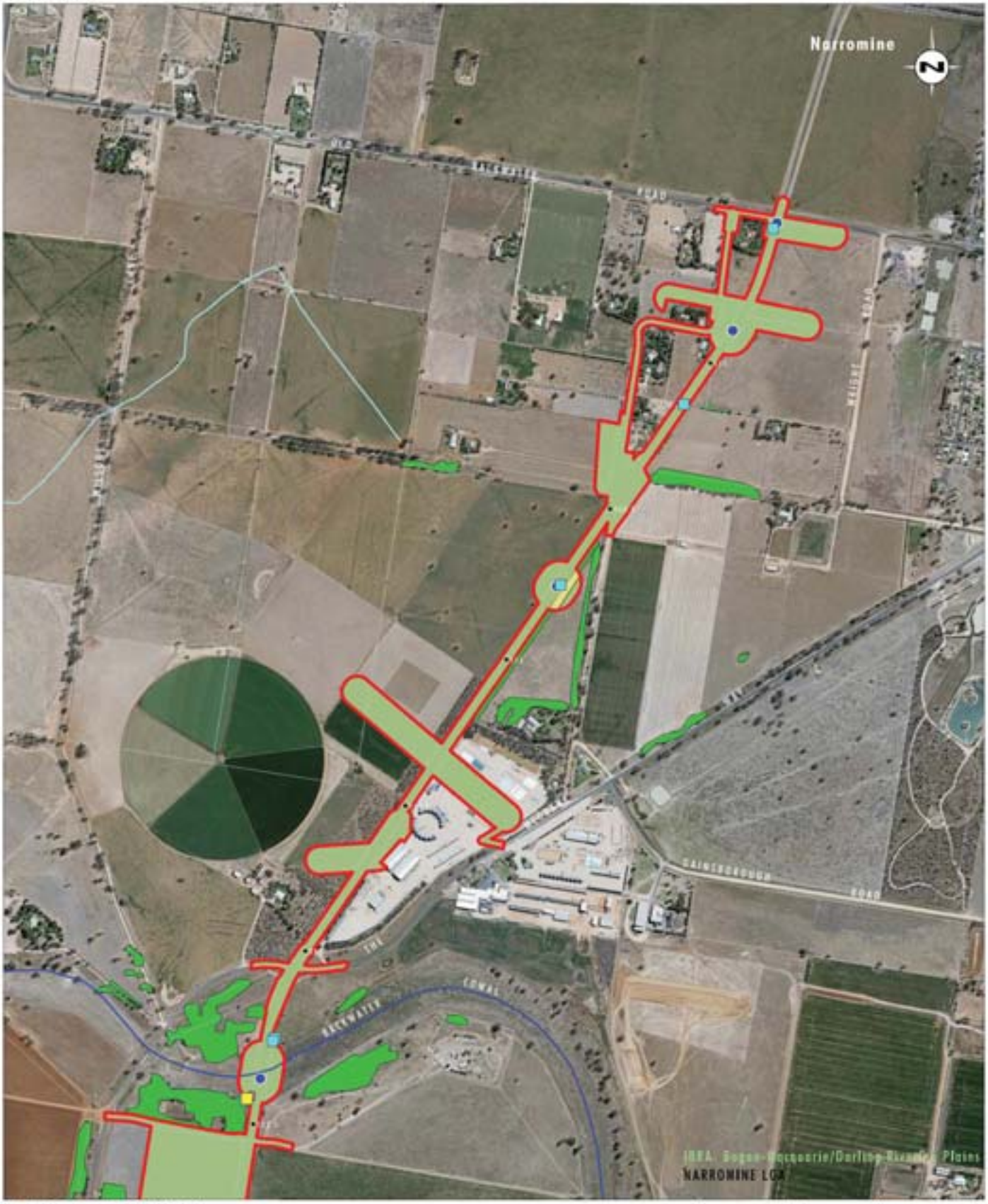


Image Source: ARTC (2016)
Data Source: ARTC (2016), Umwelt (2016)
Note: For full legend, refer to legend page

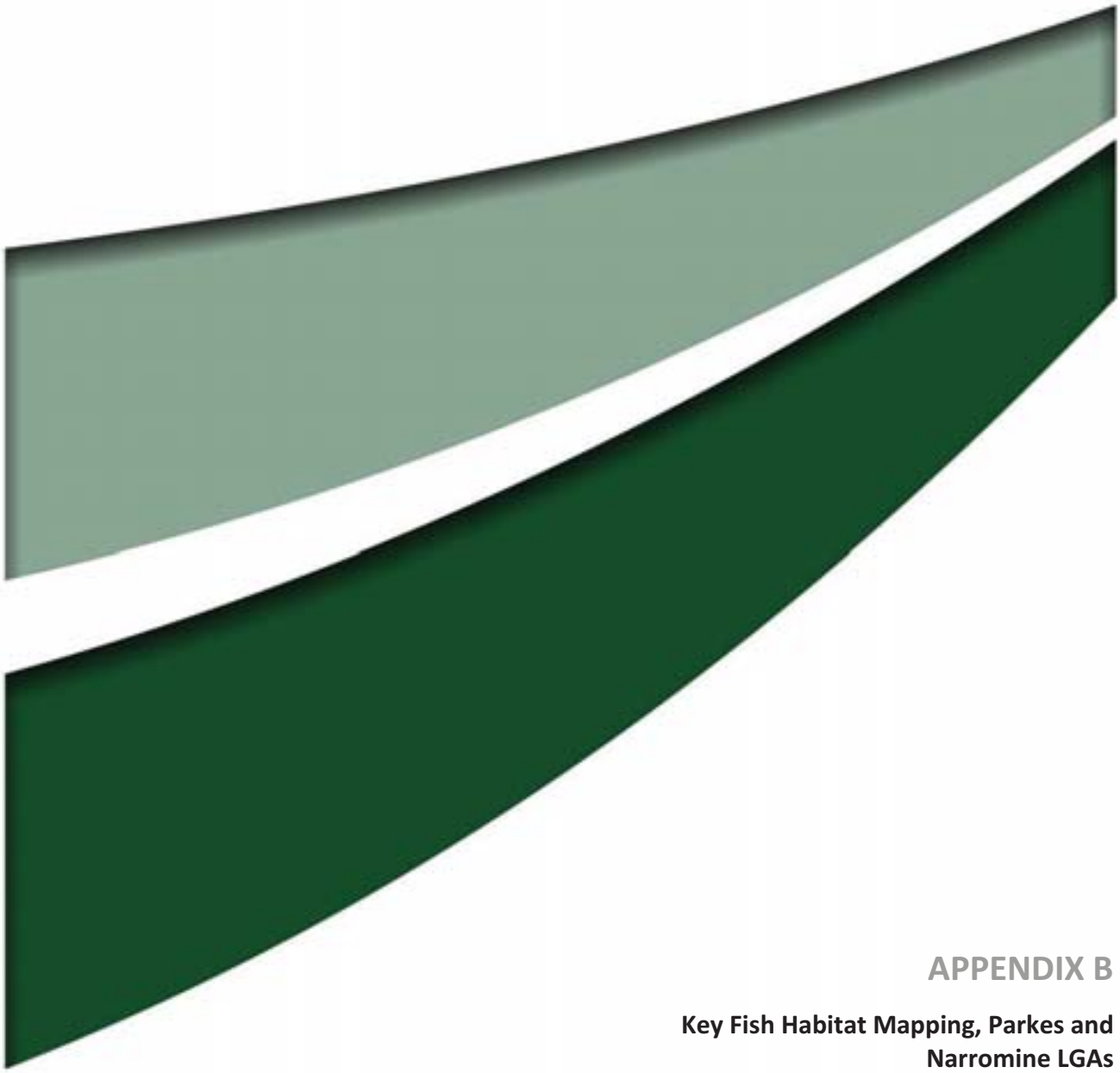
0 250 500 750m
1:15 000

Legend

- Proposal Area
- Rail Line Kilometerage

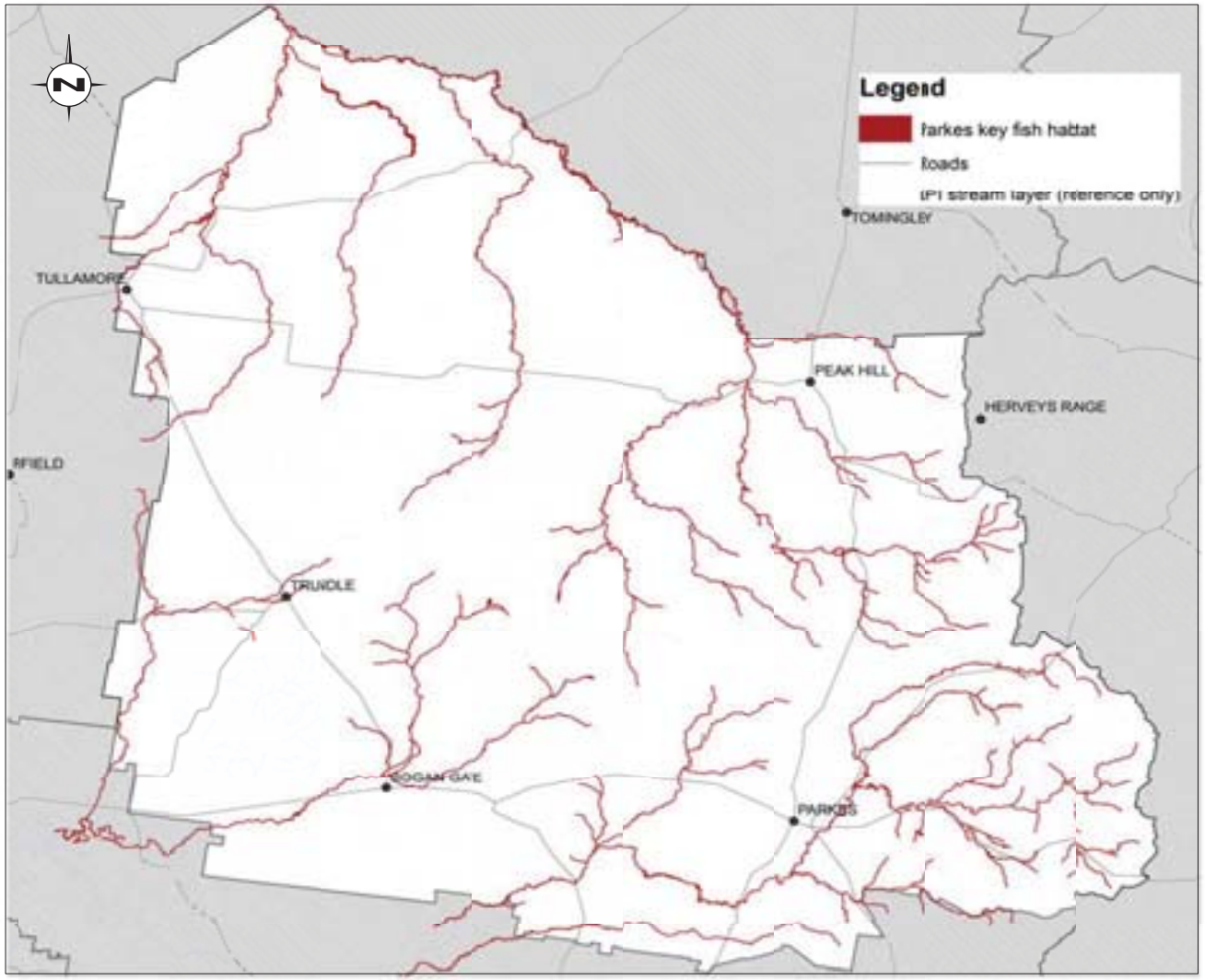
FIGURE A21

Vegetation Map, Landscape Assessment and Watercourses



APPENDIX B

Key Fish Habitat Mapping, Parkes and Narromine LGAs



APPENDIX B1

Key Fish Habitat Mapping
Parkes LGA

0 10 20 30km
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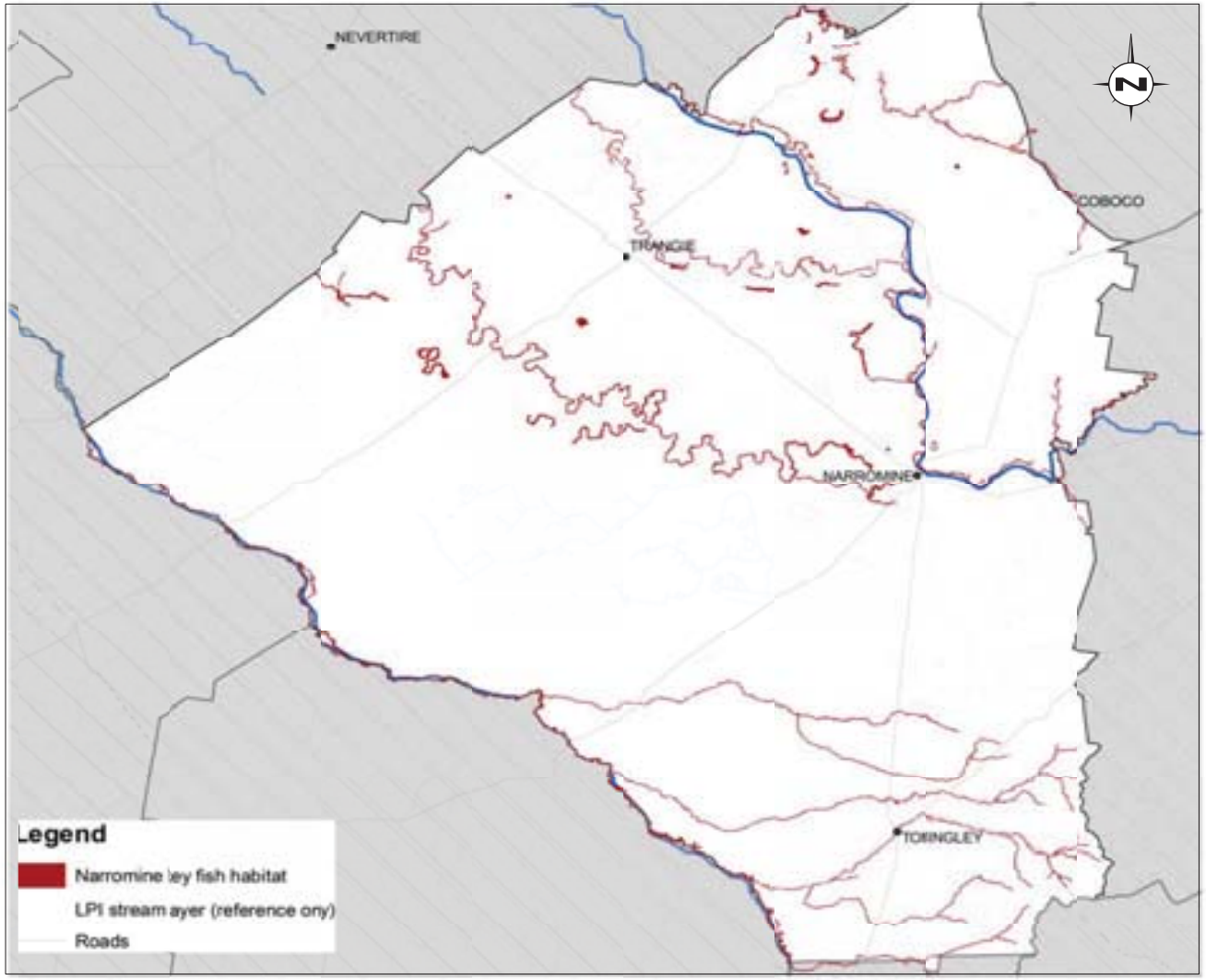
Image Source: Department of Primary Industry, NSW

File Name (A4): R10/3606_079.dgn
20140214 9.05



APPENDIX B2

Key Fish Habitat Mapping
Narromine LGA

0 10 20 30km
1:700 000

Image Source: Department of Primary Industry, NSW

File Name (A4): R10/3606_078.dgn
20140214 9.05

APPENDIX C

Protected Matters Search Tool (PMST) report

Australian Government
Department of the Environment

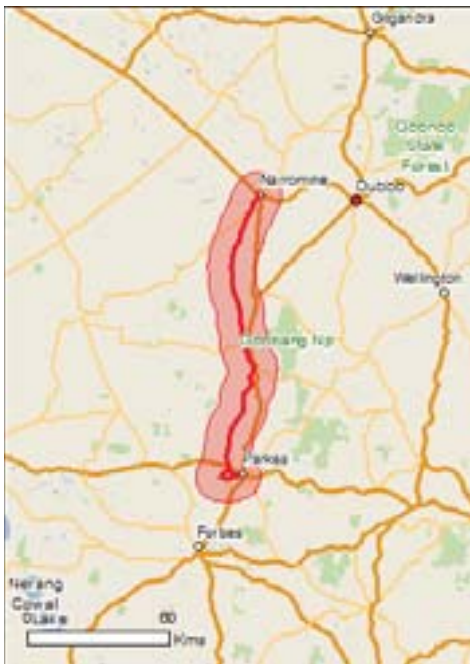
EPBC Act Protected Matters Report

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 Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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



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 Administrative Guidelines on Significance.

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 permit 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.		
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 Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Rostratula australis		
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, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	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 [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
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 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
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.

Name	Threatened	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
Lathamus discolor 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 Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana 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 likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat 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 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, Trompillo [12323]		Species or species habitat likely to occur within area

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

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-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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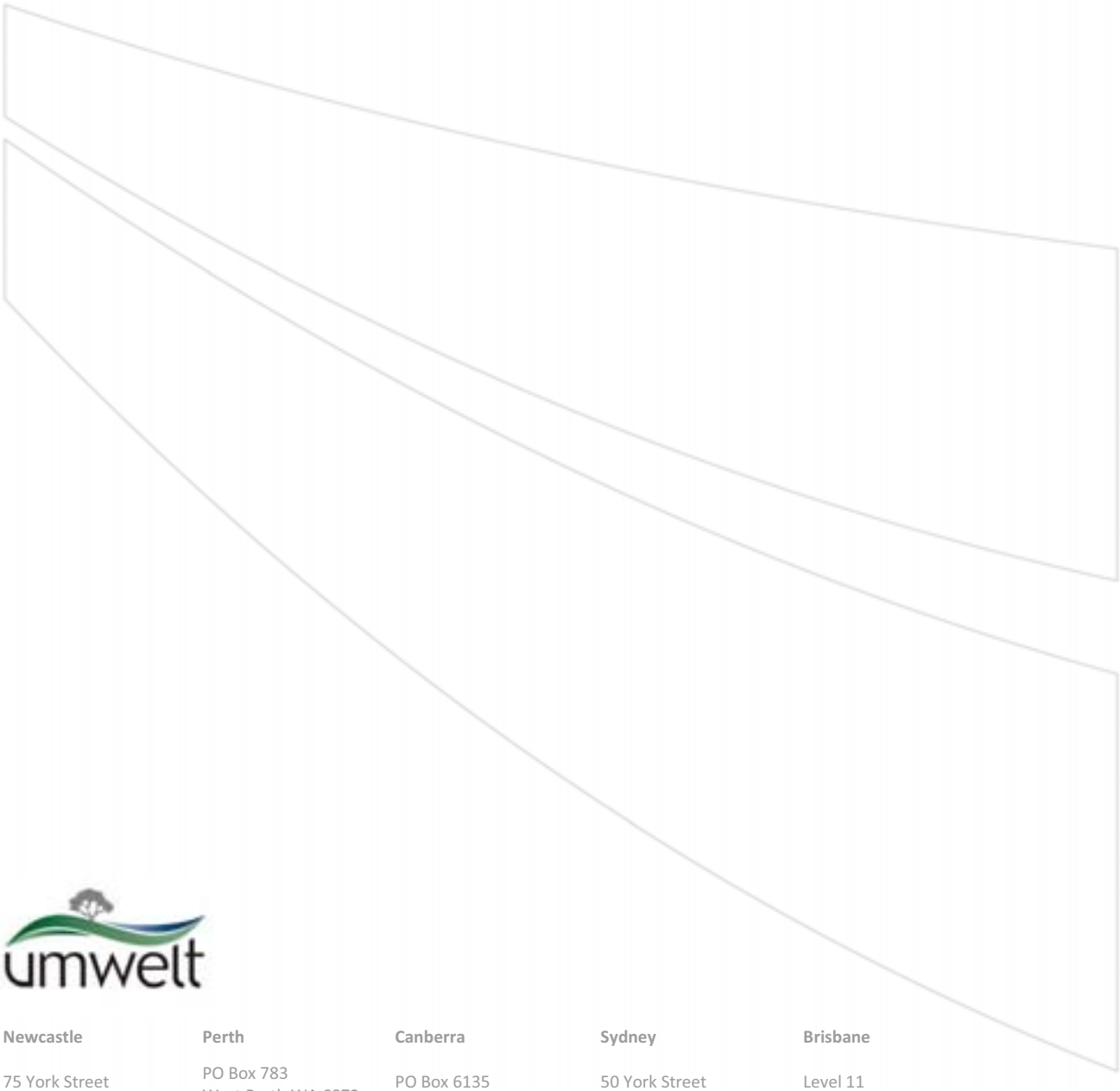

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ARTC

INLAND RAIL – PARKES TO NARROMINE

Commonwealth Matters Assessment

FINAL

June 2017

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Commonwealth Matters Assessment

FINAL

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on behalf of
Australian Rail Track Corporation

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Glossary

ARTC	Australian Rail Track Corporation
BAR	Biodiversity Assessment Report
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CMA Subregion	Catchment Management Authority Subregion
DoEE	Commonwealth Department of the Environment and Energy
DPI	Department of Primary Industries
EEC	Endangered Ecological Community
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*
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
KP	Kilometre point (rail line kilometrage)
LGA	Local Government Area
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 site	The area of impact within the proposal boundary.
proposal area	The total construction impact zone associated with the proposal which incorporates both permanent and temporary disturbance. The proposal area corresponds to the Development Site as described in the Biodiversity Assessment Report (Umwelt 2017a) and as shown on Figures in Section 3.0
SPRAT	Species Profile and Threats Database (Commonwealth)
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

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1.0 Introduction

This report has been prepared on behalf of the Australian Rail Track Corporation Ltd (ARTC) by Umwelt (Australia) Pty Limited (Umwelt) and provides an assessment of the Parkes to Narromine section of Inland Rail in relation to commonwealth Matters of National Environmental Significance (MNES). It addresses the specific requirements of Attachment A of the Environmental Assessment Requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued following determination of the proposal by the Department of the Environment and Energy (DoEE) as a controlled action on 11 October 2016.

1.1 Background and Overview of the Proposal

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 (**Figure 1.1**).

ARTC is seeking approval to construct and operate the Parkes to Narromine section of Inland Rail ('the proposal'), which consists of 106 kilometres of upgraded rail track and associated facilities.

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 also from the Commonwealth Minister of the Environment and Energy (DoEE) under Part 9 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This report has been prepared 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 addresses the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), as revised and issued on 8 November 2016. The structure of this report reflects the specific requirements of Attachment A of the SEARs.

1.2 Designated Proponent

Australian Rail Track Corporation Ltd (ARTC) ('the proponent') is seeking approval to construct and operate the Parkes to Narromine section of Inland Rail ('the proposal').

1.3 Current Status of Proposal

Attachment A to the SEARs refers to the 'action', however, for consistency with remainder of the EIS, this document uses the term 'proposal'.

The proposal was deemed to be a controlled action on 11 October 2016 as result of the likely impacts to Matters of National Environmental Significance (MNES) protected under the EPBC Act namely threatened species and communities (sections 18 & 18A). The proposal is to be assessed in accordance with the NSW Assessment Bilateral Agreement (2015) and guidelines for preparing assessment documentation provided in the SEARs.

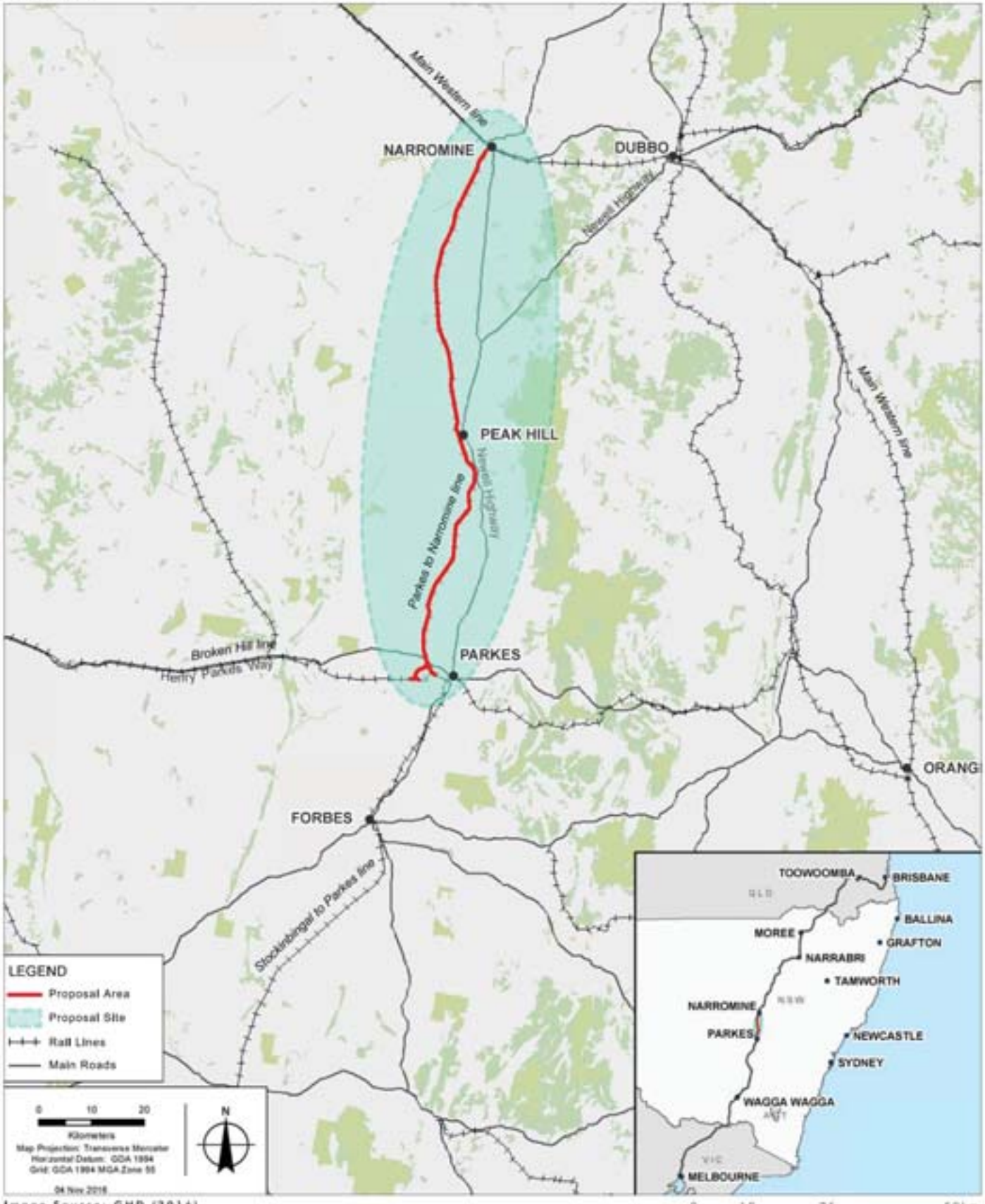


Image Source: GHD (2016)

FIGURE 1.1

Location of the Proposal

1.4 Location of the Proposal

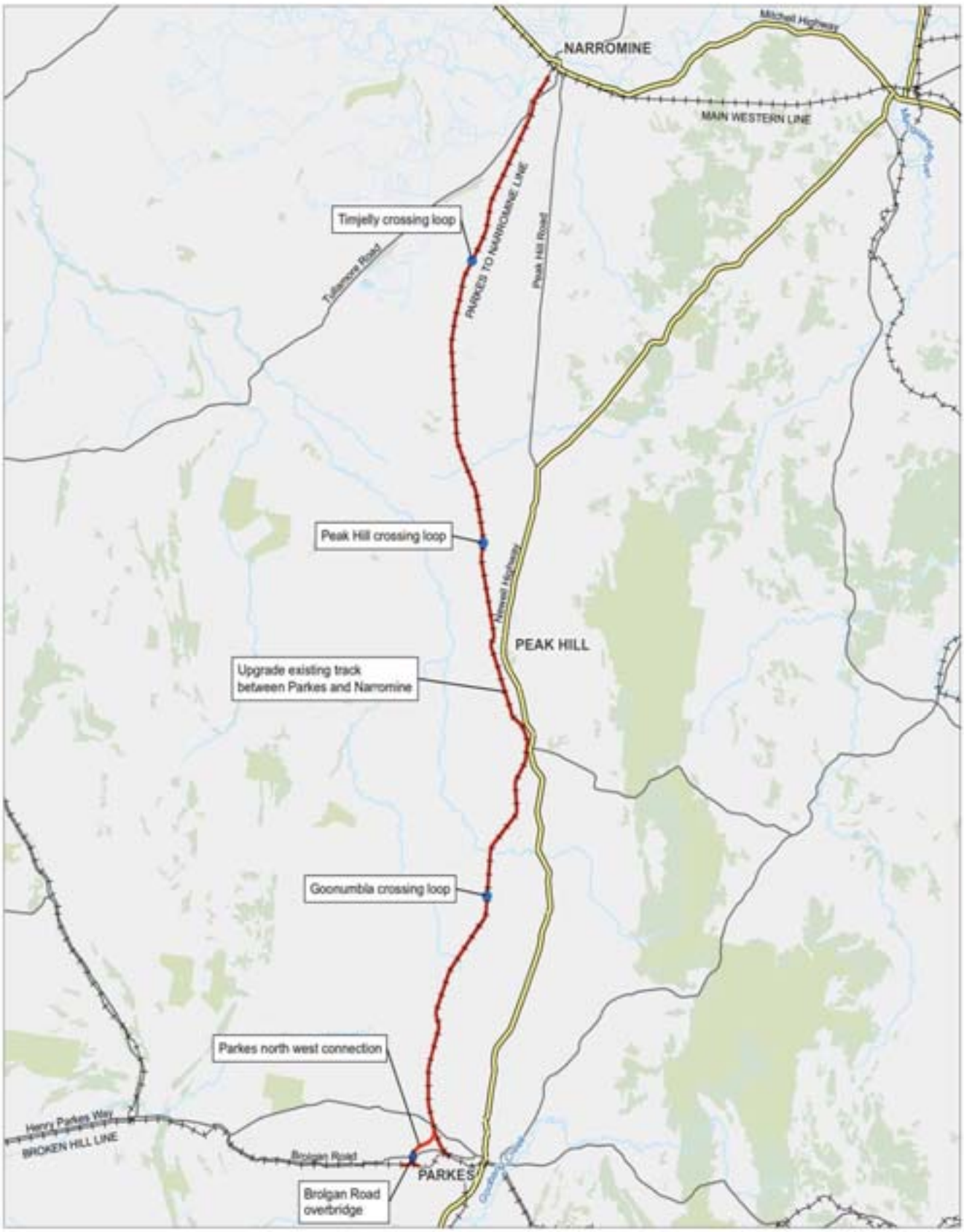
For the purposes of this Assessment of Commonwealth Matters report the location of the proposal is the construction impact zone shown on **Figure 1.2,** which is referred to in this document as the proposal area. The proposal area comprises the portion of the proposal that will be subject to temporary and permanent impact. The proposal area varies along the length of the proposal depending on the construction activities that are proposed in any given area. The proposal will be subjected to a range of temporary and permanent disturbances as outlined in **Section 3.0.**

1.4.1 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**.

Table 1.1 Location in the Landscape

Parkes to Narromine	
IBRA Bioregions	NSW South Western Slopes Darling Riverine Plains
IBRA Subregions	Lower Slopes Bogan Macquarie
Major Catchment Areas	Lachlan Central West
Mitchell Landscapes	Bimbi Plains Bogan Alluvial Plains Boggy Cowal Alluvial Plains Boggy Cowal Channels and Floodplains Goonumbla Hills Narromine Hills
LGAs	Parkes Narromine



LEGEND

- New bridge
- Crossing loop
- The proposal
- Railway
- Highway
- Road

0 2.5 5 10 15
Kilometers
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

FIGURE 1.2

Key Features of the Proposal

Image Source: GHD (2017)

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The coordinates of the turning points of the rail line from south to north are as identified in **Table 1.2**.

Table 1.2 Coordinates of the proposal

Longitude (l)	Latitude (l)	Longitude (l)	Latitude (l)
148°8'15.0"" E	33°8'10.9"" S	148°11'48.1"" E	32°45'48.2"" S
148°7'48.3"" E	33°7'51.1"" S	148°10'32.5"" E	32°42'45.1"" S
148°7'21.7"" E	33°7'6.5"" S	148°10'33.24"" E	32°42'32.8"" S
148°6'50.4"" E	33°5'37.9"" S	148°10'40.44"" E	32°42'20.1"" S
148°6'48.2"" E	33°3'52.4"" S	148°10'42.24"" E	32°42'11.1"" S
148°7'28.5"" E	33°1'42.1"" S	148°9'53.28"" E	32°38'33.0"" S
148°7'18.4"" E	33°1'11.9"" S	148°9'52.2"" E	32°38'11.7"" S
148°7'18.4"" E	33°0'55.0"" S	148°9'57.96"" E	32°37'25.2"" S
148°8'8.5"" E	32°58'55.0"" S	148°9'29.52"" E	32°35'2.4"" S
148°10'13.4"" E	32°56'22.4"" S	148°9'24.84"" E	32°34'49.3"" S
148°10'20.2"" E	32°56'11.4"" S	148°8'38.04"" E	32°33'20.2"" S
148°10'39.7"" E	32°52'47.7"" S	148°8'19.68"" E	32°32'38.2"" S
148°10'46.2"" E	32°52'37.1"" S	148°8'15.0"" E	32°32'20.7"" S
148°12'6.8"" E	32°51'14.4"" S	148°7'51.6"" E	32°27'35.5"" S
148°12'14.0"" E	32°51'4.1"" S	148°8'3.4"" E	32°26'28.7"" S
148°12'16.5"" E	32°50'51.7"" S	148°8'21.4"" E	32°25'26.3"" S
148°12'9.7"" E	32°49'29.9"" S	148°8'36.2"" E	32°24'23.1"" S
148°12'11.5"" E	32°49'23.5"" S	148°9'13.3"" E	32°23'22.8"" S
148°12'47.8"" E	32°48'25.0"" S	148°9'56.5"" E	32°22'1.9"" S
148°12'54.3"" E	32°47'28.3"" S	148°10'14.8"" E	32°20'36.0"" S
148°12'52.9"" E	32°47'19.8"" S	148°12'43.5"" E	32°16'11.4"" S
148°12'34.9"" E	32°46'41.9"" S	148°12'49.6"" E	32°15'55.2"" S
148°12'28.8"" E	32°46'35.8"" S	148°12'54.0"" E	32°15'31.2"" S
148°12'1.8"" E	32°46'18.0"" S	148°13'41.5"" E	32°14'29.6"" S
148°11'53.5"" E	32°46'8.0"" S	148°13'47.6"" E	32°14'17.0"" S

1.4.2 Size

The proposal area covers approximately 923 hectares.

1.5 Relationship to Other Actions

The proposal forms one of 13 sections of the Inland Rail. Currently the Narrabri to North Star section of Inland Rail is the only other section to be referred to the DoEE. Similar to the Parkes to Narromine proposal, the Narrabri to North Star section of Inland Rail was determined to be a controlled action and will be assessed under the NSW Assessment Bilateral Agreement. ARTC is currently preparing an EIS to assess the impacts of the Narrabri to North Star section.

The relative location of the Parkes to Narromine and Narrabri to North Star sections of Inland Rail are shown on **Figure 1.3**.

1.6 Purpose and Scope of this Report

This report provides the findings of the assessment of Commonwealth matters. It addresses the specific requirements of the revised SEARs following determination of the proposal as a controlled action on 11 October 2016. Based on the information provided in the referral, and additional information provided on 19 August 2016, The DoEE consider the proposal is likely to have a significant impact on matters of national environmental significance, 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 also considers that *T.linearis* may be present within the proposal site and a significant impact on this species from the proposal is possible. Attachment A of the revised SEARs identifies the requirements for preparing assessment documentation relevant to the EPBC Act and these requirements are identified in **Table 1.3**.

Table 1.3 SEARs Related to Commonwealth Matters of National Environmental Significance and where they are addressed in the report

SEARs Attachment A	Where Addressed In Report
4. The title of the action, background to the development and current status.	Section 1.0
5. The precise location and description of all works to be undertaken (including associated offsite work and infrastructure), structures to be built or elements of the action that may have impacts on matters of national environmental significance (MNES)	Section 2.0 **Figures 1.1** and **1.2**

SEARs Attachment A	Where Addressed In Report
6. How the action relates to any other actions that have been, or are being taken, in the region affected by the action.	Section 1.5
7. How the works are to be undertaken and design parameters of those aspects of the structures or elements of the action that may have relevant impacts on MNES.	Section 2.0
Impacts	
8. The EIS must include an assessment of the relevant impacts of the action on threatened species and communities; including: • a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; • a statement whether any relevant impacts are likely to be known, unpredictable or irreversible; • analysis of the significance of relevant impacts; • any technical data and other information used or needed to make a detailed assessment of the relevant impacts; and • a comparative description of the impacts of alternatives, if any, on the threatened species and communities.	Section 3.2 Section 3.3 Section 3.4 Section 4.1.2
Avoidance, mitigation and offsetting	
9. For each of the relevant matters protected that are likely to be impacted by the development, the EIS must provide information on proposed avoidance and mitigation measures to deal with the relevant impacts of the action, including: • a description and an assessment of the expected or predicted effectiveness of the mitigation measures; • any statutory policy basis for the mitigation measures; • the cost of mitigation measures; • a description of the outcomes that the avoidance and mitigation measures will achieve; • and outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action; • a description of the offsets proposed to address the residual adverse significant impacts and how these offsets will be established.	Section 4.4 Section 4.2 Costs of mitigation measures will be developed during detailed design. Section 4.3 Section 4.3 Section 4.5
10. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	Section 4.5

SEARs Attachment A	Where Addressed In Report
Key Issues – Biodiversity	
11. The EIS must address the following issues in relation to biodiversity including separate: • Identification of each EPBC Act listed threatened species and community likely to be impacted by the development. Any likely impacts must be described for each matter and, if there are impacts, how these impacts are avoided, mitigated and if required offset. Note that only significant residual adverse impacts are required to be offset.	Appendix 1 and Section 3.3 Section 4.1 Section 4.5
12. For each of the relevant EPBC Act listed threatened species and communities likely to be impacted by the developments the EIS must provide a separate: • description of the habitat and habits (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans, threat abatement plans and wildlife conservation plans; and • details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements. • description of the impacts of the action having regard to the full national extent of the species or community's range. (Note: the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database)	Appendix 1 and Section 3.3 Section 3.1 Section 3.2 and 3.3
13. For each of the relevant EPBC Act listed threatened species and communities likely to be impacted by the development the EIS must provide a separate: • identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account • detailed of how the current published NSW Framework for Biodiversity Assessment (FBA) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; • details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habit and/or threatened communities occurring on proposed offset sites. (Note: for the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposal i.e. 'like for like'. In applying the FBA, residual impacts on EPBC Act listed threatened ecological communities must be offset with plant community type (s) (PCT) that are ascribed to the specific EPBC listed ecological community. PCTs from a different vegetation class will not generally be acceptable as offsets for EPBC listed communities.)	Section 5.0 Section 4.5 Section 4.5

SEARs Attachment A	Where Addressed In Report
14. Any significant residual impacts not addressed by the FBA may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 environmental Offset Policy. (Note: if the EPBC Act Environmental Offset Policy is used to calculate proposed offsets for a threatened species or community you may wish to seek further advice from the Department of Planning and Environment.)	None relevant
15. For each threatened species and community likely to be impacted by the development, the EIS must provide reference to, and consideration of, relevant approved conservation advice or recovery plan for the species or community. (Note: the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database)	Appendix 2 and Section 3.3
Environmental Record of person proposing to take action	Section 6.0
16. Information in relation to the environmental record of a person proposing to take action must include details as prescribed in Schedule 4 Clause 6 of the EPBC Regulations 2000.	Section 6.0

Legend

- Existing Track
- New Track
- Upgrade Track

FIGURE 1.3

Inland Rail Project

2.0 Description of the Proposal

2.1 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 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**.

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

A detailed description of the proposal is provided in the EIS main text.

2.2 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. The proposal is expected to be operational in 2020. Inland Rail as a whole is expected to be operational in 2025.

2.3 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.

3.0 Impact Assessment

3.1 Methods

A detailed description of the flora and fauna surveys undertaken within the proposal area can be found in Section 2.0 of the *ARTC Inland Rail – Parkes to Narromine Biodiversity Assessment Report* (Umwelt, 2017). A summary of the survey methodology is provided below. During all biodiversity surveys, consideration was given to relevant Commonwealth threatened species survey guidelines, conservation listing advice, recovery plans and policy statements to ensure appropriate survey techniques and seasonal considerations were employed.

The threatened species and ecological communities known or likely to occur within the proposal area were identified through appropriate database searches and detailed field surveys. The database searches included:

- EPBC Protected Matters Search Tool (05/12/16, refer to **Appendix 1**)
- OEH Atlas of NSW Wildlife (April 2016)
- NSW DPI - Fishing and Aquaculture – Threatened and protected species record viewer (May 2016).

Following the identification of target species and communities, the native vegetation assessment consisted of relevant desktop reviews prior to completing comprehensive field surveys over several seasons to identify the communities and threatened flora species present within the proposal area. The following activities were undertaken:

- literature and database review
- digital aerial photograph interpretation
- systematic plot/transect surveys
- semi-quantitative rapid sampling
- meandering transects
- vegetation mapping.

A total of 48 systematic plots/transect surveys and 218 rapid vegetation assessments were conducted across the proposal area during the surveys undertaken for this assessment (refer to Figures A1-A36 in Appendix A of the BAR). These surveys were undertaken over 19 days and four survey periods, being:

- 15 – 16 October 2014
- 11 – 21 January 2016
- 2 – 5 May 2016
- 1 – 2 June 2016.

Targeted threatened fauna surveys were undertaken in July, November and December 2015 with consideration of the survey guidelines for Australia's threatened mammals (DSEWPC 2011), bats (DSEWPC 2010), birds (DSEWPC 2010b), fish (DSEWPC 2011b), reptiles (DSEWPC 2011c) and frogs (DSEWPC 2010c). In order to identify the range of threatened fauna species occurring in the proposal area the following survey methods were utilised:

- habitat assessment
- diurnal bird area searches
- diurnal reptile/amphibian area searches
- nocturnal spotlighting
- nocturnal amphibian surveys in appropriate freshwater wetland habitat
- nocturnal call playback surveys
- nocturnal Anabat surveys targeting micro-bat species
- targeted fauna species inspections of cavities and expansion joints of timber, steel and concrete bridges
- targeted surveys for threatened species (refer to **Table 3.1**).

The survey methodology is shown on Figures A1-A36 in Appendix A of the BAR.

Table 3.1 Summary of Targeted Surveys Completed for EPBC Act-listed Threatened Species Predicted to Occur in the Proposal site (Umwelt 2017a, b)

Species	Status EPBC Act	Required Survey Period*	Survey Technique, Timing and Location
Flora			
Tylophora linearis	E	September - May	Targeted threatened flora searches in suitable habitat undertaken in October 2014, January 2016 and May 2016 throughout the proposal site. Opportunistic observations undertaken throughout all Umwelt survey periods.
Birds			
superb parrot *Polytelis swainsonii*	V	September – December	Diurnal bird surveys undertaken in November-December 2015 throughout the proposal site. Tree hollows were recorded on a GPS and hollows that could potentially provide suitable habitat were watched for activity across all survey sites. Selected suitable habitat trees were watched for at least an hour, in the morning where possible for any superb parrot activity. Opportunistic observations undertaken throughout all Umwelt survey periods.
swift parrot *Lathamus discolor*	CE	March – July	Targeted winter bird surveys were undertaken in July 2015 throughout the proposal site. Opportunistic observations undertaken throughout all Umwelt survey periods.

Species	Status EPBC Act	Required Survey Period*	Survey Technique, Timing and Location
regent honeyeater *Anthochaera phrygia*	CE	All year	Targeted call playback and bird surveys in July 2015 throughout the proposal site. Each survey consisted of a 5 minute period of call playback for the species followed by 20 minutes of searching, which consisted of a slow walking transect within a two hectare area within suitable vegetation types. Surveys were undertaken during early to mid-morning and mid to late afternoon. Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10 x. Opportunistic observations undertaken throughout all Umwelt survey periods.

*As specified in the NSW Threatened Species Profile Database which identifies required survey periods for threatened species. Where appropriate, the Survey Guidelines for Australia's Threatened Birds (DEWHA 2010a) were considered for survey timing and methods.
Source: Table 2.3 and Table 2.4 of the BAR (Umwelt 2017a). Further details provided in Section 2.4.3 of the BAR (Umwelt 2017a)

3.2 Nature and Extent of the Likely Short Term and Long Term Relevant Impacts

The construction and operation of the proposal will result in a range of direct impacts on MNES within the proposal area. Direct impacts include the loss of native vegetation and fauna habitats as a result of direct and permanent clearance works and track upgrades. The location and extent of direct (permanent) impacts is shown on **Figure 3.1A** to **3.1E**. The relevant impacts of the proposal are considered to be well known and predictable based on the extensive knowledge of the ecological values of the proposal area and a sound understanding of the impacts. The direct impacts of the proposal, as they relate to the clearing of threatened species habitat and ecological communities are predicted to be permanent; however, areas of temporary disturbance are also proposed.

The proposal would involve upgrading the existing rail line between Parkes and Narromine, including:

- upgrading the existing track and track formation
- replacement of culverts and bridges
- construction of new crossing loops, at Goonumbla, Peak Hill, and Timjelly
- rationalisation and upgrading of level crossings
- curve easing
- constructing the Parkes north west connection.

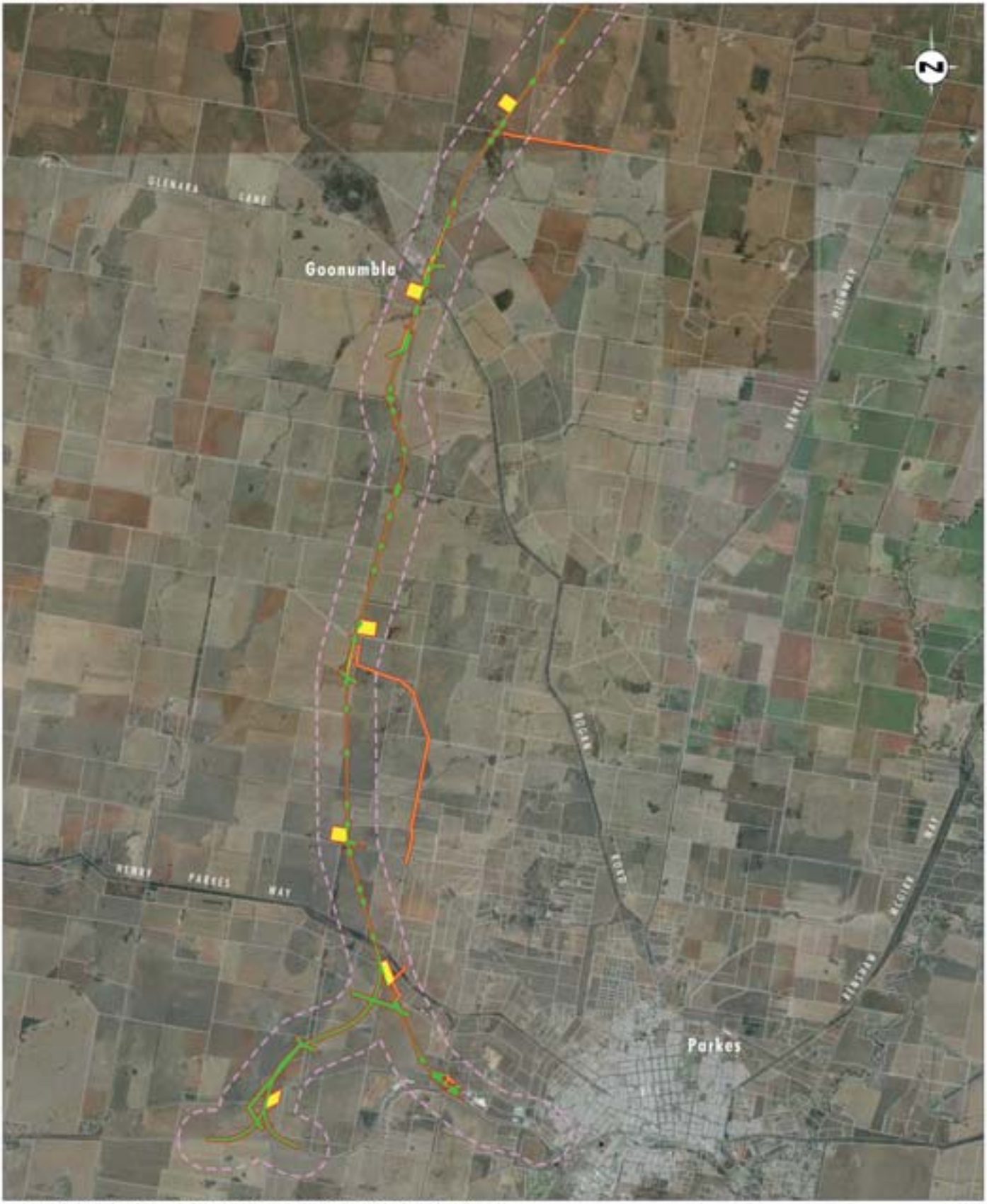

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 3.1A

Development Site Impact Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 3.1B

Development Site Impact
Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 3.1C

Development Site Impact Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 3.1D

Development Site Impact Parkes to Narromine

Image Source: Google Earth/CNES/Astrium/DigitalGlobe (Dec 2015)
Data Source: Geoscience Australia (2009), Parsons Brinckerhoff (2014)

0 1.0 2.5 5.0 km
1:100 000

Legend

- Development Site
- Temporary Impact Zone
- Permanent Impact Zone
- 550m Buffer Area

FIGURE 3.1E

Development Site Impact Parkes to Narromine

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The following ancillary works would also be undertaken:

- changes to some property access roads and the local road network in some locations as a result of the rationalisation of level crossings
- stormwater drainage works
- upgrading signalling and communications
- establishing or upgrading existing fencing of the rail corridor
- relocation of some services and utilities.

Further information regarding the proposal is contained in the main text of the EIS.

3.2.1 Direct and Permanent Impacts to MNES

Table 3.2 below outlines the impact of the proposal on Commonwealth listed ecological communities. A total of 49.82 hectares of direct impacts to native vegetation communities, and flora and fauna species and their habitats is proposed. Direct impacts have been focused, where possible, outside of native vegetation communities, with 579.71 hectares of cleared/non-native vegetation subject to direct impacts.

Table 3.2 Direct and Permanent Impacts of the Proposal on Threatened Ecological Communities

EPBC Act listed Threatened Ecological Community	Corresponding Plant Community Type in the Proposal Site	Area of TEC within the Proposal Site (ha)
Weeping Myall Woodlands EEC	PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	0.99
Total *Weeping Myall Woodlands EEC*		**0.99**
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	7.89
	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	23.64
Total *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*		**31.53**

EPBC Act listed Threatened Ecological Community	Corresponding Plant Community Type in the Proposal Site	Area of TEC within the Proposal Site (ha)
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	0.46
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.40
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	10.32
Total *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*		**17.3**

Table 3.3 Direct and Permanent Impacts of the Proposal on EPBC Act Listed Threatened Species

EPBC Act listed Threatened Species	Habitat within the Proposal Site	Area of Habitat within the Proposal Site (ha)
Tylophora linearis	PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	1.54
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.4

EPBC Act listed Threatened Species	Habitat within the Proposal Site	Area of Habitat within the Proposal Site (ha)
Total *Tylophora linearis* habitat		**8.06**
superb parrot *Polytelis swainsonii*	PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	3.16
	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	0.87
	PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	0.62
	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	0.94
	PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	6.12
	PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	1.54
	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	8.58
	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good - DNG*	23.48
	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	1.41

EPBC Act listed Threatened Species	Habitat within the Proposal Site	Area of Habitat within the Proposal Site (ha)
	PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	1.20
	PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	1.50
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good – DNG*	0.46
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.40
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good – DNG*	10.32
Total superb parrot foraging habitat		**66.72**
swift parrot *Lathamus discolor*	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	8.58
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.40
Total swift parrot foraging habitat		**15.10**

EPBC Act listed Threatened Species	Habitat within the Proposal Site	Area of Habitat within the Proposal Site (ha)
regent honeyeater *Anthochaera phrygia*	PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	8.58
	PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	3.12
	PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	3.40
Total regent honeyeater foraging habitat		**15.1**

3.2.2 Indirect and Temporary Impacts

The construction of the proposal will result in temporary impacts relating to construction impacts associated with facilities such as compounds and temporary access tracks. Native vegetation occurring in these areas is not expected to be fully impacted (i.e. will not be cleared) but will be subject to some disturbance and is expected to recover. While the vegetation and habitats in these areas will be impacted in the short term, it is considered that these areas will regenerate following the completion of the construction phase of the proposal. The location and extent of temporary impacts is shown on **Figure 3.1A** to **3.1E**.

To facilitate the regeneration of temporary impact locations, a rehabilitation strategy will be prepared as part of the Construction Environmental Management Plan (CEMP).

3.2.3 Are any Relevant Impacts Likely to be Unknown, Unpredictable or Irreversible?

The relevant impacts of the proposal are considered to be well known and predictable based on the extensive knowledge of the ecological values of the proposal area and a sound understanding of the impacts of the proposal (e.g. clearing of vegetation, earthworks and water management). The direct impacts of the proposal, as they relate to the clearing of threatened species habitat and ecological communities listed under the EPBC Act are predicted to be permanent; however, a biodiversity offset program will be developed as part of the proposal in order to compensate for the residual impacts of habitat loss that cannot be adequately avoided or minimised.

3.3 Analysis of the Significance of Relevant Impacts

Following the completion of the database searches discussed in **Section 3.1**, an analysis of the EPBC Act listed threatened species and communities that could occur in the proposal area was undertaken. **Appendix 1** details the results of the EPBC Act protected matters database search which identified five communities and 23 threatened species as known or predicted to occur in suitable habitat within 10km of the proposal site. A description of the ecology of each threatened species and ecological community is provided along with a description of the outcomes of targeted surveys. For those threatened species and communities that were considered to be potentially significantly impacted by the proposal, an Assessment of Significance was undertaken in accordance with the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (DotE 2013).

The EPBC Act Significant Impact Guidelines 1.1 states the following:

When deciding whether or not a proposal is likely to have a significant impact on a matter of national environmental significance, the precautionary principle is relevant. Accordingly, where there is a risk of serious or irreversible damage, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on a matter of national environmental significance.

In light of the above, where there was lack of scientific certainty, the maximum potential impact was assumed. The development of mitigation and offset strategies were based on the outcomes of the impact assessment and the precautionary principle will also be applied in the development of the mitigation and offset strategies to ensure that uncertainties are compensated for with more robust mitigation or more substantial offset outcomes.

The assessments of significance were undertaken following an initial screening process to identify species that may be potentially significantly affected by the proposal (refer to **Appendix 1**), with a consequential full assessment of the likely significance of impacts being completed for these species (refer to **Appendix 2**).

The assessments of significance do not take into account the range of impact mitigation strategies and biodiversity offsets proposed for the proposal, rather they consider the impacts of the proposal without any mitigation or offsetting, consistent with the requirements of both State and Commonwealth significant impact assessment guidelines (Department of the Environment 2013). The Assessment of Significance was completed for the threatened species and threatened ecological communities (TECs) identified in **Appendix 1**, either due to their recorded presence or the presence of potential habitat in the proposal area, and the potential for the species or TECs to be significantly impacted.

Based on the information provided in the referral, and additional information provided on 19 August 2016, The DoEE consider the proposal is likely to have a significant impact on matters of national environmental significance, including but not limited to:

- the removal of up to 17.3 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 31.53 ha of endangered Grey Box *(Eucalyptus microcarpa)* Grassy woodlands and Derived Native Grasslands of South-eastern Australia
- the removal of over 66 ha of known foraging habitat for the Superb Parrot *(Polytelis swainsonii),* and
- the removal of approximately 15 ha of known foraging habitat for the Regent Honeyeater *(Anthochaera phrygia),* and Swift Parrot *(Lathamus discolor).*

The Department also considers that *T.linearis* may be present within the proposed action area and a significant impact on this species from the proposed action is possible. Approximately 8.06 hectares of potential habitat is present. Attachment A of the SEARs requires an assessment of the relevant impacts of the proposal on threatened species and communities. This assessment is provided for the above relevant species and communities in the following sections.

3.3.1 *Tylophora linearis*

Tylophora linearis is listed as endangered under the EPBC Act and is a herbaceous climber with clear latex growing to approximately 2 m in length (DoEE 2008). In NSW the species is rarely collected, known from less than 10 localities in the Dubbo area and Mt Crow near Barrabra, growing in dry scrub, open forest and woodlands. It is also known to overlap in distribution with *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act (DoEE 2008), which occurs in the proposal area.

Tylophora linearis was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. A total of 48 systematic plots/transect surveys and 218 rapid vegetation assessments were conducted across the proposal area during the surveys undertaken for this assessment, and random meanders searching for threatened species within areas of native woodland and grassland. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). However due to the presence of the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC and PCT70 (CW220, LA223) White Cypress Pine woodland on Sandy Loams in Central NSW Wheatbelt in the proposal area, there is a low potential for this species to occur. A total of approximately 8.06 hectares of potential habitat for this species will be permanently removed.

3.3.2 Superb parrot – *Polytelis swainsonii*

The superb parrot is listed as vulnerable under the EPBC Act and is found in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems; vagrants have also been recorded in southern Queensland.

In the Southwest Slopes Bioregion, the superb parrot forages in box-gum woodlands dominated by white box, yellow box and Blakely's red gum (Webster 1988). The species has also been widely recorded between Parkes and Narromine (OEH 2016d). Breeding habitat for this species includes hollows more than 60 mm in diameter that are located more than 4 metres above ground (OEH 2016b). The national recovery plan for the species (Baker-Gabb 2011) identifies Blakely's red gum (*Eucalyptus blakelyii*) as the most important tree species for breeding for the superb parrot in the south western slopes bioregion, with most breeding events confined to this tree species. Blakely's red gum was not recorded in the proposal area and therefore breeding habitat is not considered likely to occur. Potential breeding habitat for this species is not likely to be impacted by the proposal.

Six superb parrots were recorded flying over the proposal area at two locations during targeted surveys.

- Two individuals were opportunistically recorded flying over rail line while Umwelt ecologists were undertaking targeted flora surveys in October 2014. The species was recorded around kilometre point (KP) 495.5 (refer to Figure A18 in Appendix A of the BAR).

- Four individuals were opportunistically recorded flying overhead while Umwelt ecologists were undertaking vegetation surveys in May 2016 at two locations within the proposal area. The species was recorded around KP 497 and 523 (refer to Figures A18 and A26 in Appendix A of the BAR).

The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All of the vegetation communities identified in the proposal area are expected to provide potential foraging habitat, however potential breeding habitat is not expected to occur. The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that provides potential habitat for this species.

3.3.3 Regent Honeyeater - *Anthochaera phrygia*

The regent honeyeater is listed as critically endangered under the EPBC Act and has a patchy distribution extending from south-east Queensland, into NSW and the Australian Capital Territory, to central Victoria (CoA, 2016). The species is highly mobile, capable of travelling large distances and occurs only irregularly at most sites in varying numbers. Adding further difficulty to the survey and study of this species is its ability to often go long periods without being observed anywhere (CoA 2016). Its primary habitat is box-ironbark eucalypt woodland and dry sclerophyll forest, however it does utilise riparian vegetation and lowland coastal forest. Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations.

It is known to undertake a complex series of movements, which are thought to be governed mainly by the flowering of a select number of Eucalyptus species. It is likely the species use different areas within its range in different years depending on food resources (CoA 2016).

The proposal area does not occur within the four known breeding areas for the species where it is regularly recorded, namely Bundarra-Barraba area of NSW, the Capertee Valley in NSW, Hunter Valley in NSW and the Chiltern area of north-east Victoria.

The regent honeyeater was not recorded within the proposal area despite thorough fauna surveys (including targeted winter bird surveys in 2015) undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (CoA 2016)). The closest record of the species occurs approximately 30 km to the east of the proposal area near Dubbo (OEH 2016d). The habitat within the proposal area is substantially degraded, however the proposal will remove approximately 15.1 hectares of potential foraging habitat for the species, associated with the woodland component of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia. This species is considered to have a low likelihood of occurrence within the proposal area.

3.3.4 Swift Parrot – *Lathamus discolor*

The swift parrot is listed as critically endangered under the EPBC Act. The species breeds in Tasmania and moves to mainland Australia for the non-breeding season (usually arriving between February and March) (Saunders and Tzaros 2011). Most of the population winters in Victoria and NSW where is disperses across broad landscapes foraging on nectar and lerps in eucalypts. Until recently it was believed that in NSW, swift parrots forage mostly in the coastal and western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region (Saunders and Tzaros 2011). However, evidence is gathering that the forests on the coastal plains from southern to northern NSW are also important. They return to Tasmania in spring (September-October). The movements of this species on the mainland are poorly understood, but it is considered to be nomadic and irruptive, moving in response to food supply.

Upon reaching their core non-breeding range there is no known geographical pattern of movement. During the non-breeding season, the home-range varies tremendously between individuals and between years.

Priority sites for this species have been identified within the National Recovery Plan for the species (Saunders and Tzaros 2011).This species is likely to utilise box-ironbark vegetation associations within the western slopes natural resource management region, in communities dominated by mugga ironbark (*Eucalyptus sideroxylon*), grey box (*Eucalyptus microcarpa*), white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*) (Saunders and Tzaros 2011).

The swift parrot was not recorded within the proposal area despite thorough fauna surveys (including targeted winter bird surveys in 2015) undertaken in accordance with the seasonal requirements for this species. The proposal area contains three known foraging tree species (according to the approved National Recovery Plan (Saunders and Tzaros 2011)). The closest record of the species occurs approximately 16 km to the south east of the proposal area (OEH 2016d). The habitat within the proposal area is substantially degraded, however the proposal will remove approximately 15.1 hectares of potential foraging habitat for the species, associated with the woodland component of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC and Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia. This species is considered to have a low likelihood of occurrence within the proposal area.

The swift parrot occurs as a single population, although it migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and western slope woodlands of mainland eastern Australia (Saunders 2002).

3.3.5 Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia is listed as an EEC under the EPBC Act. The community is characterised by a canopy dominated by inland grey box (*Eucalyptus microcarpa*), while several other canopy species are also commonly associated with the EEC. These include, but are not limited to bulloak (*Allocasuarina luehmannii*), kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*).

A comprehensive analysis of this vegetation community was undertaken to determine whether it conformed to the listing advice for the EEC (TSSC 2010).

Particular Area

In relation to the particular area of the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, the Threatened Species Scientific Committee (TSSC) (2010) states that the community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia.

The area in which this community occurs within the proposal area is situated within the lower slopes of central NSW.

Additional Criteria – Key Diagnostic Characteristics

The *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* occupies a transitional landscape zone between semi-arid communities, temperate woodlands and forests of the lower slopes and ranges. Key diagnostic characteristics are provided within the Listing Advice for this EEC (TSSC 2010) as many of the plant species present in the community are widespread or occur is a variety of other vegetation types that adjoin the community. The key diagnostic characteristics are provided and assessed below.

- ***The ecological community occurs on low slopes and plains from central NSW, through northern and central Victoria into South Australia. Disjunct occurrences are known from near Melbourne and in the Flinders-Lofty Block Bioregion of South Australia.***

The woodland and associated derived native grassland (DNG) within the proposal area that is considered to conform with the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act occurs on low slopes and plains of central NSW, particularly from Parkes to Narromine, NSW.

- ***The vegetation structure of the ecological community is typically a woodland to open forest.***

The vegetation communities within the proposal area that are considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* are typically a woodland but also occur in the form of derived native grasslands, with the canopy and understorey shrubs absent.

- ***The tree canopy is dominated (≥50% canopy crown cover) by Eucalyptus microcarpa (Grey Box). Other tree species may be present in the canopy and, in certain circumstances, may be co-dominant with Grey Box but are never dominant on their own.***

The woodland within the proposal area that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* comprised a canopy dominated by inland grey box (*Eucalyptus microcarpa*). Other canopy species were recorded but were never dominant. These species included kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*). Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

- ***The mid layer comprises shrubs of variable composition and cover, from absent to moderately dense. The mid layer usually has a crown cover of less than 30% with local patches up to 40% crown cover.***

Shrubs were commonly present in the mid stratum of the woodland within the proposal area being considered as conforming to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC*, however, they generally comprised a total crown cover of less than 10 per cent.

- ***The ground layer is highly variable in development and composition, ranging from almost absent to mostly grassy to forb-rich. Ground layer flora commonly present include one or more of the graminoid genera: Austrodanthonia, Austrostipa, Elymus, Enteropogon, Dianella and Lomandra; and one or more of the chenopod genera: Atriplex, Chenopodium, Einadia, Enchylaena, Maireana, Salsola and Sclerolaena.***

The woodland within the proposal area that is considered to conform to *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* varied in quality from diverse to species poor. Both woodland and DNG forms of the community recorded comprised at least one

of the graminoid genera listed above. Specifically, *Austrodanthonia*, *Austrostipa*, *Atriplex*, *Einadia* and *Sclerolaena* were common.

Derived grasslands are a special state of the ecological community, whereby the canopy and mid layers have been mostly removed to <10 per cent crown cover but the native ground layer remains largely intact, with 50 per cent or more of the total vegetation cover being native.

Only grasslands surrounding or in the vicinity of grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act. These areas of the EEC within the proposal area are predominantly absent of a remnant canopy, with only scattered trees and shrubs remaining. The cover of native flora species in the ground layer is at least 50 per cent.

Additional Criteria - Condition Thresholds

The condition thresholds identified in the Listing Advice for this EEC (TSSC 2010) have multiple criteria in order for vegetation to conform with the EEC under the EPBC Act. There are general criteria as well as a number of additional criteria depending on the size of the patch, and additional criteria for DNG.

General criteria (TSSC 2010) require:

- ***the minimum patch size is 0.5 hectare;***
- ***the canopy contains inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant; and***
- ***the vegetative cover of non-grass weed species is less than 30% in the ground layer at any time of year.***

Due to the nature of the proposal, many of the patches are small in size and would not, in isolation, meet the size requirements of the general criteria. However these mapped areas within the corridor are part of larger patches adjacent to the corridor and were consequently larger than 0.5 hectares. Woodland patches all comprised inland grey box (*Eucalyptus microcarpa*) as a dominant or co-dominant and the vegetative cover of non-grass weed species was less than 30 per cent throughout the mapped communities.

Additional criteria (TSSC 2010) for patches between 0.5 and 2 hectares require:

- ***at least 50% of the vegetative cover of the ground layer comprises perennial native species at any time of year; and***
- ***8 or more perennial native species are present in the mid and ground layers at any time of year.***

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland within the proposal area had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances where this was not the case, however the large size of the proposal area and restrictive nature of the corridor resulted in limitations for plot locations. For this reason and based on the data collected, it is considered that the vegetation community meets this additional criterion. All floristic plots contain at least 8 perennial native species within the mid and ground layers.

Additional criteria (TSSC 2010) for patches where the canopy is less developed or absent include:

- ***The patch is a derived grassland with clear evidence that the site formerly was a woodland with inland grey box (Eucalyptus microcarpa) as a dominant or co-dominant;***

- ***At least 50% of the vegetative cover in the ground layer comprises perennial native species at any time of year; and***

- ***The ground layer comprises at least 12 native species at any time of year.***

Only native grasslands surrounding or in the vicinity of existing grey box woodland were considered to be derived from grey box woodlands and therefore conforming to the EEC under the EPBC Act.

The biometric plots that were completed within PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good – Derived Native Grassland within the Development Site predominantly had at least 50 per cent of the vegetation cover comprised by perennial native species. There were some circumstances within this community where this was not the case, however the large size of the proposal area and restrictive nature of the rail corridor resulted in limitations for plot locations. Additionally, these plots all comprised at least 12 native species.

Summary

The proposal area supports a total of 31.53 hectares of *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC* under the EPBC Act within Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – Moderate to Good and Moderate to Good – Derived Native Grassland. Of this extent, the proposal will result in the permanent loss of approximately 31.53 hectares of the EEC, comprising 7.89 hectares of remnant woodlands and 23.64 hectares of derived native grassland.

3.3.6 White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a CEEC under the EPBC Act. This community occurs along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees.

A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*, the TSSC (2006) states that the community occurs within the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions.

The area in which this community occurs within the proposal area is situated within the NSW South Western Slopes Bioregion (refer to **Appendix A** of the BAR for the extent of the community within the proposal area).

Additional Criteria

Detailed assessment of the vegetation communities described and mapped within the proposal area was undertaken to determine whether the vegetation present met the condition class thresholds identified in the Listing Advice (TSSC 2006). These thresholds have been incorporated into an identification flowchart for the CEEC within the EPBC Act Policy Statement (DEH 2006) for the community which was also utilised during the assessment.

- **Is, or was previously, at least one of the most common overstorey species white box, yellow box or Blakely's red gum?**

All vegetation in the proposal area assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria was identified as having or previously having either white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) or Blakely's red gum (*Eucalyptus blakelyi*) as one of the dominant overstorey species.

- **Does the patch have predominantly native understorey?**

A patch of White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the proposal area was assessed as not having a predominantly native understorey. This patch had been heavily grazed and pasture improved and did therefore not meet the condition threshold for the CEEC. All other patches of vegetation in the proposal area assessed against the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* criteria had a predominantly native understorey.

- **Is the patch 0.1 hectare or greater in size?**

Due to the restricted nature of the proposal area, a majority of patches strictly within the proposal area were smaller than the required 0.1 hectare size. A process was undertaken to identify which patches extended outside the bounds of the proposal area and therefore met the area patch requirements of the EPBC Act community.

- **Are there 12 or more native understorey species present (excluding grasses), of which at least one is deemed an important species.**

A patch of White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion – Moderate to Good Condition in the southern portion of the proposal area was assessed as not having 12 native understorey species present (excluding grasses) and therefore did not meet the condition threshold of the CEEC. All other patches of vegetation in the proposal area assessed against the White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC criteria were identified as containing at least 12 or more native understorey species.

Summary

The proposal area is considered to support 17.3 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* within White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion (Moderate to Good – in part and Moderate to Good_DNG condition) and Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion (Moderate to Good and Moderate to Good_DNG condition).

3.3.7 Summary of Technical Data and Other Information Used or Needed to Make a Detailed Assessment of the Relevant Impacts

The detailed assessment of the relevant impacts of the proposal was based on a thorough review of technical data and other relevant information, including but not limited to the following key resources, policies and documents:

- Matters of National Environmental Significance Significant Impact Guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013)
- (DEWHA) Department of the Environment, Water, Heritage and the Arts (2010a) survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DEWHA) Department of the Environment, Water, Heritage and the Arts (2010b) survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DEWHA) Department of the Environment, Water, Heritage and the Arts (2010c) survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DSEWPC) Department of Sustainability, Environment, Water, Population and Communities (2011a) survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DSEWPC) Department of Sustainability, Environment, Water, Population and Communities (2011b) survey guidelines for Australia's threatened fish: Guidelines for detecting fish listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DSEWPC) Department of Sustainability, Environment, Water, Population and Communities (2011c) survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*
- (DoEE)– Department of the Environment and Energy (2016). *Species Profile and Threats Database (SPRAT)*
- Credit Calculator for Major Projects and BioBanking Operational Manual (OEH 2016a)
- Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a)
- Threatened species assessment guidelines The Assessment of Significance, DECCW (2007)
- BioBanking Assessment Methodology 2014 (OEH 2014b)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004)
- BioBanking Credit Calculator (Major Project Assessment Type) (BBCC 2016), accessed in July 2016
- OEH Threatened Species Profile Database (TSPD) (OEH 2016b), assessed between April and July 2016

- Vegetation Information System (VIS) Classification Database (OEH 2016c), accessed between April and July 2016
- BioNet Atlas of NSW Wildlife database and mapping tool (OEH 2016d), accessed in April 2016
- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Parkes and Narromine LGAs, accessed July 2016
- Department of the Environment (DoE) (now the Department of the Environment and Energy) Protected Matters Database (DoE 2016a), accessed in December 2016
- Environmental Assessment Northparkes Step Change Project (Umwelt 2013)
- NSW Guide to Surveying Threatened Plants (OEH 2016e)
- Regional and sub-regional vegetation mapping reports including:
    - Reconstructed and Extant Distribution of Native Vegetation in the Central West and Lachlan Catchment (DEC 2006)
    - Travelling Stock Reserve Conservation Values spatial layer (Rural Lands Protection Board 2010)
- results from the comprehensive ecological surveys undertaken by Umwelt;
- relevant listing/conservation advices and policy statements including:
    - Department of the Environment and Heritage (DEH) (2006) *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List*, Appendix A of the *EPBC Act Policy Statement 3.5 for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community*.
    - Department of Sustainability, Environment, Water, Population and Communities (2012) *Grey Box (Eucalyptus macrocarpa) Grassy Woodlands and Derived native Grasslands of South-eastern Australia, A guide to the identification, assessment and management of a nationally threatened ecological community.* EPBC Act Policy Statement.
    - NSW Scientific Committee (NSWSC) (2002) Final Determination to list *White Box Yellow Box Blakely's Red Gum Woodland* as an endangered ecological community, 15 March 2002.
    - NSW Scientific Committee (NSWSC) (2007) Final Determination to list *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* as an endangered ecological community, 27 April 2007.
    - Threatened Species Scientific Committee (TSSC) (2006a) *White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* Listing Advice, registered 17 May 2006.
    - Threatened Species Scientific Committee (TSSC) (2008) Approved Conservation Advice for *Tylophora linearis*. October 2008.
    - Threatened Species Scientific Committee (TSSC) (2010) *Listing Advice for Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*.

- Threatened Species Scientific Committee (TSSC) (2015*) Conservation Advice for Anthochaera phrygia Regent Honeyeater*.
- Threatened Species Scientific Committee (TSSC) (2016*) Conservation Advice for Lathamus discolor Swift Parrot*.
- Threatened Species Scientific Committee (TSSC) (2016*) Conservation Advice for Polytelis swainsonii Superb Parrot*.

- relevant national and/or NSW recovery plans including:
  - Baker-Gabb (2011) *National Recovery Plan for the Superb Parrot Polytelis swainsonii*. Department of Sustainability and Environment (DSE) Melbourne, Victoria.
  - Department of the Environment (2016) *National Recovery Plan for the Regent Honeyeater* (*Anthochaera phrygia*). Commonwealth of Australia, 2016.
  - Department of Environment, Climate Change and Water (DECCW) (2010) *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney.
  - Saunders and Tzaros (2011) National Recovery Plan for the Swift Parrot *Lathamus discolor*. Birds Australia, Melbourne.

The technical data and other information considered in determining the relevant impacts of the Proposal on listed threatened and migratory species is provided in Sections 3.1 and 3.2 of the *ARTC Inland Rail – Parkes to Narromine Biodiversity Assessment Report* (Umwelt, 2017).

4.0 Avoidance, Mitigation and Offsetting

A range of avoidance, mitigation and offset strategies are proposed to minimise the impact of the proposal on threatened species and ecological communities, including relevant MNES listed under the EPBC Act.

4.1 Avoidance

4.1.1 Site Selection

ARTC commissioned a range of studies to guide the site selection for the proposal. Two major studies have been undertaken in relation to the development of an inland rail route between Melbourne and Brisbane. The first study, completed in 2006, considered potential corridors for the rail line to determine which route would deliver the best economic and financial outcome. This study identified that the 'far western corridor' through Parkes would be the best option.

The Melbourne-Brisbane Inland Rail Alignment Study (ARTC 2010) was finalised in 2010 and was prepared to determine the optimum alignment of the entire route in terms of operational, engineering and environmental factors. At each stage the options were analysed in sufficient detail to enable key decisions to be made and finally narrow the rail corridor options down to a single rail alignment. The successive stages of route analysis included:

- Inland rail route options – identification of a range of available route options. Environmental and land use assessments were undertaken along each route section.
- Identification of the route – evaluation of the route options and preliminary analysis of: Melbourne to Parkes; Parkes to Moree; and Moree to Brisbane.
- Analysis of the route – the route was analysed in terms of capital cost, environmental impacts and journey times as well as its preliminary economic and financial viability. Environmental constraints mapping was produced and survey data was obtained to assist with the alignment development.
- Development of the rail alignment – the rail alignment was developed considering environmental and engineering factors. Environmental risks were eliminated or minimised through consideration of local alternatives and moving the alignment to avoid significant constraints where possible.

For the Parkes to Narromine section of the Inland Rail, the proposed works only include upgrades to existing tracks as opposed to the construction of new track or work in greenfield sites. As a result, the overall disturbance footprint of the proposal is reduced through the use of the existing corridor. As the proposed works occur along or adjacent to the existing track, further positioning works to avoid native vegetation and habitat areas would only be possible in some cases. Conversely, these works would be primarily undertaken in the existing rail corridor that is regularly subject to disturbances related to rail activities and surrounding agricultural pursuits with relatively few important biodiversity features and habitats.

In light of this proposal utilising an existing corridor, the Melbourne-Brisbane Inland Rail Alignment Study (ARTC 2010) identified that some of the most significant environmental impacts of the proposal were those associated with vegetation removal required for construction of the railway and track upgrades. Identified impacts associated with the removal of vegetation included effects on threatened species, populations and ecological communities, the fragmentation of wildlife areas and habitats, and severance of wildlife (ARTC 2010).

Further information on proposal alternatives and options is outlined in Chapter 6 of the EIS.

4.1.2 Planning Phase

Ecological investigations were also undertaken during the constraints analysis phase to help to determine the potential impacts of the proposal. This facilitated the amendment of the design, where possible, to minimise potential impacts on threatened species, communities and their habitats.

The ecological investigations undertaken by Umwelt (2014) identified a range of key biodiversity constraints for the Parkes to Narromine section of the proposal. These investigations included database and literature reviews and rapid ecological field surveys of the rail corridor that included vegetation assessments, targeted inspections of bridge structures for micro-bats and rapid aquatic assessments. The investigations identified the presence of multiple threatened ecological communities (TECs) under the TSC and EPBC Acts occurring within and adjacent to the rail corridor. Fauna habitats, however, were found to be relatively limited due to the previous and ongoing disturbances within the rail corridor and extensive agricultural lands surrounding the proposal area.

Following these investigations, consideration was given to where works could be relocated outside of native vegetation (such as construction compounds) and to locate these areas in primarily disturbed or exotic landscapes. However, in most cases there was little scope for further avoidance of ecological impacts for the construction of the proposal itself as the location of works is constrained by the location the existing rail line and the existing rail corridor.

Further mitigation measures are described in **Section 4.2** below with the aim of further minimising impacts.

4.1.3 Avoidance Summary

ARTC undertook a detailed ecological constraints study to guide the design of the proposal which allowed for early consideration of the impacts of the proposal on significant ecological features, including MNES. ARTC was then able to implement avoidance measures, as described in **Table 4.1** that reduced the area of direct impact on EPBC Act listed threatened ecological communities and threatened species habitats.

Table 4.1 below outlines a summary of the avoidance measures that have been or will be implemented to minimise the impacts of the proposal.

Table 4.1 Avoidance Measures

Action	Outcome	Timing	Responsibility
The Melbourne-Brisbane Inland Rail Alignment Study	• Identification of a preliminary proposal route • Avoidance of native vegetation and habitat areas, where practicable	Site Selection	ARTC
Ecological constraints investigations	• Identification of areas of high conservation value • Relocation of works outside native vegetation and habitat areas, where practicable • Maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas)	Planning Phase	ARTC

Action	Outcome	Timing	Responsibility
Demarcation of areas approved for clearing, where practicable	• Minimisation of accidental clearing/disturbance of surrounding native vegetation	Construction	Construction contractor

4.2 Statutory or Policy Basis for Mitigation Measures

No specific State or Commonwealth policies are currently available to form the basis of the proposed mitigation strategy. The mitigation strategy has been developed specifically for the proposal based on previous learning and experience at ARTC and utilising best practise guidelines in ecological impact minimisation. Consideration has also been given to State and Commonwealth Recovery Plans and Threat Abatement Plans, where relevant.

4.3 Impact Mitigation and Biodiversity Management Measures

4.3.1 Construction

A CEMP would be prepared to detail the approach to environmental management during construction, as outlined below and in accordance with the conditions of approval for the proposal. The CEMP would include a number of sub-plans and management measures including for biodiversity. The key aspects of the proposed management plans are provided in **Table 4.2** and further detail regarding proposed environmental management is provided in the EIS. The measures identified in **Table 4.2** are a subset of the total measures provided in the EIS as these are measures that will mitigate impacts on the subject species and ecological communities as identified by the DoEE and assessed herein.

Table 4.2 Proposed Management Measures for Subject Species and Ecological Communities

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
1. General	The CEMP would outline the construction conditions and temporary environmental protection measures to manage the impact of construction activities. It would be consistent with the mitigation and management measures documented in this EIS, conditions of the approval, the conditions of any licences or permits issued by government authorities, and ARTC's environmental management system.	Site induction	All employees, contractors and subcontractors would receive an environmental induction which would include: • all proposal specific and standard noise and vibration mitigation measures • relevant conditions of licences/approvals/determinations etc • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • heritage requirements • construction employee areas • designated loading/unloading areas and procedures • construction traffic routes • site opening/closing times (including deliveries) • environmental incident procedures.	Informing employees and contractors of their responsibilities will encourage environmental awareness and should reduce unnecessary impacts on surrounding habitats and vegetation. This is applicable for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot
		Roles and responsibilities	The CEMP would identify all members of the Inland Rail and construction team, including roles and responsibilities relevant to implementation of the CEMP. Contact details would be provided, including contacts in the case of emergencies or incidents as well as out-of-hours contacts.	

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Reporting and communication	The CEMP would outline reporting requirements for different levels of environment incidents, as well as the required procedure for emergency and incident management, non-compliance management and corrective and preventative actions Any additional training requirements would be identified (in addition to the site induction). Reporting requirements would be included, including for the control of environmental records.	Early communication of any issues through reporting, monitoring and auditing will allow adaptive management to be undertaken to improve the environmental outcomes during construction. This is relevant for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot
		Monitoring and auditing	The CEMP would identify monitoring, auditing and inspection requirements, and determine the framework for the management of key environmental issues for construction.	

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Environmental control maps	The location of sensitive areas (e.g. heritage items and trees/vegetation to be retained) would be clearly identified on environmental control maps, which would be supplied to construction managers and workers.	Clear communication on areas approved for disturbance and the locations of sensitive environmental features should reduce unnecessary impacts on surrounding habitats and vegetation. This is applicable for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Working hours and out of hours protocol	Permissible working hours and activities would be defined. • An out-of-hours work protocol would be developed to guide the assessment, management, and approval of works for proposal construction hours.	Clear working hours and activities will assist in controlling access to work sites and may help reduce unnecessary impacts to surrounding areas of habitat and vegetation. This is relevant for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
Soil and water	The soil and water management sub-plan would detail how potential impacts on soils, erosion, sedimentation, watercourses and water quality (surface and groundwater) would be mitigated and managed during construction. The plan would provide for incident management in relation to potential water quality contamination incidents. It would include procedures to manage the impact of the proposal on flooding, and would take into account the requirements of relevant guidelines, including: • Managing Stormwater: Urban Soils and Construction Vol 1 (Landcom, 2004) • Managing Stormwater: Urban Soils and Construction Vol 2A Installation of Services (DECC, 2008) • Managing Urban Stormwater Volume 2C:	Erosion of exposed soils and sediment management	Sediment and erosion control devices would be installed to minimise mobilisation and transport of sediment in accordance with Managing Urban Stormwater, Soils and Construction (Landcom, 2004). Maintenance and checking of the erosion and sedimentation controls would be undertaken on a regular basis and any subsequent records retained. Sediment would be cleared from behind barriers/sand bags on a regular basis as required and all controls would be managed to ensure they work effectively at all times. The area of exposed surfaces would be minimised. Disturbed areas would be stabilised progressively to ensure that no areas remain unstable for any extended length of time. Soil and sediment that accumulates in erosion and sediment control structures would be reused where practicable during site reinstatement, unless it is contaminated or otherwise inappropriate for reuse. Work would cease where practicable during heavy rainfall events when there is a risk of sediment loss off site or ground disturbance due to waterlogged conditions. Equipment, plant and materials would be placed in construction compound/storage areas where they are least likely to cause erosion. Erosion control devices would be removed as part of the final site clean-up. This would include removing any sediment in drainage lines that has been trapped by erosion control devices, and restoring disturbed areas. Exposed surfaces would be stabilised, and final landscaping implemented, as soon as practicable.	Management of sediment and erosion will assist in the maintenance of habitat quality and vegetation community integrity and therefore minimise and mitigate the impacts of construction on the following MNES: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
	Unsealed roads (DECC, 2008) • OEH, 2012, Erosion and sediment control on unsealed roads (OEH, 2012) Technical Guideline: Temporary stormwater drainage for road construction (RMS, 2011) Waste Classification Guidelines (EPA, 2014).	Stockpile management	Stockpiles would be managed by implementing sediment and erosion control devices in accordance with Managing Urban Stormwater, Soils and Construction (Landcom, 2004). No stockpiles of materials or storage of fuels or chemicals would be located within high/medium flood risk areas or flow paths.	Stockpile management manages weeds and therefore mitigates potential for vegetation community integrity degradation for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis*

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Spill/incident management	Spill kits would be maintained on-site at all times. Machinery would be checked daily to ensure that no oil, fuel or other liquids are leaking. Refuelling of plant and equipment would be undertaken within designated areas with appropriate controls. Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) would be undertaken on a regular basis to identify any potential spills. Vehicle wash down and/or cement truck washout would occur in a designated bunded area or off-site.	Spill management will assist in the maintenance of habitat quality and vegetation community integrity and therefore minimise and mitigate the impacts of construction in relation of the following MNES: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Groundwater	Any groundwater encountered during construction would be managed and disposed of in accordance with the Waste Classification Guidelines (EPA, 2014). Groundwater would be managed to ensure it does not cause pollution of waters in accordance with section 120 of the POEO Act. If dewatering is required during construction, the water would be tested, and treated if necessary, prior to re-use, discharge or disposal in accordance with the testing results.	Groundwater management (where required) will assist in the maintenance of habitat quality and vegetation community integrity and therefore minimise and mitigate the impacts of construction in relation of the following MNES: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
Biodiversity management	The biodiversity management sub-plan would detail how construction impacts on aquatic and terrestrial flora and fauna would be mitigated, managed and monitored.	Vegetation management	Employee education and training including inductions for staff, contractors and visitors to the site would include the biodiversity issues present at the site and so they know their role and responsibilities in relation to the protection and/or minimisation of impacts to native biodiversity. The CEMP and construction plans would document the extent of clearing required.	Employee education and training will encourage environmental awareness and should reduce unnecessary impacts on surrounding habitats and vegetation. This is applicable for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Management of trees to be retained	The management of trees in the vicinity of the construction zone would be consistent with the AS 4970-2009 Protection of trees on development sites (incorporating Amendment No. 1 (March 2010)).	The management of trees in the vicinity of the construction zone should reduce unnecessary impacts on surrounding habitats and vegetation. This is applicable for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Pre-clearance surveys – woody native vegetation	Pre-clearance surveys would be implemented within areas of woody native vegetation that are to be cleared. Pre-clearance surveys will be undertaken by suitably qualified and experienced ecologists and involve the following: • The demarcation of areas approved for clearing to reduce risk of accidental clearing/disturbance of surrounding native vegetation where practicable. • The likely habitat resources and habitat trees would be identified and marked. Habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs and burrows. • The potential presence of threatened flora and fauna species, endangered populations and TECs would be identified. • The identification of species or habitat features that are suitable for translocation or salvage. • In areas of koala habitat, visual inspection of trees for koalas prior to clearing.	Pre-clearance surveys provide the opportunity to minimise impacts on flora and fauna species occupying the habitat to be cleared and will therefore reduce potential impacts to: • *Tylophora linearis* • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Tree-felling	Tree clearing would be completed as close to the completion of pre-clearance surveys as practicable and would include: All habitat trees would be vigorously shaken with heavy machinery the day prior to clearing. On the day of habitat tree felling, the following would be undertaken: • all habitat trees would be subject to a visual inspection for threatened species • all reasonable attempts would be made to reduce the impact of felling on all fauna species • the lowering of hollow-bearing trees would be done as gently as possible with heavy machinery • if a native fauna species is identified in a habitat tree on the day of felling, an ecologist or appropriately qualified fauna handler would advise the most appropriate method to minimise potential harm • uninjured animals would be released on the day of capture into nearby suitable secure habitat and would not be held for extended periods of time • injured animals would be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. Following felling, habitat trees would be inspected for remaining or injured fauna species and to ensure that no hollows are blocked against the ground. This may require the tree to be rolled to ensure adequate access. All felled habitat trees would remain in place for a least one night to allow any fauna still present to move on.	Tree-felling supervision provides the opportunity to minimise impacts on fauna species occupying the habitat to be cleared and will therefore reduce potential impacts to: • superb parrot • regent honeyeater • swift parrot

Item/sub-plan	What would the plan address?	Issue	Management measures to be included in the CEMP and implemented during construction	MNES benefited by Proposed Management Measures
		Weed management	Weeds would be managed and disposed of in accordance with the requirements of the *Noxious Weeds Act 1993* and/or the Weeds of National Significance Weed Management Guide. Weed control mitigation and management strategies would be documented and implemented as follows: • vehicles or equipment being brought onto the proposal site and/or travelling around the site must be inspected and cleaned prior to commencing work to limit the spread of seeds and plant material • regular inspections to monitor the spread of weed species • training of environmental personnel on the identification of target weed species. • Any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include: • spraying with herbicides • physical removal • minimisation of area available for weed infestation, through prompt revegetation of bare areas.	Weed management will mitigate the potential for vegetation community integrity degradation for: • *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC* • *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC* • *Tylophora linearis*

4.3.2 Operation

An Operational Environmental Management Plan (OEMP) will also be developed for the proposal. Specific to MNES, the following management measures will be included in the OEMP:

- annual inspections would be undertaken for weed infestations and to assess the need for control measures
- any outbreak of noxious and/or weeds of national environmental significance would be managed in accordance with the *Noxious Weeds Act 1993*, the Weeds of National Significance Weed Management Guide, and the requirements of relevant authorities.

These management actions will assist in the maintenance of habitat quality and vegetation community integrity. Furthermore, the communication of any issues through reporting, monitoring and auditing will allow adaptive management to be implemented to improve environmental outcomes during operation. This will result in the mitigation of impacts to the following MNES during operation of the proposal:

- *White Box-Yellow box Blakely's Red Gum Grassy Woodland and DNG CEEC*
- *Grey Box Grassy woodlands and DNG of South-eastern Australia EEC*
- *Tylophora linearis*
- superb parrot
- regent honeyeater
- swift parrot.

4.4 Predicted Effectiveness of the Mitigation Measures

As discussed in **Section 4.3**, ARTC will prepare an appropriate biodiversity management sub-plan in accordance with the EIS and conditions of approval. The measures proposed to be implemented for the proposal are well established mitigation techniques that are commonly used and are well understood. The measures have been found to be effective in mitigating impacts, however, as they rely on procedural implementation (i.e. clearing supervision undertaken etc.) there is an element of human error risk. This risk will be mitigated by development of the biodiversity management sub-plan and appropriate personnel training. The human error risk is further mitigated be the mitigation measures being well established approaches that are therefore commonly understood by construction personnel and management.

Ongoing site inspections will be used to assess and inform the implementation and effectiveness of mitigation and management actions. The effectiveness and long-term success of mitigation actions will be evaluated against key outcomes, which necessitate regular and appropriately targeted auditing, in accordance with the requirements of the CEMP. This will be achieved by undertaking due diligence assessments that periodically examine measurable changes over time and provide information on impacts and the success or otherwise of mitigation actions. This process will provide for adaptive management allowing mitigation measures to be modified as required during construction or operations so that they remain effective.

The techniques proposed to be used to monitor the effectiveness of mitigation measures will be documented in the CEMP and biodiversity and soil and water management sub plans, however it will be targeted, systematic and repeatable.

4.5 Biodiversity Offset Strategy

In accordance with the Bilateral Agreement, offsets for MNES will be provided through the offset contribution required by the NSW FBA. The FBA offsetting requirements have been documented below with specific reference to relevant MNES.

ARTC is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the proposal under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a). Firstly, ARTC has, where possible, altered the proposal to avoid and minimise ecological impacts in the proposal planning stage, and a range of impact mitigation strategies have been included in the proposal to mitigate the impact on ecological values (refer to **Section 4.3**) prior to the consideration of offsetting requirements.

4.5.1 NSW Framework for Biodiversity Assessment Biodiversity Credit Report

The controlled Action notification identified that the proposal was to be assessed via the Bilateral Agreement and the biodiversity assessment has been conducted in accordance with the NSW Framework for Biodiversity Assessment (FBA). The FBA process requires the calculation of biodiversity credits using a NSW Government credit calculator. The credits calculated and presented in this report have been prepared based on a proposal area provided by GHD in April 2016 (refer to **Appendix A**). It is noted that since this time, a range of alterations to the proposal were made following completion of further technical assessments and engineering design of the proposal which result in some changes to the proposal site. For this reason the proposal site used in this assessment, whilst substantially similar to the final proposal site, is different to that described in the remainder of the EIS. It is expected that the final credit generation for the proposal will be confirmed as an outcome of the detailed design process and that biodiversity offsetting for the proposal will be based on the final credit calculations.

Table 4.3 below provides a summary of the ecosystem and species credits that require offsetting in accordance with the NSW FBA and Major Projects Offset Policy**.** The total area of each PCT is included in **Table 4.3** and several PCTs are consistent entirely or in-part with EPBC Act listed threatened ecological communities. Ecosystem credits requiring offsetting in accordance with the FBA include communities that conform to *Weeping Myall Woodlands* EEC, *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* and *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC.* The retirement of credits associated with the native vegetation communities occurring in the proposal area also ensures that the habitat for EPBC Act listed threatened bird species (regent honeyeater, swift parrot and superb parrot) and the potentially occurring *Tylophora linearis* are all offset as part of the proposal.

Like-for-like credit retirement is to be undertaken for MNES significantly impacted by the proposal in accordance with the biodiversity offset strategy and Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH 2014a). The final application of offset credits following the like-for-like principle will be determined during detailed design.

Table 4.3 Plant Community Types Requiring Offset and the Total Ecosystem Credits Required in accordance with the NSW FBA and the outcomes of the Biodiversity Assessment Report (Umwelt 2017)

Plant Community Type	Corresponding MNES: TEC or Threatened Species Habitat	Total Area to be Impacted (ha)	Total Ecosystem Credits Required
PCT26 (CW205, LA212) Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion *Moderate to Good*	0.99 hectares meets condition threshold criteria of Weeping Myall Woodlands CEEC Superb parrot	3.16	146
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Moderate to Good*	Superb parrot	0.87	46
PCT36 (CW183, LA193) River Red Gum tall to very tall open forest / woodland wetland on rivers on floodplains mainly in the Darling Riverine Plains Bioregion *Low_Regeneration*	Superb parrot	0.62	8
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good*	Superb parrot	0.94	49
PCT55 (CW104, LA105) Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions *Moderate to Good_DNG*	Superb parrot	6.12	293
PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt *Moderate to Good*	*Tylophora linearis* Superb parrot	1.54	38
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good*	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC Swift parrot Regent honeyeater Superb parrot	8.58	473

Plant Community Type	Corresponding MNES: TEC or Threatened Species Habitat	Total Area to be Impacted (ha)	Total Ecosystem Credits Required
PCT76 (CW145, LA154) Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions *Moderate to Good_DNG*	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC	23.48	556
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good*	Superb parrot	1.41	79
PCT244 (CW172, LA178) Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt) *Moderate to Good_DNG*	Superb parrot	1.20	35
PCT201 (CW138, LA145) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion *Moderate to Good*	Superb parrot	1.50	70
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good*	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC Swift parrot Regent honeyeater Superb parrot *Tylophora linearis*	3.12	169
PCT267 (CW213, LA218) White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion *Moderate to Good_DNG*	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	0.46	16

Plant Community Type	Corresponding MNES: TEC or Threatened Species Habitat	Total Area to be Impacted (ha)	Total Ecosystem Credits Required
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good*	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC Swift parrot Regent honeyeater Superb parrot *Tylophora linearis*	3.40	235
PCT276 (CW226, LA226) Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion *Moderate to Good_DNG*	White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	10.32	348
TOTAL		**66.72**	**2,561**
Species Credits			
koala (*Phascolarctos cinereus*)			491
Total			**491**

5.0 Summary of Impacts on Relevant MNES

Table 5.1 provides a summary of the direct and permanent impacts associated with the proposal that are described in **Section 3.2** and the range of avoidance, mitigation and management, and biodiversity offset strategies described in **Section 4.0.** As detailed in **Section 4.5** above, like-for-like offsets for MNES impacted by the proposal will be retired in accordance with the NSW FBA.

Table 5.1 Summary of the Impacts of the Proposal on Threatened Species and Ecological Communities

Matter	Avoidance and Mitigation	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland CEEC	Avoidance of native vegetation and habitat areas through proposal design, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in **Table 4.3** to be implemented as described in the: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	The proposal will result in the permanent loss of 17.3 hectares of the CEEC, of which 6.52 hectares comprises woodland and 10.78 hectares of grassland.	Subject to the revision of credits as part of the detailed design process, 768 ecosystem credits will be retired to offset impacts to this CEEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC	Avoidance of native vegetation and habitat areas through proposal design, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in **Table 4.3** to be implemented as described in the proposed: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	The proposal will result in the permanent loss of 31.53hectares of the EEC, of which 7.89 hectares comprises woodland and 23.64 hectares of derived native grasslands.	Subject to the revision of credits as part of the detailed design process, 1029 ecosystem credits will be retired to offset impacts to this EEC, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

Matter	Avoidance and Mitigation	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
Tylophora linearis	Avoidance of native vegetation and habitat areas through proposal design, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in **Table 4.3** to be implemented as described in the proposed: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. *Tylophora linearis* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal site within Goobang National Park (OEH 2016d). This species distribution is known to overlap with occurrences of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, which occurs in the proposal site and therefore there is potential for this species to occur (albeit low) in the proposal site. A *population* of the species (as described by the significant impact guidelines) is not expected to occur within the proposal area.	Subject to the revision of credits as part of the detailed design process, 442 ecosystem credits will be retired to offset impacts to *White Box Yellow Box – Blakely's Red Gum Woodland* CEEC, which provides potential habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Superb Parrot	Avoidance of native vegetation and habitat areas through proposal design, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in Table 4.3 to be implemented as described in the proposed: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	Six superb parrots were recorded flying over the proposal site at two locations during targeted surveys. Four individuals were recorded within the proposal area 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All of the vegetation communities identified in the proposal site are expected to provide potential foraging habitat, however potential breeding habitat is not expected to occur. The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that provide foraging habitat for the species. Blakely's red gum was not recorded in the proposal site and therefore breeding habitat is not likely to be impacted by the proposal.	Subject to the revision of credits as part of the detailed design process, 2,561 ecosystem credits will be retired to offset impacts to the habitat of this threatened species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

Matter	Avoidance and Mitigation	Proposal Impact	Like-for-like Offset In accordance with NSW FBA
Regent Honeyeater	Avoidance of native vegetation and habitat areas through proposal design, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in **Table 4.3** to be implemented as described in the proposed: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016c)). The closest record of the species occurs approximately 30 km to the east of the Proposal area near Dubbo (OEH 2016d). The habitat within the proposal site is substantially degraded. This species is considered to have a low likelihood of occurrence within the proposal site, however approximately 15.1 hectares of potential foraging habitat for the species will be directly impacted.	Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.
Swift Parrot	Avoidance of native vegetation and habitat areas, where practicable and maximising disturbances within areas of low conservation value (exotic grasslands, disturbed areas) Mitigation of impacts through controls described in Table 4.3 to be implemented as described in the proposed: • CEMP • Soils and Water Management Sub-plan • Biodiversity Management Sub-plan.	The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species undertaken throughout the proposal site. There are no known records of swift parrot within 10km of the proposal site.	Subject to the revision of credits as part of the detailed design process, 877 ecosystem credits will be retired to offset impacts to habitat for this species, in accordance with the Programme Biodiversity Offset Strategy and the NSW FBA.

6.0 Environmental Record of the Proponent

Table 6.1 provides a summary of the environmental record of the proponent.

Table 6.1 The Environmental Record of the Proponent.

Environmental Record of the Proponent	Yes	No
Does the party taking the action have a satisfactory record of responsible environmental management?	X	
Provide details Through implementation of ARTC's Code of Practice, Environmental Management System, and Environmental Management Plans for a variety of construction projects, ARTC has maintained a satisfactory record of responsible environmental management.		
Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?		X
If yes, provide details		
If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?	X	
If yes, provide details of environmental policy and planning framework ARTC Code of Practice for environmental impact assessment of development proposals in NSW ARTC Environmental Management System (EMS)		
Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?	X	
Provide name of proposal and EPBC reference number (if known) Kooragang Coal Terminal Arrival Roads Stage 2 Upgrade, Newcastle, NSW (2014/7229) Rail Upgrades at Geelong Port Project (2010/5363) Maitland to Minimbah Third Track Project, NSW (2009/4897)		

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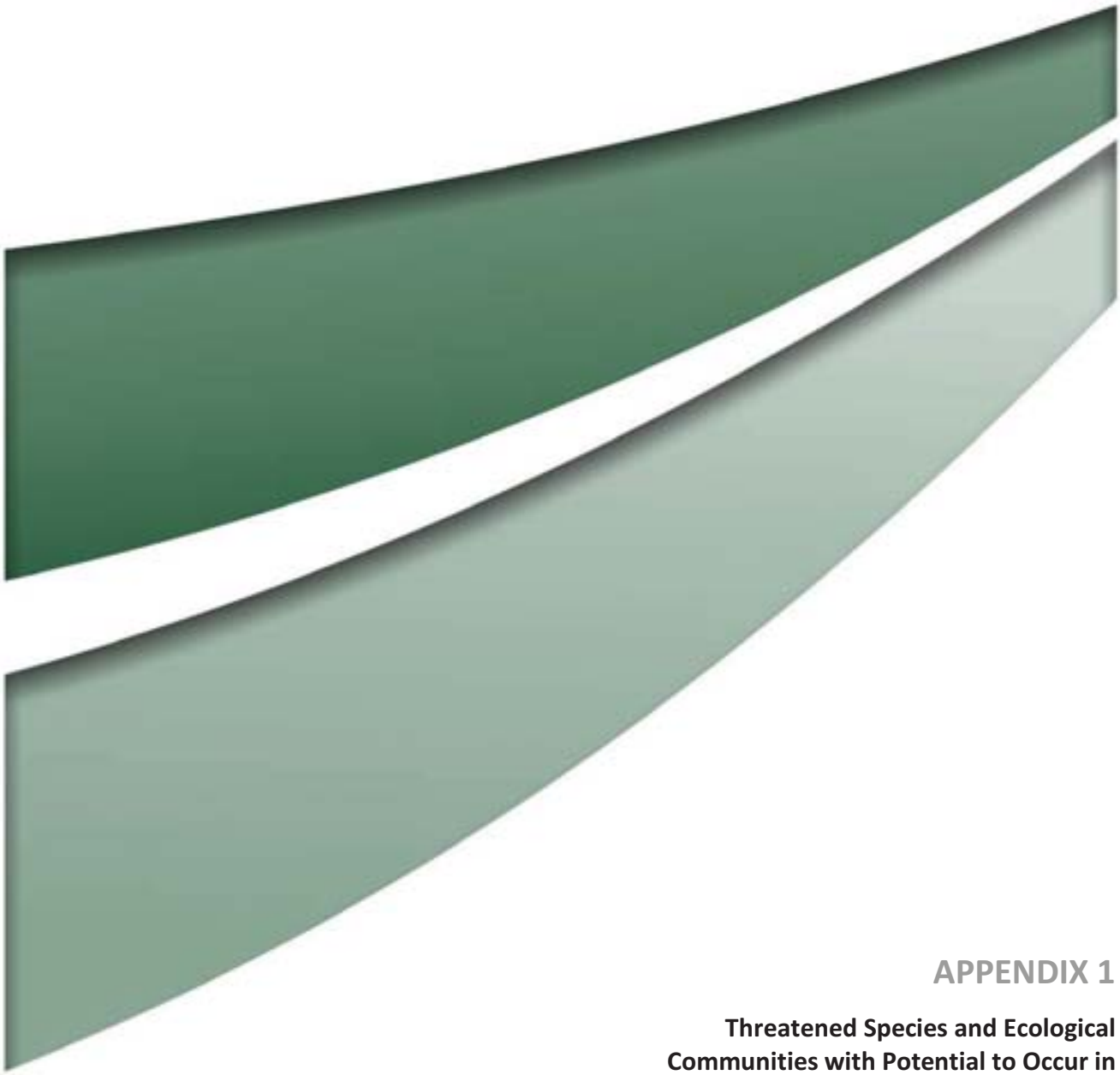


APPENDIX 1

Threatened Species and Ecological Communities with Potential to Occur in the Proposal Area

Appendix 1 – Threatened Species and Ecological Communities with Potential to Occur in the Proposal Area

Threatened species and threatened ecological communities (TECs) listed under the EPBC Act recorded or having the potential to occur within the proposal area have been identified based on the results of the searches of the OEH Atlas of NSW Wildlife Database, DoEE Protected Matters Database and the Primary Industries Fishing and Aquaculture Records Viewer.

Any threatened species or threatened ecological communities considered to have the potential to be significantly impacted are further assessed in **Appendix 2**.

The following abbreviations or symbols are used in the list:

V Vulnerable

E Endangered

CE Critically Endangered

EEC Endangered Ecological Community

CEEC Critically Endangered Ecological Community

Table 1 – Threatened Species and TECs Recorded or with Potential to Occur within the Proposal area

Species/Community Habitat Requirements and Ecological Features	Status	Likelihood to Occur	Assessment of Significance Required?
Threatened Ecological Communities			
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions Coolibah – Black Box Woodland of the Darling Riverine Plains and the Brigalow Belt South Bioregion is limited to the Darling Riverine Plains and Brigalow Belt South bioregions in northern NSW and southern Queensland (TSSC 2011). It is broadly characterised by a canopy dominated by coolibah (*Eucalyptus coolabah* subsp. *coolabah*) and black box (*Eucalyptus largiflorens*) with a grassy understorey (TSSC 2011).	EEC	This community is not likely to occur in the proposal area and will not be impacted by the proposal.	No
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* is listed as an endangered ecological community under the EPBC Act (TSSC 2010a). The community is characterised by a canopy dominated by inland grey box (*Eucalyptus microcarpa*), while several other canopy species are also commonly associated with the EEC (TSSC 2010a). These include, but are not limited to bulloak (*Allocasuarina luehmannii*), kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*) (TSSC 2010a). The proposal will permanently impact 31.37 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act. Of this, 7.89 hectares comprises remnant woodland and 23.64 hectares occurs in the form of derived native grassland. An additional 0.69 hectares of plant community type (PCT) -76/BVT-CW145/LA154 - Western Grey Box Tall Grassy Woodland (Moderate/Good condition) does not meet the condition thresholds of the EEC under the EPBC Act.	EEC	31.53 hectares to be permanently impacted	**Yes** – refer to Appendix 2
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland *Natural Grassland on Basalt and Fine-textured Alluvial Plains of Northern NSW and Southern QLD* occurs from the Darling Downs in Queensland to Dubbo in New South Wales however within this broad geographical area it is confined to where climate, soils and landform are conducive to the development of tussock grasslands. The community is typically dominated by tussock grasses in the genera *Austrostipa, Bothriochloa, Chloris, Enteropogon, Rytidosperma* or *Themeda*.	CEEC	This community is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features	Status	Likelihood to Occur	Assessment of Significance Required?
Weeping Myall Woodlands Weeping Myall Woodlands ecological community occur on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland. It occurs in the Riverina, NSW South Western Slopes, Darling Riverine Plains, Brigalow Belt South, Brigalow Belt North, Murray-Darling Depression, Nandewar and Cobar Peneplain Interim Biogeographic Regionalisation for Australia (IBRA) Bioregions. The ecological community currently occurs in small pockets throughout this range (TSSC 2008a). The Weeping Myall Woodlands occur in a range from open woodlands to woodlands, generally 4-12 m high, in which Weeping Myall (*Acacia pendula*) trees are the sole or dominant overstorey species. Weeping Myall trees often occur in monotypic stands, however other vegetation may also occur in the ecological community, though not as dominant species, including western rosewood (*Alectryon oleifolius* subsp. *elongatus*), poplar box (*Eucalyptus populnea*) or black box (*Eucalyptus largiflorens*) (Threatened Species Scientific Committee 2008a).	EEC	0.99 hectares to be permanently impacted	No
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a critically endangered ecological community under the EPBC Act. This community occurs along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees. The proposal will permanently impact 6.52 hectares of box gum woodlands and 19.69 hectares of derived native grasslands that meet the condition thresholds of the EPBC Act listed White Box Yellow Box Blakely's Red Gum Woodland CEEC. Detailed assessment of the vegetation communities described and mapped within the proposal area was undertaken to determine whether the vegetation present in the proposal area met the condition class thresholds identified in the Listing Advice (TSSC 2006).	CEEC	17.3 hectares to be permanently impacted	**Yes** – refer to Appendix 2

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Threatened Flora Species				
Austrostipa metatoris	Austrostipa metatoris is a perennial grass that grows in tussocks to 1 m tall (TSSC 2008b). Within NSW, the species occurs along the Murray Valley near Balranald and the central-western slopes near Lake Cargelligo (TSSC 2008b). It occurs on sandy mallee areas on sandhills, sand ridges, undulating plains and flat open mallee country (TSSC 2008b). Austrostipa metatoris was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal survey requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and ongoing disturbance from the rail corridor. The proposal area is not considered to support suitable habitat for this species. The closest record of the species occurs approximately 100 km to the east of the proposal area at Condobolin (OEH 2016d).	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
a spear-grass *Austrostipa wakoolica*	*Austrostipa wakoolica* is a densely-tufted, perennial grass that grows to 1 m tall (TSSC, 2014). This spear grass flowers in response to rain (Jacobs and Everett 1993) between October to December (TSSC 2014). The species is considered unlikely to tolerate disturbance and may require sites that are protected from impacts of herbivore grazing and rabbits (TSSC 2014). *Austrostipa wakoolica* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal survey requirements for this species, including after rain events. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor, making the habitat unsuitable for *Austrostipa wakoolica*. The closest record of the species occurs approximately 5 km to the east of the proposal area between Parkes and Bogan Gate (OEH 2016d).	E	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Philotheca ericifolia	*Philotheca ericifolia* is a wide spreading shrub to 2 m tall that in NSW is known only from the upper Hunter Valley and Pilliga to the Peak Hill districts (TSSC 2008c). It occupies dry sclerophyll forest and heath on damp sandy flats and gullies (TSSC 2008c). Philotheca ericifolia was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal survey requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest, most recent record of the species occurs within 1 km from the western edge of the proposal area at Peak Hill but was recorded in 1905 (OEH 2016d)	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
slender darling pea *Swainsona murrayana*	Slender darling pea is an ascending to erect perennial forb to 25 cm tall (TSSC 2008d). In NSW the species occurs in the central western slopes, Western Division and the Riverina Area in grassland, herbland and Black-box woodland (TSSC 2008d). The species occupies heavy grey or brown clays, loams or red cracking clays (TSSC 2008d). Slender darling pea was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal survey requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest most recent record of the species occurs approximately 30 km to the north of the proposal area (OEH 2016d). Extensive survey work in the locality has been undertaken and no populations have been found in the proposal area.	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Tylophora linearis	*Tylophora linear*is is an herbaceous climber with clear latex growing to approximately 2 m in length (TSSC 2008e). In NSW the species is rarely collected, known from less than 10 localities in the Dubbo area and Mt Crow near Barrabra, growing in dry scrub, open forest and woodlands. It is also known to overlap in distribution with White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland critically endangered ecological community under the EPBC Act (TSSC 2008e). *Tylophora linearis* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). However due to the presence of the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC in the proposal area, there is a potential for this species to occur (albeit low) and thus be significantly impacted.	E	Low likelihood of occurrence, it was not recorded in the proposal area, lack of records within 10 km of the proposal area, however 8.06 ha of the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC and PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt will be permanently removed which comprises potential habitat.	**Yes** – refer to Appendix 2

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Threatened Aquatic Species				
trout cod *Maccullochella macquariensis*	The natural distribution and abundance of trout cod (*Maccullochella macquariensis*) has declined since European settlement. They 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. There are no known threatened fish records for the watercourses crossed by the existing rail corridor between Parkes and Narromine.	E	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
Murray cod *Maccullochella peelii*	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. However the Macquarie River does not occur within the proposal area. 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. No records of threatened fish species known within the Parkes LGA (DPI 2016).	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Macquarie perch *Macquaria australasica*	Macquarie perch (*Macquaria australasica*) 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 within the Parkes LGA (DPI 2016). There are no threatened fish records for the watercourses crossed by the existing rail corridor between Parkes and Narromine.	E	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
Threatened Reptiles				
pink-tailed worm-lizard *Aprasia parapulchella*	The pink-tailed worm-lizard is a small, legless and slender lizard growing to 25 cm in length that lives underground (TSSC 2015a). In NSW the species only occurs from Central and Southern Tablelands and the South Western Slopes (TSSC 2015a). The species occupies both primary and secondary grasslands, grassy woodlands and woodlands, usually inhabiting sloping sites that contain rocky outcrops or scattered, partially buried rocks (TSSC 2015a). The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The pink-tailed worm-lizard was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There are no known records of this species within 10 kilometres of the proposal area (OEH 2016d).	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Striped legless lizard *Delma impar*	The striped legless lizard has a long and think body, growing to about 30 cm long, when the tail is unbroken it is about twice the length of the body (Smith and Robertson 1999). The species is restricted to temperate grassland habitats in NSW, however has been recorded in secondary grasslands, box-gum woodlands and grasslands with a high proportion of introduced species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The striped legless lizard was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There are no known records of this species within 10 kilometres of the proposal area (OEH 2016d).	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
Threatened Birds				
regent honeyeater *Anthochaera phrygia*	The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (DoE 2016)). The closest record of the species occurs approximately 30 km to the east of the Proposal area near Dubbo (OEH 2016d). The habitat within the proposal area is substantially degraded, however the proposal will remove approximately 15 hectares of potential foraging habitat for the species. The closest record of the species in the local area is approximately 30 km from the proposal area. This species is considered to have a low likelihood of occurrence within the proposal area but has the potential to be significantly impacted due to the removal of 15 hectares of potential foraging habitat for the species.	CE	Low likelihood of occurrence, it was not recorded in the proposal area, lack of records within 10 km of the proposal area, but there is 15.1 ha of the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC which comprises potential habitat	**Yes** – refer to Appendix 2

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Australasian bittern *Botaurus poiciloptilus*	Australasian bittern was not recorded within the proposal area despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the north of the proposal area along the Macquarie River north of Narromine (OEH 2016d). The proposal area does not contain any permanent freshwater wetlands with tall, dense fringing vegetation, which is required habitat for the species. This species is not likely to occur in the proposal area and will not be impacted by the proposal.	E	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
curlew sandpiper *Calidris ferruginea*	The curlew sandpiper is a small and slim sandpiper that in NSW are widespread east of the Great Divide especially in coastal regions, Riverina and south-west NSW, but occasionally recorded in the Tablelands (TSSC 2015b). The species does not breed in Australia, its general habitat is on intertidal mudflats in sheltered coastal areas, while inland it occupies ephemeral and permanent lakes, dams, waterholes and bore drains that have bare edges of mud or sand (TSSC 2015b). Feeding habitat includes mudflats and nearby shallow water. The curlew sandpiper was not recorded within the proposal area despite extensive fauna survey undertaken throughout the proposal area across multiple seasons. There are two records of curlew sandpiper within 10km of the proposal area, both of which occur approximately 2km east of the proposal area in Parkes. The proposal area is not considered to contain suitable wetlands that supports mudflat habitat. The species is not likely to occur in the proposal area and will not be impacted by the proposal.	CE	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
painted honeyeater *Grantiella picta*	Targeted surveys of the proposal area did not identify any painted honeyeaters. The species has been recorded once in the local area with one record in the Atlas of NSW wildlife within 10km of the proposal area from 1990, approximately 1.6km east of Peak Hill. The painted honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. The conservation advice for the painted honeyeater (TSSC 2015c) describes the species habitat as mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. Within the proposal area potential woodland habitat is restricted to small linear patches and scattered trees, mostly fragmented by agricultural lands but sometimes with adjoining woodland areas. Due to the highly dispersive nature of the species, the species is considered to have a single population. The proposal area does not support a key population for breeding and dispersal, does not provide habitat for a portion of the population that is necessary for maintaining genetic diversity and the species is not at the limit of its range in the proposal area. Therefore, the proposal area does not contain an important population of the painted honeyeater.	V	An important population of the species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
swift parrot *Lathamus discolor*	The swift parrot is a slim, medium sized parrot approximately 25 cm in length (TSSC 2016a). In NSW the species disperses widely to forage in forests and woodlands throughout the coastal and western slopes on flowers and *psyllid* lerps in Eucalyptus species (TSSC 2016a). It is considered that the proposal will permanently remove 15 ha of potential foraging habitat for the species. Breeding occurs in Tasmania, there is no breeding habitat in the proposal area. The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. There are no known records of swift parrot within 10km of the proposal area. This species is considered to have a low likelihood of occurrence within the proposal area but has the potential to be significantly impacted due to the removal of 15 hectares of potential foraging habitat for the species.	CE	Low likelihood of occurrence, it was not recorded in the proposal area, lack of records within 10 km of the proposal area, but there is 15.1 ha of the *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC which comprises potential habitat	**Yes** – refer to Appendix 2
malleefowl *Leipoa ocellata*	The malleefowl is a mound building species of bird that is restricted to the mainland, inhabiting semi-arid and arid habitats (Benshemesh, 2007). The species occupies shrublands and low woodlands dominated by mallee and associated semi-arid and arid habitats. The proposal area is not considered to support suitable habitat critical for this species. The malleefowl was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There is one record of malleefowl within 10km of the proposal area, approximately 5km east of the proposal area in Peak Hill. This species is not likely to occur in the proposal area and will not be impacted by the proposal.	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

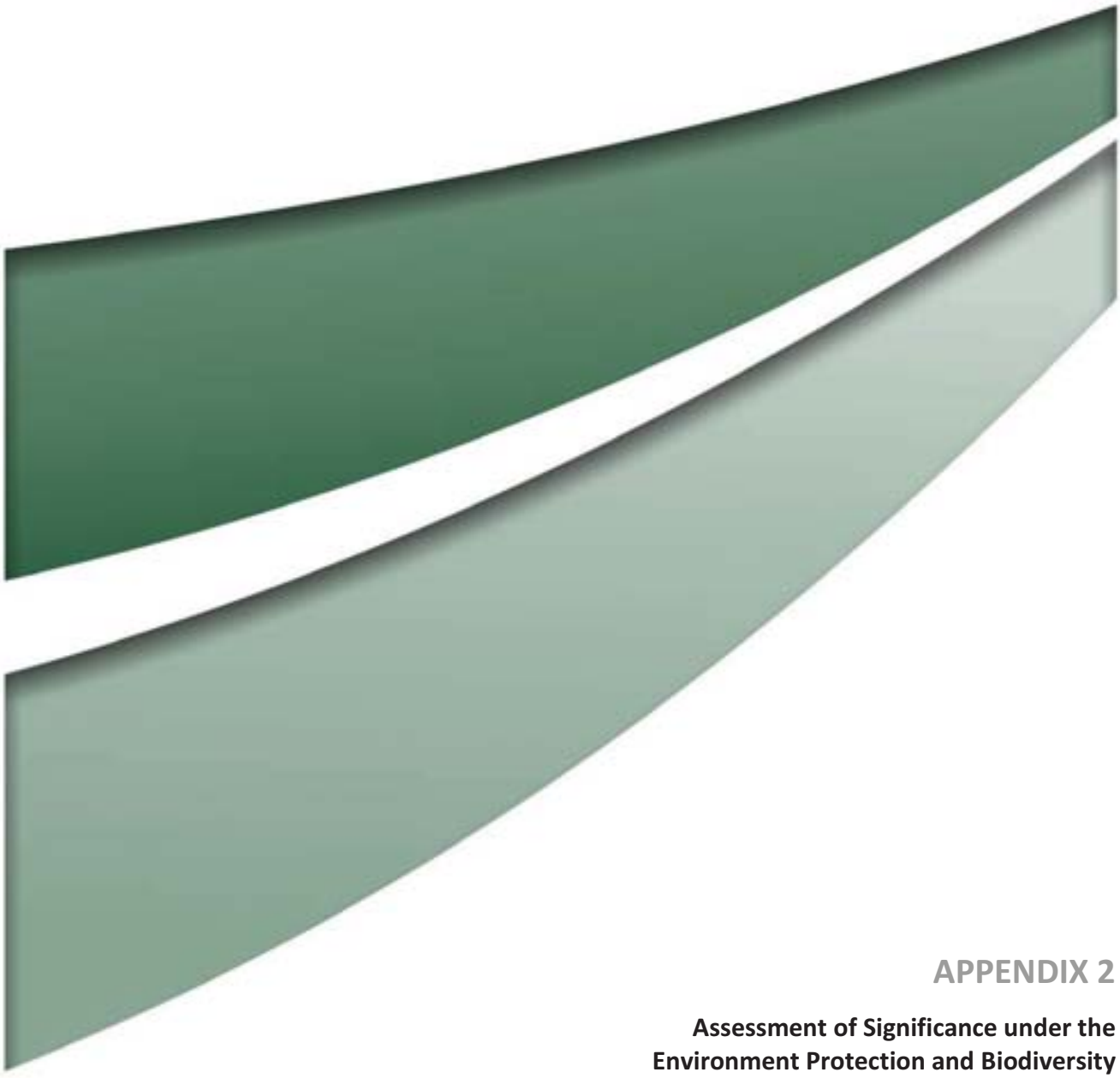
Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
eastern curlew *Numenius madagascariensis*	The eastern curlew is the largest migratory shorebird in the world, with long neck, long legs and very long downcurved bill (TSSC 2015d). The species does not breed in Australia, therefore no breeding habitat occurs in the proposal area. In general, the eastern curlew is largely associated with sheltered coasts, but also occurs on beaches, saltmarshes and mudflats fringed by mangroves (TSSC 2015d). The eastern curlew was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There are no known records of eastern curlew within 10km of the proposal area. The proposal area is not considered to contain suitable habitat to support this species. The species is not likely to occur in the proposal area and will not be impacted by the proposal.	CE	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
superb parrot *Polytelis swainsonii*	The superb parrot occurs through the inland slopes and plains of NSW (including the Australian Capital Territory) to northern Victoria. The breeding range of the superb parrot is mostly in the NSW South Western Slopes and Riverina bioregions. The three main breeding areas are: (1) bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young (NSW);(2) along the Murrumbidgee River, between Wagga Wagga and Toganmain Station (near Bringagee), and farther north at Goolgowi (NSW); and (3) along the Murray and Edward Rivers, from east of Barmah and Millewa State Forest to south of Taylors Bridge (Baker-Gibb 2011). The proposal area is considered unlikely to provide breeding habitat for the species. Breeding habitat for this species includes hollows more than 60 mm in diameter located more than 4 metres above ground (OEH 2016b). The national recovery plan for the species (Baker-Gabb 2011) identifies Blakely's red gum (*Eucalyptus blakelyi*) as the most important tree species for breeding for this species in the south western slopes bioregion, with most breeding events confined to this tree species. Blakely's red gum was not recorded in the proposal area and therefore breeding habitat is not considered likely to occur. Potential breeding habitat for this species is not likely to be impacted by the proposal. Superb parrot was recorded on three occasions within the proposal area during surveys. Four individuals were recorded within the proposal area 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All vegetation communities identified in the proposal area are expected to provide potential foraging habitat. The proposal will result in the permanent loss of approximately 75.77 hectares of native woodland and grassland communities.	V	Foraging habitat of the species recorded within the proposal area and 66.72 hectares will be removed as a result of the project.	**Yes** – refer to Appendix 2

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
Australian painted snipe *Rostratula australis*	The Australian painted snipe is a stocky wading bird between 24 and 30 cm in length (TSSC 2013). This species occupies shallow freshwater and occasionally brackish wetlands that are both ephemeral and permanent with a good cover of grass, rush, reeds, low scrub and open timber (TSSC 2013). The Australian painted snipe was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There are no known records of Australian painted snipe within 10km of the proposal area. The proposal area is not considered to contain suitable habitat to support this species. The species is not likely to occur in the proposal area and will not be impacted by the proposal.	E	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
Threatened Mammals				
south-eastern long-eared bat *Nyctophilus corbeni*	The south-eastern long-eared bat is found in southern central Queensland, central western NSW, north-western Victoria and eastern South Australia, where it is patchily distributed, with most of its range in the Murray Darling Basin (TSSC 2015e). The south-eastern long-eared bat is found in a wide range of inland woodland vegetation types. These include box / ironbark / cypress pine woodlands, Buloke woodlands, Brigalow woodland, Belah woodland, smooth-barked apple woodland, river red gum forest, black box woodland, and various types of tree mallee (TSSC 2015e). The species mainly roosts in tree hollows (TSSC 2015e). The south-eastern long-eared bat was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There is one record of this species on the OEH Atlas of NSW Wildlife within 10 kilometres of the proposal area (recorded in 1997), approximately 10km north east of Peak Hill. Based on the scarcity of local records and small area of habitat within the proposal area, it is considered unlikely that an important population of the south-eastern long-eared bat occurs within the proposal area.	V	An important population of the species is not likely to occur in the proposal area and will not be impacted by the proposal.	**No**

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
koala *Phascolarctos cinereus*	Koala was not recorded within the proposal area despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The proposal area contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)) for the Western Slopes and Plains Koala Management Area. Four records of the species occur within 10 km of the proposal area (OEH 2016d). One koala was recorded approximately 500 metres from the Proposal area as road kill on the Newell Highway. Another was recorded in remnant vegetation approximately 7 km south of the proposal area, while a third was recorded approximately 3.5 km to the east of the proposal area. Another record occurs approximately 8.5 km to the north-east of the proposal area between Narromine and Narromine East. These were all located in remnant vegetation. The Referral Guidelines advise that the assessment of significant impacts on the koala is to be undertaken primarily through the assessment of habitat critical to the survival of the koala and actions that interfere substantially with the recovery of the koala. This approach aims to avoid and address habitat loss as well as promote a streamlined assessment and approval process. Umwelt undertook an assessment of Koala Habitat Quality within the proposal area that resulted in a total score of 2, which is less than the score indicating habitat critical for the survival of the koala of ≥5. The proposal area is considered to contain potential habitat for the species in accordance with the TSPD, but the species is not considered likely to occur in the proposal area and will not be impacted by the proposal.	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No

Species/Community Habitat Requirements and Ecological Features		Status	Likelihood to Occur	Assessment of Significance Required?
New Holland mouse *Pseudomys novaehollandiae*	New Holland mouse is a small, burrowing native rodent that occurs in fragmented distributions across Tasmania, Victoria, New South Wales and Queensland (TSSC 2010). Throughout its range it is known to inhabit open heathlands, open woodlands with heathy understorey and vegetated sand dunes (TSSC 2010). The New Holland mouse was not recorded despite thorough fauna surveys undertaken throughout the proposal area. There are no known records of New Holland mouse within 10km of the proposal area. The proposal area is not considered to contain suitable habitat to support this species. The species is not likely to occur in the proposal area and will not be impacted by the proposal.	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No
grey-headed flying-fox *Pteropus poliocephalus*	Grey-headed flying-fox was not recorded within the proposal area despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 25 km to the east of the proposal area near Dubbo (OEH 2016d) and no camps have been recorded in the locality (DoE 2016b). This species is not likely to occur in the proposal area and will not be impacted by the proposal.	V	This species is not likely to occur in the proposal area and will not be impacted by the proposal.	No



APPENDIX 2

Assessment of Significance under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Appendix 2 – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the completion of an Assessment of Significance relating to the potential impacts of a proposed action on listed Matters of National Environmental Significance (MNES). A search of the Department of the Environment and Energy (DoEE) Protected Matters Database (undertaken on 5 December 2016) identified threatened species and ecological communities known to occur or considered likely to occur, on the basis of habitat modelling, within 10 kilometres of the proposal area.

Following vegetation community and fauna habitat assessment and targeted threatened species surveys, an assessment of the likelihood of occurrence of each ecological community and threatened species identified in the Protected Matters Database search was completed (see **Appendix 1**).

An Assessment of Significance (according to the EPBC Act significant impact guidelines 1.1 (DotE 2013) is provided below for those ecological communities and threatened species considered to be impacted by the proposal by the DoEE. As outlined in **Appendix 1**, no migratory species are considered to be potentially significantly impacted by the proposal, and further assessment of migratory species is not provided.

Table 1 presents the threatened ecological communities and **Table 2** presents the threatened species considered in the following assessment.

Table 1 Threatened Ecological Communities Considered in the Following Assessments of Significance

Threatened Ecological Communities
Critically Endangered Ecological Communities
White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act
Endangered Ecological Communities
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act

Table 2 Threatened Species Considered in the Following Assessments of Significance

Common Name	Scientific Name
Critically Endangered	
regent honeyeater	*Anthochaera phrygia*
swift parrot	*Lathamus discolor*
Endangered	
	Tylophora linearis
Vulnerable Species	
superb parrot	*Polytelis swainsonii*

Description of Impacts

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 crossing loops mainly within the existing rail corridor, at Goonumbla, Peak Hill, and Timjelly
- providing a 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 following works would also be undertaken:

- Changes to some property access roads and the local road network in some locations as a result of the rationalisation of level crossings.
- Flood protection works.
- Stormwater drainage works.
- Upgrading signalling and communications.
- Establishing or upgrading existing fencing of the rail corridor.
- Relocation of some services and utilities.

White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a critically endangered ecological community under the EPBC Act. This community occurs along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) or Blakely's red gum (*Eucalyptus blakelyi*) trees.

The proposal area supports a total of 24.93 hectares of box gum woodlands and derived native grasslands that meet the condition thresholds of the EPBC Act listed White Box Yellow Box Blakely's Red Gum Woodland CEEC. Detailed assessment of the vegetation communities described and mapped within the proposal area was undertaken to determine whether the vegetation present in the proposal area met the condition class thresholds identified in the Listing Advice (TSSC 2006). These thresholds have been incorporated into an identification flowchart for the CEEC within the EPBC Act Policy Statement (TSSC 2006) for the community which was also utilised during the assessment. Vegetation communities that conform to the EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC is included in **Table 3** below.

Of the total 24.93 hectares of the CEEC identified in the proposal area, a total of 17.3 hectares will be permanently disturbed.

Table 3 White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act mapped within the proposal area

Vegetation Community	Permanent Disturbance Area (ha)	Temporary Disturbance Area (ha)
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion_Moderate/Good	3.12 (all meets the criteria of the EPBC Act CEEC)	0.12 (all meets the criteria of the EPBC Act CEEC)
White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion_Moderate/Good - Derived Native Grassland	0.46 (all meets the criteria of the EPBC Act CEEC	0.11 (all meets the criteria of the EPBC Act CEEC)
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion _Moderate/Good	3.40 (all meets the criteria of the EPBC Act CEEC)	3.76 (all meets the criteria of the EPBC Act CEEC)
Yellow Box grassy tall woodland on alluvium or parna loams and clays on flats in NSW South Western Slopes Bioregion _Moderate/Good - Derived Native Grassland	10.32 (all meets the criteria of the EPBC Act CEEC)	3.64 (all meets the criteria of the EPBC Act CEEC)
TOTAL	**17.3**	**7.63**

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- **Reduce the extent of an ecological community**

The proposal would result in the permanent reduction in extent of approximately 17.3 hectares of the White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands CEEC, of which comprises 6.52 hectares of the remnant woodland form and 10.78 hectares of Derived Native Grassland.

The estimated total current national extent of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland is estimated to be approximately 416 000 hectares (TSSC 2006). The permanent loss of approximately 17.3 hectares of the CEEC as a result of the proposal represents a negligible reduction in the estimated current extent of the community across its national range.

- **Fragment or increase fragmentation of an ecological community**

A total of 17.3 hectares of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland occurs within the proposal area, adjacent to the existing rail corridor. This community is already highly fragmented within the local region with adjacent land typically comprising heavily disturbed agricultural land.

The proposal is not likely to further fragment or increase the degree of fragmentation of the ecological community within the proposal area or local area.

- **Adversely affect habitat critical to the survival of an ecological community**

Due to a long history of agricultural practices within the local area, the habitat of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland exists in a relatively disturbed and fragmented state.

- **Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alternation of surface water drainage patterns**

The proposal would result in the permanent reduction in extent of 17.3 hectares of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands, of which 6.52 hectares is remnant woodland and 10.78 hectares is Derived Native Grasslands.

The proposal would result in the modification of abiotic factors necessary for this ecological community's survival within the permanent impact area in the proposal area, but not in the temporary impact area. However, the proposal would be unlikely to adversely modify or destroy abiotic factors necessary for the survival of the ecological community in the local area.

- **Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The proposal would result in the permanent reduction in extent of 17.3 hectares of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands, of which 6.52 hectares is remnant woodland and 10.78 hectares is Derived Native Grasslands. However, the proposal is unlikely to impact upon the species composition (including causing a decline or loss of functionally important species) of this ecological community in the local area.

- **Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**

    - **Assisting invasive species, that are harmful to the listed ecological community, to become established, or**

    - **Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community,**

The proposal would result in the permanent reduction in extent of 17.3 hectares of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands, of which 6.52 hectares is remnant woodland and 10.78 hectares is Derived Native Grasslands.

The proposal is not expected to result in the introduction of invasive species or cause the regular mobilisation of fertilisers, herbicides or other chemicals or pollutants in the community.

- **Interfere with the recovery of an ecological community.**

The proposal would result in the permanent reduction in extent of 17.3 hectares of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands, of which 6.52 hectares is remnant woodland and 10.78 hectares is Derived Native Grasslands. This removal of area is not likely to interfere with the recovery of this ecological community due to the small incremental decrease in the size of the patches occurring within the proposal area and the very high degree of fragmentation currently affecting the community within the proposal area.

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia is listed as an endangered ecological community under the EPBC Act. The community is characterised by a canopy dominated by inland grey box (*Eucalyptus microcarpa*), while several other canopy species are also commonly associated with the EEC. These include, but are not limited to bulloak (*Allocasuarina luehmannii*), kurrajong (*Brachychiton populneus*) and white cypress pine (*Callitris glaucophylla*).

The proposal area supports a total 41.67 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act. Of this 41.67 hectares, a total of 31.53 hectares will be permanently disturbed.

The breakdown of the community into woodland and derived native grassland; and permanent and temporary disturbance is provided in **Table 4**.

Table 4 Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC under the EPBC Act mapped within the proposal area

Vegetation Community	Permanent Disturbance Area (ha)	Temporary Disturbance Area (ha)
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions _Moderate/Good	8.58 (7.89 meets the criteria of the EPBC Act EEC)	1.55 (all meets the criteria of the EPBC Act EEC)
Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions _Moderate/Good - Derived Native Grassland	23.64 (all meets the criteria of the EPBC Act EEC)	8.59 (all meets the criteria of the EPBC Act EEC)
TOTAL	**31.53**	**10.14**

An additional 0.69 hectares of plant community type Western Grey Box Tall Grassy Woodland (Moderate/Good condition) does not meet the condition thresholds of the EEC under the EPBC Act.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- **Reduce the extent of an ecological community**

The proposal would result in the permanent reduction in extent of approximately 31.53 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC, comprising 7.89 hectares of remnant woodlands and 23.64 hectares of derived native grasslands.

The estimated total current national extent of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC is estimated to be approximately 332 000 hectares (TSSC 2010). The permanent loss of approximately 31.53 hectares of the EEC as a result of the proposal represents a negligible reduction in the estimated current extent of the community across its range.

- **Fragment or increase fragmentation of an ecological community**

A total of 41.67 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC occurs within the proposal area, adjacent to the existing rail corridor. This community is already highly fragmented within the local region with adjacent land typically comprising heavily disturbed agricultural land.

The proposal is not likely to further fragment or increase the degree of fragmentation of the ecological community within the proposal area or local area.

- **Adversely affect habitat critical to the survival of an ecological community**

Due to a long history of agricultural practices within the local area, the habitat of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC exists in a relatively disturbed and fragmented state therefore is not considered to be habitat critical to the survival of the community.

- **Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alternation of surface water drainage patterns**

The proposal would result in the permanent reduction in extent of approximately 31.53 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC, of which 7.89 hectares is remnant woodland and 23.64 hectares is derived native grasslands.

The proposal would result in the modification of abiotic factors necessary for this ecological community's survival within the permanent reduction extent of the proposal area, but not the temporary reduction area. However, the proposal would be unlikely to adversely modify or destroy abiotic factors necessary for the survival of the ecological community in the local area.

- **Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The proposal would result in the permanent reduction in extent of approximately 31.53 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC, of which 7.89 hectares is remnant woodland and 23.64 hectares is derived native grasslands. However, the proposal is unlikely to impact upon the species composition (including causing a decline or loss of functionally important species) of this ecological community in the local area.

- **Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
    - **Assisting invasive species, that are harmful to the listed ecological community, to become established, or**
    - **Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community,**

The proposal would result in the permanent reduction in extent of approximately 31.53hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC, of which 7.89 hectares is remnant woodland and 23.64 hectares is derived native grasslands.

The proposal is not expected to result in the introduction of invasive species or cause the regular mobilisation of fertilisers, herbicides or other chemicals or pollutants in the community.

- **Interfere with the recovery of an ecological community.**

The proposal would result in the permanent reduction in extent of approximately 31.53 hectares of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC, of which 7.89 hectares is remnant woodland and 23.64 hectares is derived native grasslands. This removal of area is unlikely to interfere with the recovery of this ecological community as it involves the removal from an already highly fragmented state of the ecological community within the proposal area or local area.

CRITICALLY ENDANGERED SPECIES

Regent Honeyeater (*Anthochaera phrygia*)

The regent honeyeater has a patchy distribution extending from south-east Queensland, into New South Wales and the Australian Capital Territory, to central Victoria (CoA, 2016). The species is highly mobile, capable of travelling large distances and occurs only irregularly at most sites in varying numbers. Adding further difficulty to the survey and study of this species is its ability to often go long periods without being observed anywhere (CoA 2016). Its primary habitat is box-ironbark eucalypt woodland and dry sclerophyll forest, however it does utilise riparian vegetation and lowland coastal forest. Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations.

It is known to undertake a complex series of movements, which are thought to be governed mainly by the flowering of a select number of Eucalyptus species. It is likely the species use different areas within its range in different years depending on food resources (CoA 2016).

The proposal area does not occur within the four known breeding areas for the species where it is regularly recorded, namely Bundarra-Barraba area of NSW, the Capertee Valley in NSW, Hunter Valley in NSW and the Chiltern area of north-east Victoria.

The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area contains two known foraging tree species (according to the approved National Recovery Plan (CoA 2016)). The closest record of the species occurs approximately 30 km to the east of the Proposal area near Dubbo (OEH 2016d). The habitat within the proposal area is substantially degraded, however the proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. This species is considered to have a low likelihood of occurrence within the proposal area.

In this case, a population of a species is an occurrence of 1 species in a particular area that include but are not limited to:

- **a geographically distinct regional population, or collection of local populations; or**
- **a population, or collection of local populations, that occurs within a particular bioregion.**

Although there appears to be minor behavioural differences between regent honeyeaters in the three main areas inhabited by the species (the Bundarra-Barraba area in NSW, the Capertee Valley in NSW, and north-eastern Victoria), the direction and extent of movements, including evidence of movement between breeding sites, and a lack of discernible genetic differences between the sites suggest that the regent honeyeater occurs as a single, contiguous population (Garnett and Crowley 2000).

The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the east of the proposal area near Dubbo (OEH 2016d). Therefore, the proposal area does not contain a portion of the population of the regent honeyeater.

In this case, habitat critical to the survival of a species refers to areas that are necessary:

- **for activities such as foraging, breeding, roosting, or dispersal;**
- **for the long-term maintenance of the species, including the maintenance of species essential to the survival of the species such as pollinators;**
- **to maintain genetic diversity and long term evolutionary development; or**
- **for the reintroduction of populations or recovery of the species.**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. However the closest record of regent honeyeater in the local area is approximately 30 km from the proposal area and it was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. Despite the presence of approximately 15.1 hectares of potential foraging habitat for the species within the proposal area, it is not considered to be habitat critical to the survival of the species.

An action has, will have, or is likely to have a significant impact on a critically endangered species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of a population, or;**

The proposal area does not provide critical habitat for, or a population of the regent honeyeater. Therefore the proposal is considered unlikely to lead to a long-term decrease to a *population* of the regent honeyeater.

- **reduce the area of occupancy of the species, or;**

The proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the regent honeyeater. However the proposal area does not provide critical habitat for, or a population of the species. The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the east of the proposal area near Dubbo (OEH 2016d).

Therefore the proposal is considered unlikely to reduce the area of occupancy of a *population* of the regent honeyeater.

- **fragment an existing population into two or more populations, or;**

The proposal will permanently remove approximately 15.1 hectares of known foraging habitat for the regent honeyeater from an area that is already considered to be a highly fragmented landscape. However the proposal area does not provide critical habitat for, or a population of the species. The regent honeyeater was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 30 km to the east of the proposal area near Dubbo (OEH 2016d). Therefore the proposal is not considered to support a *population* of the regent honeyeater, and thus will not fragment an existing population of the species into two or more populations.

- **adversely affect habitat critical to the survival of a species, or;**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately15.1 hectares of potential foraging habitat for the species. However the closest record of regent honeyeater in the local area is approximately 30 km from the proposal area and it was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. Despite the presence of approximately 15.1 hectares of potential foraging habitat for the species within the proposal area, it is not considered to be habitat critical to the survival of the species.

- **disrupt the breeding cycle of an population, or;**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. However the closest record of regent honeyeater in the local area is approximately 30 km from the proposal area and it was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. The proposal area does not occur within one of the four key breeding locations known to be important to the species. Therefore the proposal is considered unlikely to disrupt the breeding cycle of a *population* of the regent honeyeater.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. However the habitat within the proposal area is already substantially degraded and therefore the proposal is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat for the regent honeyeater to the extent that the species would likely decline.

- **result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat, or;**

The proposal is unlikely to result in an invasive species that is harmful to the regent honeyeater becoming established in its habitat.

- **introduce disease that may cause the species to decline, or;**

Psittacine beak and feather disease (BFD) is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. BFD affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered unlikely that the Proposal will introduce BFD or any other disease that may cause regent honeyeater to decline.

- **interfere with the recovery of the species.**

The proposal is unlikely to interfere substantially with the recovery of the regent honeyeater.

Swift Parrot (*Lathamus discolor*)

In this case, a population of a species is an occurrence of the species in a particular area that include but are not limited to:

- **a geographically distinct regional population, or collection of local populations; or**
- **a population, or collection of local populations, that occurs within a particular bioregion.**

The swift parrot occurs as a single population, although it migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders 2003). The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species undertaken throughout the proposal area. There are no known records of swift parrot within 10km of the proposal area. Therefore, the proposal area does not contain a population of the swift parrot.

In this case, habitat critical to the survival of a species refers to areas that are necessary:

- **for activities such as foraging, breeding, roosting, or dispersal;**
- **for the long-term maintenance of the species, including the maintenance of species essential to the survival of the species such as pollinators;**
- **to maintain genetic diversity and long term evolutionary development; or**
- **for the reintroduction of populations or recovery of the species.**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. There are no known records of swift parrot within 10km of the proposal area and it was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. Despite the presence of approximately 15.1 hectares of potential foraging habitat for the species within the proposal area, it is not considered to be habitat critical to the survival of the swift parrot.

An action has, will have, or is likely to have a significant impact on a critically endangered species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of a population, or;**

The proposal area does not provide critical habitat for, or a population of the swift parrot. Therefore the proposal is considered unlikely to lead to a long-term decrease to a *population* of the swift parrot.

- **reduce the area of occupancy of the species, or;**

The proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the swift parrot. However the proposal area does not provide critical habitat for, or a population of the species. The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. Additionally, there are no known records of swift parrot within 10km of the proposal area.

Therefore the proposal is considered unlikely to reduce the area of occupancy of a *population* of the swift parrot.

- **fragment an existing population into two or more populations, or;**

The proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the swift parrot from an area that is already considered to be a highly fragmented landscape. However the proposal area does not provide critical habitat for, or a population of the species. The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. There are no known records of swift parrot within 10km of the proposal area. Therefore the proposal is not considered to support a *population* of the swift parrot, and thus will not fragment an existing population of the species into two or more.

- **adversely affect habitat critical to the survival of a species, or;**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately 15.1 hectares of known foraging habitat for the species. The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. There are no known records of swift parrot within 10km of the proposal area. Therefore despite the presence of approximately 15.1 hectares of potential foraging habitat for the species within the proposal area, it is not considered to be habitat critical to the survival of the species.

- **disrupt the breeding cycle of an population, or;**

Despite habitat within the proposal area being substantially degraded, the proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. The swift parrot was not recorded within the proposal area despite thorough general fauna surveys, as well as targeted surveys for the species in winter 2015, undertaken in accordance with the seasonal requirements for this species. There are no known records of swift parrot within 10km of the proposal area. Therefore the proposal is considered unlikely to disrupt the breeding cycle of a *population* of the swift parrot.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposal will permanently remove approximately 15.1 hectares of potential foraging habitat for the species. However the habitat within the proposal area is already substantially degraded and therefore the proposal is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat for the swift parrot to the extent that the species would likely decline.

- **result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat, or;**

The proposal is unlikely to result in an invasive species that is harmful to the regent honeyeater becoming established in its habitat.

- **introduce disease that may cause the species to decline, or;**

Psittacine beak and feather disease (BFD) is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. BFD affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered unlikely that the Proposal will introduce BFD or any other disease that may cause swift parrot to decline.

- **interfere with the recovery of the species.**

The proposal is unlikely to interfere substantially with the recovery of the swift parrot.

ENDANGERED SPECIES

Tylophora linearis

Tylophora linearis is an herbaceous climber with clear latex growing to approximately 2 m in length (DoEE 2008). In NSW the species is rarely collected, known from less than 10 localities in the Dubbo area and Mt Crow near Barrabra, growing in dry scrub, open forest and woodlands. It is also known to overlap in distribution with *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act (TSSC 2008), which occurs in the proposal area.

Tylophora linearis was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). However due to the presence of 8.06 hectares of woodland that conforms to *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC and PCT70 (CW220, LA223) White Cypress Pine woodland on sandy loams in central NSW wheatbelt in the proposal area, there is a potential for this species to occur (albeit low).

In this case, a population of a species is an occurrence of the species in a particular area that include but are not limited to:

- **a geographically distinct regional population, or collection of local populations; or**

- **a population, or collection of local populations, that occurs within a particular bioregion.**

Tylophora linearis was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. Therefore, the proposal area does not contain an important population of the *Tylophora linearis*.

In this case, habitat critical to the survival of a species refers to areas that are necessary:

- **for activities such as foraging, breeding, roosting, or dispersal;**

- **for the long-term maintenance of the species, including the maintenance of species essential to the survival of the species such as pollinators;**

- **to maintain genetic diversity and long term evolutionary development; or**

- **for the reintroduction of populations or recovery of the species.**

The habitats within the proposal area are generally highly disturbed and in low condition due to surrounding agricultural practices and disturbance from the rail corridor. *Tylophora linearis* was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area.

An action has, will have, or is likely to have a significant impact on an endangered species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of a population, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. The proposal area does not provide critical habitat for, or a population of *Tylophora linearis*. Therefore the proposal is considered unlikely to lead to a long-term decrease to a *population* of the species.

- **reduce the area of occupancy of the species, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. However, the species was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). Therefore the proposal is considered unlikely to reduce the area of occupancy of a *population* of the *Tylophora linearis*.

- **fragment an existing population into two or more populations, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. However, the species was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). Therefore the proposal is not considered to support a *population* of the *Tylophora linearis*, and thus will not fragment an existing population of the species into two or more.

- **adversely affect habitat critical to the survival of a species, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. However, the species was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). Therefore despite the presence of potential habitat in the proposal area, it is not considered to be habitat critical to the survival of *Tylophora linearis*.

- **disrupt the breeding cycle of an population, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. However, the species was not recorded within the proposal area despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the east of the proposal area within Goobang National Park (OEH 2016d). Therefore the proposal is considered unlikely to disrupt the breeding cycle of *Tylophora linearis*.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposal will permanently remove 8.06 hectares of woodland which provides potential habitat for the species in the proposal area. However the habitat within the proposal area is already substantially degraded and therefore the proposal is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat for the *Tylophora linearis* to the extent that the species would likely decline.

- **result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat, or;**

The proposal is unlikely to result in an invasive species that is harmful to the *Tylophora linearis* becoming established in its habitat.

- **introduce disease that may cause the species to decline, or;**

The proposal is unlikely to introduce disease that may cause *Tylophora linearis* to decline.

- **interfere with the recovery of the species.**

The proposal is unlikely to interfere substantially with the recovery of the *Tylophora linearis*.

VULNERABLE SPECIES

Superb Parrot (*Polytelis swainsonii*)

The Superb Parrot (*Polytelis swainsonii*) occurs through the inland slopes and plains of NSW (including the Australian Capital Territory) to northern Victoria. The breeding range of the Superb Parrot is mostly in the NSW South Western Slopes and Riverina bioregions. The three main breeding areas are: (1) bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young (NSW);(2) along the Murrumbidgee River, between Wagga Wagga and Toganmain Station (near Bringagee), and farther north at Goolgowi (NSW); and (3) along the Murray and Edward Rivers, from east of Barmah and Millewa State Forest to south of Taylors Bridge (Baker-Gibb 2011). The proposal area is considered unlikely to provide breeding habitat for the species.

Six superb parrots were recorded flying over the proposal area at two locations during targeted surveys. Four individuals were recorded within the proposal area 1-4 km to the south of Peak Hill in May 2016 and two individuals were recorded approximately 25 km north of Peak Hill in October 2014. The species has also been widely recorded between Parkes and Narromine (OEH 2016d). All of the vegetation communities identified in the proposal area are expected to provide potential foraging habitat, however potential breeding habitat is not expected to occur. The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that are likely to provide habitat for the species.

Breeding habitat for this species includes hollows more than 60 mm in diameter located more than 4 metres above ground (OEH 2016b). The national recovery plan for the species (Baker-Gabb 2011) identifies Blakely's red gum (*Eucalyptus blakelyi*) as the most important tree species for breeding for this species in the south western slopes bioregion, with most breeding events confined to this tree species. Blakely's red gum was not recorded in the proposal area and therefore breeding habitat is not considered likely to occur. Potential breeding habitat for this species is not likely to be impacted by the proposal.

In this case, an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The superb parrot was recorded at two locations within the proposal area, however the proposal area is not expected to support a key population for breeding and dispersal, does not provide habitat for a portion of the population that is necessary for maintaining genetic diversity and the species is not at the limit of its range in the proposal area. Blakely's red gum was not recorded in the proposal area and therefore breeding habitat is not considered likely to occur. Therefore, the proposal area is not likely to not contain an important population of the superb parrot.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species, or;**

The proposal area does not provide habitat for an important population of the superb parrot. Therefore the proposal is considered unlikely to lead to a long-term decrease to an *important population* of the superb parrot.

- **reduce the area of occupancy of an important population, or;**

The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities that comprise habitat for the species. However the proposal area does not provide habitat for an important population of the superb parrot. Therefore the proposal is considered unlikely to reduce the area of occupancy of an *important population* of the superb parrot.

- **fragment an existing important population into two or more populations, or;**

The proposal area does not provide habitat for an important population of the superb parrot. The proposal area occurs within a highly fragmented landscape and therefore, the proposal is considered unlikely to fragment an *important population* of the superb parrot.

- **adversely affect habitat critical to the survival of a species, or;**

The proposal area is not considered to represent habitat critical to the survival of the superb parrot and therefore the proposal is unlikely to adversely affect habitat critical to the survival of the superb parrot.

- **disrupt the breeding cycle of an important population, or;**

The proposal will result in the permanent loss of approximately 66.72 hectares of native woodland and grassland communities. However the proposal area does provide suitable breeding habitat for the species and thus does not provide habitat for an important population of the superb parrot. Therefore the proposal is considered unlikely to disrupt the breeding cycle of an *important population* of the superb parrot.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The proposal would result in the removal of known and potential habitat for the superb parrot. However, the proposal is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat for the superb parrot to the extent that the species would be likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

The proposal is unlikely to result in an invasive species that is harmful to the superb parrot becoming established in its habitat.

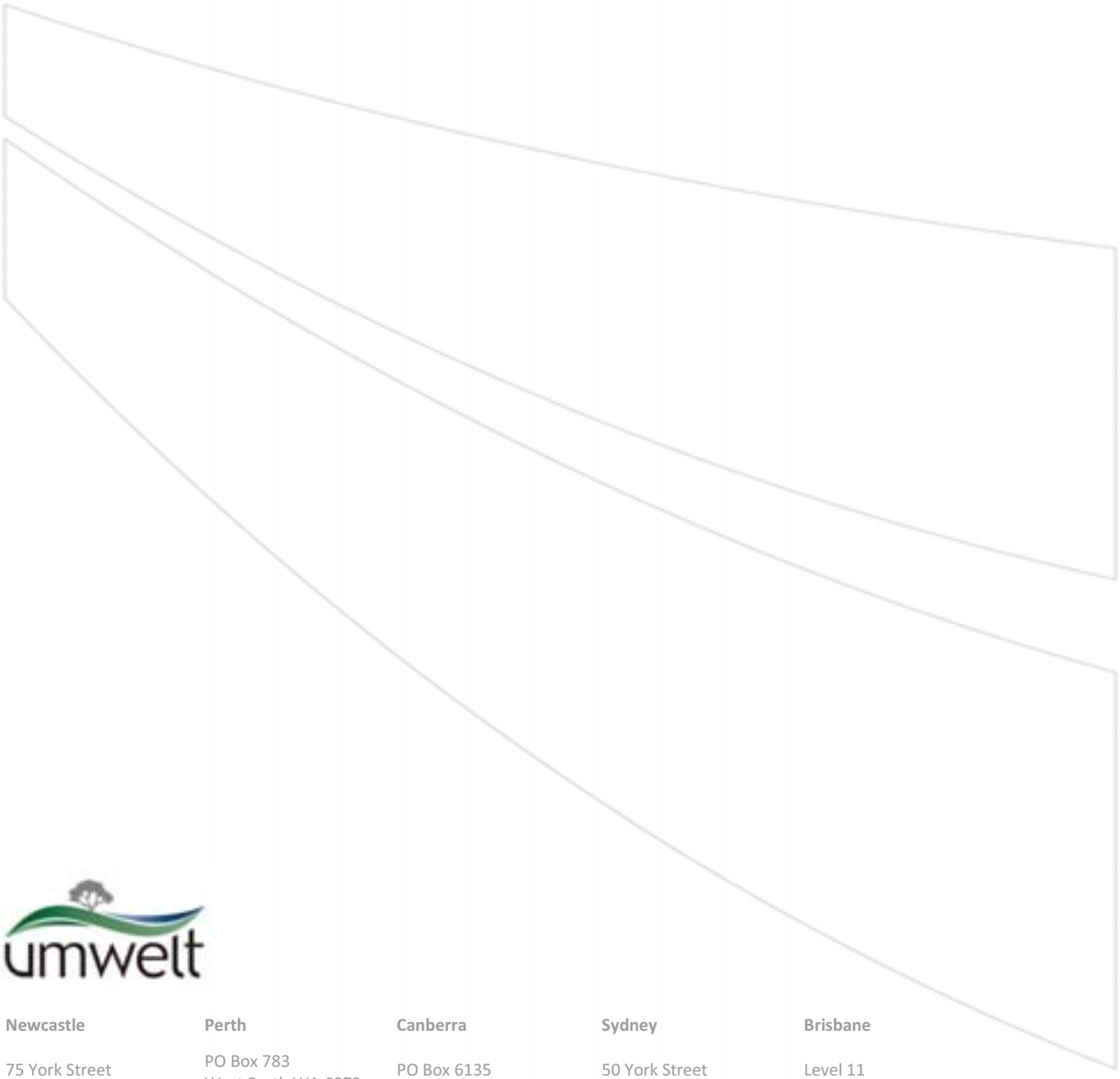
- **introduce disease that may cause the species to decline, or;**

Psittacine beak and feather disease (BFD) is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. BFD affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered unlikely that the Proposal will introduce BFD or any other disease that may cause superb parrot to decline.

- **interferes substantially with the recovery of the species.**

The proposal is unlikely to interfere substantially with the recovery of the superb parrot.



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