

Newell Highway Heavy Duty Pavements, North Moree

Preliminary environmental investigation

Roads and Maritime Services | November 2017



Roads and Maritime Services

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Prepared by WSP Australia Pty Ltd and Roads and Maritime Services



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Document controls

Approval and authorisation

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Signed	
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Draft 1.2	31 August 2017	Katherine Fox	Emma Dean
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Executive summary

The proposal

Roads and Maritime Services NSW (Roads and Maritime) has started planning for major pavement upgrades to about 30 kilometres of Newell Highway north of Moree within the existing road corridor.

The proposal is located in the Central West of NSW, and within the Moree Plains Local Government (LGA). Moree is located around 500 kilometres north west of Sydney. Key features of the proposal would include:

- upgrading and resurfacing sections of the existing Newell Highway north of Moree
- road widening on one side or both sides of the highway
- upgrading intersections
- upgrading drainage to improve the Newell Highway flood immunity.

Need for the proposal

The Newell Highway north of Moree has road surface and structural deficiencies. The road was built in the 1960s using natural gravel and a pavement thickness appropriate for the low volumes of regional traffic during that period. Today, 98 per cent of the road along this section of the highway has a remaining theoretical life of 10 years or less. Due to its structural limitations, the road is also at heightened risk of surface failure caused by rainfall.

These road surface deficiencies, along with a high freight demand, are affecting travel reliability and travel times for freight movements between Victoria and Queensland, as well as increasing maintenance costs and reducing road safety.

Proposal objectives

The proposal's primary objective is to provide productivity gains across the economy by improving freight movement efficiency on the National Land Transport Network. More specifically, the proposal aims to:

- reduce travel times on the Newell Highway
- reduce vehicle operating costs on the Newell Highway
- reduce the costs of maintaining the Newell Highway by providing a fit for purpose pavement
- improve the safety of the Newell Highway
- improve flood immunity of the Newell highway.

Community and stakeholder consultation

A project web page is available that outlines the benefits, features and objectives of the project as well as other project information and documents available.

A Community and Stakeholder Engagement Plan will be prepared for the planning, development and delivery of the proposal. This plan will identify key stakeholders, proposed communication tools, key messages and protocols to be implemented.

Environmental issues and recommendations

Based on the preliminary assessment the following are considered key environmental issues:

- disruptions and management of traffic and transport on the Newell Highway, including heavy and light vehicle movements, and access to rural/residential properties, and commercial, agricultural and industrial land uses
- threats to ecological values, primarily due to the presence of *Weeping Myall Woodlands* threatened ecological community, listed under both the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), and *Threatened Species Conservation Act 1995* (TSC Act), and the presence of *Poplar Box Grassy Woodland* nominated for listing under the EPBC Act
- potential impacts to identified Aboriginal heritage items adjacent to the proposal
- management of potentially high salinity risks and contamination potential
- water quality and hydrology, due potential direct impacts to short-lived waterbodies
- management of flooding risk to and from the proposal
- noise and vibration issues to local rural/residential land uses
- socio-economic impacts due to the competition for construction labour, materials and influx of workers placing pressure on local infrastructure
- cumulative issues to the local community and environment due to other major projects.

Based on the outcomes of the Preliminary Environmental Investigation (PEI), the following recommendation should be considered during design and planning:

- apply the 'avoid, minimise, mitigate and offset' hierarchy during further design development, specifically in relation to threatened communities and species consistent with commitment made within the EPBC Act Strategic Assessment – Strategic Assessment Report (Roads and Maritime, 2015b)
- detailed geotechnical investigations and assessment, and preliminary site assessments, should be carried out to support further design development
- further design development and detailed environmental assessment for the proposal should assess potential flooding impacts during construction and operation including consideration of the NSW Government's Floodplain Development Manual (Department of Natural Resources, 2005), Practical Consideration of Climate Change - Flood risk management guideline (DECC, 2007) and Australian Rainfall and Runoff: A guide to flood estimation (Commonwealth of Australia (Geoscience Australia) 2016)
- further detailed environmental assessment for the proposal should assess potential noise and vibration impacts in line with the following Roads and Maritime guidelines; Noise Mitigation Guidelines (Roads and Maritime, 2015a), Noise Criteria Guideline (Roads and Maritime, 2015b) Noise model validation Guideline (Roads and Maritime, 2016b) Construction and Noise Vibration Guideline (Roads and Maritime, 2016a)
- a basic level of socio-economic assessment should be carried out in line with the Roads and Maritime Environmental Impact Practice Note: Socio-economic Assessment (EIA N-05).

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Appendix A Newell Highway upgrade: North Moree preliminary ecological assessment

1 Introduction

This chapter introduces the proposal and provides the context of the preliminary environmental investigations (PEI). In introducing the proposal, the objectives and project development history are detailed and the purpose of the report provided.

1.1 Proposal overview

Roads and Maritime Services NSW (Roads and Maritime) has started planning for major road upgrades to about 30 kilometres of Newell Highway north of Moree. This report addresses the proposed pavement upgrades north of Moree (the proposal).

The proposal is located in the Central West of NSW, and traverses the Moree Plains Local Government (LGA). Moree is located around 500 kilometres North West of Sydney. For the purpose of this report, the study area has been established using a 30 m buffer either side of the existing road corridor centreline. The general location of the study areas is shown in Figure 1-1.

To assist in identifying environmental issues, the proposal has been divided into three segments applicable to the pavement upgrade. The three segments and indicative work which is investigated in this PEI is included in Table 1-1 and shown in Figure 1-1.

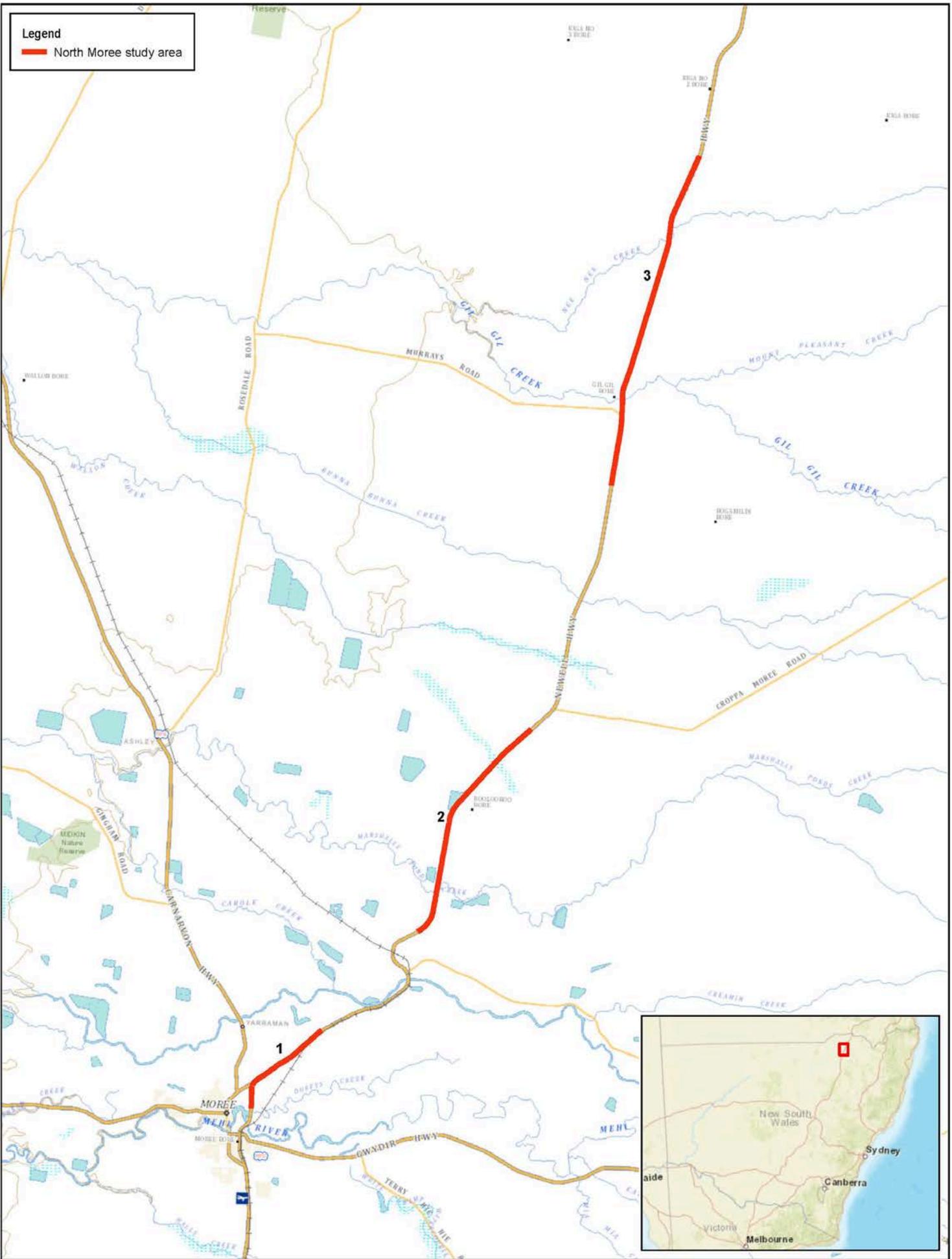
Key features of the proposal would include:

- upgrade and resurface sections of the existing highway north of Moree
- road widening on one side or both sides of the highway
- upgrade intersections
- upgrade drainage to improve the Newell Highway flood immunity up to a 20-year average recurrence interval where feasible and reasonable.

The proposal consists of three segments of upgrades to the Newell Highway north of Moree in northern NSW. The three segments and indicative works which are investigated in this PEI are included in Table 1-1.

Table 1-1 Segments and proposed works

Segments	Location	Proposed works
Segment 1	2.73 km to 7.57 km north of Moree	• Upgrading 4.84 km of highway (heavy duty Pavement)
Segment 2	15.02 km to 29.84 km north of Moree	• Upgrading of 10.49 km of highway (heavy duty Pavement)
Segment 3	36.91 km to 51.83 km north of Moree	• Upgrading 14.92 km of highway (heavy duty Pavement)



Map: 2270618A_GIS_F004_A2	Author: mitchellem		 1:150,000 Scale ratio correct when printed at A3
Date: 13/07/2017	Approved by: -		
<small>Data source: Source: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox, © OpenStreetMap contributors, and the GIS User Community © Land and Property Information 2015, Office of Environment and Heritage 2017</small>			

PEI - North Moree

Figure 1.1
Study Area

1.2 Strategic context

The Newell Highway corridor (A39) is the longest highway in NSW, extending 1085 km through the State providing an essential connection for central western NSW and a vital transport corridor between Victoria, NSW, and Queensland. The highway supports access between key regional primary industries and export markets in addition to regional tourism.

1.2.1 Newell Highway Corridor Strategy

Transport for NSW (TfNSW) in collaboration with Roads and Maritime released a Newell Highway Corridor Strategy in May 2015 to address the transport needs of the corridor, including support for greater use of Higher Productivity Vehicles (HPVs) over the full length of the highway. The report identified a large portion of the northern section of the highway nearing the end of its life, with regular failure occurring with structural pavement, as well as large sections not meeting desired cross section dimensions. Furthermore, the NSW Long Term Transport Master Plan (TfNSW, 2012) identified the need to provide heavy duty pavement between Narrabri and the Queensland border as well as additional overtaking lanes to improve overtaking opportunities and safety as a short term priority.

The key strategic planning and policy documents relevant to the proposal are:

- National Road Safety Strategy 2011–2020 (Australian Transport Council, 2011)
- Melbourne–Brisbane Corridor Strategy: Building our National Transport Future (Commonwealth of Australia, 2007)
- NSW Making it happen (NSW Government, 2015)
- NSW Long Term Transport Master Plan (TfNSW, 2012)
- State Infrastructure Strategy (NSW Government, 2014)
- NSW Road Safety Strategy 2012–21 (TfNSW, 2012)
- NSW Freight and Ports Strategy (NSW Government, 2013)
- New England North West Regional Transport Plan (TfNSW, 2013)
- Newell Highway Corridor Strategy (NSW Government, 2015)
- New England North West Strategic Regional Land Use Plan (DPE, 2012).

1.3 Need for the proposal

The Newell Highway north of Moree has road surface and structural deficiencies. The road was built in the 1960s using natural gravel and a pavement thickness appropriate for the low volumes of regional traffic during that period. Today, 98 per cent of the road along this section of the highway has a remaining theoretical life of 10 years or less. Due to its structural limitations, the road is also at heightened risk of surface failure caused by rainfall.

To address this issue, Roads and Maritime has improved and reconstructed parts of this section of the highway using granular pavements, but these have not resulted in a satisfactory level of service for the full design life of the highway.

The following deficiencies would be addressed by the completion of the proposal:

- excessive maintenance cost when compared to similar roads
- old pavement which was constructed in the 1960's
- portions of the highway being flood prone during a 1 in 5-year event, rather than the desired 1 in 20-year event
- culverts with an insufficient capacity during flooding events
- crash history on intersections, and insufficient intersection standards.

These road surface deficiencies, coupled with a strong freight demand, are affecting travel reliability and travel times for freight movements between Victoria and Queensland, as well as increasing maintenance costs and reducing road safety.

1.4 Proposal objectives

The primary objective for the proposal is to provide productivity gains across the economy by improving freight movement efficiency on the National Land Transport Network. More specifically, the proposal aims to:

- reduce travel times on the Newell Highway
- reduce vehicle operating costs on the Newell Highway
- reduce the costs of maintaining the Newell Highway by providing a fit for purpose pavement
- improve the safety of the Newell Highway
- improve flood immunity of the Newell highway.

Other supporting objectives of the proposal are to:

- ensure route development meets the standards required of the National Land Transport Network
- develop a proposal that contributes to the economic development of the region and improves transport efficiency on this section of the Newell Highway in terms of travel time and vehicle operating costs
- ensure that all potential impacts of the proposal on the local community are assessed and appropriate mitigation measures are developed
- ensure broad road safety objectives are met by reducing the crash rate along the Newell Highway
- ensure an adequate level of service for existing and predicted traffic volumes
- ensure route development minimises the impact on environmentally sensitive areas and that appropriate mitigation measures are included in the proposal to manage any impact
- ensure stakeholder involvement in all phases of the proposal development
- ensure compatibility of the road network and the long-term land use planning for the area.

1.5 Purpose of the report

This PEI has been prepared by WSP Australia Pty Ltd on behalf of Roads and Maritime's Freight and Regional Program Office.

The purpose of the PEI is to:

- identify potential environmental issues for the proposal
- provide recommendations to inform options considerations, the design process and future detailed environmental impact assessment
- integrate environmental, economic and social outcomes into decision making.

The information and recommendations in this PEI will be used to inform the options investigations and ongoing design process for the proposal with an aim to avoid or minimise environmental, economic and social impacts wherever possible.

Once a preferred option has been identified and a concept design has been developed, a detailed environmental impact assessment would be prepared. This detailed environmental assessment would entail environmental safeguards and management measures that would be implemented.

1.6 Exclusions and limitations

Biodiversity and Aboriginal and Non-Aboriginal assessments have included searches of relevant databases, and brief site visits undertaken on 31 May and 1 June 2017. The remaining assessments have been prepared with reference to preliminary desktop assessments of published data including relevant databases and reports, and the design shown in Figure 1-1.

2 Statutory and planning framework

This chapter outlines the planning and approvals processes that may apply to the proposal.

2.1 Environmental Planning and Assessment Act 1979

Clause 94 of State Environmental Planning Policy (Infrastructure) 2007 ISEPP permits development for the purpose of roads and road infrastructure facilities as development without consent. The proposal can be characterised as being for the purpose of a road/road infrastructure facility.

The planning pathway for the proposal is likely to be an assessment under Part 5 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and a Review of Environmental Factors (REF) would be prepared to document the environmental assessment. Roads and Maritime would be the proponent and determining authority. Other approvals may also be required for the proposal as set out in section 2.1.2 below.

Should the proposal be likely to significantly affect the environment then the proposal would become State Significant Infrastructure (SSI) under Part 5.1 of the EP&A Act. An Environmental Impact Statement (EIS) would be prepared in accordance with environmental assessment requirements of the Secretary of the Department of Planning and Environment and the Minister for Planning would be the consent authority. Some approvals required under other legislation do not apply in respect of SSI.

The appropriate planning pathway will be confirmed as part of more detailed environmental assessment.

2.1.1 Local Environmental Plans

The proposal and resulting study area is located within the Moree Plains local government area (LGA) and is subject to land use zones of the Moree Plains Local Environmental Plan (LEP) 2011. Table 2-1 outlines the local land use zonings and objectives within the segments.

Table 2-1 Land use zoning Moree Plains LEP 2011

LEP Provisions	Objective
Primary production – RU1	<ul style="list-style-type: none">• To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.• To encourage diversity in primary industry enterprises and systems appropriate for the area.• To minimise the fragmentation and alienation of resource lands.• To minimise conflict between land uses within this zone and land uses within adjoining zones.
Large lot residential – R5	<ul style="list-style-type: none">• To provide residential housing in a rural setting while preserving, and minimising impacts on, environmentally sensitive locations and scenic quality.• To ensure that large residential lots do not hinder the proper and orderly development of urban areas in the future.• To ensure that development in the area does not unreasonably increase the demand for public services or public facilities.• To minimise conflict between land uses within this zone and land uses within adjoining zones.

The provisions of the ISEPP override any development consent requirements under the Moree Plains LEP and therefore the upgrade would not require development consent from Moree Plains Shire Council. However, the proposal would be developed with reference to the above objectives where relevant.

2.2 State environmental planning policies

2.2.1 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and is to be carried out on behalf of Roads and Maritime, it can be assessed under Part 5 of the EP&A Act. Development consent from council is not required.

The proposal is not located on land reserved under the National Parks and Wildlife Act 1974 and does not affect land or development regulated by State Environmental Planning Policy No. 14 – Coastal Wetlands, State Environmental Planning Policy No. 26 – Littoral Rainforests, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Major Development) 2005.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities before starting certain types of development. Consultation, including consultation as required by ISEPP (where applicable), would be determined in the REF.

2.2.2 State Environmental Planning Policy 44 (Koala Habitat Protection)

The aim of State Environmental Planning Policy No – 44 Koala Protection (SEPP 44) is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas. SEPP 44 applies to each local government area listed in Schedule 1 of the SEPP, which includes Parkes LGA.

The koala is considered to have a moderate likelihood of occurring within the study area based on reoccurring occurrence within the locality and the availability of potential habitat. However, vegetation within the landscape is highly fragmented and there is limited connectivity to larger areas of bushland (WSP, 2017a).

While SEPP 44 does not apply to projects being assessed under Part 5 of the EP&A Act, this assessment recognises the intent of SEPP.

2.3 Other relevant NSW legislation

2.3.1 *Threatened Species and Conservation Act 1995*

The NSW *Threatened Species Conservation Act 1995* (TSC Act) lists a number of threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened species, communities, or their habitats.

Where there may be an impact on threatened species, communities, or their habitats a test of significance, pursuant to Section 5A of the EP&A Act would be required to assess the significance of potential impacts on threatened biota listed under the TSC Act. Where there is a significant impact on threatened species, populations or ecological communities listed under the TSC Act the preparation of a species impact statement would be required.

A biodiversity memorandum is included in Appendix A, and summarised in Section 4.2.

2.3.2 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act) provides the basis for the management of National Parks estate, and for legal protection and management of Aboriginal sites within NSW.

National parks

No National Parks are located in the overall study area.

Aboriginal sites

Part 6 of the Act provides provisions for the protection and management of Aboriginal sites.

Implementation of the Aboriginal heritage provisions in the Act is the responsibility of the Office of Environment and Heritage (OEH).

All Aboriginal sites and objects, other than those made for sale, are protected under the NPW Act.

Under Section 86 the NPW Act, it is an offence to:

- knowingly harm or desecrate an Aboriginal object
- harm or desecrate an Aboriginal object or Aboriginal place.

Under Section 86 provides the following defences against prosecution of harm to Aboriginal objects:

- the harm or desecration concerned was authorised by an Aboriginal heritage impact permit (AHIP) and the conditions to which that AHIP was subject were not contravened
- if due diligence was exercised to determine whether the upgrade work would harm an Aboriginal object and reasonably determined that no Aboriginal object would be harmed.

A desktop search for Aboriginal heritage has been carried out. Refer to Section 6.2 for further detail.

2.3.3 *Biodiversity Conservation Act 2016*

On 25 August 2017, the NSW Government will enact the Draft Biodiversity Conservation Regulation 2017 which will repeal the *Threatened Species Conservation Act 1995* and the *National Parks and Wildlife Act 1974*.

Subsequent assessments for this project will need to adhere to these new guidelines and methodology.

2.3.4 *Noxious Weeds Act 1993*

The *Noxious Weeds Act 1993* provides for the identification, classification and control of noxious weeds in NSW. It aims to reduce the negative impacts of weeds on the economy, community and environment by establishing control mechanism to:

- prevent the establishment of significant new weeds
- prevent, eliminate or restrict the spread of significant weeds, and
- effectively management widespread significant weeds in the state.

Part 3 of the Act outlines public authority obligations to control noxious weeds managed lands.

A desktop review of noxious weeds has been carried out. Refer to section 4.2.2 for further detail.

2.3.5 *Fisheries Management Act 1994*

The NSW *Fisheries Management Act 1994* (FM Act) aims to conserve threatened species, populations and ecological communities of fish and key fish habitats. The FM Act is administered by the Department of Primary Industries (DPI). Part 7 of the FM Act relates to the protection of aquatic habitats including

providing management of dredging and reclamation work within permanently or intermittently flowing watercourses.

Construction works associated with culvert work may meet the definition of reclamation work under Section 198A of the FM Act, which defines reclamation' as:

1. using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or
2. depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge) or
3. draining water from water land for its reclamation.

Roads and Maritime are required to consult with DPI prior to carrying out any reclamation work, as defined under Section 199 of the FM Act.

A preliminary ecological investigation is included in Appendix A, and summarised in Section 4.2.

2.3.6 *Protection of the Environment Operations Act 1997*

The *Protection of Environment and Operations Act 1997* (POEO Act) focuses on protecting, restoring and enhancing the environment within NSW and through the use of various mechanisms, reduce potential risks to human health and the environment. It aims to provide opportunity for increased public involvement and access to information about environmental protection.

Environment protection licenses are issued under the POEO Act for scheduled developments and activities listed under Schedule 1.

Clause 35 of Schedule 1 identifies 'road construction' as a scheduled activity and states:

1. this clause applies to road construction, meaning the construction, widening or re-routing of roads, but does not apply to the maintenance or operation of any such road
2. the activity to which this clause applies is declared to be a scheduled activity if it results in the existence of 4 or more traffic lanes (other than bicycle lanes or lanes used for entry or exit) for at least:
 - a. where the road is classified, or proposed to be classified, as a main road (but not a freeway or tollway) under the Roads Act 1993:
 - i. 3 kilometres of their length in the metropolitan area, or
 - ii. 5 kilometres of their length in any other area.

Other scheduled activities listed under Schedule 1 that may apply to the upgrade work include 'extractive industries', 'crushing, grinding and separating' and/or 'contaminated soil treatment', depending on whether the volumes specified in Schedule 1 are exceeded.

In addition, during the construction phase, Roads and Maritime would be obliged to notify Environment Protection Authority (EPA) if a 'pollution incident' occurs that causes or threatens 'material harm' to the environment.

2.3.7 *Roads Act 1993*

Section 138 of the *Roads Act 1993* requires consent from the relevant roads authority (Roads and Maritime) for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road. The construction of the proposal would require partial lane closures.

The Newell Highway is a classified road and requires consent from the road authority to proceed. Approval would be sought for a road occupancy licence for the temporary closure of traffic lanes and, if required, the movement of over-sized vehicles during construction.

2.3.8 *Heritage Act 1997*

The *Heritage Act 1997* (Heritage Act) is concerned with the conservation of buildings, work, relics and other places of historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance to the state. It is designed to manage all aspects of heritage conservation ranging from basic protected against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement. All matters protected under the act are listed on the State Heritage Register (SHR), and includes the heritage schedules of local council LEPs, and the heritage and conservation registers established under section 17 of the Act by NSW state Government agencies (section 170 registers).

Approval under section 60 of the act would be required for any action that would adversely affect an item that is subject to an interim Heritage order or listing on the SHR. Under Section 139 of the act, approval from the NSW Heritage Council is required prior to the disturbance or excavation of land if a project will or likely result in disturbance to a relic.

Further heritage assessments may be required as part of the environmental assessment. This would determine the need for a permit under Section 138 of the Heritage Act.

A preliminary heritage assessment is summarised in sections 4.3 and 4.4.

2.4 Commonwealth legislation

2.4.1 *Environment Protection and Biodiversity Conservation Act 1999*

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. The matters of national environmental significance are:

- World Heritage properties
- National Heritage places
- RAMSAR Wetlands
- listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- nuclear actions
- Great Barrier Marine Park.

A search for matters of national environmental significance and other matters protected under the EPBC Act within a 20 kilometre radius of the proposal was undertaken on 28 April 2017. Search results are included in the *Newell Highway Upgrade: North Moree Preliminary Ecological Investigation* in Appendix A.

Due to the approval of a strategic assessment approval under the EPBC Act by the Australian Government in September 2015, referral is not required for the proposed road activities in the event that they affect nationally listed threatened species, populations, endangered ecological communities and migratory species.

2.4.2 *Native Title Act 1993*

The *Native Title Act 1993* provides the legislative framework that:

- recognises and protects native title
- establishes ways in which future dealings affecting native title may proceed, and to set standards for those dealings, including providing certain procedural rights for registered native title claimants and native title holders in relation to acts which affect native title
- establishes the National Native Title Tribunal.

The National Native Title Tribunal has a number of functions under the Act including maintaining the Register of Native Title Claims, the National Native Title Register and the Register of Indigenous Land Use Agreements and mediating native title claims. The NSW *Native Title Act 1994* was introduced to ensure that the laws of NSW are consistent with the Commonwealth *Native Title Act 1993*.

A search of the National Native Title Tribunal applications register was undertaken 22 March 2017. The proposal transverses land subject to the Registered Native Title Claim NC2011/006 by the Gomeroi People filed on 20 December 2011. Part 3 of the Registered Native Title Claim stipulates that any public works commenced before 23 December 1996 are excluded from the claim. The Newell Highway and associated infrastructure contained within the roads reserve are considered public works. Hence the land occupied by these public works is excluded from the Gomeroi People Native Title Claim NC2011/006; Federal Court file no. NSD2308/2011).

3 Stakeholder engagement and community consultation

This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

3.1 Consultation strategy

A project web page is available that outlines the benefits, features and objectives of the project as well as other project information and documents available.

A Community and Stakeholder Engagement Plan will be prepared for the planning, development and delivery of the proposal. This plan will identify key stakeholders, proposed communication tools, key messages and protocols to be implemented.

The plan will provide an agreed approach to communication and engagement.

3.2 Community involvement

To date, no community consultation has been carried out for the proposed investigations. Following project announcement, community and stakeholder consultation will commence. Any issues raised during this consultation will be considered in further design development and detailed environmental impact assessment.

3.3 Aboriginal community involvement

Aboriginal representatives from the following organisations participated in the field survey:

- Gomeroi People Native Title Claim Group (Gomeroi NTCG; Tribunal file no. NC2011/006; Federal Court file no. NSD2308/2011)
- Narrabri Local Aboriginal Land Council (Narrabri LALC)
- Moree Local Aboriginal Land Council (Moree LALC).

Table 3-1 Summary of Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation

Stage	Description
Stage 1	Initial Roads and Maritime assessment
Stage 2	Site survey and further assessment
Stage 3	Formal consultation and preparation of a cultural heritage assessment report
Stage 4	Implement environmental impact assessment recommendations

Table 3-2 Issues raised through Aboriginal community consultation

Group	Issue	Response / where addressed in PEI
Gomeroi People Native Title Claimants	<ul style="list-style-type: none"> • No significant known or potential Aboriginal cultural heritage features as identified by the survey will be affected by the project. • If any infrastructure such as bridges or bridge culverts are to be relocated test pitting will be required. 	<ul style="list-style-type: none"> • Section 4.4

3.4 Government agency and stakeholder involvement

To date, agency consultation has been completed for the proposal with Australian Rail Track Corporation (ARTC) in regards to the Narrabri to North Star project which runs alongside the Newell Highway and Moree Plains Shire Council who were invited to attend and provide input into the proposal risk workshop which was held in June 2017. Following project announcement, it is anticipated that broad community and stakeholder consultation will commence. Any issues raised during this consultation will be considered in further design development and detailed environmental impact assessment.

3.5 Ongoing or future consultation

Specific notification and consultation will be carried out with adjacent and potentially affected residences, groups and landowners prior to the start of the proposed works and during the next phase of the environmental assessment. If issues are raised during the initial consultation, comments would be considered in the proposed work methodology.

4 Environmental issues

For the purposes of chapter 4 and identifying potential environmental issues, the proposal has been divided into three segments (refer to Figure 1-1). For each environmental issue described below, an initial overview of the issues is provided with specific issues provided for each segment as required.

4.1 Traffic and transport

This section identifies the traffic and transport impacts of the proposal.

4.1.1 Methodology

The investigation considered how the Newell highway upgrade and associated construction may temporarily impact the traffic network performance, all modes of public and private transport, and access to public roads and private property within the study area.

Source information has been obtained from the following resources:

- Roads and Maritime (2015) Newell Highway Corridor Strategy
- Moree and Narrabri LGA online information
- reviews of relevant online aerial photography and mapping tools
- the schedule of classified and unclassified roads.

4.1.2 Existing environment

Road network

The proposal extends over the area of highway extending north from the town of Moree. Newell Highway is classified as a Class 4 rural road (4R) for its entire length. The road typically contains undivided carriageways with two lanes which also have overtaking lanes.

The road was constructed in the mid-1960s and an overlay of natural gravel install onto the north section mid-1990. Segmented areas along the Newell Highway exist as old narrow pavement on flat terrain with six bridges. The speed limit on rural road is 110 km/hr, limited to 50 km/h to 80 km/h through towns and urban areas and 40 km/h in school zones.

Traffic volume and mix

Average daily traffic volumes (ADT) vary from around 1200 to 4000 vehicles per day on rural sections. In urban centres such as Moree volumes can exceed 20,000 ADT.

A large number of heavy vehicles use the Newell highway as a key freight route between Victoria and Queensland representing an average of between 26 per cent and 52 per cent of daily traffic volumes. The highest percentage of heavy vehicles is in the northern sections between Narrabri and Boggabilla.

The section of highway North of Moree receives in excess of 2000 ADT of which 52 per cent are heavy vehicles (Table 4-1). The highway carries a seasonally high proportion of Caravan and tourist traffic travelling between Victoria and Queensland. There are between 50 and 1000 caravans per day during this time.

Table 4-1 Newell highway vehicle movements (Moree to Boggabilla)

Vehicle Type	Average daily vehicle movements
Heavy Vehicles	1185 (52%)
Light Vehicles	1095 (48%)
TOTAL	2280

Source: Roads and Maritime (2015) Newell Highway Corridor Strategy

Public transport

Public transport on the highway corridor is generally restricted to urban areas. A local bus service operates in Moree, with one route using the Newell Highway. No services are operated within the segments.

Pedestrian, cycling and road user facilities

Similar to bus services, dedicated walking and cycling corridors are restricted to towns. As a minimum between towns, a sealed road shoulder less than two metres is provided for bicycle travel. There are some shared pedestrian/cyclist facilities on sections of the Newell Highway that pass through town centres. A shared path follows the Newell Highway and Mehi River. An upgrade of an existing heavy vehicle rest area was completed in 2012, Boolooroo on the Newell Highway, six kilometres north of Moree.

There are three vehicle rest areas in the study area north of Moree on the Newell Highway. Two of these are located adjacent to the proposed work area. The Gil Gil rest area is located 40.4 kilometres north of Moree, a further two kilometres beyond this is an additional unnamed rest area located on the western side of the highway.

Property access

There are 26 property access roads which join the highway within the study area. 12 of these are located within segment 1, eight in segment 2, and 10 within segment 3 (refer to Figure 4-1).

4.1.3 Summary of issues

The following table outlines the issues associated with the development of the proposal outlined in the above sections of this investigation.

Table 4-2 Summary of traffic and transport constraints to the proposal

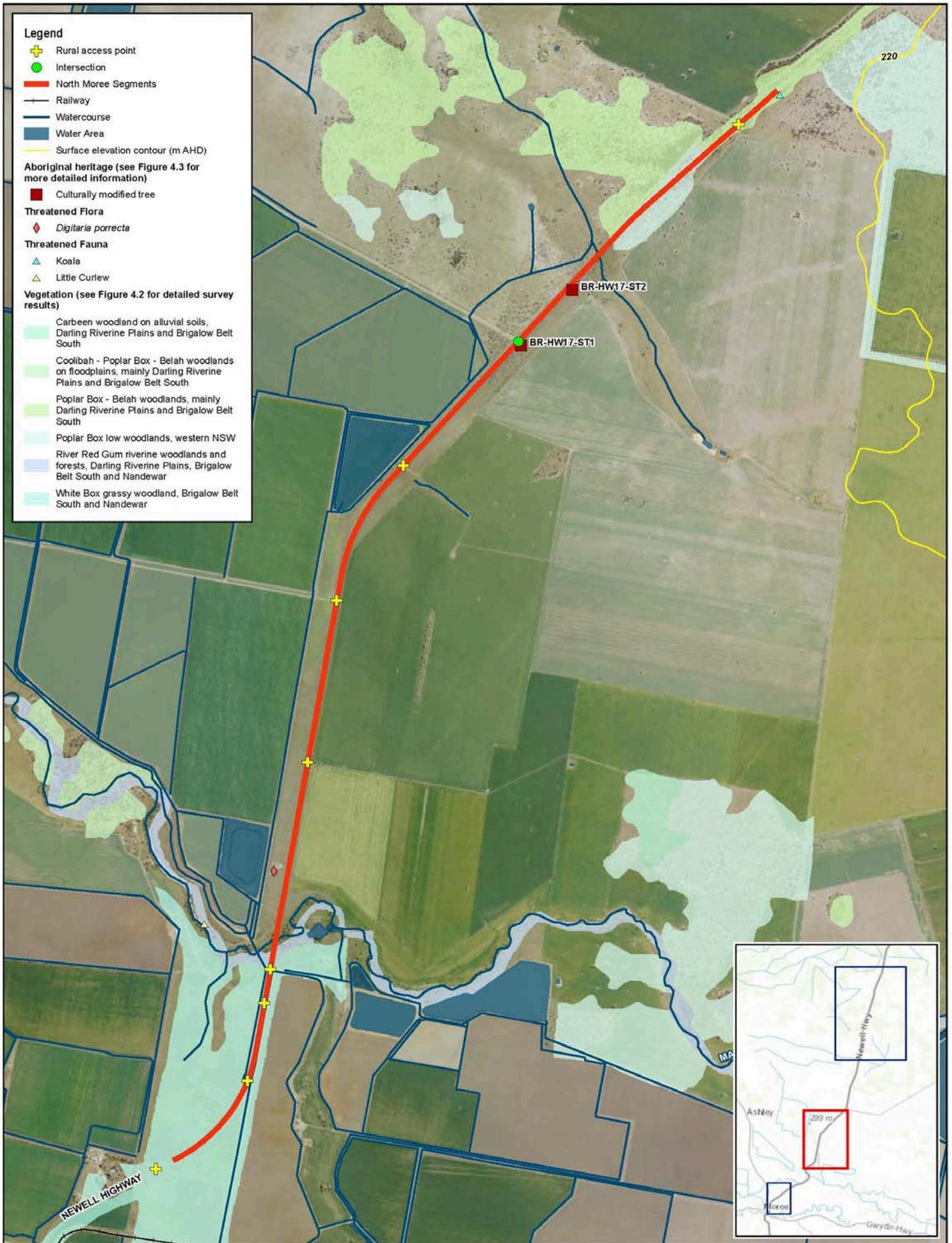
Segment	Issue	Distance from Moree (km)
Segment 1	Management of vehicle access to 12 rural/residential properties	3.0 km – 6.94 km
	Management of access to Boggabilla Rd	3.6 km
	Management of access to Stirton Rd	4.0 km
	Management of access to Gwydirfield Rd	5.6 km
	Management of disruptions on the outskirts of Moree	3.0 – 4.0 km
Segment 2	Management of vehicle access to eight rural/residential properties	15.0 km – 26.0 km
	Management of access to Milo Rd	22.6 km

Segment	Issue	Distance from Moree (km)
Segment 3	Management of access to Success Park Rd	36.2 km
	Management of access to six rural residential properties	36.9 – 51.0 km
	Management of access to Murrays Rd	40.1 km
	Management of access to Bogamildi Rd	40.6 km
	Management of heavy and light vehicle movements to and from, and stationary vehicle access to Gil Gil rest area	40.4 km
	Management of heavy and light vehicle movements to and from, and stationary vehicle access to an unnamed rest area	42.5 km

4.1.4 Recommendations

The following recommendations are made in relation to traffic and transportation issues of the proposal.

- consultation with the ARTC regarding the proposed inland rail alignment should be carried out to ensure cumulative traffic and transport impacts are understood and assessed consider the need for construction staging within design development to ensure access for heavy vehicles to is maintained
- consultation with community, trucking association and agricultural industry groups to minimise network disruptions and manage peak periods; and other major project proponents to manage potential cumulative impacts
- a traffic assessment would be completed as part of the further development of the project.



Legend

- + Rural access point
- Intersection
- North Moree Segments
- Railway
- Watercourse
- Water Area
- Surface elevation contour (m AHD)

Aboriginal heritage (see Figure 4.3 for more detailed information)

- Culturally modified tree

Threatened Flora

- ◆ *Digitaria porrecta*

Threatened Fauna

- ▲ Koala
- ▲ Little Curlew

Vegetation (see Figure 4.2 for detailed survey results)

- Carbeen woodland on alluvial soils, Darling Riverine Plains and Brigalow Belt South
- Coolibah - Poplar Box - Belah woodlands on floodplains, mainly Darling Riverine Plains and Brigalow Belt South
- Poplar Box - Belah woodlands, mainly Darling Riverine Plains and Brigalow Belt South
- Poplar Box low woodlands, western NSW
- River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar
- White Box grassy woodland, Brigalow Belt South and Nandewar

Map: 2270618A_GIS_F002_A6 Author: mitchellem

Date: 13/07/2017 Approved by: -

Coordinate system: GDA 1994 MGA Zone 55 Scale ratio correct when printed at A3

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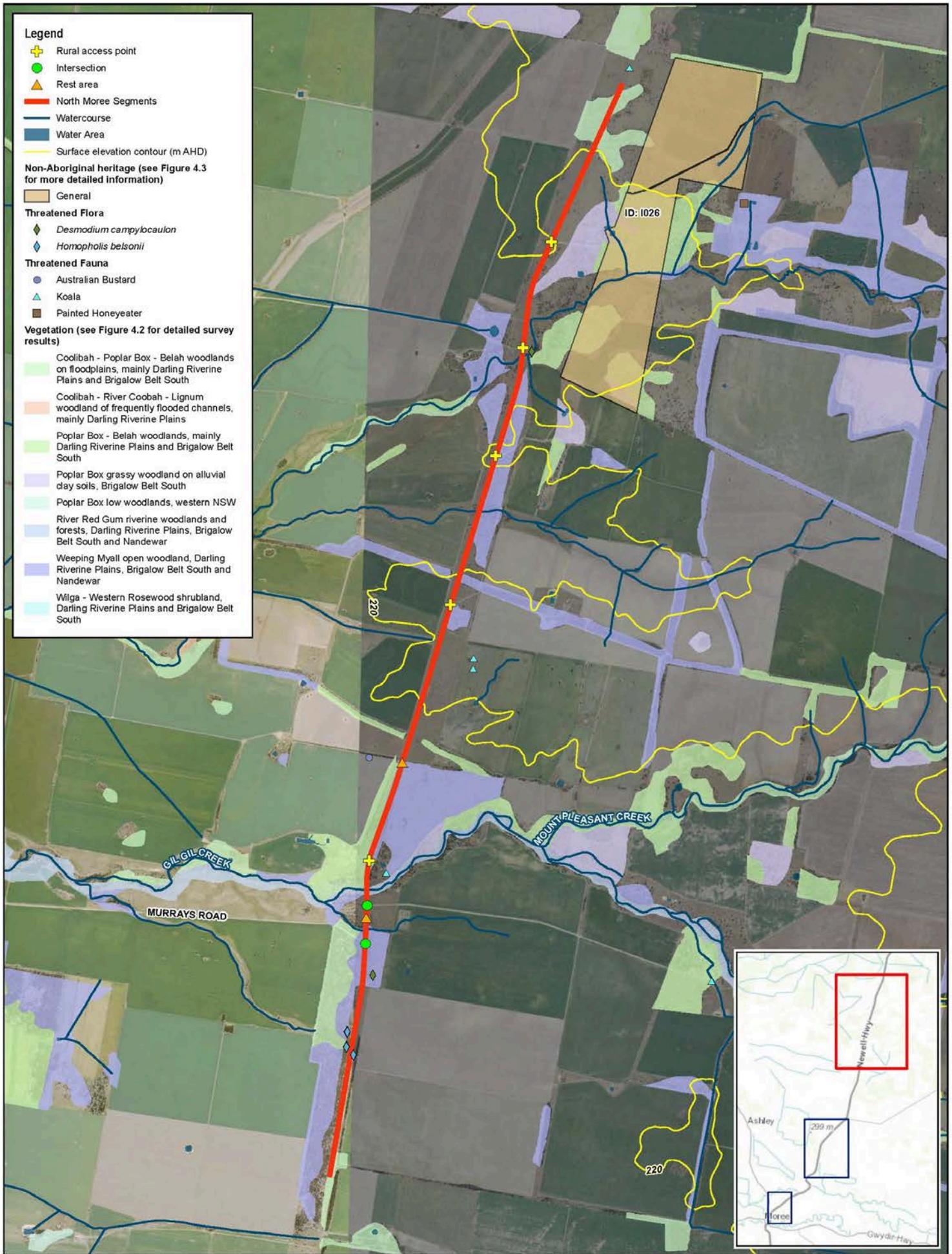


ROADS AND MARITIME SERVICES

PEI - North Moree

Figure 4.1 General Constraints Segment 2

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- Legend**
- + Rural access point
 - Intersection
 - ▲ Rest area
 - North Moree Segments
 - Watercourse
 - Water Area
 - Surface elevation contour (m AHD)

Non-Aboriginal heritage (see Figure 4.3 for more detailed information)

- General

Threatened Flora

- ◆ *Desmodium campylocaulon*
- ◆ *Homopholis belsonii*

Threatened Fauna

- Australian Bustard
- ▲ Koala
- Painted Honeyeater

Vegetation (see Figure 4.2 for detailed survey results)

- Coolibah - Poplar Box - Belah woodlands on floodplains, mainly Darling Riverine Plains and Brigalow Belt South
- Coolibah - River Coobah - Lignum woodland of frequently flooded channels, mainly Darling Riverine Plains
- Poplar Box - Belah woodlands, mainly Darling Riverine Plains and Brigalow Belt South
- Poplar Box grassy woodland on alluvial clay soils, Brigalow Belt South
- Poplar Box low woodlands, western NSW
- River Red Gum riverine woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar
- Weeping Myall open woodland, Darling Riverine Plains, Brigalow Belt South and Nandewar
- Wilga - Western Rosewood shrubland, Darling Riverine Plains and Brigalow Belt South

Map: 2270618A_GIS_F002_A6 Author: mitchellem

Date: 13/07/2017 Approved by: -

Coordinate system: GDA 1984 MGA Zone 55 Scale ratio correct when printed at A3

Data source: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GEBCO, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox, Mapbox, OpenStreetMap contributors, and the GIS User Community
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ROADS AND MARITIME SERVICES

PEI - North Moree

Figure 4.1 General Constraints Segment 3

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4.2 Biodiversity

This section identifies the biodiversity values within the study area and potential impacts from the proposed highway upgrade. This section is based on the results of the desktop and preliminary biodiversity assessment.

4.2.1 Methodology

This section is based on the results of the *Newell Highway Upgrade: North Moree Preliminary Ecological Investigation* included in Appendix A.

Background research

The aim of the background research was to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed Migratory species or critical habitat recorded previously or predicted to occur in the locality of the study area. Searches were carried out within the locality (20 km) of the study area.

This allowed for known habitat characteristics of locality to be compared with those present within the study area to determine the likelihood of occurrence of each species or populations. These results informed the identification of appropriate field survey effort and the groups likely to occur.

The following spatial data was accessed to determine the landscape features and site values:

- NSW Mitchell Landscapes (Office for Environment & Heritage, 2016)
- Interim Biogeographic Regionalisation of Australia (IBRA version 5.1) (Thackway and Cresswell, 1995)
- Border Rivers-Gwydir Catchment vegetation mapping (Eco Logical Australia, 2009)
- records of threatened species, populations and ecological communities known or predicted to occur in the locality of the road corridor were obtained the following databases included in Table 4-3.

Table 4-3 Database searches (20 km search around the road corridor)

Database	Search date	Source
BioNet Atlas of NSW Wildlife	28/04/2017	(Office of Environment & Heritage, 2017)
Protected Matters Search	28/04/2017	(Department of the Environment and Energy, 2017b)
Directory of Important Wetlands	28/04/2017	(Department of Environment and Energy, 2017a)
Groundwater Dependant Ecosystems Atlas Map	28/04/2017	(Australian Bureau of Meteorology, 2017)
Critical habitat Register (TSC Act)	28/04/2017	(Office of Environment and Heritage, 2017a)
Register of Critical Habitat (EPBC Act)	28/04/2017	(Department of Environment and Energy, 2017b)
Register of Critical Habitat (FM Act)	28/04/2017	(Department of Primary Industries, 2017c)
Key Fish Habitats (FM Act)	28/04/2017	(Department of Primary Industries, 2017a)

Field survey

Field surveys were undertaken on the 31 May and 1 June 2017, and consisted of one rapid assessment and three plot based surveys whilst undertaking incidental observations within the study area.

4.2.2 Existing environment

The study area is located within a highly fragmented and largely cleared landscape where land use is primarily agricultural, dominated by cropping. The road corridor has also been routinely cleared. For the purpose of this report, the study area has been established using a 30 m buffer either side of the existing road corridor centreline. Few occurrences of native vegetation along the road corridor have connectivity to larger areas of native vegetation.

The majority of vegetation within the study area is comprised of derived native grasslands of PCT 56, PCT56/BR186 Poplar Box – Belah woodland on clay loam soils on alluvial plains of north – central NSW (Poplar Box – Belah woodland) and Miscellaneous Ecosystem (Exotic Grasslands) (WSP, 2017a).

A total of 192 flora species were recorded during field surveys for both this report and the Narrabri to Moree PEI (WSP 2017b). Of these, 131 were native (68 per cent) and 61 were exotic (32 per cent). A total of 52 species of bird were recorded in the study area during field surveys. Of these, three species were exotic and one, Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), is listed as Vulnerable under the TSC Act.

Whilst no surface water was recorded, several ephemeral creeks, Nee Nee Creek, Gil Gil Creek, Marsall Ponds Creek and Skinners Creek, intersect the study area and have been classified as supporting minimal Key Fish Habitat watercourses (Class 3) as they are ephemeral aquatic habitat which are not supporting native aquatic or wetland vegetation. These creeks may be utilised opportunistically in times of high rainfall and flooding by a number of fauna species including birds, amphibians and reptiles.

The closest RAMSAR listed wetland, the Gwydir Wetlands, are situated 23 km to the west of Moree.

Vegetation communities and habitat

Database searches identified nine threatened ecological communities listed under the TSC Act as occurring within locality of the study area. Based on field verification of existing vegetation mapping, one of the plant community types recorded was consistent with TSC Act listed threatened ecological community. One Commonwealth listed threatened ecological community was recorded within the study area being Weeping Myall Woodlands. This community is listed as Endangered under the EPBC Act and corresponds with PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Weeping Myall open woodland) identified above. The recorded plant community type and its aligning threatened ecological community is outlined in Table 4-4 and shown on Figure 4-2.

Table 4-4 Threatened ecological communities reordered within the study area

Plant community type	Threatened Ecological Community	TSC Act Status	EPBC Act Status
PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Endangered	Endangered

The occurrence of Weeping Myall open woodland within the study area is restricted to isolated patches and linear strips fringing Newell Highway.

Rapid assessments of Weeping Myall open woodland revealed the occurrences within the study area to have a structurally intact canopy cover where 50 percent is comprised of native species being dominated by *Acacia pendula* (Weeping Myall). However, due to the variable area of vegetation patches, only the larger patches Weeping Myall open woodland met the EPBC Act listing criteria and will be considered to form Weeping Myall Woodland EEC. Further assessment is required to determine the amount of Weeping Myall open woodland which meets EPBC Act status.

Threatened flora

Database searches (BioNet Atlas of NSW Wildlife) revealed five species of threatened flora under the TSC Act, as being known to occur or considered likely to occur within locality of the study area. Of these five threatened flora species are considered to have a moderate or higher likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the absence of suitable habitat (Refer to the flora likelihood of occurrence tables within Appendix B of Ecological Assessment (Appendix A of this Report)).

Results of threatened species database searches (Protected Matters Search) identified six threatened plant species listed under the EPBC Act as being known to occur or considered likely to occur within locality of the study area. Of these, four species were considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat.

Table 4-5 outlines those listed flora species with a moderate or higher likelihood of occurring within the study area whilst Appendix B of the Preliminary Ecological Assessment provides the complete likelihood of occurrence assessment. Targeted surveys are recommended to confirm the presence or inform likelihood of the below species occurring.

Table 4-5 TSC and EPBC listed threatened flora species considered to have a moderate to high likelihood of occurrence

Common name	TSC Act Status ¹	EPBC Act Status ²	Likelihood of occurrence assessment
Creeping Tick-trefoil	E1	-	Moderate Brown clay soils, plant community types and several understorey species associated with <i>Desmodium campylocaulon</i> were recorded within the study area. Potential habitat in form of BR233 recorded within the study area.
Bluegrass	V	E	Moderate Though not previously recorded within locality, associated habitat presents within study area. Potential habitat in the form of BR196 and BR233 recorded within the study area.
Finger Panic Grass	E1	E	Moderate Associated habitat and soils type present within the study area. Recent records within the locality. Potential habitat in the form of BR186 and BR233 recorded within the study area.
Homopholis belsonii	E1	V	Moderate Previously recorded within locality, associated vegetation recorded within the study area. Potential habitat in the form of BR186 and BR233 recorded within the study area.
Slender Darling Pea	V	V	Moderate Associated soils types and vegetation present within the study area. Potential habitat in the form of BR233 recorded within the study area.

(1) TSC Act Status: V = Vulnerable E1 = Endangered species

(2) EPBC Act Status: V = Vulnerable E = Endangered

Threatened fauna

Results of threatened species database searches identified 22 threatened fauna species listed under the TSC Act as being known to occur or considered likely to occur within locality of the study area. Of these one vulnerable species, the Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*), was recorded. A further seven species were considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the

absence of suitable habitat (Refer to the fauna likelihood of occurrence tables within Appendix D of Ecological Assessment (Appendix A of this Report)).

Results of threatened species database searches identified 21 threatened fauna species listed under the EPBC Act as being known to occur or considered likely to occur within locality of the study area. Of these one species; the Koala (*Phascolarctos cinereus*) was considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat.

Table 4-6 outlines those TSC Act and EPBC listed fauna species with a moderate likelihood of occurring within the study area whilst Appendix D of the Preliminary Ecological Assessment (Appendix B) provides the complete likelihood of occurrence assessment.

Table 4-6 TSC and EPBC listed threatened fauna with a moderate or high likelihood of occurrence

Common name	TSC Act Status ¹	EPBC Act Status ²	Likelihood of occurrence assessment
Birds			
Glossy Black-Cockatoo	V	–	Moderate
Spotted Harrier	V	–	Moderate
Turquoise Parrot	V	–	Moderate
Grey-Crowned Babbler (Eastern subspecies)	V	–	Recorded
Mammals			
Little Pied Bat	V	–	Moderate
Koala (NSW, ACT & QLD - excluding SE QLD)	V	V	Moderate
Yellow-bellied Sheath-tail-bat	V	–	Moderate

(1) TSC Act Status: V = Vulnerable E1 = Endangered species

(2) EPBC Act Status: V = Vulnerable E = Endangered

Noxious weeds

Of the 61 exotic flora species recorded within the study area, five were listed under the *Noxious Weeds Act 1993* within the Moree Plains noxious weed control area. Of these African Boxthorn, Tiger Pear and Velvety tree pear are listed as a Weeds of National Significance (WONS).

Table 4-7 Noxious weeds and Weeds of National Significance recorded within the study area

Common Name	Noxious Weed Listing ¹	Weed of national significance
	Moree Plains	
Paterson's curse ¹	4	
African boxthorn ¹	4	Yes
Tiger pear ¹	4	Yes
Velvety tree pear ¹	4	Yes
Johnson grass ¹	4	

(1) Control Categories under the Noxious Weeds Act 1993 - Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.* Denotes exotic species

Endangered populations

The results of background research did not identify any TSC Act or EPBC Act listed endangered population known or likely to occur within the locality.

4.2.3 Summary of issues

Below is a summary of findings of the desktop study and initial phases of field surveys completed to identify the broad-scale distribution of key ecological attributed, including associated values and constrains across the study area.

Key ecological attributes include:

- the presence of the Endangered ecological community, *Weeping Myall Woodlands* which is:
 - listed under the EPBC Act as Weeping Myall Woodlands
 - listed under the TSC as Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions Act
- the presence of a community nominated for listing under the EPBC Act, Poplar Box Grassy Woodland on Alluvial Plains
- the presence of Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*) within the study area
- potential habitat for:
 - five threatened flora species listed under the TSC Act
 - seven threatened fauna species listed under the TSC Act
 - four threatened flora species listed under the EPBC Act
 - one fauna species listed under the EPBC Act.

The potential risks on the ecological values include:

- increased habitat fragmentation and edge effects through widening Newell Highway
- potential weed invasion, including noxious weeds and spread into adjacent sensitive habitats (Large patches of EPBC listed *Weeping Myall Woodlands* within close proximity)
- introduction of pathogens into the environment such as *Phytophthora cinnamomi* and Myrtle Rust.

Study area specific issues are included in Table 4-8 below.

Table 4-8 Summary of biodiversity constraints to the proposal

Segment	Issue	Distance from Moree (km)
Segment 1	A small area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located at on the south-eastern side of the highway corridor	6.0 – 6.3 km
	The presence Poplar Box Grassy Woodland on Alluvial Plains, a community nominated for listing as Endangered under the EPBC Act is located on the eastern side of the highway corridor.	5.7 – 6.9 km
Segment 2	The presence Poplar Box Grassy Woodland on Alluvial Plains, a community nominated for listing as Endangered under the EPBC Act is located on the eastern side of the highway corridor.	22.6 – 25.5 km
	A small area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located at on the south-eastern side of the highway corridor	23.4 km

Segment	Issue	Distance from Moree (km)
Segment 3	The presence Poplar Box Grassy Woodland on Alluvial Plains, a community nominated for listing as Endangered under the EPBC Act is located on both eastern and western sides of the highway corridor.	37.1 – 39.5 km 40.3 – 40.8 km 40.9 – 42.5 km 48.6 – 51.8 km
	An area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion on both sides of the Newell highway corridor	39.5 – 40.3 km
	An area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located on the eastern side of the highway corridor, opposite an unnamed vehicle rest area.	42.5 km
	An area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located on the eastern side of the highway corridor.	44.4 – 44.7 km
	An area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located on the western side of the highway corridor.	47.9 – 48.6 km
	An area of Endangered Ecological Community – Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion is located on the eastern side of the highway corridor.	48.9 km

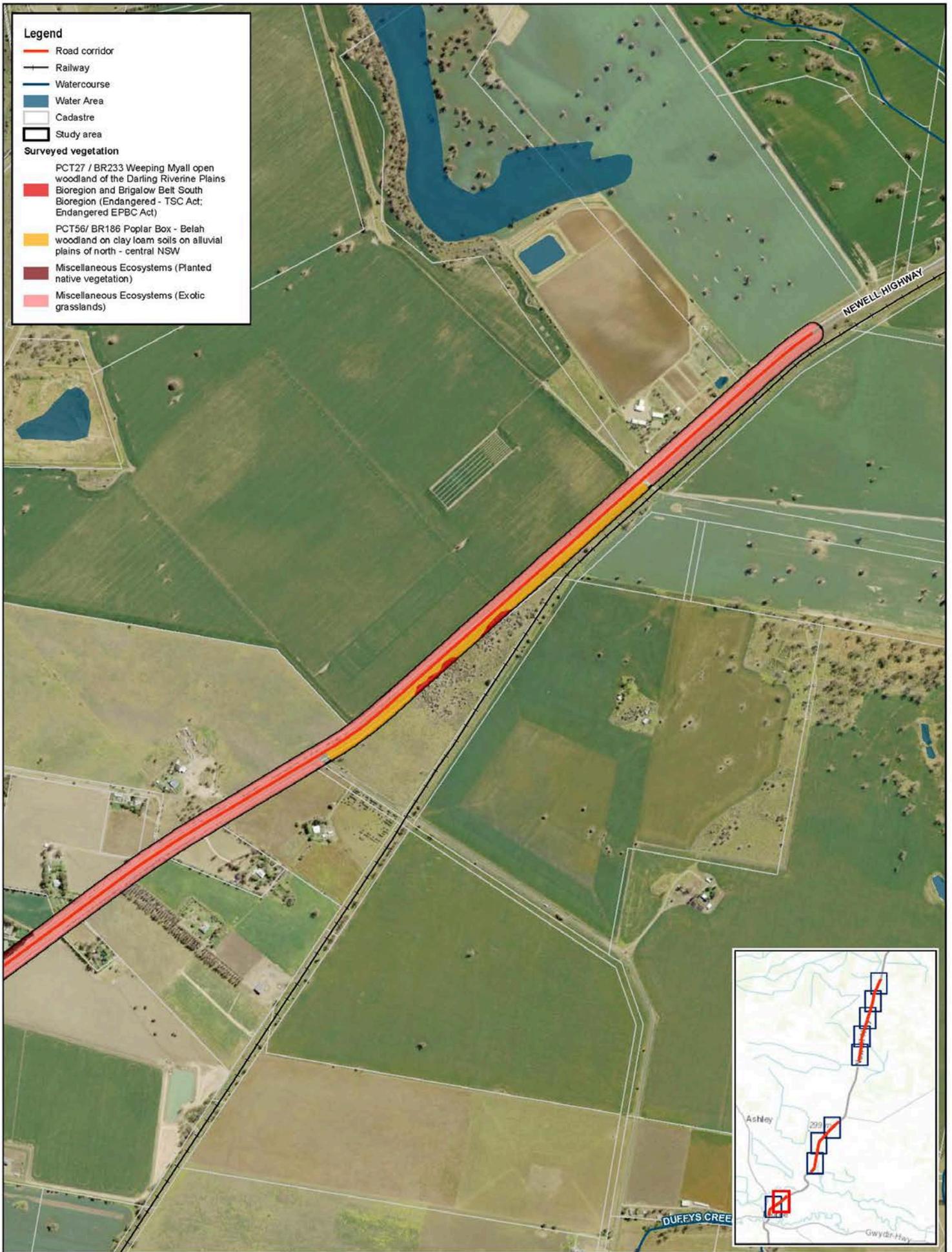
4.2.4 Recommendations

The following recommendations are made in relation to biodiversity issues of the proposal:

- apply the ‘avoid, minimise, mitigate and offset’ hierarchy during further design development, specifically in relation to threatened communities and species consistent with commitment made within the EPBC Act Strategic Assessment – Strategic Assessment Report (Roads and Maritime, 2015)
- where feasible and reasonable, avoid PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion which are/may be consistent with:
 - TSC Act listed Weeping Myall Woodlands and Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions
 - EPBC Act listed Weeping Myall Woodlands
- where feasible and reasonable, avoid PCT 56 Poplar Box Grassy Woodland on Alluvial Plains, a community nominated for listing as Endangered under the EPBC Act
- all creek crossing should be designed in accordance with the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).

Once the preferred option is identified, the ecological value and expected impacts to flora and fauna species and areas of high ecological value should be confirmed by a qualified and experienced ecologist including targeted surveys for threatened flora and fauna and detailed vegetation surveys to verify vegetation boundaries. These subsequent surveys will need to be undertaken in accordance with the Draft Biodiversity Assessment Methodology (BAM) 2017 which comes into effect on the 25 August 2017, and the Roads and Maritime Biodiversity Practice Note EIA-N06.

Measures to minimise impacts should be progressed through design.



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Figure 4.2 Biodiversity Constraints
Segment 1 - Page 2



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Map: 2270618A_GIS_F010_A5

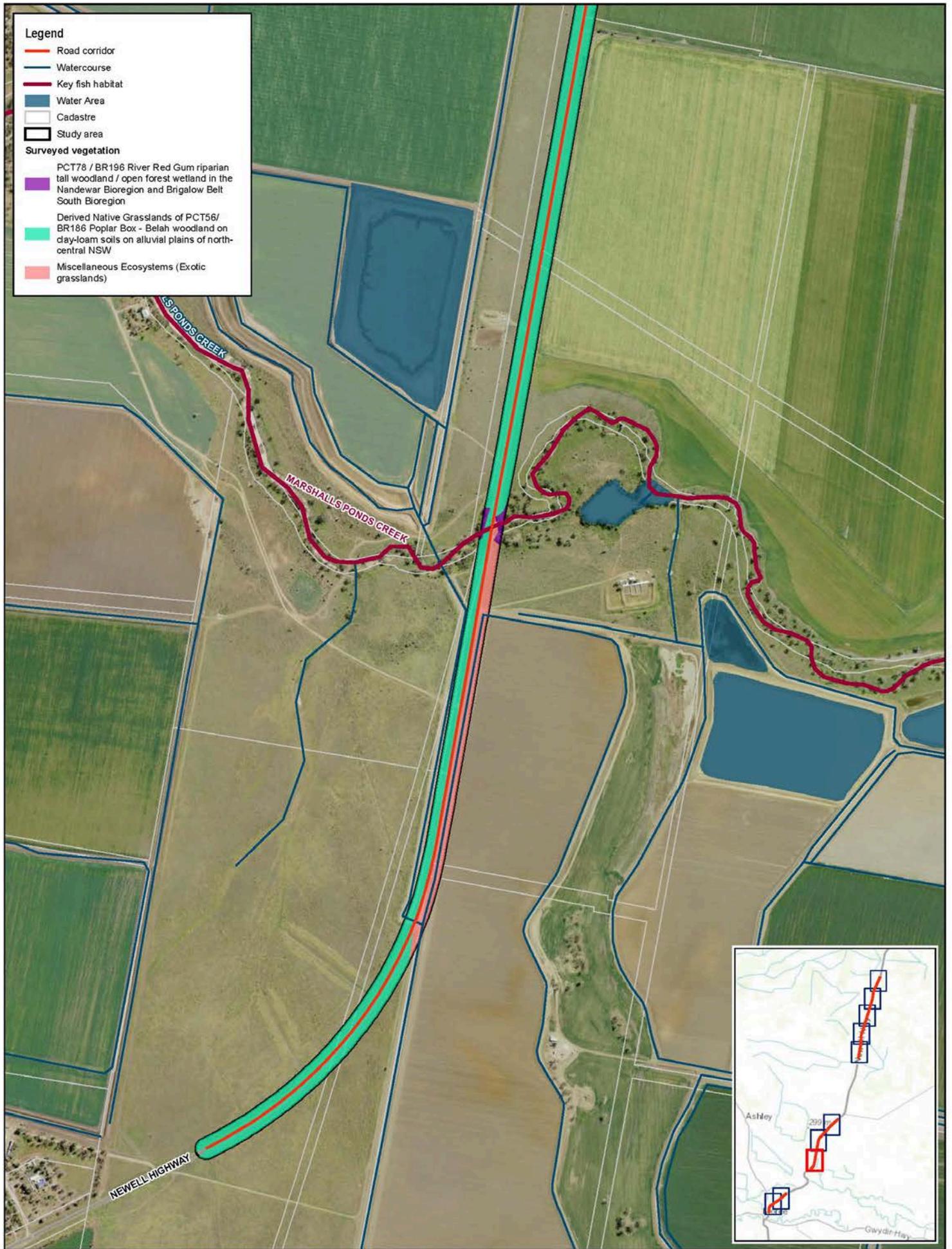
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- Legend**
- Road corridor
 - Watercourse
 - Key fish habitat
 - Water Area
 - Cadastre
 - Study area
- Surveyed vegetation**
- PCT78 / BR196 River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
 - Derived Native Grasslands of PCT56/ BR186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW
 - Miscellaneous Ecosystems (Exotic grasslands)

Map: 2270618A_GIS_F010_A5 Author: mitchellem

Date: 13/07/2017 Approved by: -

Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GEBCO, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox, © OpenStreetMap contributors, and the GIS User Community
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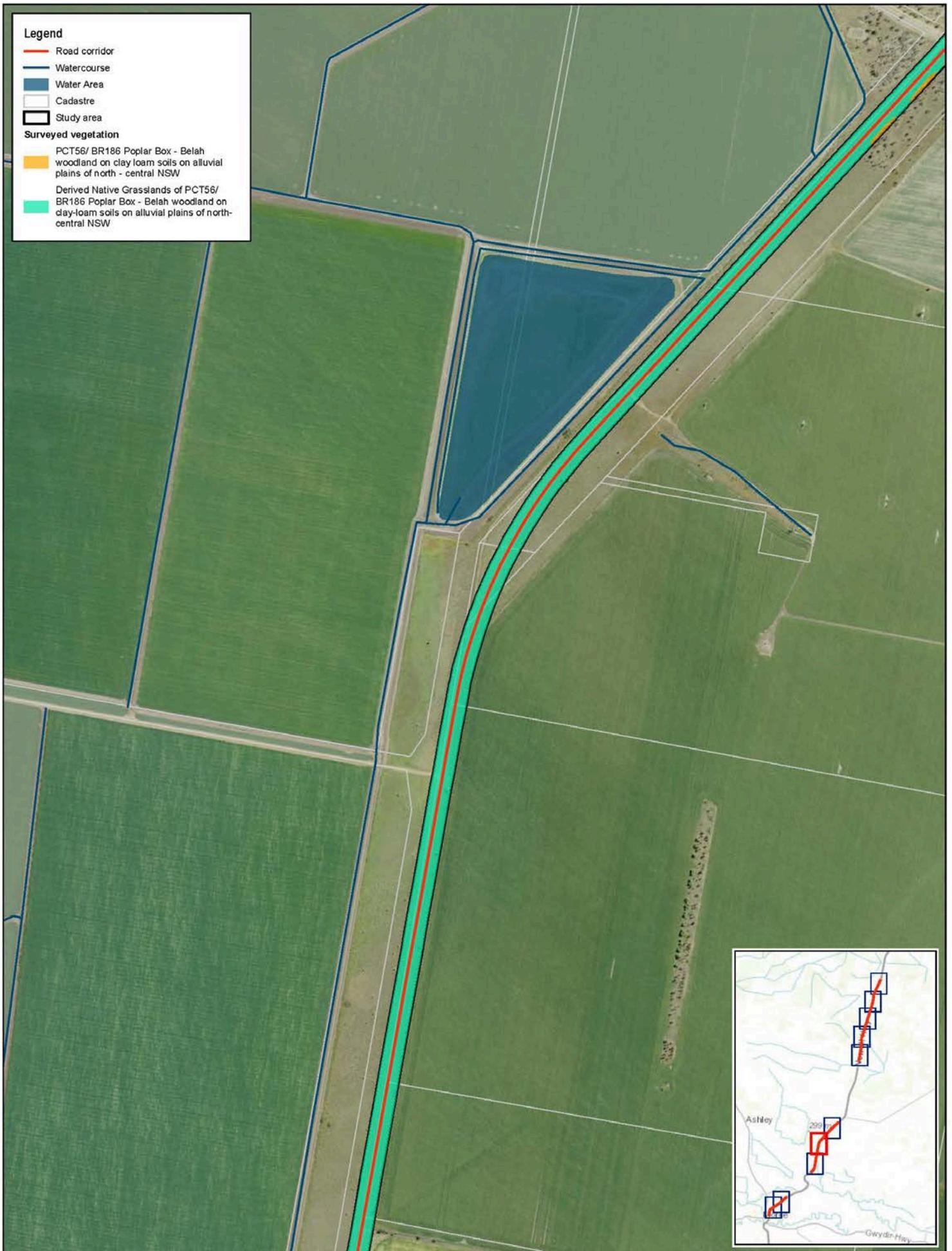
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Figure 4.2 Biodiversity Constraints Segment 2 - Page 1

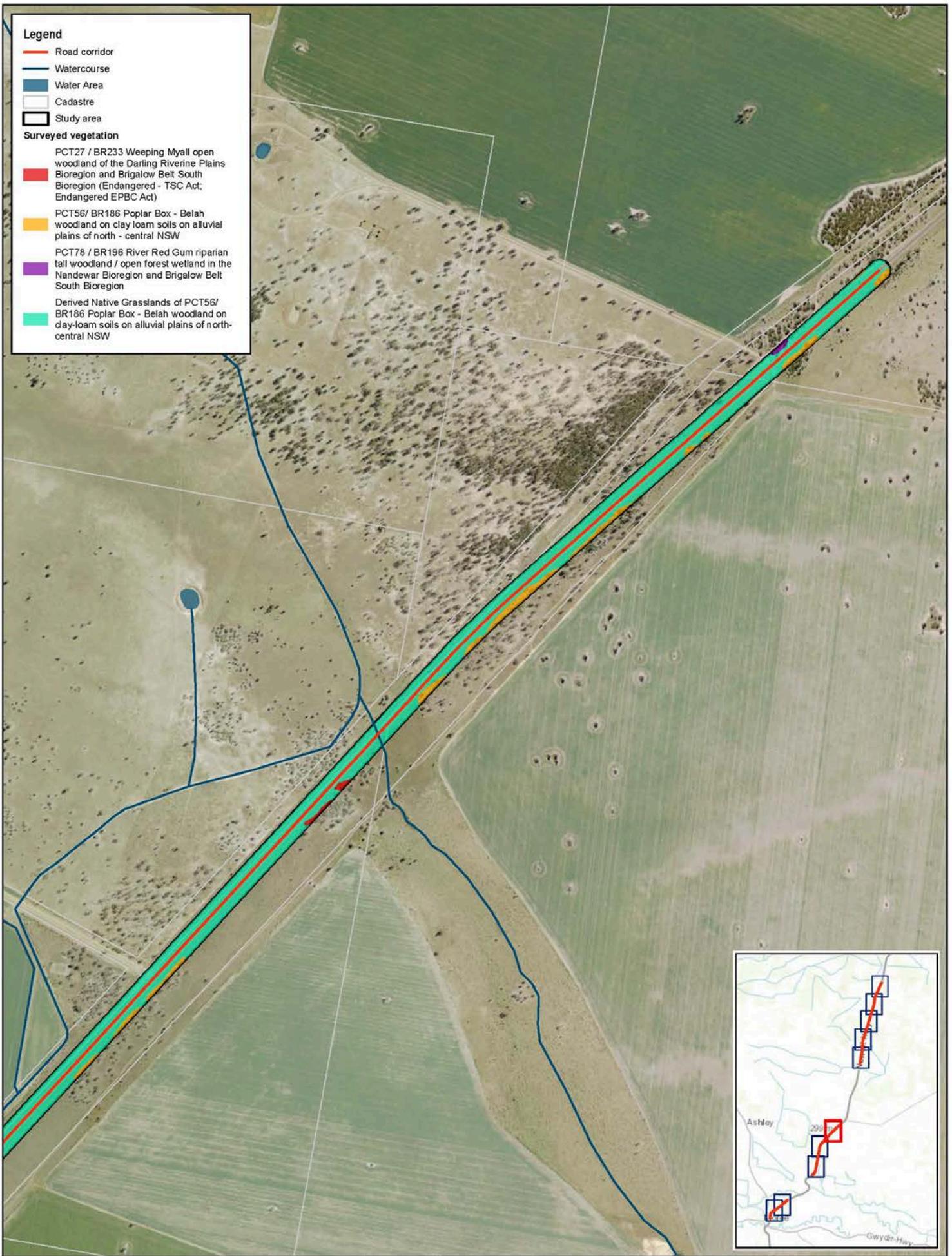


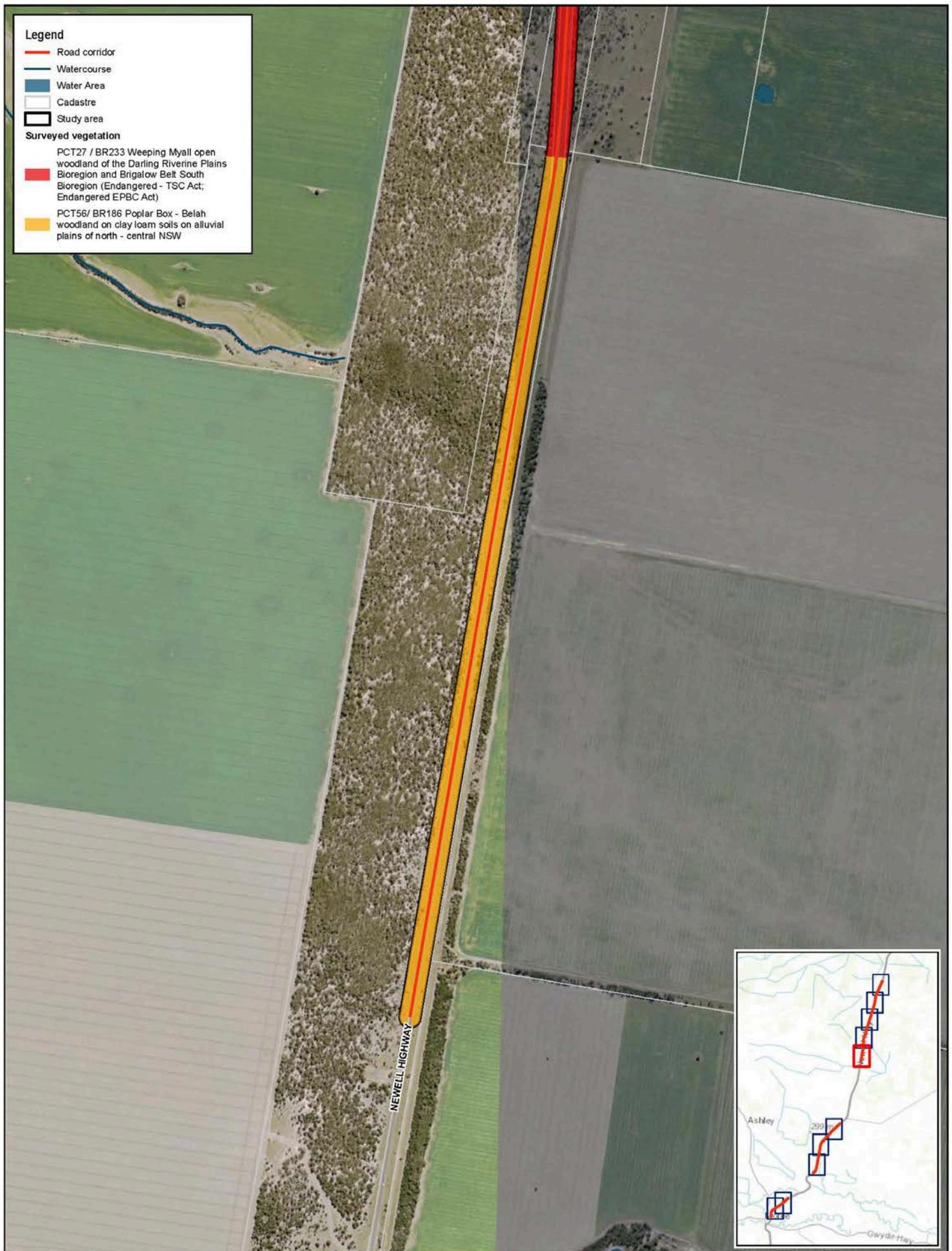
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Figure 4.2 Biodiversity Constraints
Segment 2 - Page 2



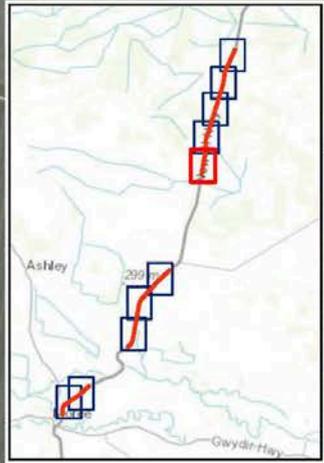


Legend

- Road corridor
- Watercourse
- Water Area
- Cadastre
- Study area

Surveyed vegetation

- PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
- PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north - central NSW



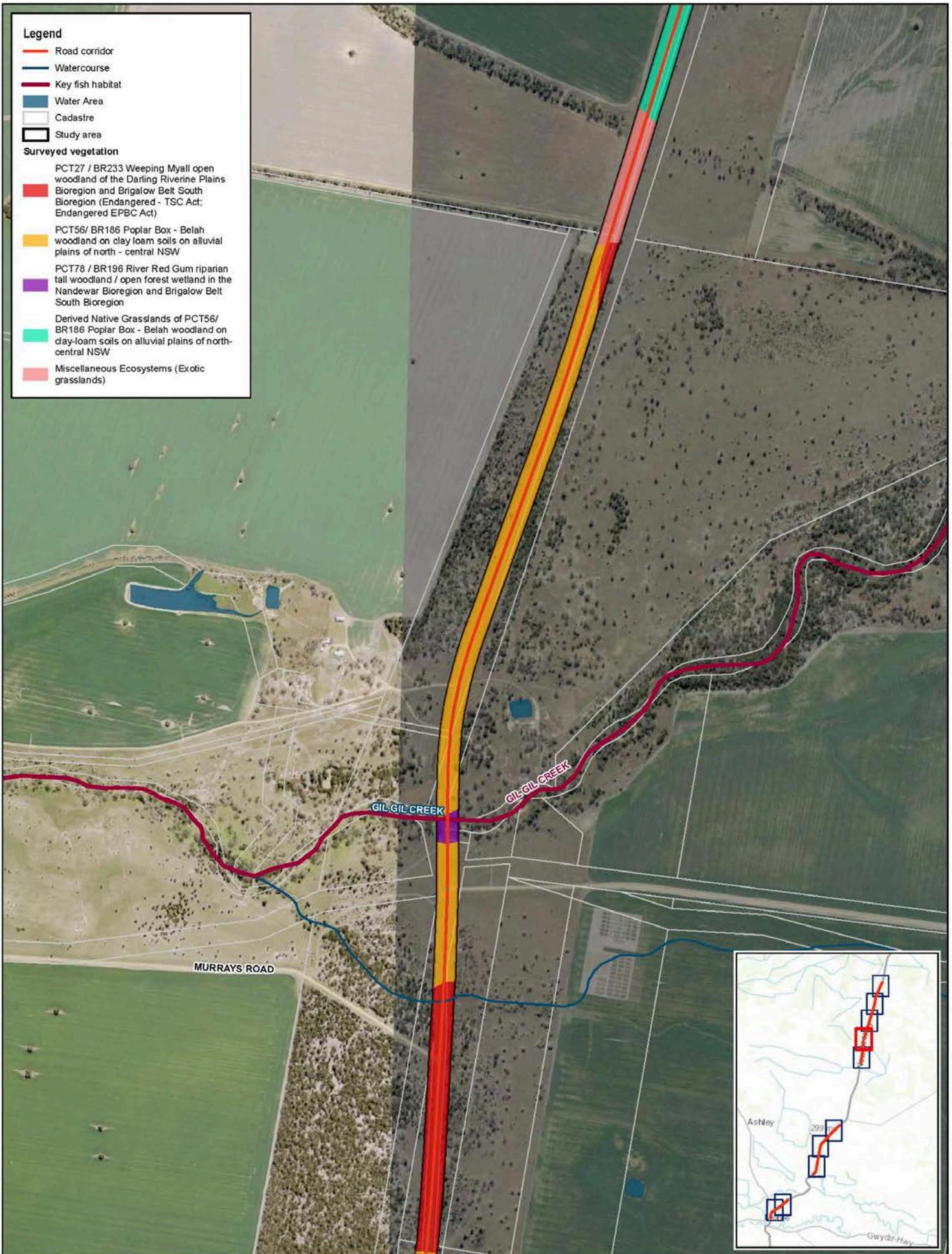
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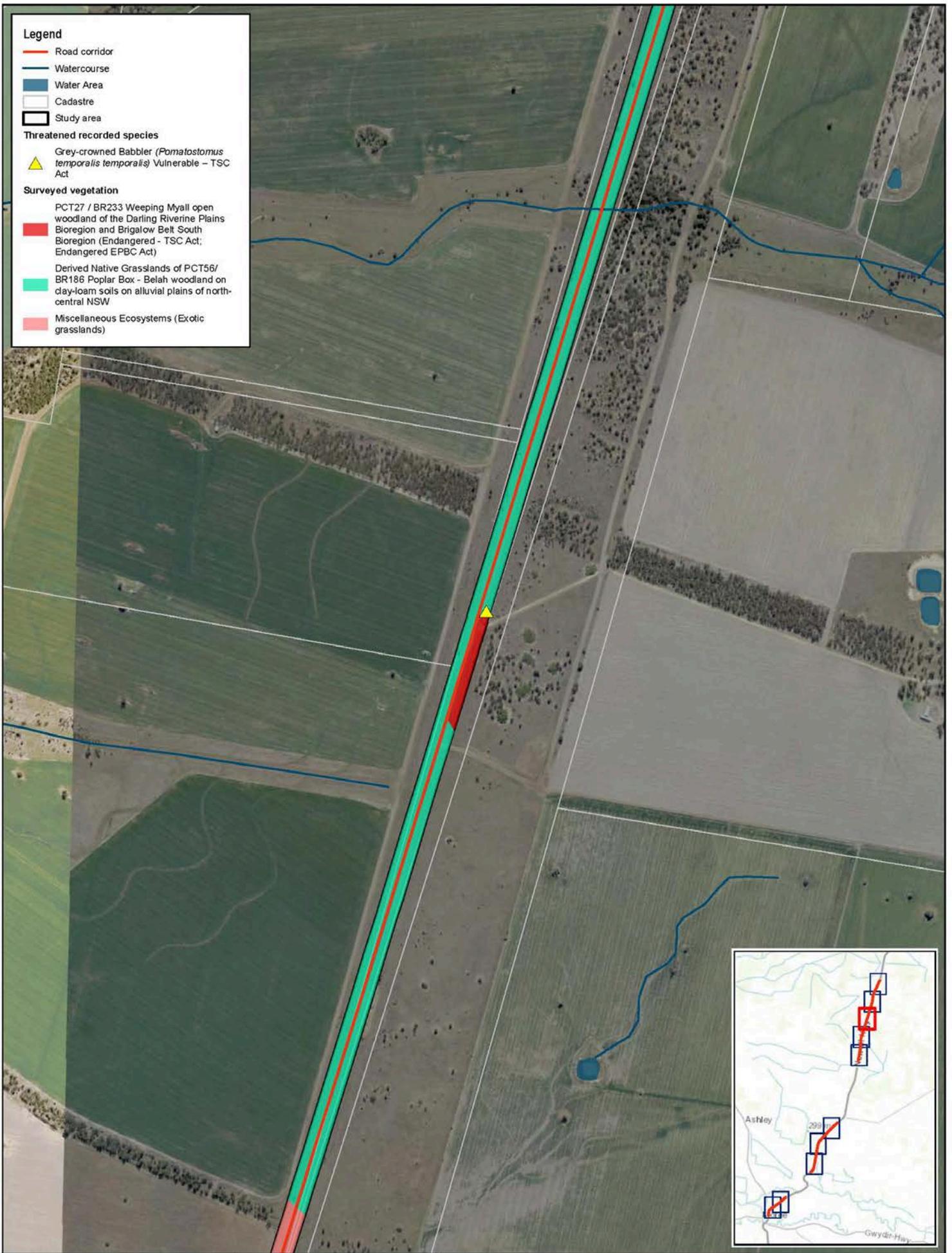
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Figure 4.2 Biodiversity Constraints
Segment 3 - Page 1



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Figure 4.2 Biodiversity Constraints
Segment 3 - Page 2



Legend

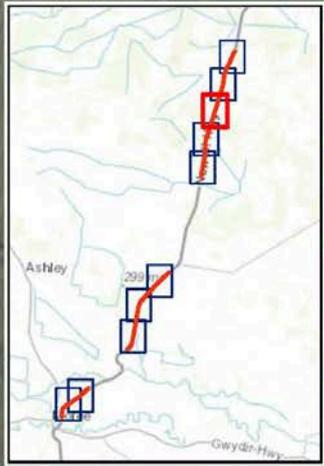
- Road corridor
- Watercourse
- Water Area
- Cadastre
- Study area

Threatened recorded species

- ▲ Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) Vulnerable – TSC Act

Surveyed vegetation

- PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
- Derived Native Grasslands of PCT56/ BR186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW
- Miscellaneous Ecosystems (Exotic grasslands)



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Date: 13/07/2017	Approved by: -		Coordinate system: GDA 1994 MGA Zone 55
<small>Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, UBOB, FAO, NPS, NRCAN, GeoBasis, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox, OpenStreetMap contributors, and the GIS User Community</small>			Scale ratio correct when printed at A3
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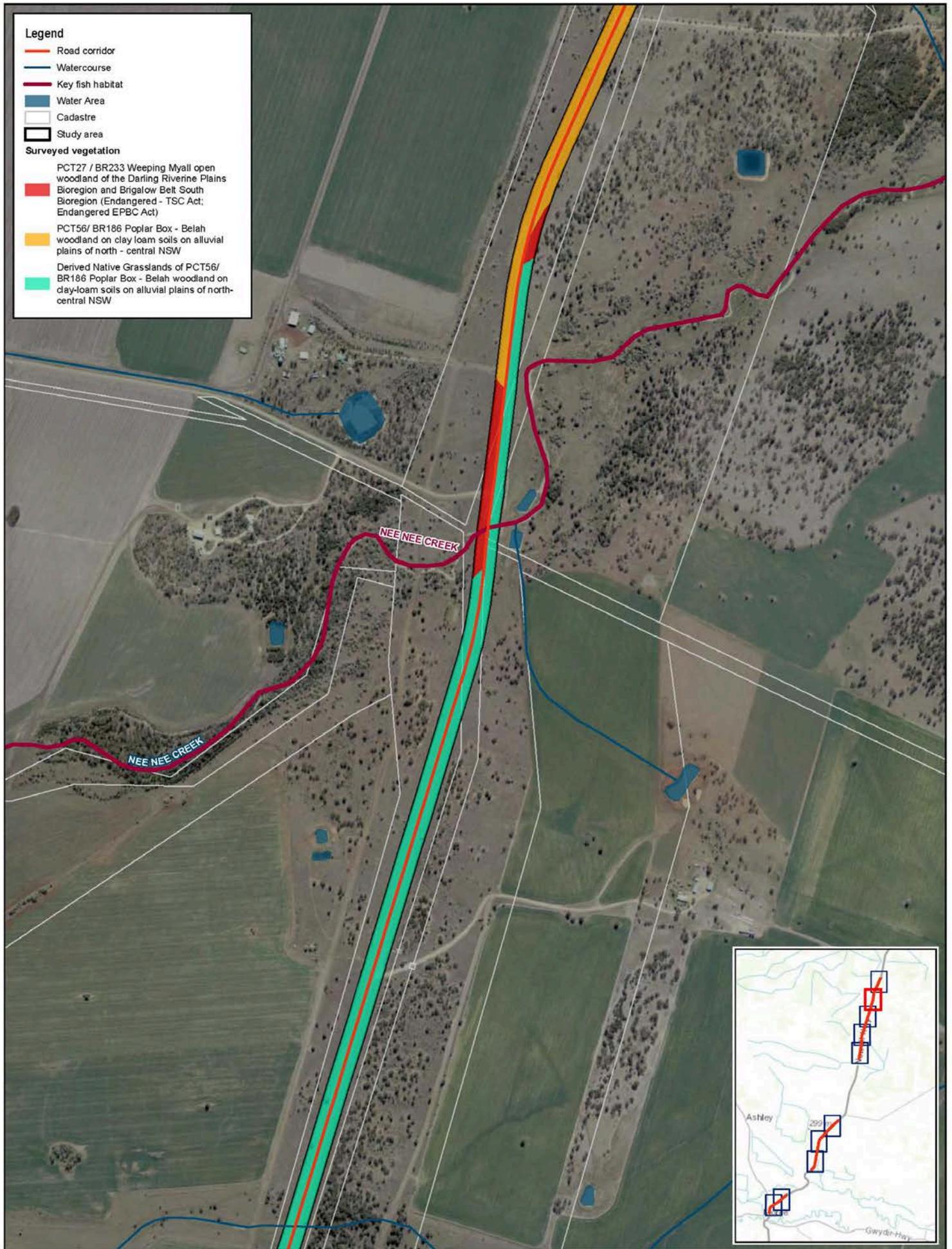


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Figure 4.2 Biodiversity Constraints Segment 3 - Page 3

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Legend

- Road corridor
- Watercourse
- Key fish habitat
- Water Area
- Cadastre
- Study area

Surveyed vegetation

- PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
- PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north - central NSW
- Derived Native Grasslands of PCT56/ BR186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW

Map: 2270618A_GIS_F010_A5 Author: mitchellem

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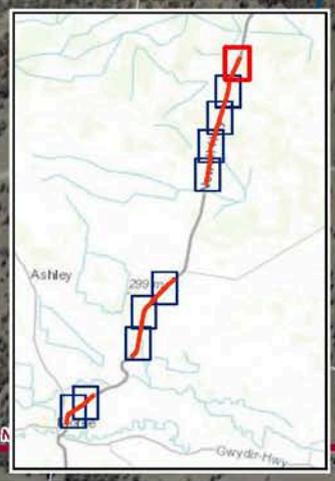
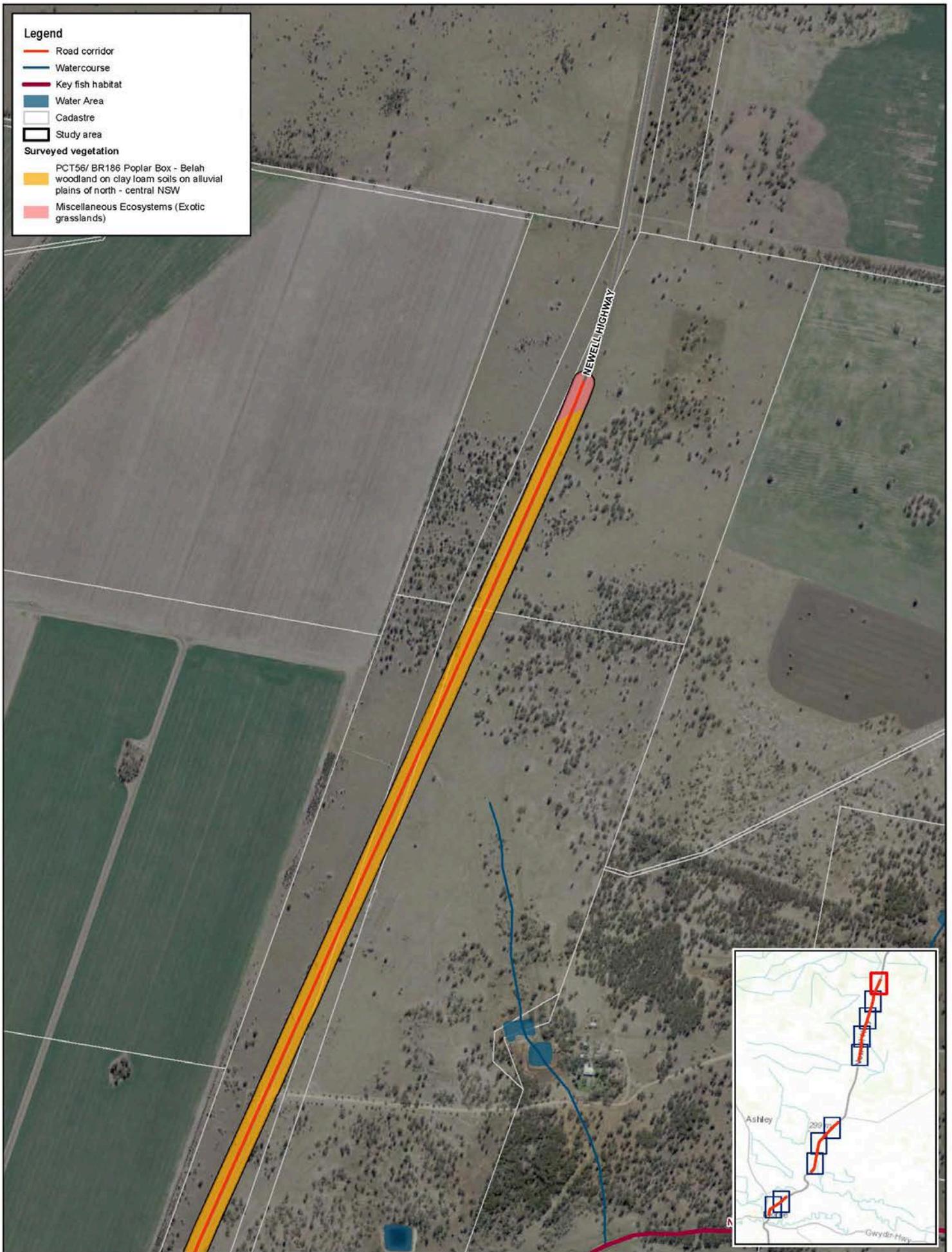


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Figure 4.2 Biodiversity Constraints Segment 3 - Page 4

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Figure 4.2 Biodiversity Constraints Segment 3 - Page 5



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4.3 Aboriginal heritage

This section identifies the Aboriginal heritage values of the study area and potential issues to be managed during further development of the proposal. This section is based on the results of the desktop and preliminary heritage assessment.

4.3.1 Methodology

The following section provides a preliminary assessment of Aboriginal heritage for the within the study area and is based on the *Draft Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Moree*.

The current assessment follows the *Code of Practice for the Investigation of Aboriginal Objects in New South Wales* (Code of Practice; DECCW 2010) and Stage 2 of the PACHCI (Roads and Maritime 2011) in order to meet the following objectives:

- undertake background research on the study area to formulate a predicative model for site location within the study area
- identify and record objects or sites of aboriginal heritage significance within the study area, as well as any landforms likely to contain further archaeological deposits
- assess the likely impacts of the proposed work to Aboriginal cultural heritage and provide management recommendations.

The fieldwork component of this assessment was undertaken by OzArk on Thursday 1 June 2017 and included five representatives from three Aboriginal groups (Gomerioi People Native Title Claim Group, Narrabri Local Aboriginal Land Council (LALC) and Moree LALC).

4.3.2 Existing environment

Preliminary searches identified 100 Aboriginal heritage sites within the designated search area. Two sites are located in segment 1 near Skinners Creek (AHIMS#10-3-0040 and #10-3-0041) and one site is located 80 metres to the east, on the banks of Skinners Creek. No other sites are located within or close to the study areas.

AHIMS #10-3-0040 is an isolated find that was destroyed during the construction of the Moree bypass and the site is listed as 'destroyed' on AHIMS. AHIMS #10-3-0041 is a potential archaeological deposit (PAD) that was subjected to archaeological test excavations. The site is located on the banks of Skinners Creek, on an undulating plain, within a highly modified riparian woodland environment. The construction of Newell Highway has created an approximately 45 metre wide disturbance footprint in the Skinners Creek PAD area. The disturbance footprint is contained between two fence lines, one to the west and one to the east, both running north–south parallel to the highway. It should be note that the site is currently listed on AHIMS as 'partially destroyed'.

Two stone artefacts were previously recovered (OzArk 2004), but both were assessed as being deposited by alluvial processes. As such, no *in situ* archaeological deposits were recorded. The current assessment has concluded that no PAD exists in the vicinity of listed Skinners Creek PAD and it is recommended to remove the site from the AHIMS database.

Culturally modified trees are the most commonly represented site type in the area (76 per cent) followed by artefact scatters and isolated finds (12 per cent). Only two PADs have been identified. One is associated with an artefact near the Mehi River and the other is located near Skinners Creek. Four burials have been recorded, including two associated with culturally modified trees, mostly located close to major watercourses. A broad range of other site types exist at low frequencies, including two resource and gathering sites, a stone quarry near Halls Creek, a habitation structure, a ceremonial ring and a conflict site (the Waterloo Creek massacre site).

Two new Aboriginal sites were recorded during the survey. Details of these sites are outlined below.

Booloroo-HW17-ST1 (BR-HW17-ST1)

BR-HW17-ST1 is an Aboriginal culturally modified tree on an undulating alluvial plain, within a highly-modified woodland environment. The tree contains an oval shaped, curved (preform) scar that suggested was used to make a shield by an Aboriginal representative present during the fieldwork. A fully enclosed northwest facing scar extending from the ground to about 1.5 metres high exists on the opposite side of the tree. It was suggested that this could be a carved panel that has been completely obscured by overgrowth. Unfortunately, there is no currently known method for confirming this idea without damaging the tree. The archaeological potential of the landform was assessed as low.

Booloroo-HW17-ST2 (BR-HW17-ST2)

BR-Newell Highway-ST2 is an Aboriginal culturally modified tree on an undulating alluvial plain, on the bank of an ephemeral minor watercourse, within a highly-modified woodland environment. The tree contains a single south-facing bark slab (sheet) removal scar. The archaeological potential of the landform was assessed as low-moderate due to the proximity to a minor watercourse.

4.3.3 Summary of issues

The assessment has found that impact to BR-HW17-ST1 and BR-HW17-ST1 can be avoided via the implementation of management strategies, as outlined below and in the recommendation section 4.2.8. This assessment also determined that no PAD exists in the vicinity of the listed Skinners Creek PAD. As such, there are no constraints to the proposal in the vicinity of Skinners Creek within segment 1 subject to confirmation from OEH and removal of the site from AHIMS.

Table 4-9 Impact assessment

Site Name	Type of Harm (Direct/Indirect / None)	Degree of Harm (Total/Partial / None)	Consequence of Harm (Total/Partial/No Loss of Value)
BR-HW17-ST1	None	None (with management)	No loss of value: Specific management recommendations apply to this site to ensure no direct or indirect harm arises from the Proposal.
BR-HW17-ST2	None	None (with management)	No loss of value: Specific management recommendations apply to this site to ensure no direct or indirect harm arises from the Proposal.

Study area specific issues are included in Table 4-10 below.

Table 4-10 Summary of Aboriginal heritage constraints to the proposal

Segment	Issue	Distance from Moree (km)
Segment 2	Aboriginal Heritage Item BR-HW17-ST1 is located on the south eastern side of the proposal around 40 m from the current highway centreline, directly opposite the Milo Road intersection. Impact can be avoided via the implementation of management strategies	22.6 km
	Aboriginal Heritage Item BR-HW17-ST2 is located on the south eastern side of the proposal around 35 m from the current highway centreline. The item is located 605 m north east of the Milo Road intersection. Impact can be avoided via the implementation of management strategies	23.2 km

4.3.4 Recommendations

Specific recommendations concerning the Proposal and identified items of Aboriginal heritage are as follows:

- design development should ensure site BR-HW17-ST1 is avoided. During construction, BR-HW17-ST1 must be demarcated using high visibility ground markers to delineate the site perimeter (ie staking and flagging) encompassing the tree canopy. The ground markers used must be visible to any person in the vicinity of the site, whether on foot or in a vehicle. BR-HW17-ST1 must be documented within the Construction Environmental Management Plan (CEMP) and detailed design plans and the canopy extent demarcated as a 'no-go' and 'no-harm' area. Vehicles must not be driven on, or in the immediate vicinity of, the BR-HW17-ST1 site extent. If required, appropriate sediment control measures must be installed, operated and maintained to prevent sediment moving onto the site extent during the proposed work
- design development should ensure site BR-HW17-ST2 is avoided. During construction, BR-HW17-ST2 must be demarcated using high visibility ground markers to delineate the site perimeter (ie staking and flagging) encompassing the tree canopy. The ground markers used must be visible to any person in the vicinity of the site, whether on foot or in a vehicle. BR-HW17-ST2 must be documented within the CEMP and detailed design plans and the canopy extent demarcated as a 'no-go' and 'no-harm' area. Vehicles must not be driven on, or in the immediate vicinity of, the BR-HW17-ST2 site extent. If required, appropriate sediment control measures must be installed, operated and maintained to prevent sediment moving onto the site extent during the proposed work.

General recommendations relating to Aboriginal Heritage are as follows:

- should design development result in changes to the study area or what is generally proposed, additional assessment may be required by a suitably qualified heritage professional and documented in an updated Stage 2 PACHI report
- at the time of writing the report a stage 3 PACHI is not required, however this be determined during future environmental assessment and concept design phases.

4.4 Non-Aboriginal heritage

This section identifies the Non-Aboriginal heritage values of the study area and potential impacts from the proposed highway upgrade. This section is based on the results of the desktop and preliminary heritage assessment.

4.4.1 Methodology

The following section provides a preliminary assessment of Non-Aboriginal heritage within the study area, and is based on the *Draft Aboriginal and Historical Archaeological Survey Report: Newell Highway HD Pavements – North Moree*.

The current assessment follows the *Cultural Heritage Guidelines* (Roads and Maritime 2015) and the *Historical Archaeology Code of Practice* (Historic Code of Practice; Heritage Council 2006) in the completion of a historical heritage assessment, including field investigations, in order to meet the following objectives:

- to assess the significance of any recorded historical heritage items or areas
- determine whether the activities of the proponent are likely to cause harm to recorded historical heritage items or areas
- provide management recommendations and options for mitigating impacts.

Desktop searches were conducted to identify any potential previously recorded heritage within the study area. Database searches were undertaken on 22 May 2017 and included the following:

- Australian National Heritage List
- Australian Heritage Database
- NSW Heritage Office Stage Heritage Register (SHR) and State Heritage register (SHI)
- Moree Plains Shire LEP.

The archaeological methods used in the historic archaeological assessment followed the Historical Code of Practice. Standard archaeological field survey and recording methods were employed (Burke and Smith 2004) to ground-truth existing levels of disturbance, confirm the location and curtilage of previously recorded heritage items, and to assess whether any other historic heritage items exist, or are likely to exist, in the study areas. A combination of pedestrian transects and vehicle traverses were used to inspect the study areas.

The fieldwork component of this assessment was undertaken by OzArk on Thursday 1 June 2017.

4.4.2 Existing environment

History

The area began to be occupied by pastoralists shortly after Mitchell passed through the area in 1831 and Coxen in 1835, each reporting good pastoral land. Around this time, Europeans began to displace Aboriginal traditional custodians with locally contingent Aboriginal responses including: fierce resistance, disease epidemics, economic hardship, resilience and opportunism (NSW HO and DUAP 1996).

In the interim, the bioregion has been subjected to a variety of landscape disturbances due to pastoralism, mining, vegetation clearance, forestry, cropping and water management. Other source of disturbance includes the construction of an urban centre at Moree, smaller towns and subdivisions, the associated houses, commercial precincts, roads, highways, railways and electricity transmission and telecommunications infrastructure. Large scale irrigation schemes have been developed to support the cultivation of cotton and other crops and include vast areas that have been laser levelled.

The major source of disturbance within the Study Area has been the construction, use and maintenance of Newell Highway, a major regional highway. Disturbances include: earthworks associated with the construction, use and maintenance of the road formation and seal; culverts; cut batters and associated drainage features; and several bridges. The footprint of previous disturbances is generally larger than the currently visible road formation as the road formation has been shifted over time, machinery has turned around beside the road, site compounds have been established, borrow pits created and rest areas constructed.

Listed heritage items

One item listed on the Moree LEP is located approximately 500 metres east of segment 3: Dwelling house – “Terlings” (I026). No new historic heritage sites were recorded during the assessment and no previously recorded historic heritage items were assessed.

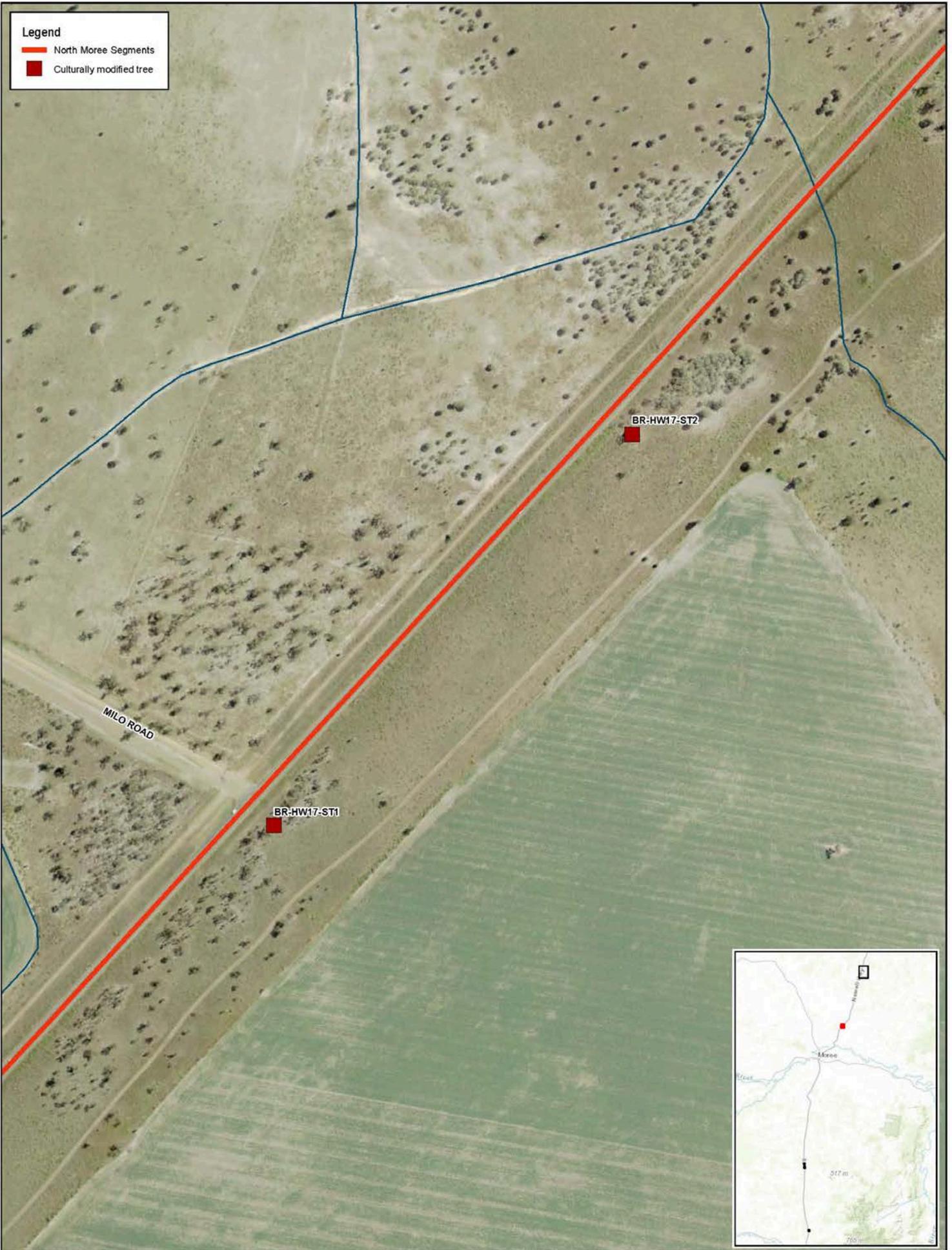
4.4.3 Summary of issues

No potential historic heritage issues associated with the proposal have been identified. There is a low probability of ground disturbing work impacting upon historic heritage within the study areas, therefore there are no historic heritage constraints for further design development.

4.4.4 Recommendations

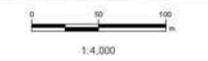
Recommendations concerning the study area are as follows and in accordance with the *Draft Aboriginal and Historical Archaeological Survey Report, Newell highway HD Pavements – North Narrabri* included:

- based on the current study area, no further non-Aboriginal archaeological assessment is required during further design development and/or detailed environmental impact assessment
- should further design development result in changes to the study area or what is generally proposed, additional assessment may be required by a suitably qualified heritage professional
- inductions for staff undertaking the proposed work must explain the legislative protection requirements for historic sites and items in NSW and the relevant fines for non-compliance.
- if objects are encountered that are suspected to be historic heritage items, the *Unanticipated Finds Protocol* must be followed.



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Figure 4.3 Heritage Items Segment 2

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4.5 Soils and geology

4.5.1 Methodology

A desktop investigation was conducted to identify any geology or contamination issues within the study area.

The following published records were reviewed to understand the potential constraints within the study area, and includes a review of regulatory databases from the following sources.

- NSW list of contaminated sites notified to the EPA (20 June 2017).

Sites appearing on the 'EPA list of NSW contaminated sites notified to the EPA' indicate that the owner consider that the sites are contaminated and warrant reporting to the EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA reviews the information before making that determination.

- Contaminated Sites Register (Accessed 20 June 2017).

A site will be included on the Contaminated Land: 'Record of Notices' only if the EPA has issues a regulatory notice in relation to the site under the Contaminated Land Management Act 1997.

- Australian Soil Resource Information System (ASRIS) to confirm acid sulphate soil (ASS) potential
- Australian Department of Agriculture and Water Resources, NSW Dryland Salinity Assessment 2000 – Assessment of Dryland Salinity extent 2050
- NSW DPI (2013) Salinity hazard report for Catchment Action Plan upgrade – Borders Rivers – Gwydir CMA.

4.5.2 Existing environment

Landform, geology and soils

The study area travels along alluvial flood plain associated with the Mehi River and Gwydir River. Colluvial sediments are found deposited downslope from hills. They were formed by erosion of hills and creep or sheetwash. The subsurface conditions are dominated by black and red clayey silt with the exception of the Jurassic aged clayey sandstone. Soils in the region are typically deep grey and brown clays with important deposits of alluvial and black earths. The study area is relatively flat (grade less than 10 per cent, and erosion risk would be considered low. Given the distance of the study area from the coast and the elevation of the areas, no acid sulfate soils are expected or known to occur along the proposal corridor.

Salinity

A review NSW DPE Salinity hazard report for Catchment Action Plan upgrade – Borders rivers-Gwydir CMA indicates that the salinity risk within the study area is classed as high (NSW DPI, 2013). Specifically, detailed assessments indicated high risks across most of the study area north of Moree.

Contamination

A search of the list of NSW contaminated sites notified to the EPA for the Moree Plains LGA identified nine contaminated sites. These notifications are predominately attributed to underground storage tanks at service stations and fuel depots.

A search of the contaminated land: Record of notices database was undertaken. This search identified five properties that are currently or formerly regulated under the *Contaminated Land Management Act 1997*. None of these properties are located within 200 m of the proposal.

Moree and Narrabri Local councils have highlighted illegal dumping an increasing problem with the LGAs, and have implemented an illegal dumping program in a bid to reduce incidents within the area (Molino, 2016). While the Newell highway was not identified as a hot spot however for illegal dumping incidents, there is potential to encounter dumped waste materials.

4.5.3 Summary of issues

The following table outlines environmental constrains/issues that have been identified relating to landform, geology and sols, and contamination issues within the study area.

Table 4-11 Summary of landform, geology and contamination constraints to the proposal

Segment	Issue	Distance from Moree (km)
Segment 1	High risk of salinity	2.7 – 7.6 km
	Potential illegal dumping of waste	2.7 – 7.6 km
Segment 2	High risk of salinity	10.0 – 29.8 km
	Potential Illegal dumping of waste	10.0 – 29.8 km
Segment 3	High risk of salinity	36.1 - 51.0 km
	Potential Illegal dumping of waste	36.1 - 51.0 km
	General contamination risks associated with accidental spills or leaks from parked vehicles and potential for illegal dumping of waste at Gil Gil rest area	40.4 km
	General contamination risks associated with accidental spills or leaks from parked vehicles and potential for illegal dumping of waste at an unnamed rest area two kilometres north of the Gil Gil rest area	42.5 km

4.5.4 Recommendations

The following recommendations are made in relation to soil and geological issues associated with the proposal.

- detailed geotechnical investigations and assessment should be undertaken to support further design development.

4.6 Hydrology and flooding

The following section provides an outline of the water and hydrological constraints identified within the study area.

4.6.1 Methodology

The preliminary hydrology and flooding assessment is based on a desktop review of the following resources.

- Moree and Environs Floodplain Risk Management Plan (Parsons Brinckerhoff, 2008)
- Moree Plains Flood Mapping (Parsons Brinckerhoff, 2007)
- Review of Moree and environs Flood Study/Floodplain Risk Management (WRM, 2017)
- various online mapping tools
- registered groundwater bore searches
- Newell Highway Upgrade Interim Flood Risk Mapping (GHD, 2017).

4.6.2 Existing environment

The proposal is located within two major river catchments. Segment 1 and 2 are located in the Gwydir River catchment and segment 3 is located in the Border Rivers catchment. Both catchment areas flow in a westerly direction from the headwaters within the Great Dividing Range forming part of the Murray Darling drainage basin. At its closest point to the study area, the Gwydir River is located about 1.3 kilometres to the north west of segment 1. Segment 3 intersects a number of smaller tributaries which form part of the Border Rivers catchment.

A summer dominant rainfall varies across both catchments and varies between 500–900 mm per year, with around 500–600 mm per year falling within the study area. Pan evaporation rates within both catchments range between 1800–2000 mm per year, with summer dominant rates of up to 10 mm/day (Green, *et.al*, 2011a).

Surface waters and associated features

The proposal crosses a number of surface water features including, Skinners Creek, Gwydir River, Marshalls Ponds Creek, Gil Gil Creek and Nee Nee Creek. North of the Gwydir River a number of artificial channels, constructed for irrigation purposes, are present (Moree Plains Shire Council 2010 State of Environmental Report).

Groundwater

Locally groundwater depths vary between 45 m to 60 m. The town of Moree is provided with a reticulated supply from 11 bores with a total production of 230 L per second. A review of the NSW Water Information data base on 21 April 2017 for the study area identified more than 50 groundwater bores existing within 500 m of Newell Highway.

The geology was assessed to comprise of alternating layers of alluvial, clay, gravel, sand and rock to the base of the bores (GHD, 2014).

Flooding

The study area is relatively flat, low lying land, comprising of flood plains for the Gwydir and Mehi River and has a long history of flooding. The study area drainage basin forms a significant catchment for the Murray-Darling River system. Moree Plains Shire council in response to a major flooding event in February 2012 commissioned a review of flooding risk information (The Draft Review of Moree and environs Flood Study/Floodplain Risk Management). The review covers segment 1 and assesses the

risk of flooding to the town of Moree and its immediate surrounds. A summary of information for segment 1 indicates:

- the area is defined as a floodway and flood storage area (mainly associated with the Mehi River, Skinners Creek and the Gwydir River)
- property hazard risk identified the area predominantly as P2 (moderate property hazard, or areas where floodwaters likely to cause structural damage to minor structures and structures not permanently affixed to the ground (ie caravans, shipping containers, etc.), with higher risk closer to gullies, creek and river channels
- flooding frequency within the study area was identified as F2 (representing a moderate frequency hazard), and F3) representing high frequency hazard areas.

No flooding information within the above sources was available for segments 2 and 3.

A review of flood mapping data (GHD, 2017) included in Figure 4.5, indicates that all of segment 1 would be inundated by a 1 in 10-year flooding event. The southern part of segment 2 would be inundated by a 1 in 10-year flooding event associated with flooding from Marshalls Ponds Creek. The central and northern portion of segment 2 are not considered to be at risk of flooding. Flooding impacts within segment 3 are located around the catchments of Gil Gil and Nee Nee creeks. While inundation of the road corridor and adjacent low lying areas would occur during a 1 in 2-year flood event, it is unclear if the highway would be impacted. Flooding however would inundate the highway during a 1 in 10-year event. Flood impacts are greater on the up-creek side of the highway, with excess water being trapped by the highway and rail culverts.

4.6.3 Summary of issues

The following environmental constraints/issues have been identified relating to hydrology and flooding within the study area:

- general impacts of the proposal on the hydrology of the area
- general impacts of the hydrology of the catchment on the proposal.

Specific issues associated with hydrology and flooding risk, is include in Table 4-12 below.

Table 4-12 Summary of hydrology and flooding constraints to the proposal

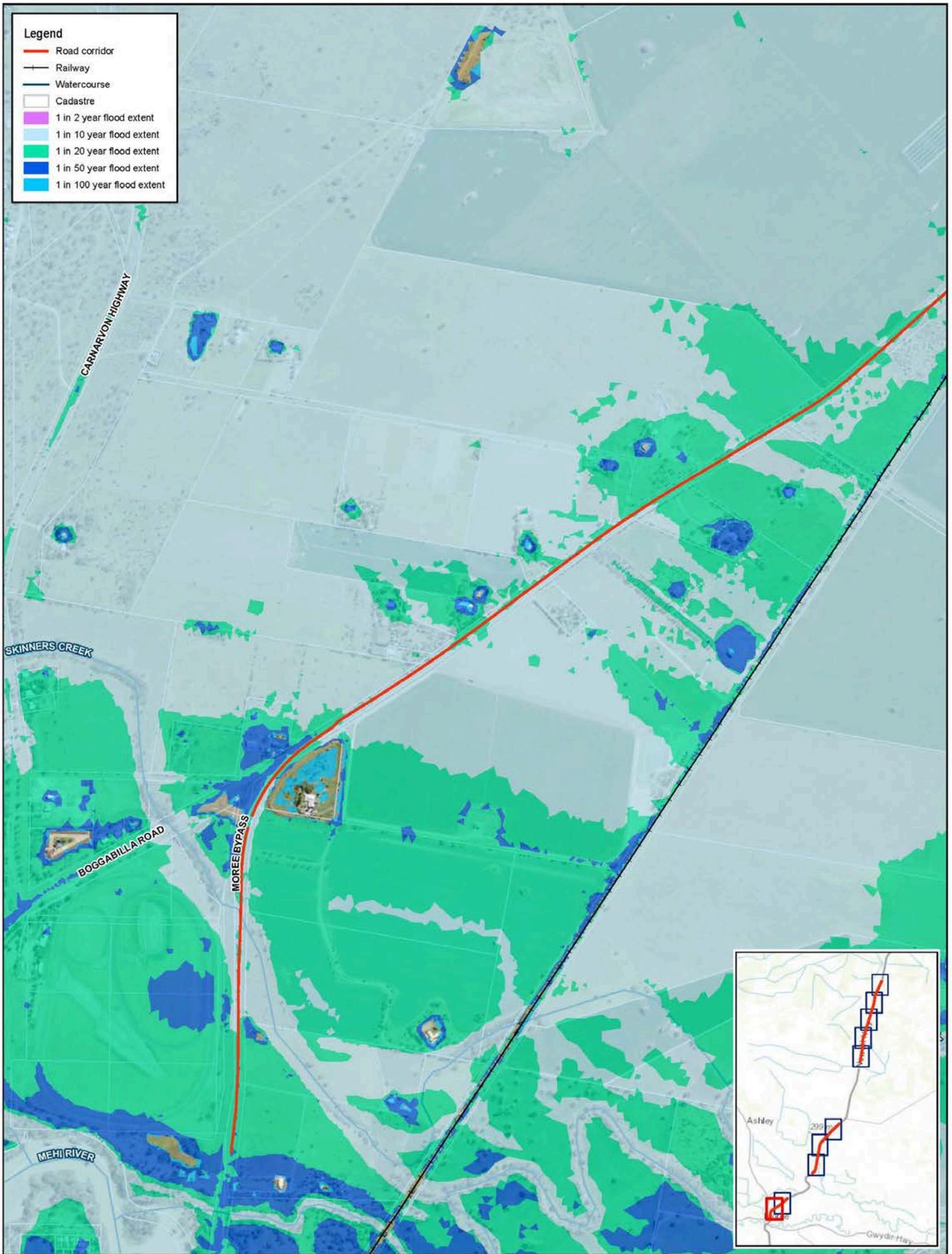
Segment	Issue	Distance from Moree (km)
Segment 1	Direct or indirect water quality impacts from the proposal on the Mehi River.	2.7 km
	Assessment of the flooding risk on the proposal from the Mehi River.	2.7 km
	Direct or indirect water quality impacts from the proposal on Skinners Creek, such as erosion of banks at crossings and sedimentation/contamination from uncontained runoff.	3.4 km
	Assessment of the flooding risk on the proposal from Skinners Creek.	3.4 km
	Direct or indirect water quality impacts from the proposal on the Gwydir River	7.5 km
	Assessment of flooding risk on the proposal from the Gwydir River.	7.5 km
Segment 2	Assessment of the flooding/inundation risk on the proposal from Marshalls Ponds Creek	17.1 km
	Direct or indirect water quality impacts from the proposal on Marshalls Ponds Creek, such as erosion of banks at crossings and sedimentation/contamination from uncontained runoff.	17.1 km

Segment	Issue	Distance from Moree (km)
Segment 3	Direct or Indirect water quality impacts from the proposal on the Gil Gil Creek catchment, such as erosion of banks at crossings and sedimentation/contamination from uncontained runoff.	40.3 km - 40.8 km
	Assessment of the flooding/inundation risk on the proposal from the Gil Gil creek catchment.	40.3 km - 40.8 km
Segment 4	Direct or indirect water quality impacts from the proposal on the Nee Nee Creek catchment, such as erosion of banks at crossings and sedimentation/contamination from uncontained runoff.	48.1 km
	Review and assessment of the flooding/inundation risk on the proposal from the Nee Nee Creek catchment.	48.1 km

4.6.4 Recommendations

Specific recommendations concerning the proposal and identified hydrology and flooding issues are as follows:

- further design development and detailed environmental assessment for the proposal should assess potential flooding impacts during construction and operation including consideration of the NSW Government's Floodplain Development Manual (Department of Natural Resources, 2005), Practical Consideration of Climate Change - Flood risk management guideline (DECC, 2007) and Australian Rainfall and Runoff: A guide to flood estimation (Commonwealth of Australia (Geoscience Australia) 2016)
- further design development and detailed environmental assessment for the proposal should include identification of potential impacts on stormwater quantity, change in stormwater runoff (increase or decrease) and sensitivity of downstream waters.



- Legend**
- Road corridor
 - Railway
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

Map: 2270618A_GIS_F014_A2 Author: mitchellem

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0 125 250
m
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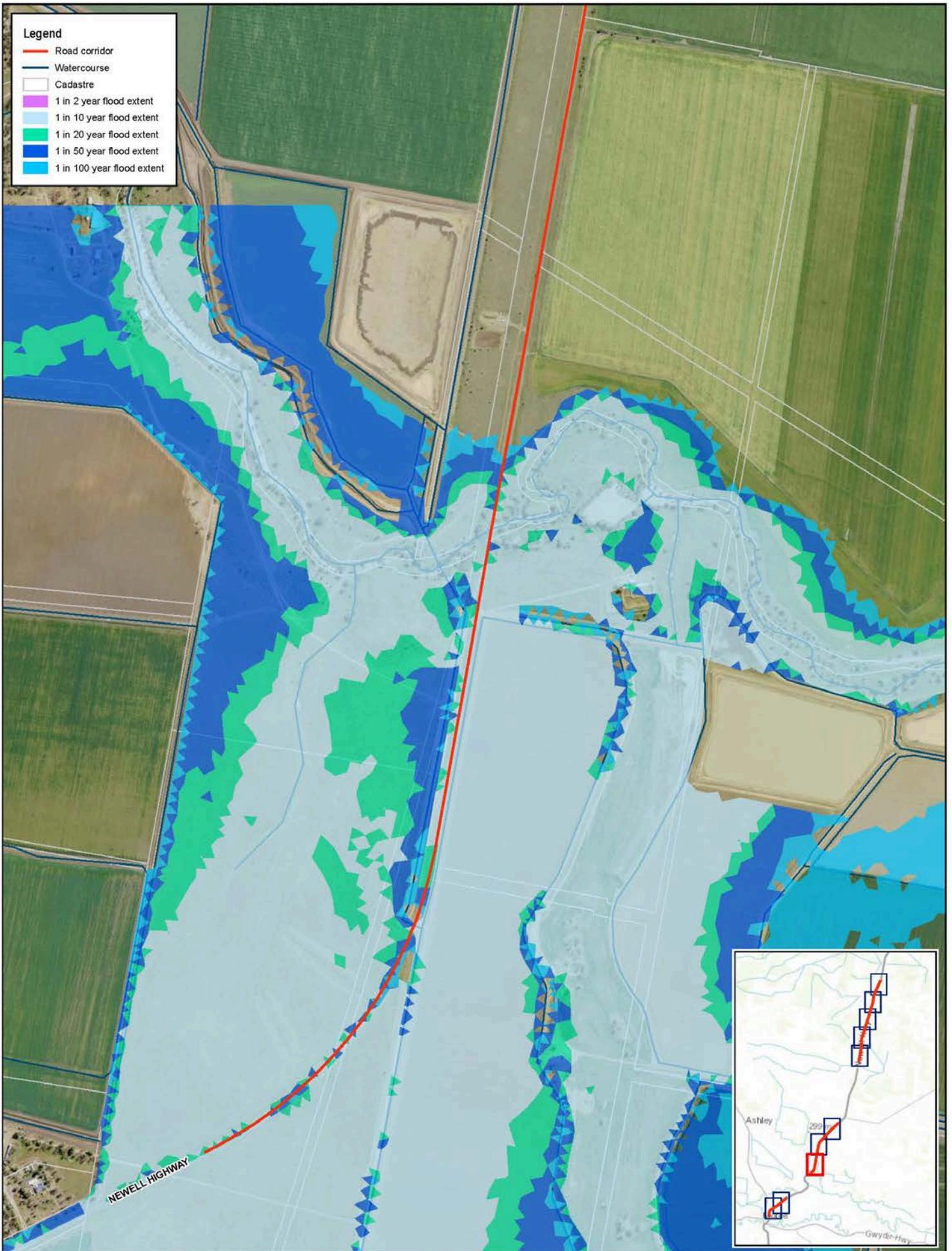
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Figure 4.4 Flooding Risk
Segment 1 - Page 1





- Legend**
- Road corridor
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

Map: 2270618A_GIS_F014_A2 Author: mitchellem
 Date: 13/07/2017 Approved by: -

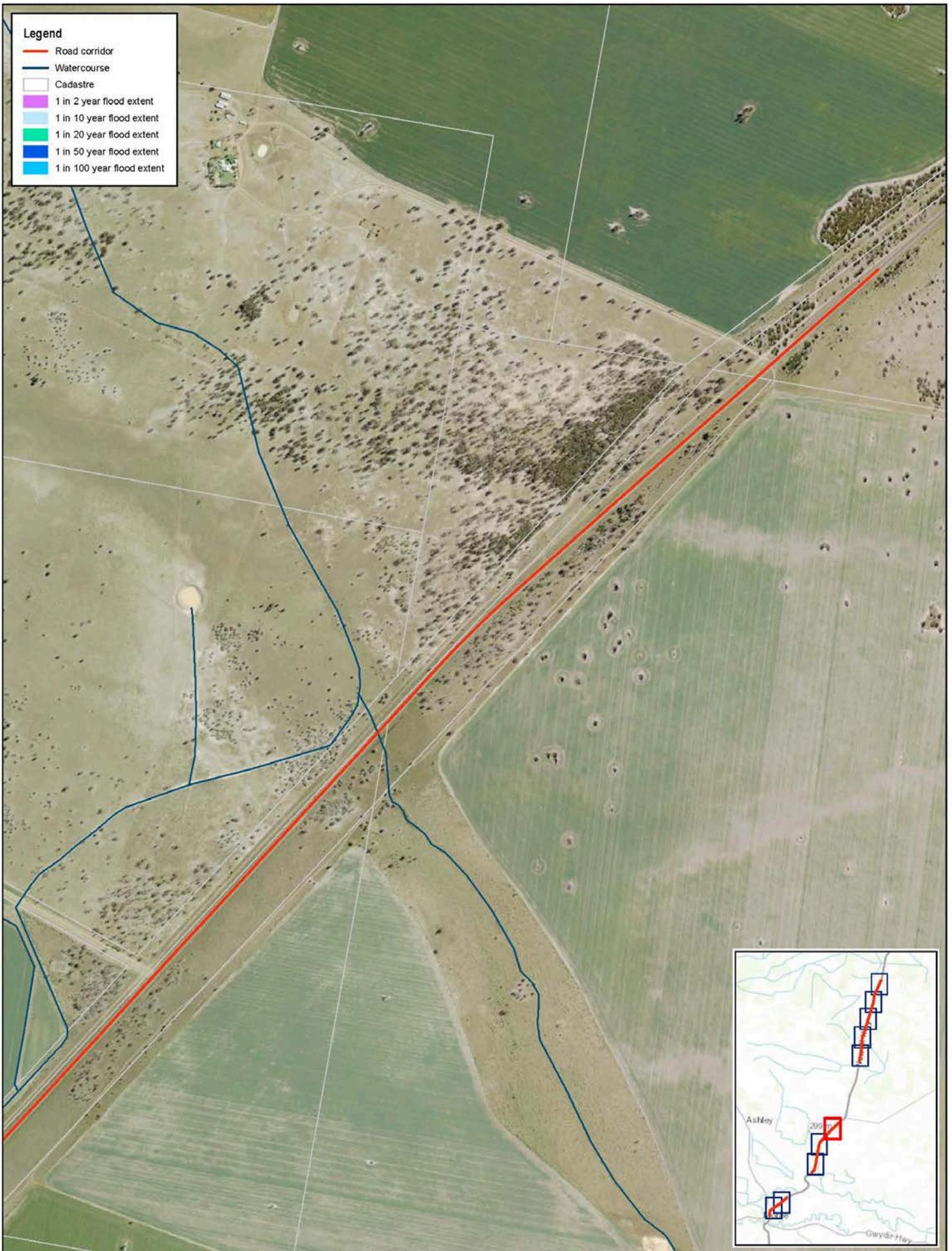
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Figure 4.4 Flooding Risk Segment 2 - Page 2

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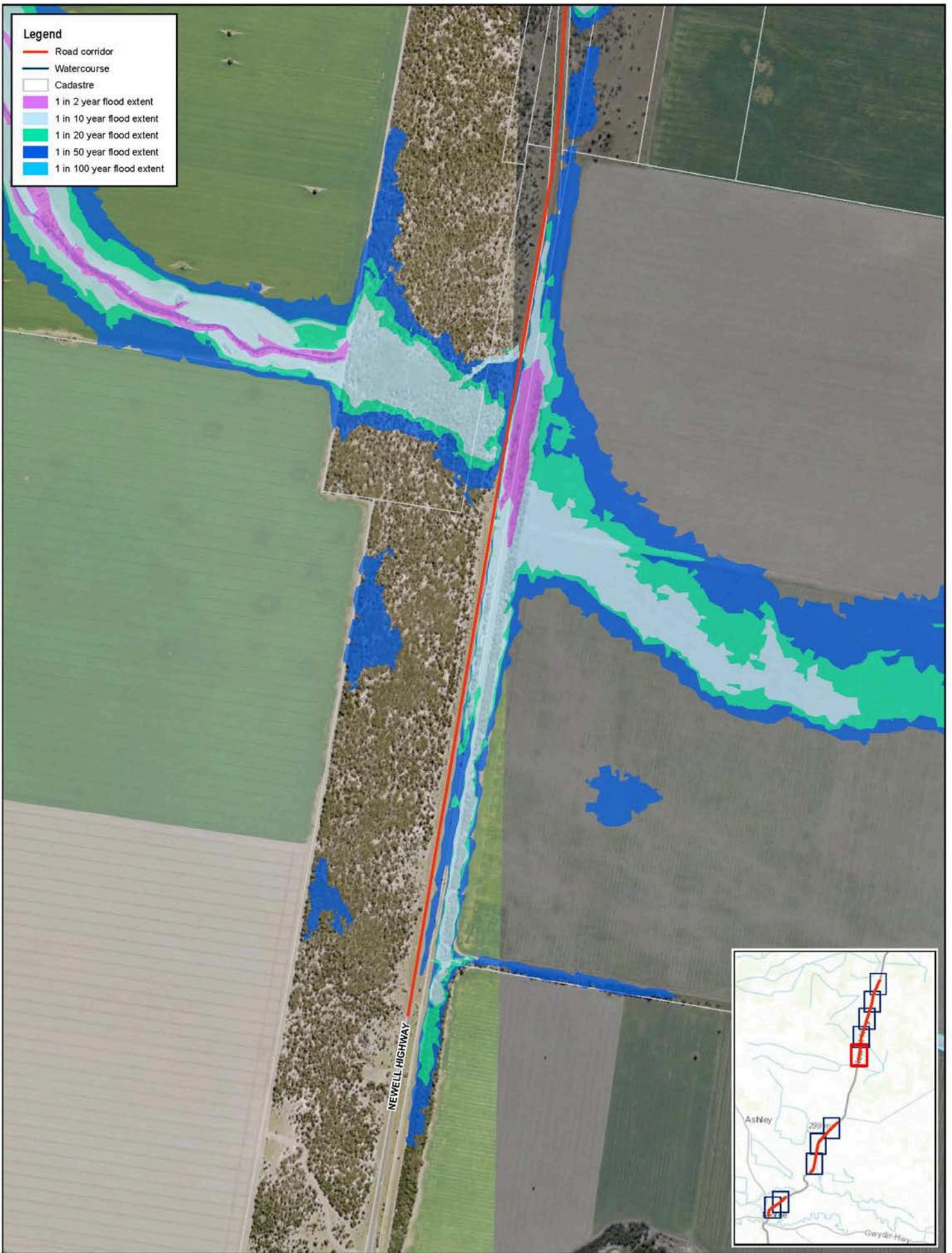
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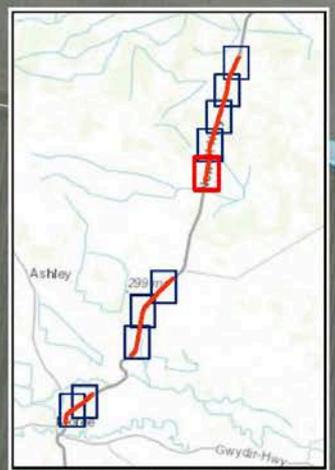
Figure 4.4 Flooding Risk
Segment 2 - Page 3

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- Legend**
- Road corridor
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

NEWELL HIGHWAY



Map: 2270618A_GIS_F014_A2 Author: mitchellem

Date: 13/07/2017 Approved by: -



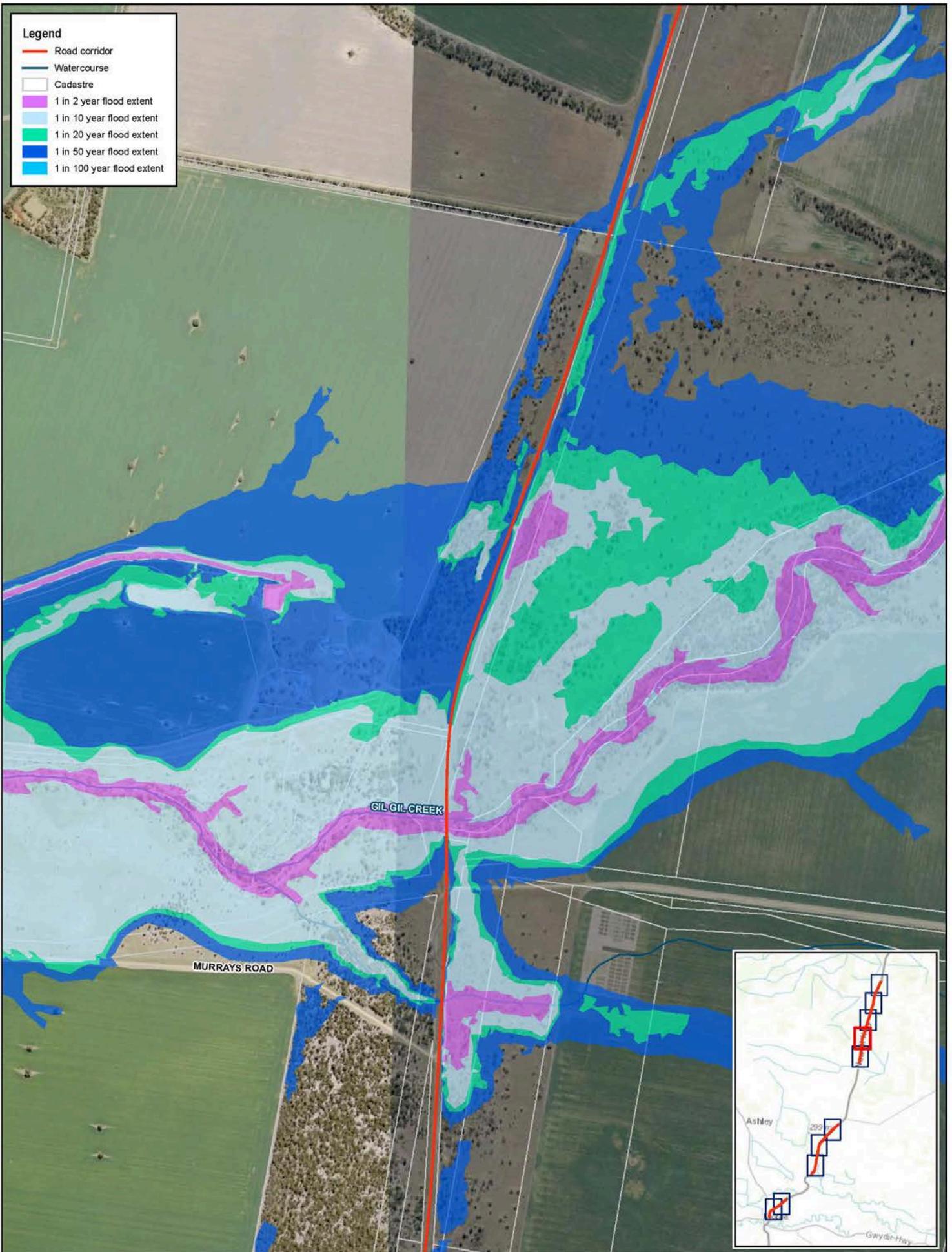
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Figure 4.4 Flooding Risk
Segment 3 - Page 1

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- Legend**
- Road corridor
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

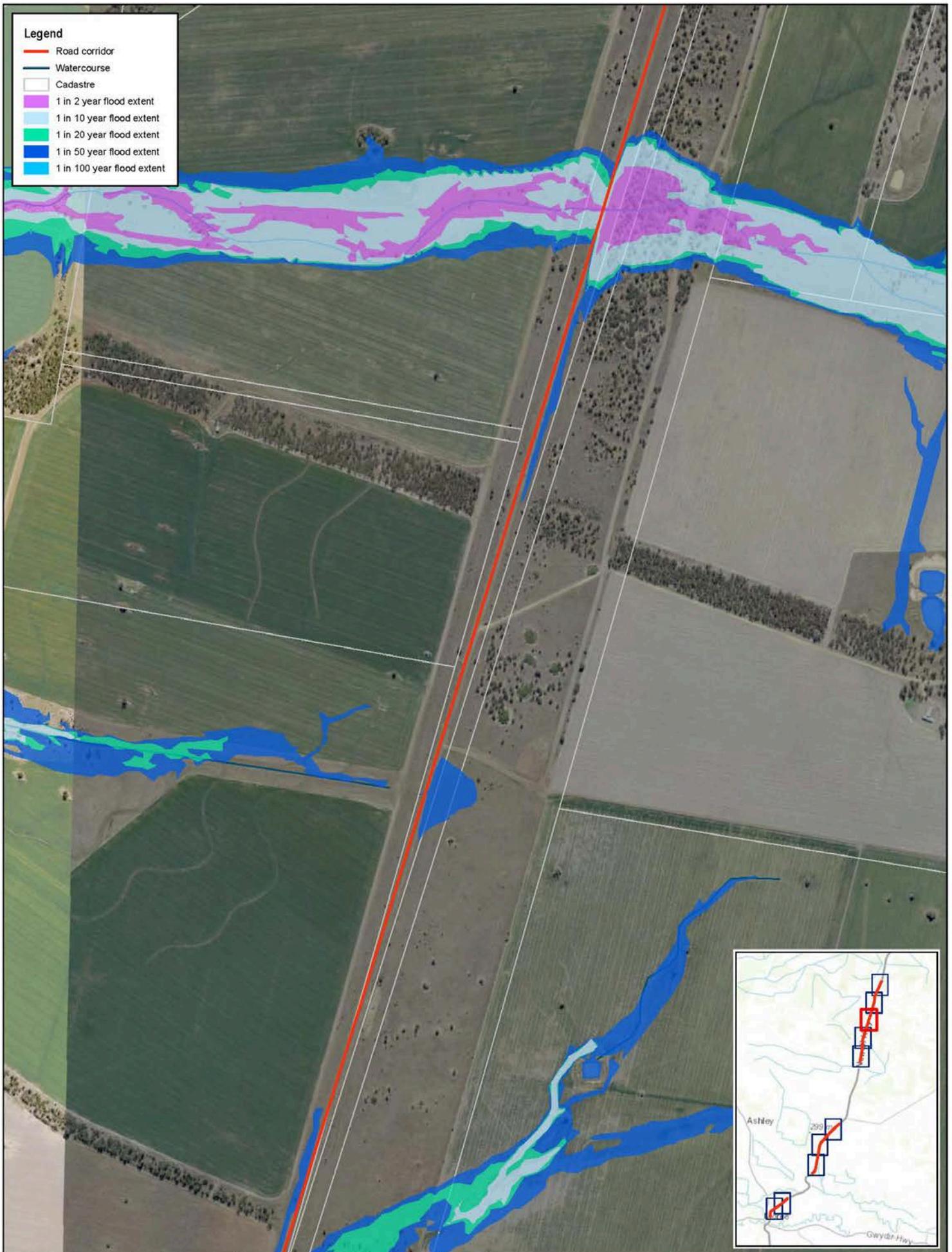
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Figure 4.4 Flooding Risk
Segment 3 - Page 2

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- Legend**
- Road corridor
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

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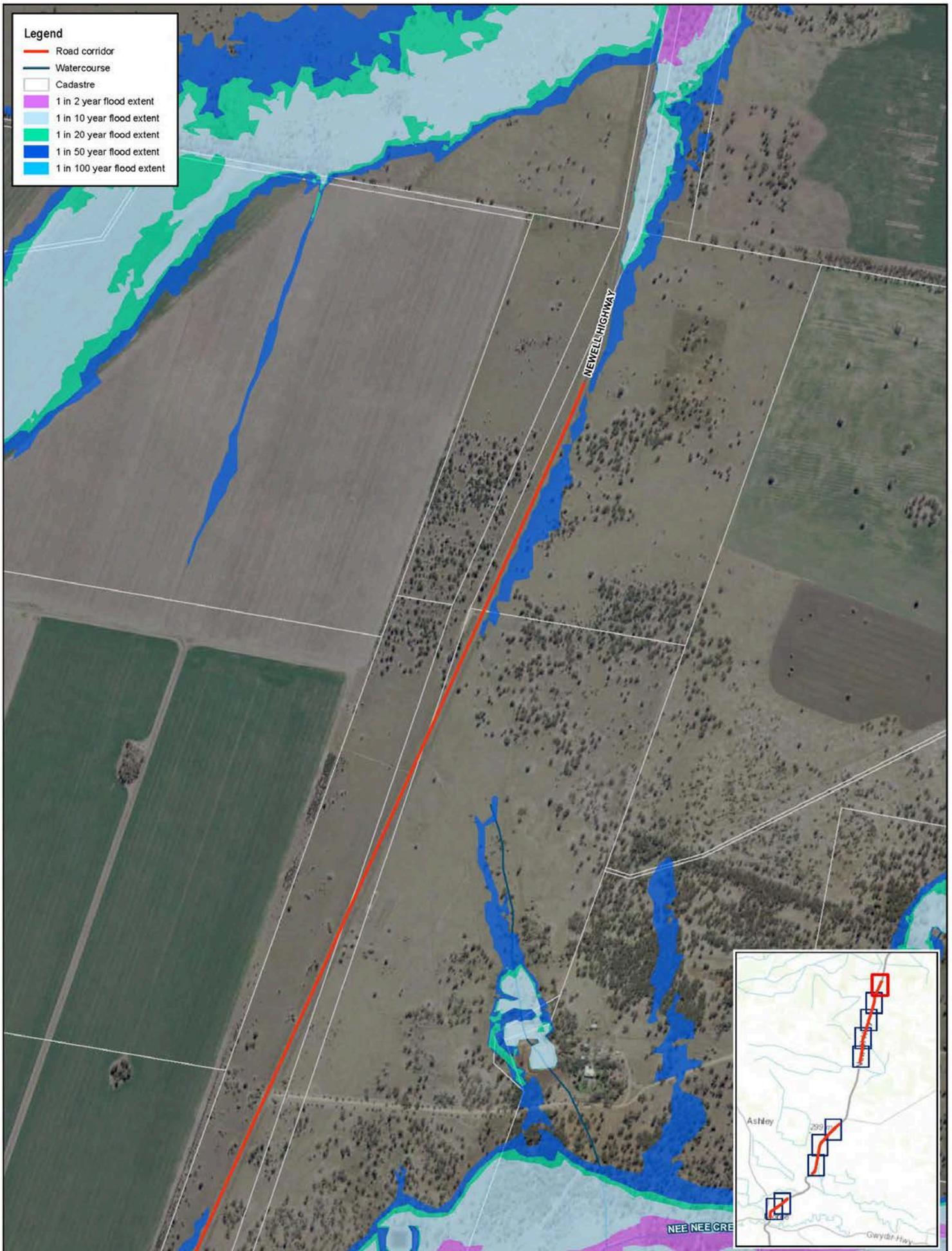


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Figure 4.4 Flooding Risk
Segment 3 - Page 3

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- Legend**
- Road corridor
 - Watercourse
 - Cadastre
 - 1 in 2 year flood extent
 - 1 in 10 year flood extent
 - 1 in 20 year flood extent
 - 1 in 50 year flood extent
 - 1 in 100 year flood extent

Map: 2270618A_GIS_F014_A2	Author: mitchellem		 1:10,000
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Figure 4.4 Flooding Risk
Segment 3 - Page 5

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4.7 Noise and vibration

This section identifies noise and vibration constraints associated with the proposal within each segment.

4.7.1 Methodology

The preliminary noise and vibration investigation has been undertaken with consideration to the following documents:

- Noise Mitigation Guidelines (Roads and Maritime, 2015a)
- Noise Criteria Guideline (Roads and Maritime, 2015b)
- Noise model validation Guideline (Roads and Maritime, 2016a)
- Construction and Noise Vibration Guideline (Roads and Maritime, 2016b).

Sensitive receivers were identified by reviewing aerial photography and identifying receivers within or adjacent to the study area. Once identified, the sensitive receivers were mapped and a constraint category was assigned. Noise constraints were classified and mapped as:

- high constraint – sensitive receivers mapped within 0–200 m of the study area
- moderate constraint – sensitive receivers located between 200–500 metres of the study area
- low constraint – sensitive receivers located between 500–1000 metres of the study area.

4.7.2 Existing environment

Background and ambient noise

No background noise data was available for the proposal. However the area is predominantly characterised as rural, and low ambient noise levels are expected. The main sources of ambient noise within the study area are farming activities, road traffic and rail operations. It is expected that noise levels would be elevated near Moree and traffic rest areas within the study area.

Australian Standard AS1055:2 Acoustics: Description and Measurement of Environmental Noise provides estimated average background noise levels for different residential areas in Australia. It would be reasonable to assume that ambient noise within rural residential areas would be about between 45 dB(A) during the day, 45 dB(A) in the evening and 30 dB(A) at night. In areas containing a mix of medium density transport and some commercial and industrial properties, it would be reasonable to assume an ambient noise of between 50 dB(A) during the day, 45 dB(A) in the evening, and 40 dB(A) at night.

Sensitive receivers

Sensitive receivers are concentrated along the southern extent of segment 1, within the northern area of town of Moree. Receivers are predominantly rural/residential land holdings. Low numbers of scattered rural residential receivers are also located within segments 2 and 3 (two and five respectively). Receivers potentially also include a recreational area on the outskirts of Moree (Moree Racing Club), this is dependent on the overnight storage of horses or offices on the premises. The nearest sensitive receivers to the proposal are shown on Figure 4-5.

Vibration

There is potential for construction work to cause vibration impacts around the rural/residential areas within segment 1 on the outskirts of Moree. The main sources of vibration would be due to rolling and/or compacting. Sensitive receivers within 20 metres of the rolling works pose a moderate constraint. However due to the distance between the proposal and receivers impacts are considered to be low.

4.7.3 Summary of issues

Specific noise and vibration issues associated with the proposal are included in Table 4-13 and shown on Figure 4-5.

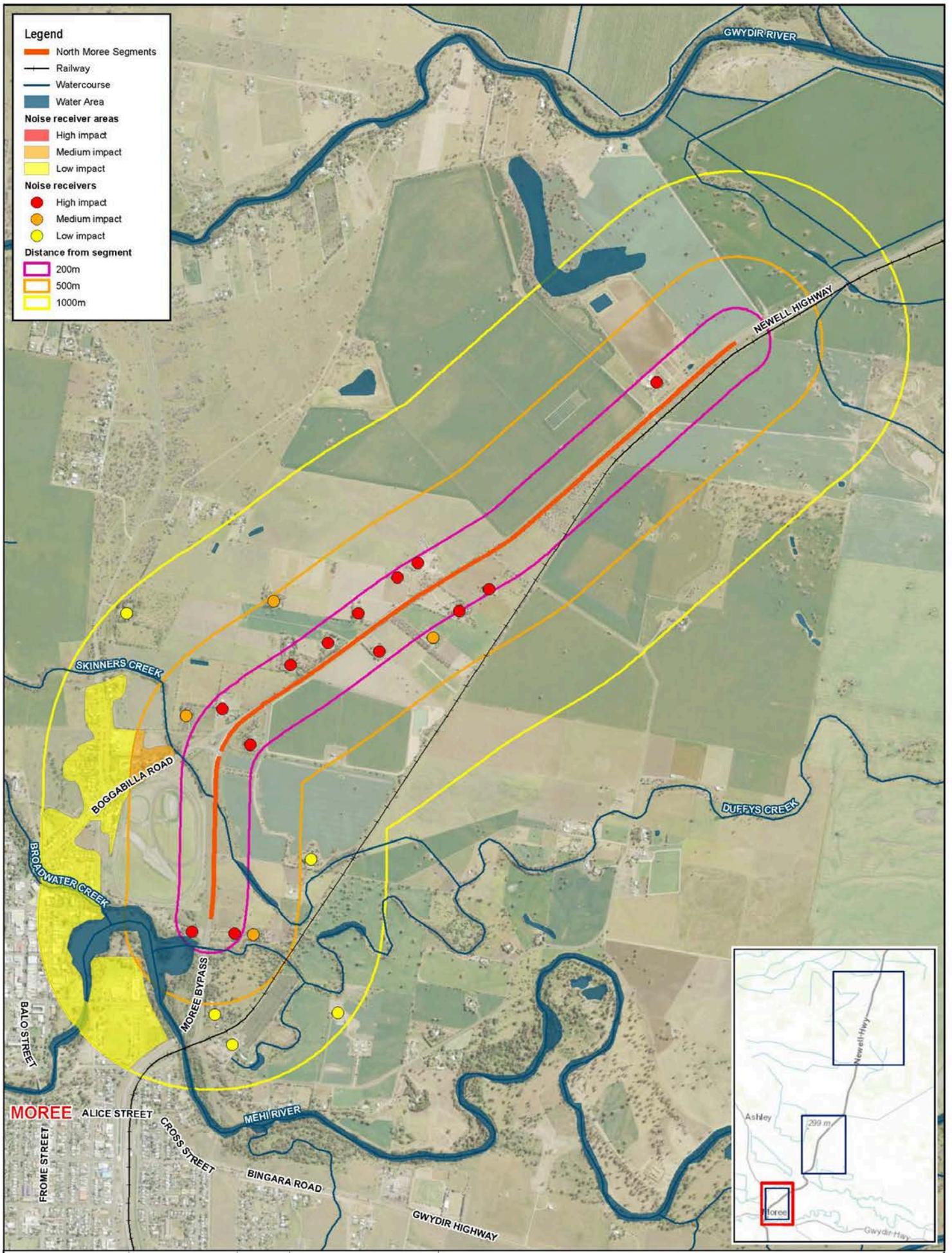
Table 4-13 Summary of noise and vibration issues of the proposal

Segment	Issue	Distance from Moree (km)
Segment 1	Various residential receivers on the outskirts of Moree	2.7 – 4.1 km
	The Moree Racing Club is located adjacent to the proposal with the club house and stable facilities around 200 metres to the west of the proposal.	3.0 km
	A cluster of nine rural residential properties with distances of approximately 70-200 m to the east and west of the proposal.	4.4 – 5.8 km
	Rural/residential receiver approximately 100 m to the west of the proposal.	7.0 km
Segment 2	Rural/residential receiver approximately 400 m to the south west of the proposal.	14.9 km
	Rural/residential receiver approximately 425 m to the east of the proposal.	17.0 km
Segment 3	Rural/residential receiver approximately 800 m to the east of the proposal.	36.2 km
	Rural/residential receiver approximately 370 m to the west of the proposal.	41.2 km

4.7.4 Recommendations

The following recommendations to reduce noise and vibration impacts during construction and operation of the proposal are:

- further detailed environmental assessment for the proposal should assess potential noise and vibration impacts in accordance with the following Roads and Maritime guidelines; Noise Mitigation Guidelines (Roads and Maritime, 2015a), Noise Criteria Guideline (Roads and Maritime, 2015b) Noise model validation Guideline (Roads and Maritime, 2016a) Construction and Noise Vibration Guideline (Roads and Maritime, 2016b).



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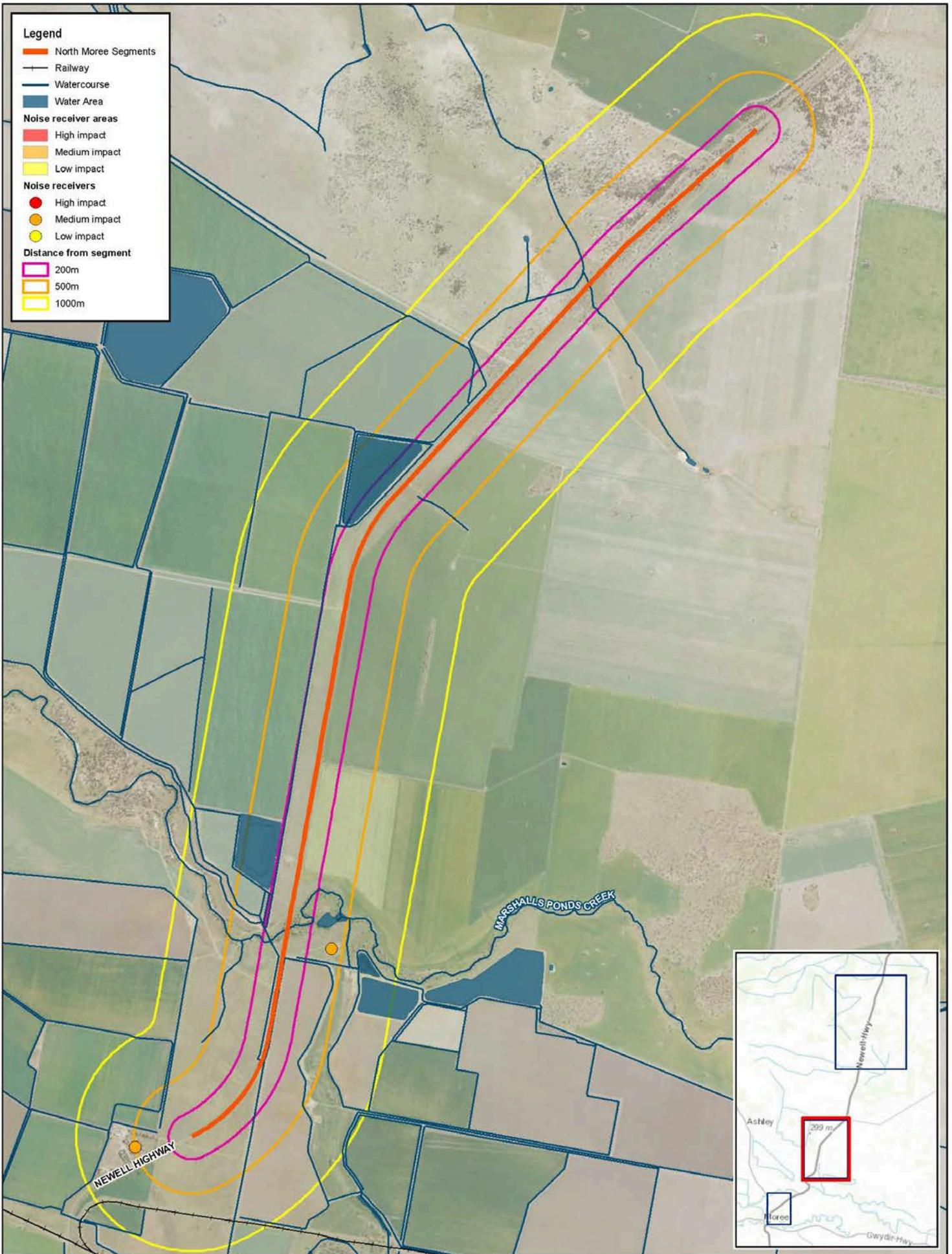
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Figure 4.5 Noise Receivers Segment 1

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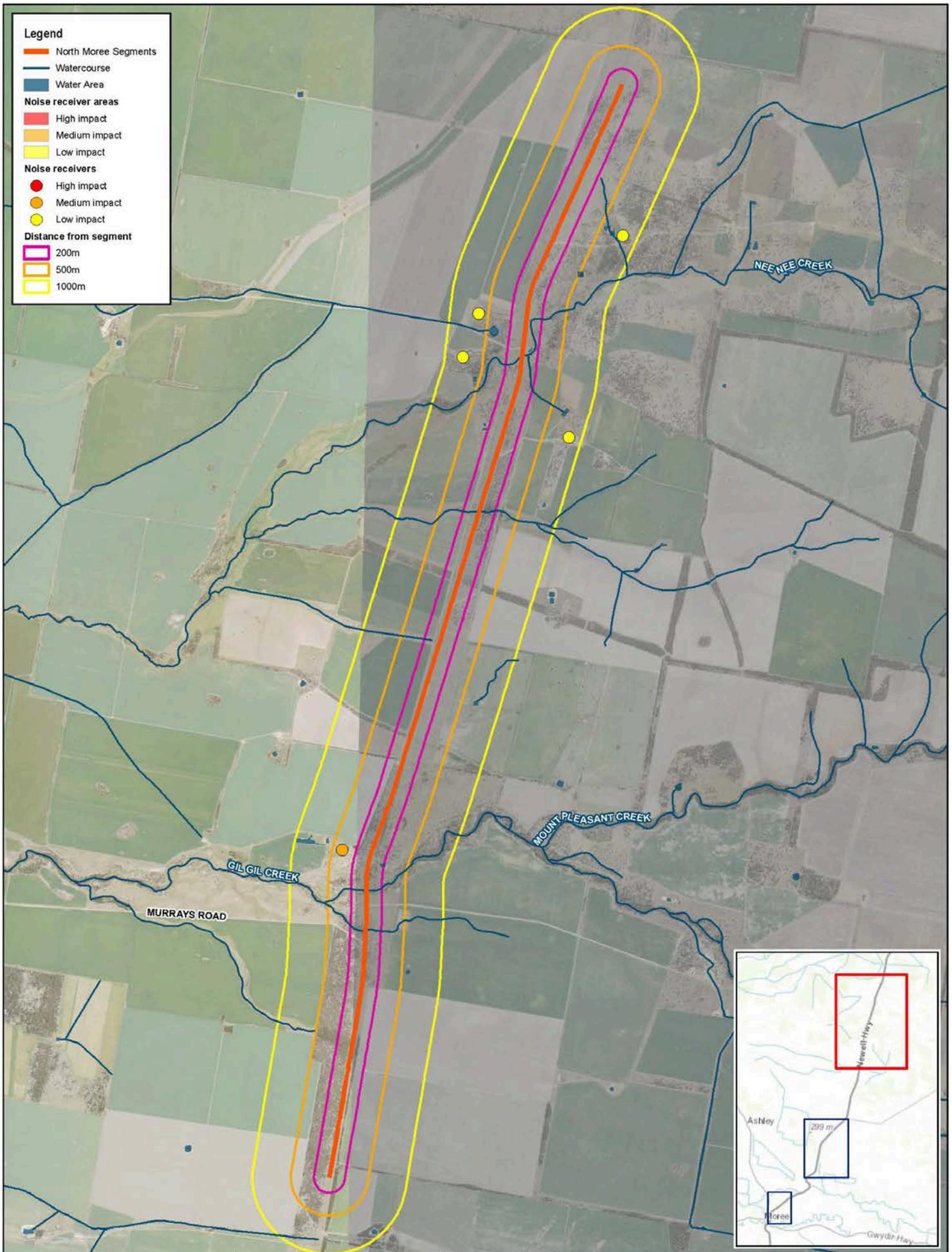
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Figure 4.5 Noise Receivers Segment 2

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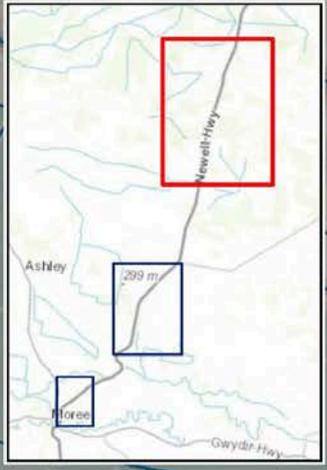
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- Legend**
- North Moree Segments
 - Watercourse
 - Water Area
 - Noise receiver areas**
 - High impact
 - Medium impact
 - Low impact
 - Noise receivers**
 - High impact
 - Medium impact
 - Low impact
 - Distance from segment**
 - 200m
 - 500m
 - 1000m

Map: 2270618A_GIS_F007_A3	Author: mitchellem		
Date: 13/07/2017	Approved by: -		
<small> Data source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, EsriBlixie, SGN, Swisstopo, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox, © OpenStreetMap contributors, and the GIS User Community © Land and Property Information 2015, Office of Environment and Heritage 2017 © 2017 Autodesk, Inc. All rights reserved. This document is the property of the user. The user is responsible for the accuracy of the information presented in this document. The user is responsible for the accuracy of the information presented in this document. The user is responsible for the accuracy of the information presented in this document. </small>			
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Figure 4.5 Noise Receivers Segment 3

4.8 Socio-economic and land use

The following section provides an outline of the likely land use, property and socio-economic issues within the study area.

4.8.1 Methodology

The information obtained within the section is based on a desktop study on a review of the following resources.

- Australian Census data (2001-2016)
- Narrabri and Moree Plains Strategic Community Planning documents
- various online mapping tools.

4.8.2 Existing environment

Population and demography

The population of the Moree Plains LGA is 13,159 (ABS, 2017). The Moree Plains LGA experienced a 10.9 per cent decline in population from 15,680 (2001) to 13,976 (2006). However since 2006 it has remained relatively steady, with only a slight decline. The Moree Plains LGA's Aboriginal population makes up 21.6 per cent of the total population (ABS, 2017). The Moree Plains LGA has a median age of 38 years old, and a weekly household income of \$1,240 (ABS, 2017). The population increases during the cotton chipping season (November – January), which also overlaps with the peak tourist season (August – December) (Moree Plains Shire, 2017).

Community value

The Moree Plains Shire promotes the area as a family friendly region, with good opportunities for education and sporting interests. The LGA has identified aims within their 2035 strategic plan for; an inclusive caring community; a vibrant regional economy which is an environmental role model; and a coordinated committed leadership to deliver the plan (Moree Plains Shire Council, 2013). The LGA has identified objectives around community safety, specifically improving safety on public roads, and providing road networks that meet the shires transport needs.

Business and employment

Agriculture remains the largest employer in the Moree Plains LGA with 15.8 per cent working in sheep, beef cattle and grain farming. Other major industries of employment included school education 6.4 per cent, other crop growing 4.3 per cent, agriculture and fishing support services 3.4 per cent and local government administration 3.1 per cent (ABS, 2011).

There is a strong focus on tourism in the Moree Plains LGA, which is managed by Tourism Moree. Tourism Moree interacts and works closely with operators, council, event organisers and community/business groups to facilitate the development and improvement of tourism products, infrastructure, facilities and services.

Land use

The Moree Plains LGA is around 18,000 square kilometres in size and is dominated by agricultural industries with significant cotton, wheat and livestock land uses. The regional town of Moree is located at the southern extent of the study area. The study area is dominated by cropland with some scattered rural residential land use, mainly to the south within segment 1 closer to the township of Moree.

4.8.3 Summary of issues

The following general issues associated with socio-economic and land use have been identified as likely to result from the proposal:

- potential conflicts in construction resourcing relating to an increase in workers or competition for workers during peak agricultural periods or other major projects within the region
- construction impacts on traffic and highway use during peak harvest and tourist seasons.

4.8.4 Recommendations

The following recommendations are made in relation to Socio-economic and land use impacts of the proposal:

- a basic level of socio-economic assessment should be carried out in line with the Roads and Maritime Environmental Impact Practice Note: Socio-economic Assessment (EIA N-05)
- consultation with local council, stakeholders, and other major projects proponents to manage cumulative socio-economic impacts of the proposal, and manage community concerns.

4.9 Landscape character and visual amenity

The following section provides an outline of the landscape character and visual amenity impacts within the study area. For the purpose of this report, the study area has been established using a 30 m buffer either side of the existing road corridor centreline.

4.9.1 Methodology

This assessment reviewed the current land uses and zones, and access for adjoining landowners. The following data was consulted to support the review:

- Moree Plains Local Environmental Plan 2011
- aerial imagery.

4.9.2 Existing environment

Landscape character

The study area traverses through a variety of land uses within Moree Plains LGA. The proposal predominantly traverses an area of primary production, with some large lot residential zones beyond segment 1 to the south, within the town of Moree, which is a major regional residential area.

Segment 1 is located 2.7 kilometres to the north of the town of Moree. The southern extent of segment 1 begins on the Newell Highway bypass of Moree. A number of rural/residential properties are located within the study area, with a cluster of homes along the highway as it exits Moree. The Moree Horse Racing club and track is situated immediately to the east and south east of the proposal. The existing highway crosses the Mehi River to the south of the study area, with low lying areas present adjacent to the river. Skinners Creek also transects the existing highway. The area towards the north is dominated by cropping land with scattered vegetation present in some areas. The Gwydir River is located around 1.3 kilometres to the north east and north of segment 1. Areas surrounding local waterways such as Skinners Creek or stands of vegetation which are likely to have a greater visual sensitivity than agricultural lands which are common within the study area.

Segment 2 is located approximately 15 kilometres north of Moree. The area is dominated by cropping land, with scattered rural/residential properties along the highway route. The highway crosses Marshalls Ponds Creek which links a series of storage dams that service the croplands in the area. The area is largely cleared of vegetation, with some pockets remaining along the creek and in the northern portion.

Segment 3, located approximately 37 kilometres to the north of Moree, is of similar characteristic to segment 2 above. Dominated by cropland, vegetation is limited to creek areas, some uncropped land, wind rows and along the highway corridor.

Visual receivers

The main visual receivers (rural/residential properties and public recreational areas) are located adjacent to Segment 1, within the vicinity of the town of Moree. Rest areas within segment 3 could be considered a visual receiver given their purpose and importance to safe travel on the Newell Highway for both heavy and light vehicles. However, receivers would be only temporary.

4.9.3 Summary of issues

The following general issues associated with landscape character and visual amenity have been identified across the study area:

- removal of vegetation especially within areas with greater visual sensitivity such as roadside vegetation along creek lines or within predominately cleared agricultural environments
- temporary ground disturbance within the proposal footprint
- widening and alterations to the current highway surface
- alteration of existing intersection and rural access roads.

A summary of specific site based impacts is included in Table 4-14 below.

Table 4-14 Summary of landscape character and visual amenity constraints to the proposal

Segment	Issue	Distance from Moree (km)
Segment 1	Proximity to northern area of the town of Moree.	2.73 – 5.6 km
Segment 3	Visual amenity associated with the Gil Gil rest area.	40.4 km
	Visual amenity associated with the unofficial rest area located two kilometres north of the Gil Gil rest area, on the western side of the proposal.	42.5 km

4.9.4 Recommendations

The following recommendations are made in relation to landscape character and visual amenity impacts of the proposal.

- an urban design, landscape character and visual impact assessment will be carried out to identify the potential visual impacts of the proposal in line with the Roads and Maritime Environmental Impact Practice Note: Guideline for Landscape Character and Visual Impact Assessment; (EIA-N04)
- further design development should consider the use of urban design principles in line with *Beyond the Pavement: Urban Design Policy Procedures and Design Principles* (Roads and Maritime, 2014).

4.10 Air quality

The following section provides an outline of the air quality impacts of the proposal.

4.10.1 Methodology

Given the rural characteristics of the area, a desktop air quality review was carried out by analysing local sensitive receivers and any contributing factors or local land uses that would likely impact local air quality. A review was also carried out of the National Pollution Inventory (NPI) to identify any registered sources of pollution within the study area.

4.10.2 Existing environment

Ambient air quality

The local air quality is influenced by agricultural activities, dust and road traffic. The air quality around the Moree Plains LGA can be stated as generally good. (State of Environment Report Moree Plains 2010). The local area's major type of pollution is naturally sourced, some include smoke from land clearing, smoke/fumes from prescribed or backyard burn off's. A review of the NPI database (Department of Environment and energy, 2017) identified seven facilities within the Moree Plains LGA. Facilities include two livestock feedlots, and five petroleum depots. No point Air emissions point sources were identified, and thus none are located within the study area.

Sensitive receivers

Sensitive receivers such as residences, schools, medical facilities, some flora and fauna are concentrated in Moree Town. Scattered dwellings and agriculture facilities populate the study area with some rural/residential properties located between 70–500 m away. Receivers that are within a one kilometre radius of the proposal are included as receivers in Figure 4-5.

4.10.3 Summary of issues

The potential sources of emissions to air, which may affect air quality and sensitive receivers from the proposal are mainly associated with construction, and include:

- gaseous emissions from mobile and station construction plant and equipment, and construction vehicles
- vehicle and mobile plant movement on paved and unpaved roads and haulage routes
- wind erosion of exposed areas
- handling and transfer of materials, including the loading and unloading of spoil and other materials
- bulk earthwork operations, such as excavations, clearing of groundcover and topsoil and the spreading of topsoil.

4.10.4 Recommendations

During the next phase of assessment further consideration will be given to managing air quality during construction including:

- potential sources of air pollution
- air quality management objectives consistent with any relevant published EPA guidelines
- mitigation and suppression measures to be implemented
- methods to manage work during strong winds or other adverse weather conditions
- a progressive rehabilitation strategy for exposed surfaces.

4.11 Greenhouse gas and climate change

This section considers issues associated with greenhouse gases and climate change that may arise or affect the proposal.

4.11.1 Methodology

Given the land use activities and rural characteristics a high-level assessment of the greenhouse gas and climate change impacts was carried out to identify any emission sources, or likely emission sources from the proposal.

4.11.2 Existing environment

The existing environment within the study area is predominantly rural with greenhouse gas emissions associated with agricultural activities and productions, agricultural plant and equipment and vehicle usage on local roads and highways. It is likely that an increase in the frequency and intensity of storms would leave to more frequent short and long term highway closures (NSW Government, 2015).

4.11.3 Summary of issues

Greenhouse gas emissions associated with construction of the proposal relate to fuel consumption of plant, equipment and vehicles. During operation greenhouse emissions may increase with the expected initial increase in traffic volumes, however upgrades to the road surface may improve fuel efficiency in addition with the NSW government proposed shift of freight from road to rail the overall emissions and particulate matter may reduce over time. This may result in marginal improvements to air quality for passing motorists and local rural residents.

4.11.4 Recommendations

Assessment of the greenhouse gas emissions for the project will be undertaken for construction and operation. This will investigate, but not be limited to, the following:

- identify and quantify the sources of greenhouse gas emissions associated with the construction, operation and maintenance of the project
- identify opportunities to reduce the greenhouse gas emissions associated with the project.

Overall, climate change risks for the proposal are considered to be readily manageable through the adoption of standard practices that are currently being applied elsewhere for similar infrastructure projects. Such measures include designing infrastructure in accordance with relevant standards and guidelines and ensuring that stormwater drainage is designed with sufficient capacity to account for the projected effects of climate change on the Central West region.

Further design development and climate change assessment would be guided by the draft Roads and Maritime Climate Change Adaptation for Road Networks Technical Guide and consider the range of climate change variables over time applicable to the proposal, including temperature, rainfall and hail, wind speed and bushfire. The assessment will identify adaptation actions to be incorporated into the design and operation of the project.

4.12 Cumulative impacts

This section identifies any major projects occurring in the vicinity of the study area and assess the cumulative impact that may result.

4.12.1 Methodology

Desktop assessment of the following:

- NSW Major Project's Assessments (Accessed 21 June 2017)
- Moree Plains Shire Council development projects (accessed 21 June 2017).

4.12.2 Existing environment

Newell Highway upgrade (Narrabri to Moree)

The Narrabri to Moree highway upgrade is the southern addition to the current proposal, not covered by this PEI. The proposal consists of highway upgrades and additional overtaking lanes on five segments of the Newell Highway totalling approximately 32.8 kilometres.

Inland Rail Line (Narrabri to North Star)

The Inland Rail Line (Narrabri to North Star) proposal is a commitment from the Australian government to construct an inland railway between Melbourne and Brisbane via the central west NSW. The \$50 million proposal would involve upgrading 183 kilometres of existing rail track in NSW between Narrabri and North Star. The rail line runs parallel to the current proposal at study areas 1 and 2 before veering to the east at Milo. The project is planned to commence in mid-2018, and expected to take around 18 months. (GHD, 2016). At the time of writing the environmental assessment requirements (SEARS) have been issued.

Moree Solar Farm

The Moree Solar farm is a 150 MW PV electricity generation facility. The project also includes construction of an electricity transmission line which would connect the solar power station to the Moree 132 kV substation. The project site is located around 10 kilometres south of Moree (Walsh et.al, 2011). At the time of writing, the power station was online and contributing electricity to the grid.

Narrabri Gas Project

The Narrabri Gas Project is a \$3.6 billion proposal for the progressive installation of up to 850 new gas wells on up to 425 new well pads over a 20 year period. The proposal also includes the construction and operation of gas processing and water treatment facilities. The proposal is for the Gunnedah basin, approximately 20 kilometres south west of Narrabri and is expected to employ up to 1300 people during the construction peak. Construction of the project is proposed to commence in early/mid 2018, subject to obtaining regulatory approval, with the first gas scheduled for 2019/2020 (GHD, 2017) As of 21 June 2017 the project was under assessment, with public submissions having closed in May 2017.

Western Slopes Gas Pipeline

The Western Slopes Gas Pipeline, located to the south west of Narrabri is a 450 kilometre high pressure gas pipeline proposal which would connect the Narrabri Gas Project to the NSW gas transmission network. The \$450 million proposal is expected to generate 250-350 full time jobs during construction. No expected construction timeframes or schedules have been identified however construction is expected to take 8-10 months (APA Group, 2017). At the time of writing the project SEARS have been issued.

Moree Gateway Project

The Moree Gateway Project is the development of a precinct at the southern entrance of the town of Moree. The proposal is located on land directly adjacent to the Airport, between the airport and the Newell highway. The proposal is aimed at generating economic activity and employment. (Moree Plains LGA, 2017).

Moree Water Park

The Moree Water Park project is underway and on completion will include the construction of three water ski lakes between 800 and 1200 m in length. The project is located around eight kilometres to the south of Moree and is anticipated to be operational in 2017 (Moree Plains LGA, 2017).

4.12.3 Summary of issues

The following projects could result in cumulative impacts with the proposal and would require consideration as part of the future planning stages:

- The Inland Rail Line (Narrabri to North Star)
- The Narrabri to Moree Newell Highway upgrade
- Narrabri Gas Project and associated Western Slopes Gas Pipeline.

The remaining proposals identified in section 4.12.2 are not considered an issue due to their location from the current proposal, the size the projects, or current development stage.

Generally the following issues require consideration:

- the timing of the proposal may coincide with other major projects currently proposed within the region placing an increase in demand and completion for construction labour, local accommodation, and construction materials
- non-resident workforce or workers relocating to the region to pursue employment opportunities have the potential to place excessive demand on regional facilities
- the timing of the project may coincide with other major projects and result in cumulative construction impacts such as traffic delays, and amenity issues relating to construction noise and dust.

The following project specific impacts require consideration:

- it is anticipated that segments 1 and 2 could be impacted by the planning and construction of the Inland Rail upgrade, and as a result will need to be considered during the planning and assessment process. Potential cumulative impacts could occur during construction
- it is anticipated that planning and assessment of the Narrabri to Moree Newell highway upgrade will be carried out in conjunction with the North Moree upgrade. Potential cumulative impacts could be associated during construction that would impact the use of the Newell Highway in addition to areas around the town of Moree
- while the Narrabri Gas project and associated Western Slopes Gas Pipeline would not impact the Newell Highway geographically given the distances between the proposals, increasing highway usage of construction vehicles, and the planned intersection upgrades of the Newell highway associated with the Narrabri Gas project would need to be considered to avoid extensive delays should construction periods align.

4.12.4 Recommendations

The following recommendation should be considered during the planning and assessment phase of the proposal.

- further assessment of cumulative impacts would be carried out as detailed environmental assessment for the proposal. This would include, but not be limited to further review of current or planned projects near the proposal for which construction may occur over a similar period, specialist studies for the environmental assessment would consider the potential for cumulative impacts arising from the proposal in combination with the impacts of other projects, and identification of mitigation measures where needed for cumulative impacts.

5 Conclusion

Road and Maritime is proposing major pavement upgrades to about 30 kilometres of Newell Highway north of Moree.

This PEI has been prepared by WSP Australia Pty Ltd on behalf of Roads and Maritime's Freight and Regional Program Office.

The information and recommendations in this PEI will be used to inform the options investigations and ongoing design process for the proposal with an aim to avoid or minimise environmental, economic and social impacts wherever possible.

Once a preferred option has been identified and a concept design has been developed, a detailed environmental impact assessment would be prepared. This detailed environmental assessment would detail environmental safeguards and management measures that would be implemented.

Based on the preliminary assessment the following are considered key environmental issues:

- disruptions and management of traffic and transport on the Newell Highway, including heavy and light vehicle movements, and access to rural/residential properties, and commercial, agricultural and industrial land uses
- threats to ecological values, primarily due to the presence of Weeping Myall Woodlands threatened ecological community, listed under both the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), and *Threatened Species Conservation Act 1995* (TSC Act), and the presence of Poplar Box Grassy Woodland nominated for listing under the EPBC Act
- potential impacts to identified Aboriginal heritage items adjacent to the proposal
- management of potentially high salinity risks and contamination potential
- water quality and hydrology, due potential direct impacts to ephemeral waterbodies
- management of flooding risk to and from the proposal
- noise and vibration issues to local rural/residential land uses
- disruptions to landscape character and visual amenity
- socio-economic impacts due to the competition for construction labour, materials and influx of workers placing pressure on local infrastructure
- cumulative issues to the local community and environment due to other major projects.

5.1 Summary of recommendations

Based on the outcomes of the PEI, the following recommendation should be considered during design and planning:

- consultation with community, trucking association and agricultural industry groups to minimise network disruptions and manage peak periods; and other major project proponents to manage potential cumulative impacts
- apply the 'avoid, minimise, mitigate and offset' hierarchy during further design development, specifically in relation to threatened communities and species consistent with commitment made within the EPBC Act Strategic Assessment – Strategic Assessment Report (Roads and Maritime, 2015)
- design development should ensure identified aboriginal and non-aboriginal sites are avoided, and management actions implemented to avoid harm to these sites

- detailed geotechnical investigations and assessment, and preliminary site assessments should be carried out to support further design development
- further design development and detailed environmental assessment for the proposal should assess potential flooding impacts during construction and operation including consideration of the NSW Government's Floodplain Development Manual (Department of Natural Resources, 2005), Practical Consideration of Climate Change - Flood risk management guideline (DECC, 2007) and Australian Rainfall and Runoff: A guide to flood estimation (Commonwealth of Australia (Geoscience Australia) 2016)
- further design development and detailed environmental assessment for the proposal should include identification of potential impacts on stormwater quantity, change in stormwater runoff (increase or decrease) and sensitivity of downstream waters
- further detailed environmental assessment for the proposal should assess potential noise and vibration impacts in line with the following Roads and Maritime guidelines; Noise Mitigation Guidelines (Roads and Maritime, 2015a), Noise Criteria Guideline (Roads and Maritime, 2015b) Noise model validation Guideline (Roads and Maritime, 2016a) Construction and Noise Vibration Guideline (Roads and Maritime, 2016b)
- a basic level of socio-economic assessment should be carried out in line with the Roads and Maritime Environmental Impact Practice Note: Socio-economic Assessment (EIA N-05)
- an urban design, landscape character and visual impact assessment will be carried out to identify the potential visual impacts of the proposal in line with the Roads and Maritime Environmental Impact Practice Note: Guideline for Landscape Character and Visual Impact Assessment; (EIA-N04)
- during the next phase of assessment further consideration will be given to managing air quality during construction including:
 - potential sources of air pollution
 - air quality management objectives consistent with any relevant published EPA guidelines
 - mitigation and suppression measures to be implemented
 - methods to manage work during strong winds or other adverse weather conditions
 - a progressive rehabilitation strategy for exposed surfaces
- assessment of the greenhouse gas emissions for the project will be carried out for construction and operation. This will investigate, but not be limited to, the following:
 - identify and quantify the sources of greenhouse gas emissions associated with the construction, operation and maintenance of the project
 - identify opportunities to reduce the greenhouse gas emissions associated with the project
- further assessment of cumulative including but not be limited to, further review of current or planned projects near the proposal with similar development schedules and specialist studies to assess the potential for cumulative impacts arising, and identification of mitigation measures where needed for cumulative impacts.

6 Certification

This preliminary environmental investigation provides a true and fair review of the proposal in relation to environment issues.

Emma Dean
Principal Environmental Scientist
WSP Australia

Date: 3 November 2017

I have examined this preliminary environmental investigation and accept it on behalf of Roads and Maritime Services.

Ben Orford
Project Development Manager
Regional Project Office | Technical Project Services

Date:

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Terms and acronyms used in this PEI

Term / Acronym	Description
A39	The Newell Highway
ADT	Average daily traffic volumes
AHIP	Aboriginal heritage impact permit
ARTC	Australian Rail Track Corporation
BAM	Draft Biodiversity Assessment Methodology 2017
dB (A)	Decibel – A-weighted
EIA	Environmental impact assessment
EIS	Environmental impact statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPA	Environment Protection Authority (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	<i>Fisheries Management Act 1994</i>
Heritage Act	<i>Heritage Act 1977</i> (NSW)
HPVs	Higher Productivity Vehicles
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
NES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
Noxious Weeds Act	<i>Noxious Weeds Act 1993</i> (NSW)
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
OEH	Office of Environment and Heritage (NSW)
PAD	Potential archaeological deposit
PEI	Preliminary environmental investigation
POEO Act	<i>Protection of Environment and Operations Act 1997</i> (NSW)
Proposal	Proposed pavement upgrades to approximately 30 kilometres of Newell Highway north of Moree
Roads and Maritime	NSW Roads and Maritime Services

Term / Acronym	Description
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP 14	<i>State Environmental Planning Policy No.14 – Coastal Wetlands</i>
SSI	State Significant Infrastructure (NSW)
TfNSW	Transport for NSW
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>

Appendix A

Newell Highway upgrade: North Moree preliminary ecological assessment

ROADS AND MARITIME SERVICES

NEWELL HIGHWAY UPGRADE: NORTH MOREE

PRELIMINARY ECOLOGICAL INVESTIGATION

AUGUST, 2017





NEWELL HIGHWAY UPGRADE: NORTH MOREE

PRELIMINARY ECOLOGICAL INVESTIGATION

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AUGUST, 2017

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GLOSSARY

*	An asterix indicates an introduced species.
Biobanking Assessment Methodology (BBAM)	Is the assessment methodology that under pins the NSW Biodiversity Banking and Offset Scheme (the BioBanking Scheme) that is established under Part 7A of the Threatened Species Conservation Act 1995 (TSC Act). For the purpose of this PEI, the BBAM 2014 methodology has been adopted for assessing and identifying the types of biodiversity values.
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (Office of Environment and Heritage, 2014).
Life cycle	The series or stages of reproduction, growth, development, ageing and death of an organism (Department of Environment and Climate Change, 2007).
Locality	The area occupied by a 'local population' of a species or the 'local occurrence' of an ecological community (Department of Environment and Climate Change, 2007). For the purpose of this report, locality refers to a 20 km buffer established around the road corridor
Local population (of a threatened or migratory species)	<p>The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.</p> <p>The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.</p> <p>The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time (Department of Environment and Climate Change, 2007).</p>
MNES	A matter/s of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000
Noxious Weed	A plant declared by an order under section 7 of the <i>Noxious Weeds Act 1993</i> (Department of Primary Industries, 2017b)
PEI	Preliminary Environmental Investigation
Population	All the individuals of a species or a sub-specific taxon (subspecies, variety) that interbreed within a given area.
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (Office of Environment and Heritage, 2014).

Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>
Weed of National Significance (WON)	In 1998, Australian governments endorsed a framework to identify which weed species could be considered (WONS) within an agricultural, forestry and environmental context. Thirty one WONS were identified through this process (Australian Weeds Committee, 2017).

1 INTRODUCTION

1.1 BACKGROUND

Roads and Maritime Services NSW (Roads and Maritime) has started planning for significant pavement upgrades to about 33 kilometres of Newell Highway north of Narrabri, and an additional 30 kilometres of Newell Highway north of Moree. Five overtaking lanes are also proposed to be included in the scope of works. This report addresses the proposed pavement upgrades and overtaking lanes for north of Moree and will refer to these proposed works as the proposal.

The study area is defined as the area directly affected by the development and any additional areas likely to be affected, either directly or indirectly. For the purpose of this report, the study area has been established using a 30m buffer either side of the existing road corridor centreline. The study area is shown in Figure 3.1.

1.2 STUDY OBJECTIVE

A Preliminary Environmental Investigation (PEI) has been prepared by WSP Australia Pty Ltd on behalf of Roads and Maritime Services Freight and Regional Program Office. The information and recommendations in this biodiversity assessment supports the PEI and will be used to inform the options investigations and ongoing design process for the proposal with an aim to avoid or minimise environmental impacts where possible.

Once a preferred option has been identified and a concept design has been developed, a detailed environmental impact assessment would be prepared and would detail environmental safeguards and management measures that would be implemented.

The objectives of this biodiversity survey report are to:

- Describe the existing environment and identify the significance of biodiversity within the study area
 - Identify flora and fauna habitats and Threatened ecological communities, populations and species listed under the TSC Act and/or the EPBC Act within the study area
 - Develop maps detailing the locations of threatened flora and fauna and any significant vegetation within the study area
 - Provide recommendations regarding further detailed ecological studies.
-

1.3 CHANGING LEGISLATION

From the 25th August, 2017 the current legislation, *Threatened Species Conservation Act 1995* and the *National Parks and Wildlife Act 1974*, will be superseded by the *NSW Biodiversity Conservation Act 2016* and *Draft Biodiversity Conservation Legislation 2017*. This change in legislation will affect the methods used during future assessments and any offsetting associated with the identified impacts of biodiversity. Future assessments will be required to follow Draft Biodiversity Assessment Methodology (BAM) 2017.

2 METHODOLOGY

2.1 PERSONNEL

The contributors to the preparation of this report, their qualification and roles are provided in Table 2.1.

Table 2.1 Contributors and their roles

NAME	QUALIFICATION	ROLE
Julia Wyllie	Bachelor of Environment	Ecologist - Field survey and reporting
Clementine Watson	Bachelor of Environmental Science and Management	Ecologist - Reporting
Allan Richardson	Bachelor of Environmental Science (Hons)	Principal ecologist- Field survey
Selga Harrington	Bachelor of Science (Hons)	Principal ecologist- Technical Review
Matt Goganovski	BSc (Geosciences)	GIS consultant – data management and map preparation

2.2 BACKGROUND RESEARCH

The aim of the background research was to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed Migratory species or critical habitat recorded previously or predicted to occur in the locality of the study area.

This allowed for known habitat characteristics of to be compared with those present within the study area to determine the likelihood of occurrence of each species or populations. These results informed the identification of appropriate field survey effort and the groups likely to occur.

The following spatial data was accessed to determine the landscape features and site values:

- NSW Mitchell Landscapes (Office for Environment & Heritage, 2016)
- Interim Biogeographic Regionalisation of Australia (IBRA version 5.1) (Thackway and Cresswell, 1995)
- Border Rivers-Gwydir Catchment vegetation mapping (Eco Logical Australia, 2009)
- Records of threatened species, populations and ecological communities known or predicted to occur in the locality of the road corridor were obtained from a range databases as detailed in Table 2.2.

Table 2.2 Database searches

DATABASE	SEARCH DATE	AREA SEARCHED	REFERENCE
BioNet Atlas of NSW Wildlife	28/04/2017	Searches were carried out within locality (20 km) of the study area	(Office of Environment & Heritage, 2017)
Protected Matters Search	28/04/2017		(Department of the Environment and Energy, 2017b)
Directory of Important Wetlands	28/04/2017		(Department of Environment and Energy, 2017a)
Groundwater Dependiant Ecosystems Atlas Map	28/04/2017		(Australian Bureau of Meteorology, 2017)

DATABASE	SEARCH DATE	AREA SEARCHED	REFERENCE
Critical habitat Register (TSC Act)	28/04/2017		(Office of Environment and Heritage, 2017a)
Register of Critical Habitat (EPBC Act)	28/04/2017		(Department of Environment and Energy, 2017b)
Register of Critical Habitat (FM Act)	28/04/2017		(Department of Primary Industries, 2017c)
Key Fish Habitats (FM Act)	28/04/2017		(Department of Primary Industries, 2017a)

2.2.1 LIKELIHOOD OF OCCURRENCE ASSESSMENT

An assessment was completed to evaluate the likelihood of occurrence of each threatened species, population and community (threatened biodiversity) identified with the potential to occur within locality of the study area. All threatened biodiversity identified during background research were considered. The habitat assessment was utilised to inform the identification of appropriate targeted surveys and was revisited after the surveys were completed based on the habitat components identified in the study area. The assessment was based on the habitat profile for the species and other habitat information in the *Threatened Species Profile Database* (Office of Environment and Heritage, 2017b). The assessment also included consideration of the dates and locations of nearby records and information about species populations in the locality. The likelihood results are summarised in Section 4 and are provided in full in Appendix B and Appendix D.

For this study, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table 2.3 below.

Table 2.3 Likelihood of occurrence criteria for threatened species and populations

CLASSIFICATION	DEFINITION
Recorded	The species was observed in the study area during surveys
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowing resources), has been recorded recently within the locality (10km) and is known or likely to maintain resident populations in the study area. Also includes known or likely to visit the study area during regular seasonal movements of migration.
Moderate	Potential habitat is present within the study area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependant (i.e. for breeding or important life cycle periods such as winter flowing resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local areas, meaning that the species is not dependant (i.e. for breeding or important life cycle periods such as winter flowing resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specially targeted by surveys and not recorded.

2.3 FIELD SURVEY

Field surveys were undertaken on the 31 March and 1 June 2017, and consisted of rapid and plot based surveys whilst undertaking incidental observations. Field survey methods undertaken are discussed below.

2.3.1 FLORA SURVEY

2.3.1.1 RAPID ASSESSMENTS

Rapid assessments were completed to ground-truth the existing broad-scale vegetation Border Rivers-Gwydir Catchment vegetation mapping (Eco Logical Australia, 2009). Where species assemblages and landscape position were consistent with communities previously mapped, this survey technique was used as the primary source of field validation. Within areas of non-native vegetation and areas which did not form recognised NSW Plant Community Types (Miscellaneous Ecosystems), rapid assessments were used to identify and map extent.

2.3.1.2 QUADRATS AND TRANSECT SURVEYS

Biobanking Assessment Methodology 2014 (BBAM) (Office of Environment and Heritage, 2014) was used to sample areas where either broad-scale mapping was not consistent with recorded vegetation communities or further clarification of vegetation community structure and composition was required. Given the preliminary nature of this report full compliance with BBAM methodology was not conducted. Native vegetation was classified according to the PCTs in the OEH Vegetation Information System (VIS) Classification Database (Office of Environment and Heritage, 2017c). Areas of non-native vegetation were also identified and mapped, plot data was collected in these areas to show the composition and abundance of vegetation in the study area.

VEGETATION CONDITION ASSESSMENT

The condition of vegetation was assessed firstly against the BBAM definitions of 'low' and 'moderate to good' broad conditions and secondly against the biometric condition benchmark data for the relevant vegetation type and other parameters such as intactness, diversity, history of disturbance, weed invasion and health.

Under FBA, vegetation in 'low' broad condition is:

- A woody native vegetation with native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and where either:
 - less than 50% of ground cover vegetation is indigenous species, or greater than 90% of ground cover vegetation is cleared

OR

- B native grassland, wetland or herbfield where either: – less than 50% of ground cover vegetation is indigenous species, or more than 90% of ground cover vegetation is cleared.

'Moderate to good' broad condition is native vegetation that is not in 'low' broad condition.

The field assessment included description and mapping of each of the identified PCTs and their condition classes under the BBAM (Office of Environment and Heritage, 2014).

2.3.1.3 PARALLEL LINE TRANSVERSES

Parallel line transverses were used to search for threatened species and involved two ecologists walking in parallel lines within proximity to existing records of threatened species which were obtained from Office of Environment and Heritage (Office of Environment & Heritage, 2017). Given the preliminary nature of this report this technique was only used to ground-truth threatened flora which had been previously recorded within the study area. This methodology is consistent with the current guidelines for threatened species searches (Department of Environment and Conservation, 2004) (Office of Environment & Heritage, 2016).

2.3.1.4 RANDOM MEANDER SURVEYS

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by (Cropper, 1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (e.g. threatened species, noxious weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

2.3.2 FAUNA SURVEYS

2.3.2.1 FAUNA HABITAT ASSESSMENT

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Due to limited access during the survey period targeted surveys could not be undertaken and subsequently fauna habitat assessments were the primary assessment tool in assessing whether threatened species likely to occur within the study area. Fauna habitat characteristics assessed included:

- Structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources.
- Presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles.
- Presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians.
- Presence of waterways (ephemeral or permanent) and water bodies.

The following criteria were used to evaluate the condition of habitat values:

- Good: A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- Moderate: Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- Poor: Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

2.3.2.2 OPPORTUNISTIC SIGHTINGS

Opportunistic sightings of animals were recorded including diurnal birds and reptiles. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

This habitat assessments informed seasonal surveys which targeted threatened fauna species. During these surveys, a hand-held GPS was used to record the locations of:

- Hollow-bearing trees
- Aquatic habitat
- Rock outcrops
- Habitat type boundaries.

3 EXISTING ENVIRONMENT

3.1 GENERAL ECOLOGICAL CONTEXT AND DISTURBANCE HISTORY

The study area is located within a highly fragmented and largely cleared landscape where land use is primarily agricultural, dominated by cropping. Few occurrences of native vegetation along the road corridor have connectivity to larger areas of native vegetation.

3.2 LANDSCAPE CONTEXT

The landscape context of the study area, including IBRA bioregions and subregions, Mitchell Landscapes and Catchment areas are described in Table 3.1.

Table 3.1 Broad study area classification

CRITERIA	LOCATIONS
IBRA Bioregion	Brigalow Belt South
IBRA subregion	Northern Outwash
CMA	Border Rivers – Gwydir region
Local Land Services	North West
NSW Botanical subdivision	North-West Plains
Mitchell Landscape	Croppa Clay Plains , Gwydir Channels and Floodplains, Gwydir Alluvial Plains
Soils	Red loams and heavy brown clays on gentle sloping terrain
Local Government Area	Moree Plains Shire Council

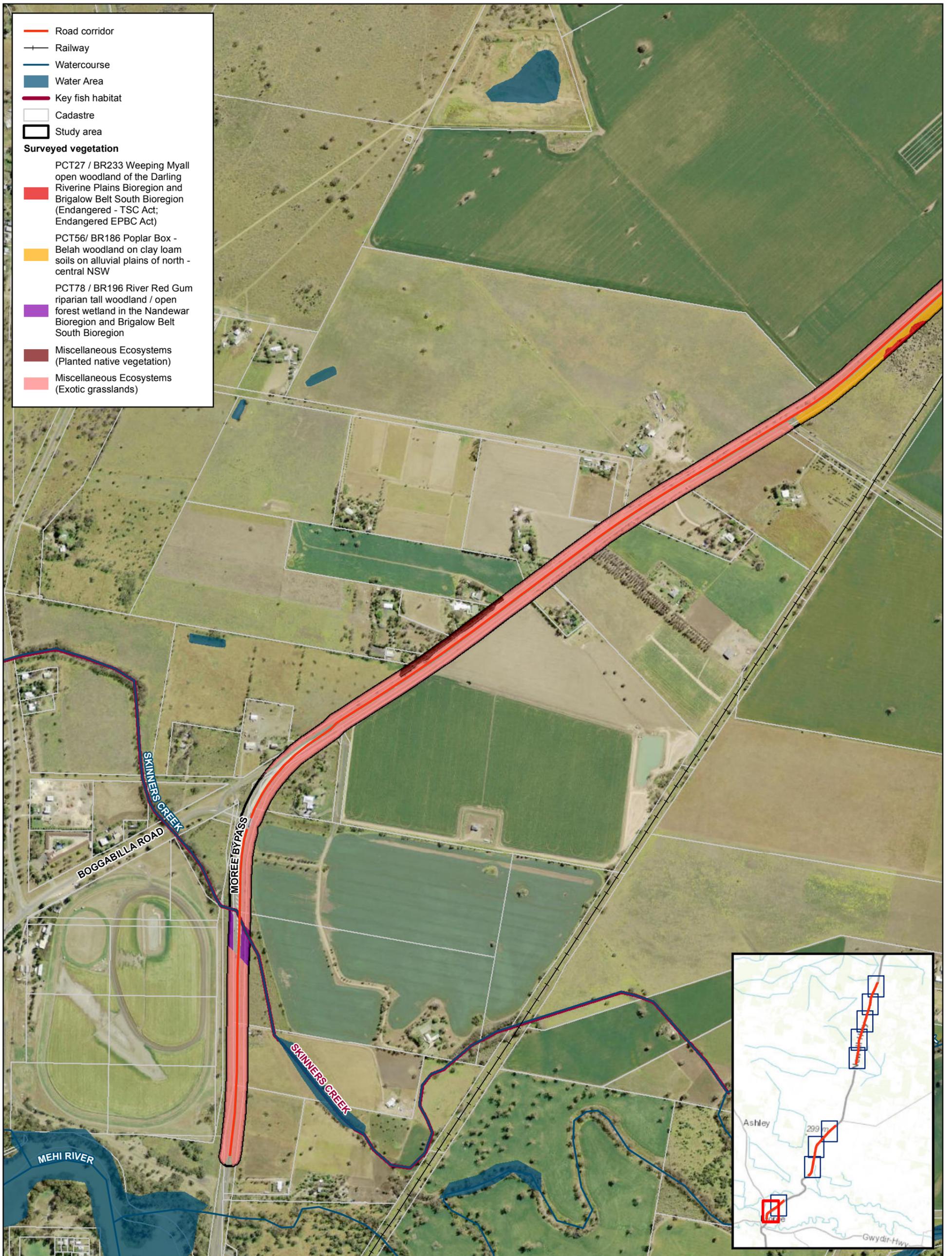
3.3 PLANT COMMUNITY TYPES

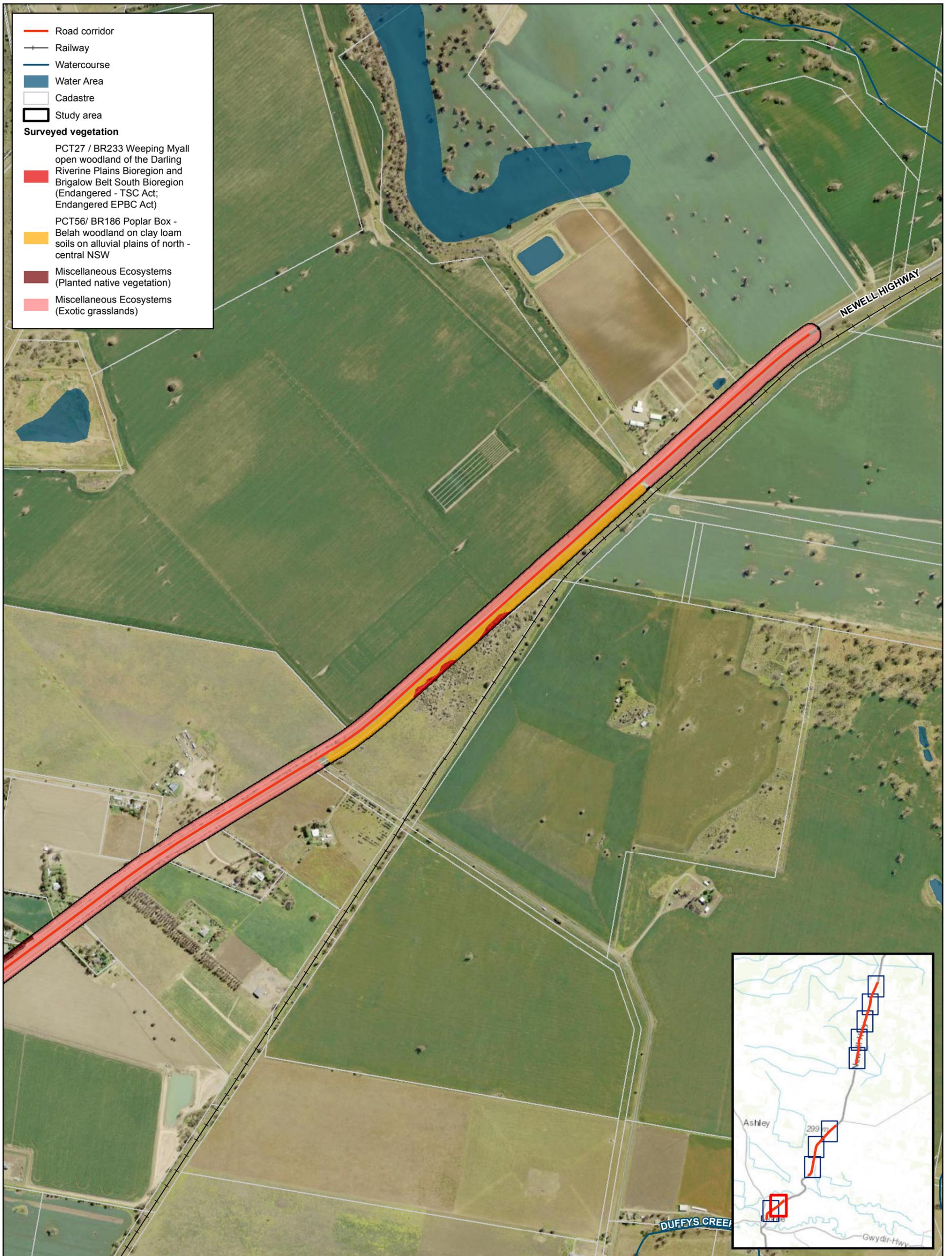
Based on the vegetation mapping and field surveys, three plant community types and two miscellaneous ecosystems were recorded, this is illustrated in Figure 3.1. These plant community types and their conservation status are outlined in Table 3.2.

The majority of vegetation within the study area was comprised of Derived native grasslands of PCT 56, PCT56/BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north - central NSW and Miscellaneous Ecosystem (Exotic Grasslands) (described in Section 3.3.4).

Table 3.2 Plant Community Types recorded within the study area

PCT	BVT	PLANT COMMUNITY NAME	LOCATION	THREATENED ECOLOGICAL COMMUNITY	
				TSC ACT STATUS	EPBC ACT STATUS
27	BR233	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Occurs as fringing vegetation in the Southern portion of the study area, connected to larger patches.	Forms part of <i>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions</i> (Endangered)	Larger patches (>0.5 ha) of PCT27/BR233 forms part of the <i>Weeping Myall Woodlands</i> (Endangered).
56	BR186	Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Occurs consistently throughout the study area in both small isolated patches and as vegetation corridors	Not listed	Currently not listed though <i>Poplar Box Grassy Woodland on Alluvial Plains</i> has been nominated for an Endangered listing under the EPBC Act, scientific assessment of the nomination by the Department of Environment and Energy is underway
78	BR196	River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	Restricted to water courses such as Gil Gil Creek, Skinners Creek and Marshalls Pond Creek	Not listed	Not listed





— Road corridor
— Railway
— Watercourse
■ Water Area
□ Cadastre
□ Study area

Surveyed vegetation

- PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
- PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north-central NSW
- Miscellaneous Ecosystems (Planted native vegetation)
- Miscellaneous Ecosystems (Exotic grasslands)

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Author: EM



Date: 11/07/2017

Approved by: JW

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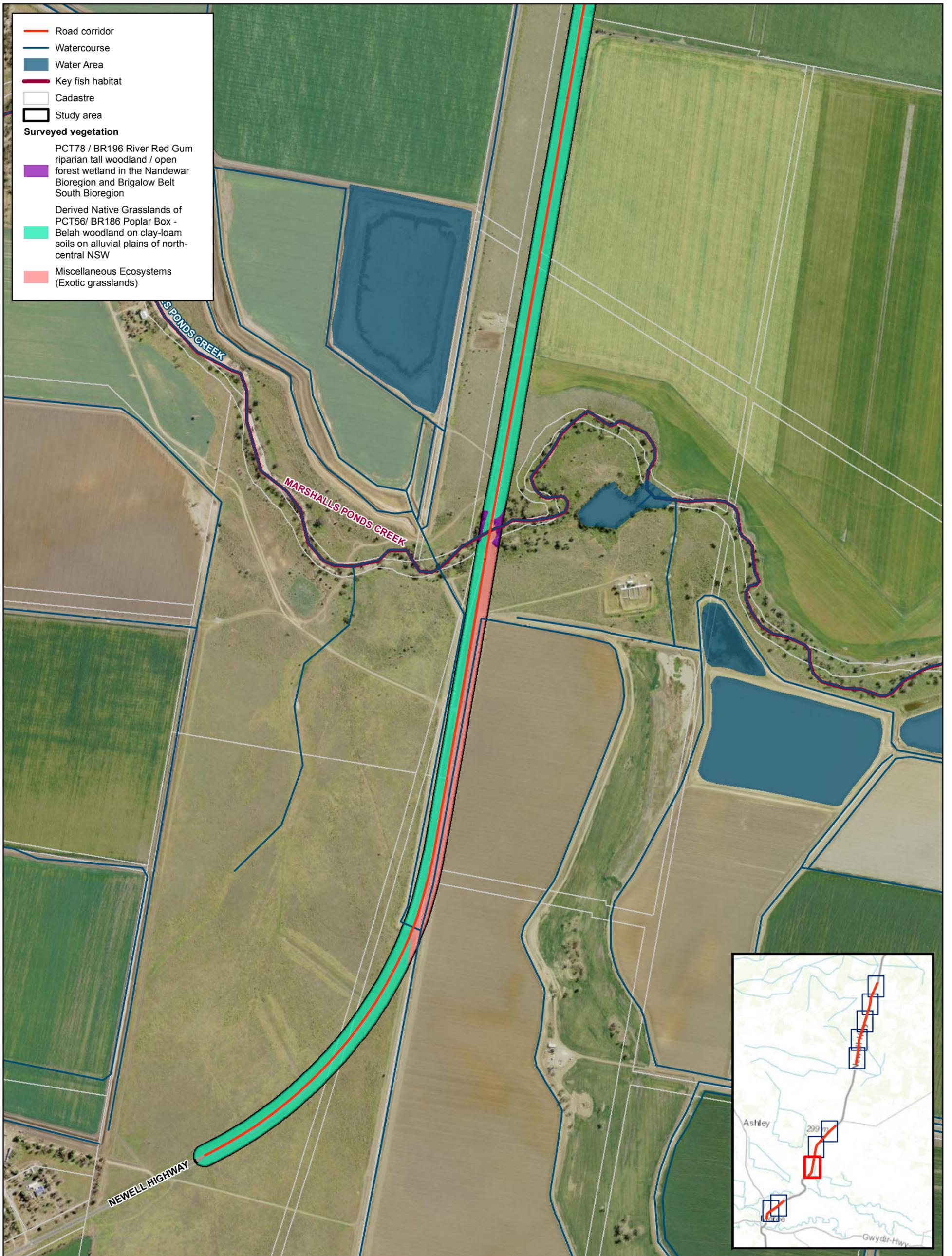
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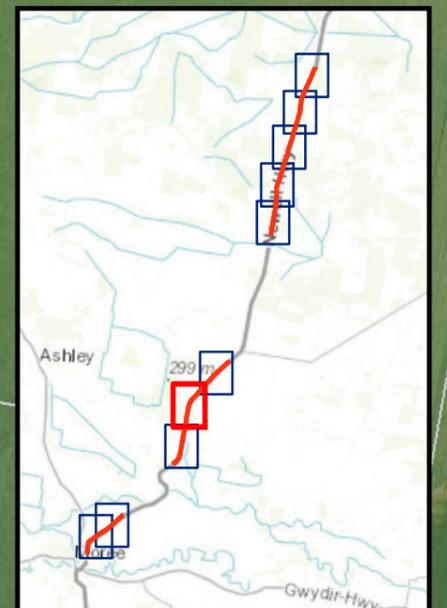
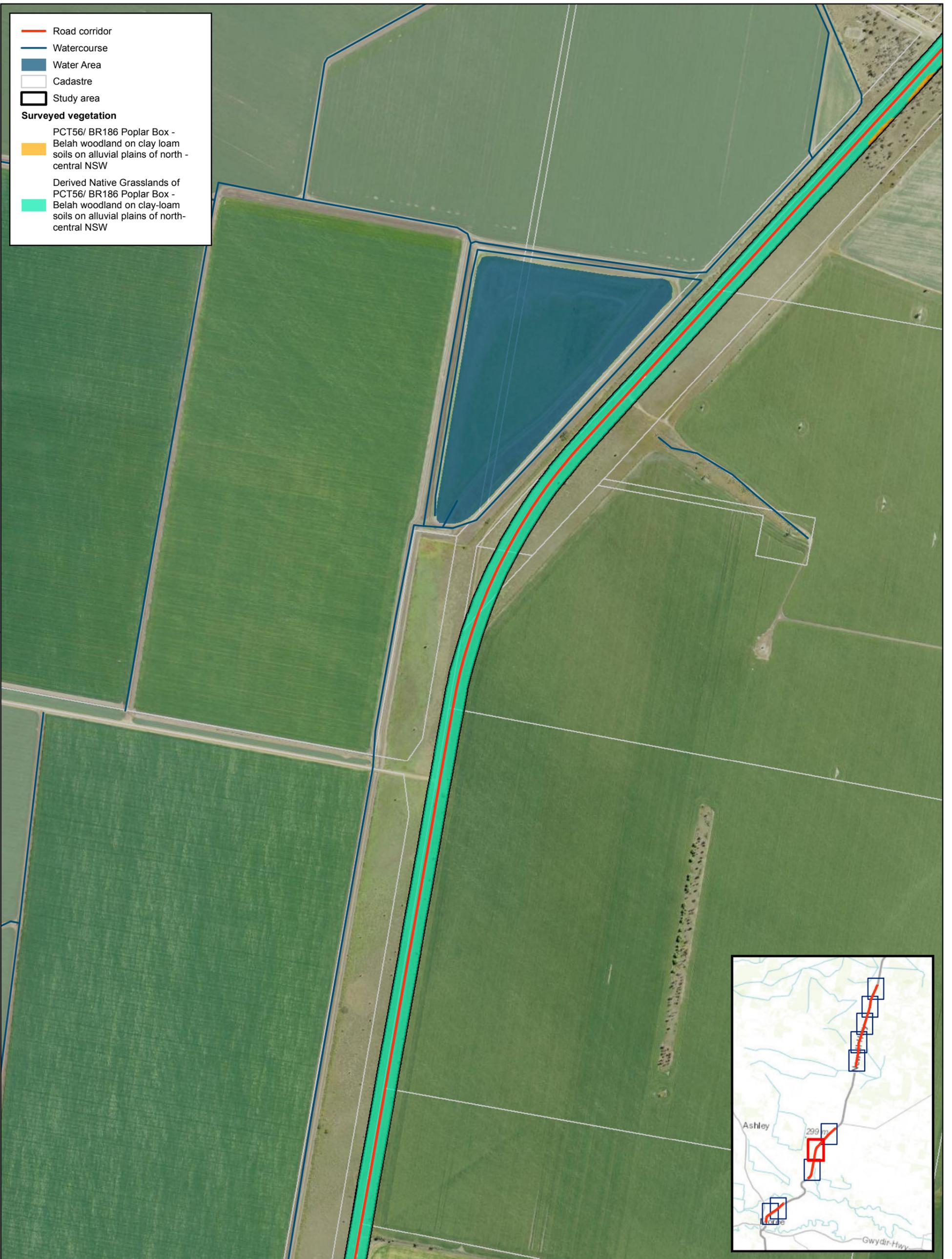
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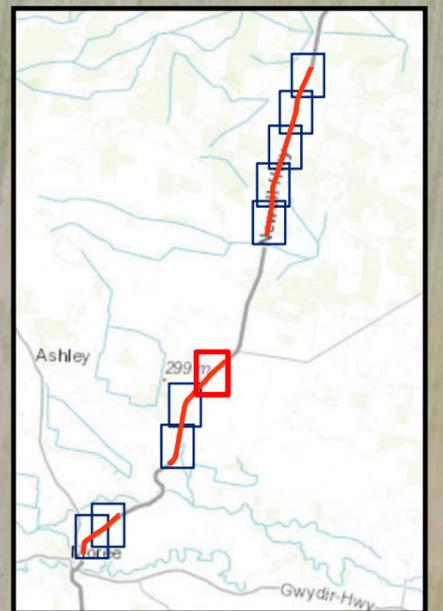
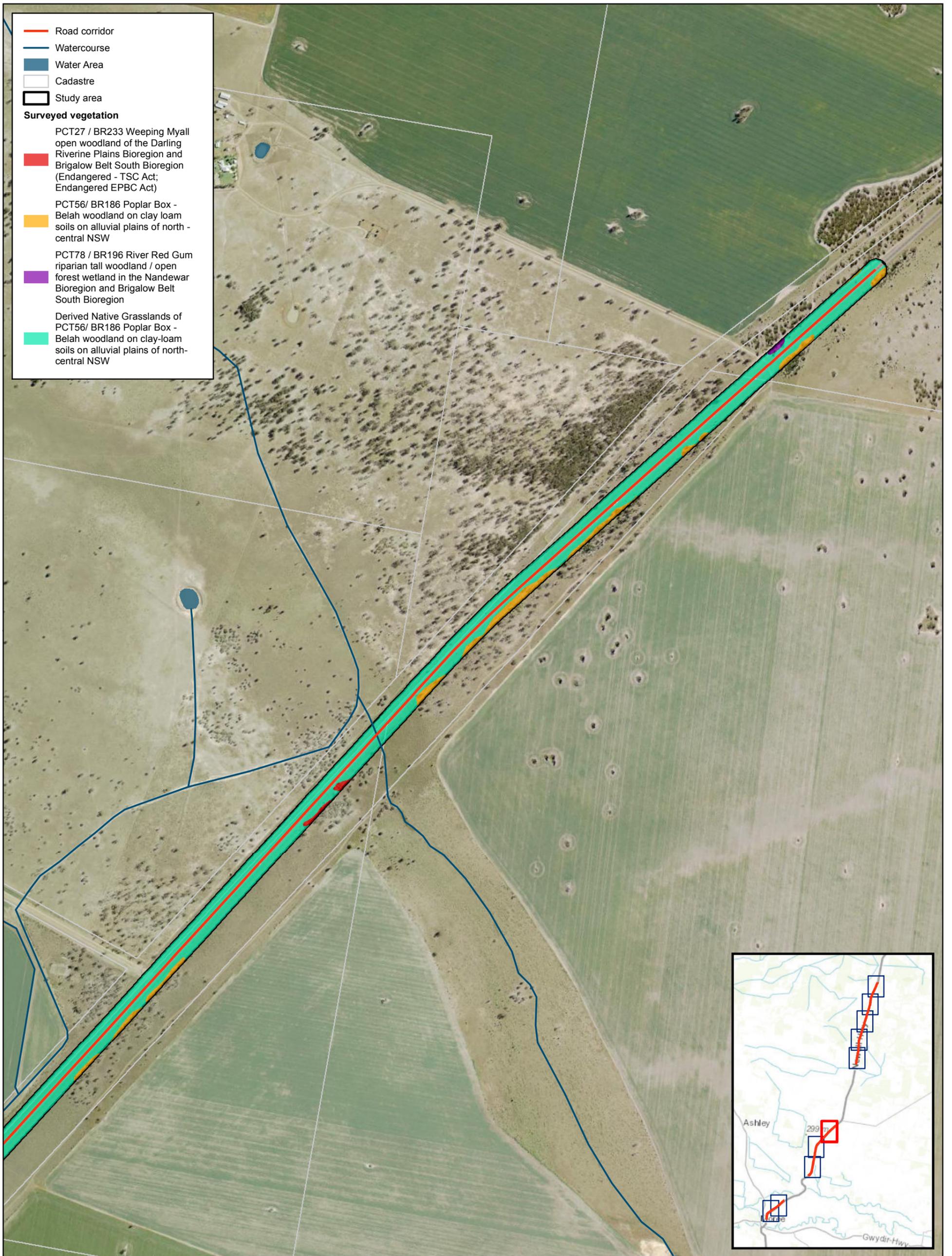


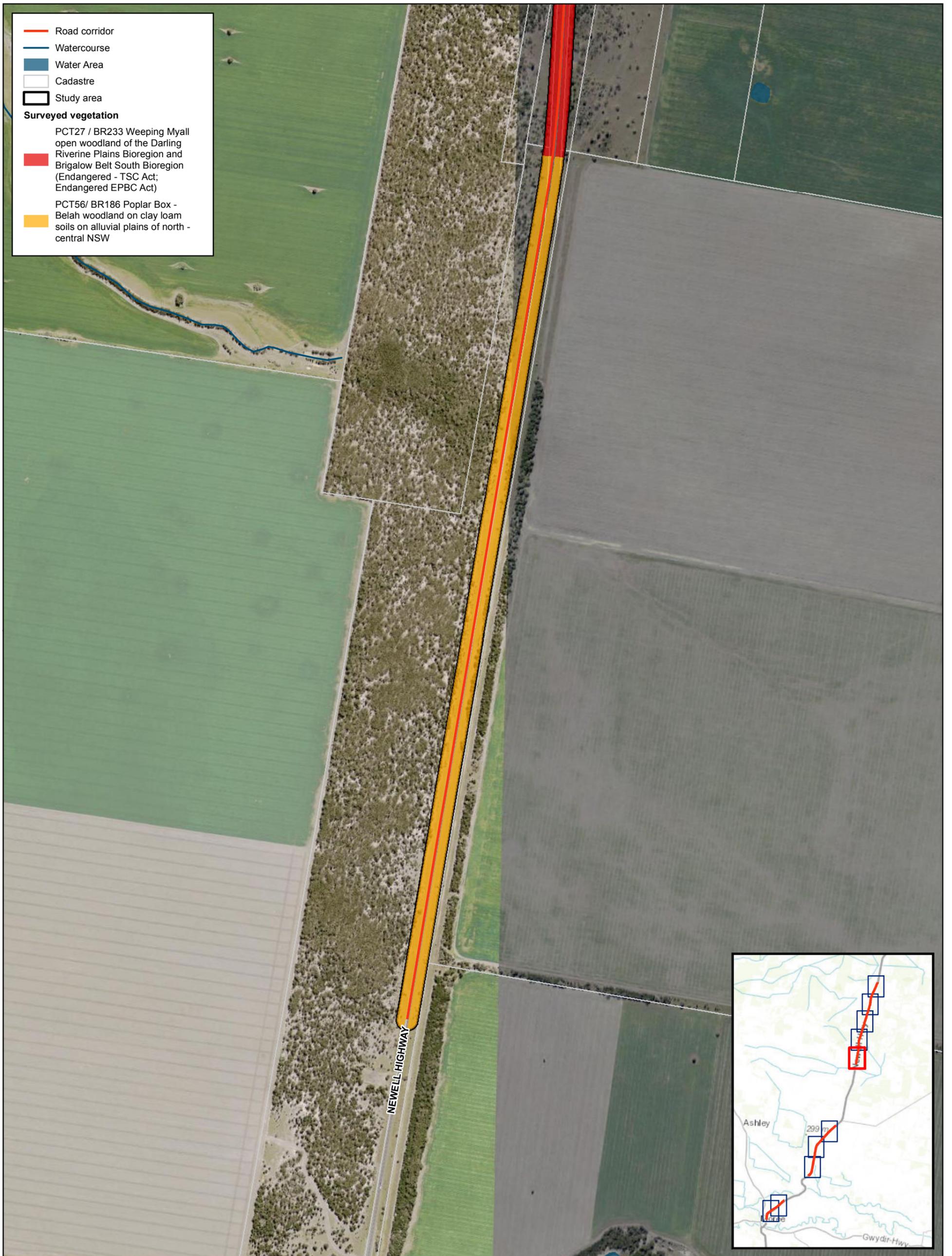
PEI - North Moree
Figure 3.1 Biodiversity Constraints
Segment 1 - Page 2

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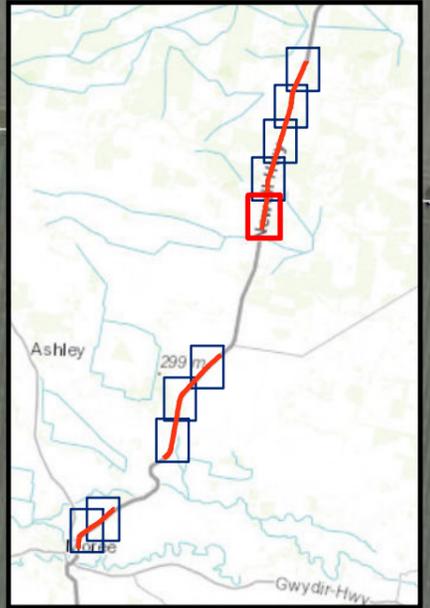


— Road corridor
— Watercourse
■ Water Area
 Cadastre
 Study area

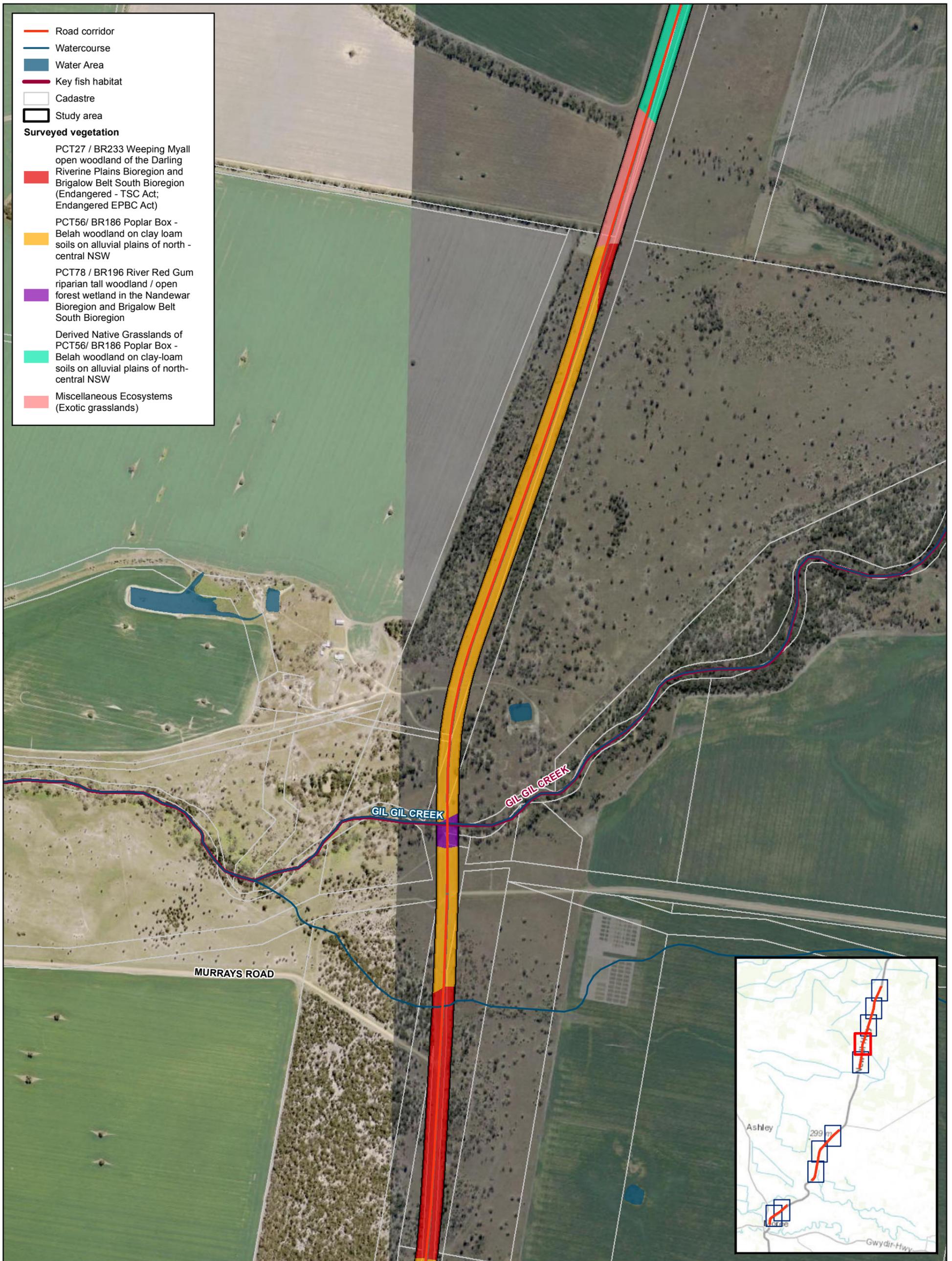
Surveyed vegetation

■ PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
■ PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north-central NSW

NEWELL HIGHWAY



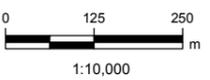
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- Road corridor
- Watercourse
- Water Area
- Key fish habitat
- Cadastre
- Study area
- Surveyed vegetation**
- PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
- PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north-central NSW
- PCT78 / BR196 River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion
- Derived Native Grasslands of PCT56/ BR186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW
- Miscellaneous Ecosystems (Exotic grasslands)

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Author: EM



Date: 11/07/2017

Approved by: JW

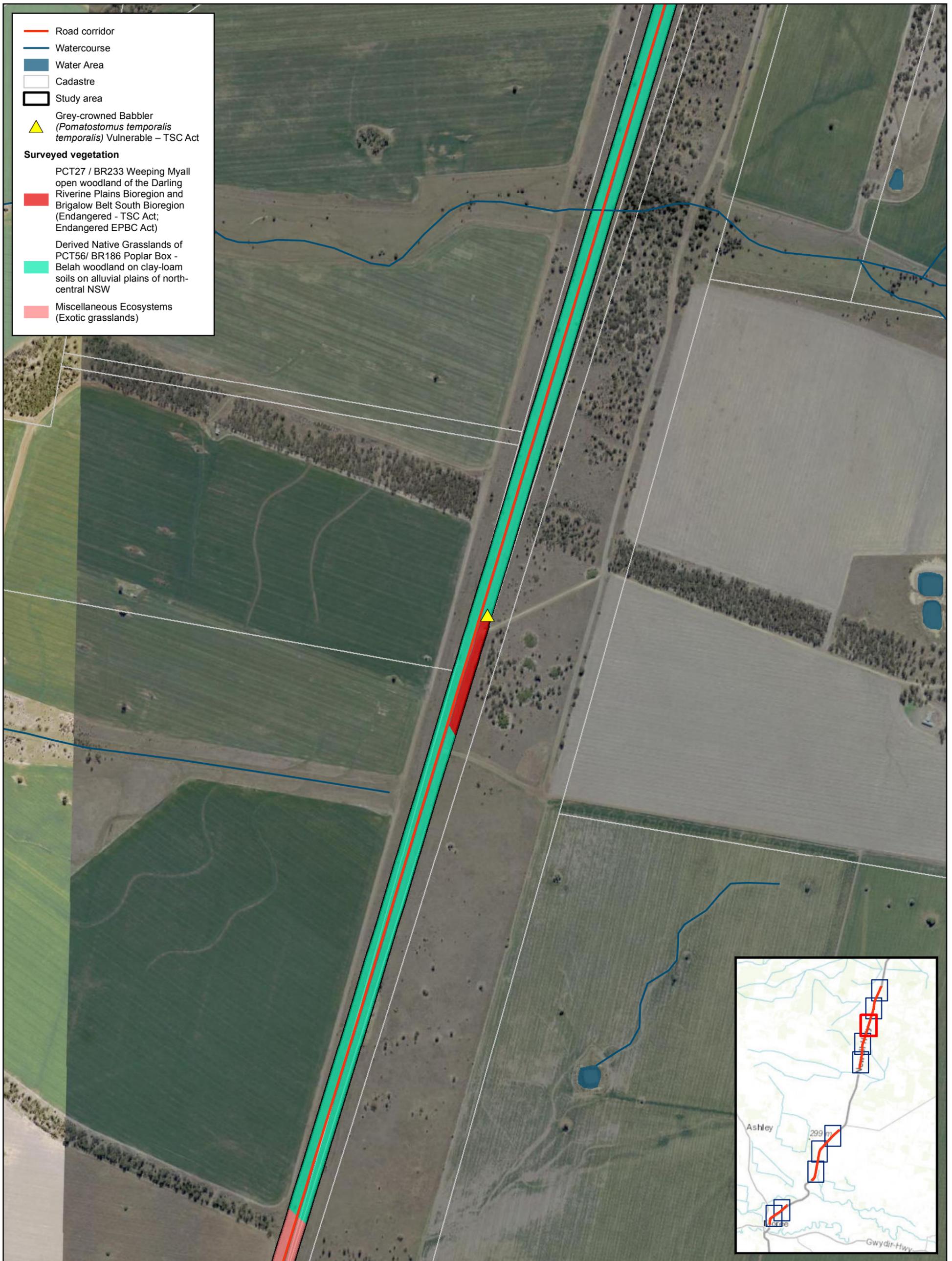
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PEI - North Moree
Figure 3.1 Biodiversity Constraints
Segment 3 - Page 2

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— Road corridor
— Watercourse
 Water Area
 Cadastre
 Study area
▲ Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) Vulnerable – TSC Act

Surveyed vegetation

■ PCT27 / BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion (Endangered - TSC Act; Endangered EPBC Act)
■ Derived Native Grasslands of PCT56/ BR186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW
■ Miscellaneous Ecosystems (Exotic grasslands)

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Author: EM



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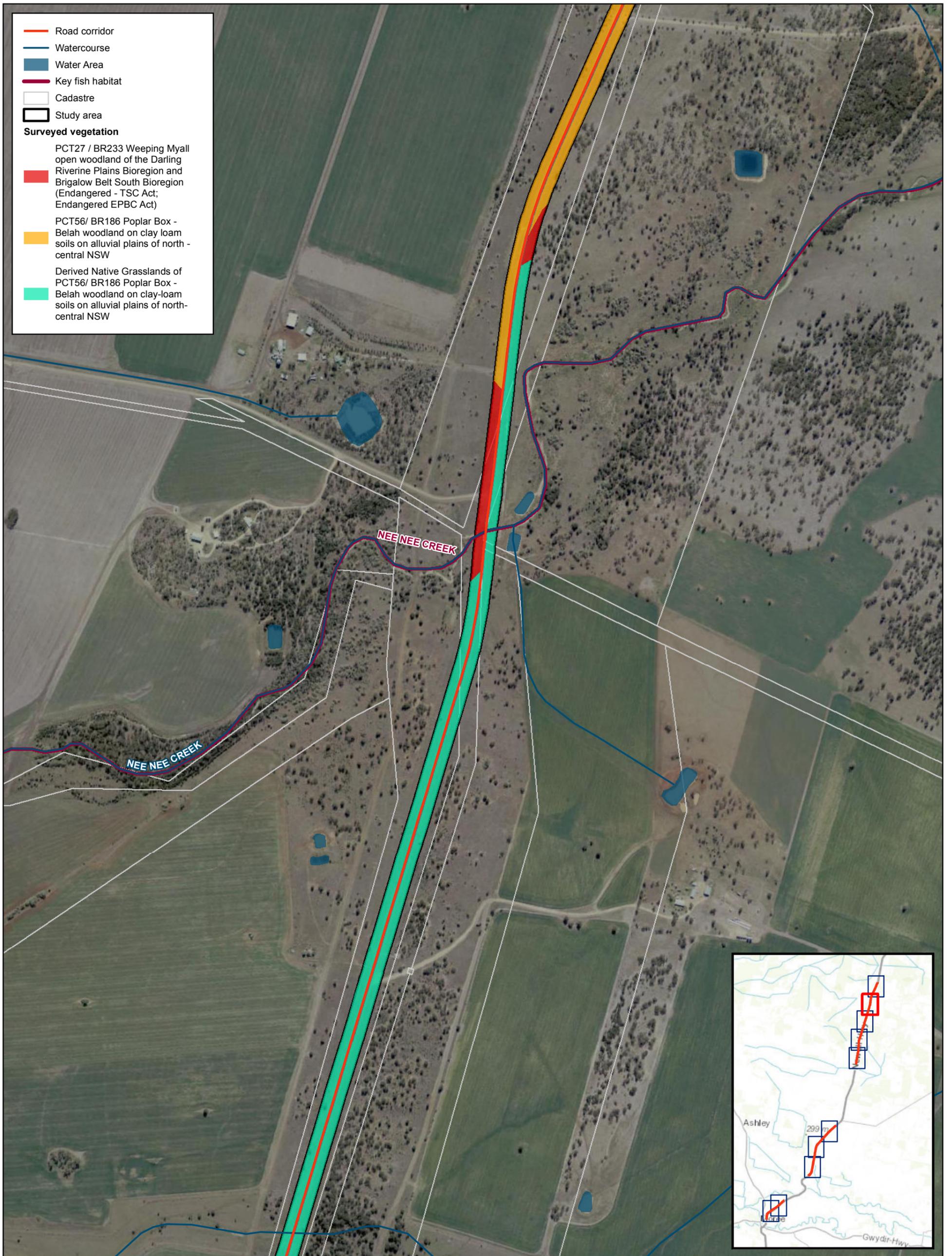
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PEI - North Moree
Figure 3.1 Biodiversity Constraints
Segment 3 - Page 3

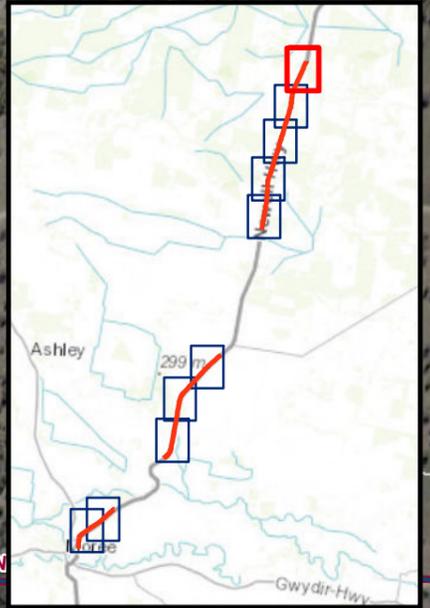
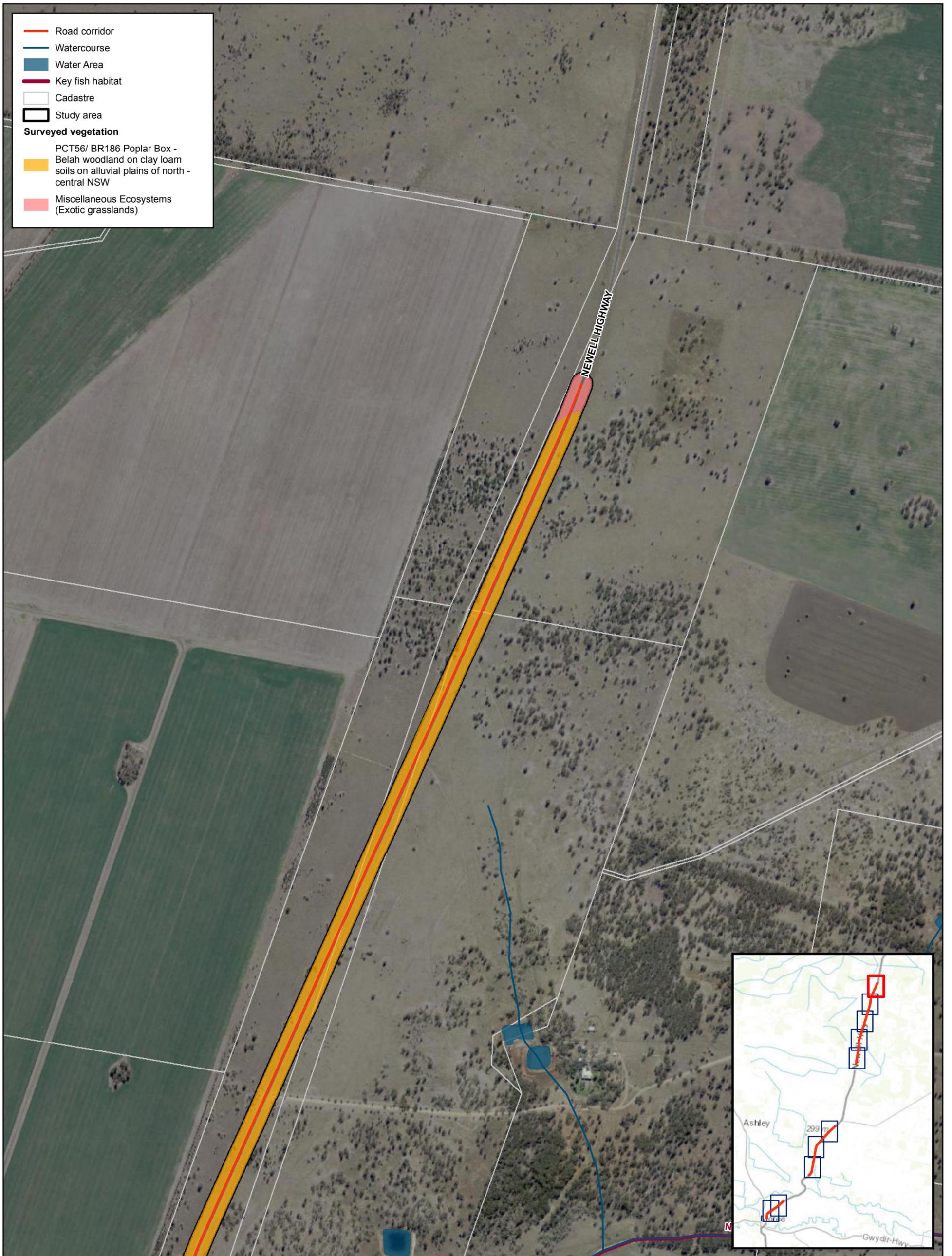
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- Road corridor
- Watercourse
- Water Area
- Key fish habitat
- Cadastre
- Study area

Surveyed vegetation

- PCT56/ BR186 Poplar Box - Belah woodland on clay loam soils on alluvial plains of north-central NSW
- Miscellaneous Ecosystems (Exotic grasslands)



3.3.1 PCT 27/BR 233 WEEPING MYALL OPEN WOODLAND OF THE DARLING RIVERINE PLAINS BIOREGION AND BRIGALOW BELT SOUTH BIOREGION

PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion was recorded throughout the study area in small patches fringing the road corridor. Mostly, these patches had connectivity to larger patches within the locality.

This community, depending on size and condition of patches, can be consistent with:

- Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions, an Endangered ecological community under the TSC Act
- *Weeping Myall Woodlands* and Endangered ecological community under the EPBC Act.

This community is illustrated in Photo 3.1 below and summarised in Table 3.3. The extent and locality within the study area is shown in Figure 3.1

Table 3.3 Summary of PCT 27/BR 233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion

ATTRIBUTE	STUDY AREA		
Vegetation formation	KF_CH11A Semi-arid Woodlands (Grassy sub-formation)		
Vegetation class	Riverine Plain Woodlands		
NSW PCT/BVT	PCT 27/BVT BR233		
PCT justification	PCT 27/BR233 was recorded within the study area in vegetation where <i>Acacia pendula</i> (Weeping Myall) was the dominant canopy species and formed an open woodland structure. Vegetation also displayed an open layer of chenopod (sometimes woody) shrubs and an open to continuous groundcover of grasses and herbs. This vegetation was recorded within the Moree LGA where this community is known to occur (Department of Environment Water Heritage and the Arts, 2008, NSW Scientific Committee, 2005).		
% cleared in CMA	This plant community type is estimates to be 90% cleared within the Border Rivers Gwydir CMA		
Vegetation mapping	This plant community type aligns closely to the Border Rivers-Gwydir Catchment vegetation description of Weeping Myall open woodland (Eco Logical Australia, 2009)		
Conservation significance	Forms part of <i>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions</i> , an Endangered ecological community under the TSC Act. Depending on condition, larger patches (where part of a patch greater than 0.5 ha) may be consistent with <i>Weeping Myall Woodlands</i> and Endangered ecological community under the EPBC Act		
Extent and distribution within the site	Southern portion of the study area in narrow strips and isolated fragments with no connectivity to larger bushland areas. This plant community type formed 4.9% of vegetation within the study area.		
Strata	Height	Plant Foliage Cover (%)	Dominant Species
Canopy	3-4	30-45	<i>Acacia pendula</i> (Weeping Myall), <i>Amyema quandang</i> var. <i>quandang</i> (Grey Mistletoe)
Shrub stratum	0.5-0.7	5-7	Juvenile <i>Acacia pendula</i> (Weeping Myall), <i>Vachellia farnesiana</i> (Mimosa Bush)
Ground layer	0.1-1.5	4-.55	<i>Tetragonia moorei</i> (Annual Spinach), <i>Rhagodia spinescens</i> (Hedge Saltbush), <i>Sclerolaena muricata</i> var. <i>muricata</i> (Black Roly Poly), <i>Einadia nutans</i> subsp. <i>nutans</i> (Climbing Saltbush), <i>Enchylaena tomentosa</i> (Ruby Saltbush), <i>Solanum esuriale</i>

ATTRIBUTE	STUDY AREA		
			(Quena), <i>Walwhalleya prolata</i> , <i>Sporobolus actinocladus</i> (Katora Grass), <i>Einadia trigonos</i> (Fishweed), <i>Opuntia aurantiaca</i> * (Tiger pear)

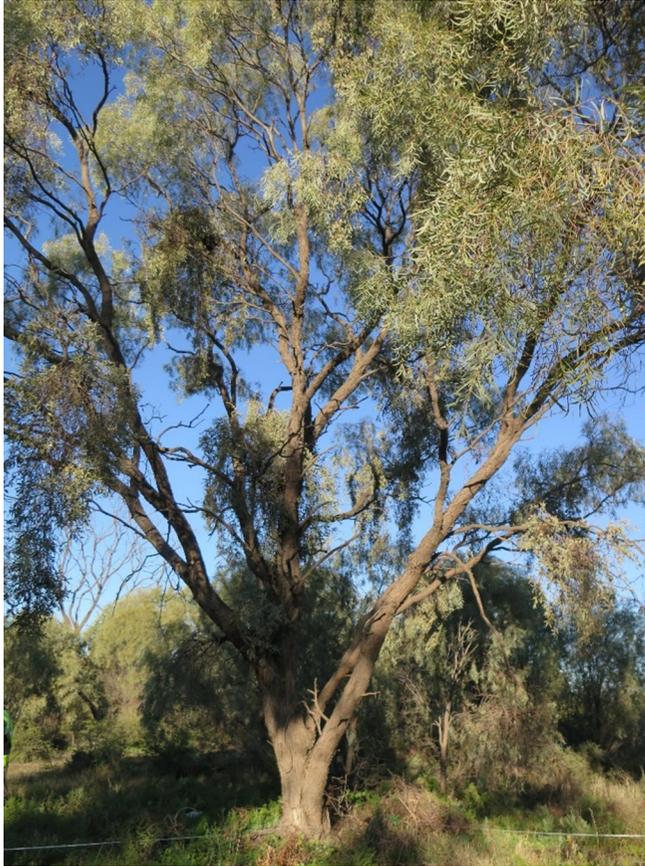


Photo 3.1 PCT 27/BR 233 Weeping Myall open woodland occurring within the study area

3.3.2 PCT 56/BR 186 POPLAR BOX - BELAH WOODLAND ON CLAY-LOAM SOILS ON ALLUVIAL PLAINS OF NORTH-CENTRAL NSW

Within the study area, this plant community type formed the majority of native vegetation and occurred consistently along the road corridor as both isolated patches and linear patches with some connectivity to riparian vegetation.

This community is not currently listed as a threatened ecological communities, however, Poplar Box Grassy Woodland on Alluvial Plains has been nominated for Endangered status under the EPBC Act {Department of the Environment and Energy, 2013 #7639}.

This community occurred in two BBAM condition types; Moderate to Good and Low Condition. Each condition was assessed using Rapid Assessment technique.

Condition types as described by BBAM Methodology recorded were:

- Moderate to Good condition vegetation displayed floristic assemblage and structural characteristics of the pre-European equivalent. The vegetation displayed resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity was high and exotic foliage cover formed less than 10%.
- Low condition vegetation was recorded in the form of derived native grasslands where floristic assemblage and landscape position was consistent with PCT56/BR 186. Due to the lack of woody overstorey vegetation, native overstorey and >50% of perennial ground stratum species being native, this vegetation was assessed to be a low condition form of PCT56/BR 186. Within Figure 3.1 these areas are mapped as 'Derived native grasslands

This community is illustrated in Photo 3.2 below and summarised in Table 3.4. The extent and locality within the study area is shown in Figure 3.1

Table 3.4 Summary of PCT56/BR 186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW

ATTRIBUTE	STUDY AREA		
Vegetation formation	KF_CH3 Grassy Woodlands		
Vegetation class	Floodplain Transitional Woodlands		
NSW PCT/BVT	PCT 56/BR186		
% cleared in CMA	80% of this plant community type is estimated to be cleared within Border Rivers - Gwydir CMA		
Vegetation mapping	This plant community type aligns closely to the Border Rivers-Gwydir Catchment vegetation description of Poplar Box-Belah Woodlands, mainly Darling Riverine Plains and Brigalow Belt South (Eco Logical Australia, 2009)		
Conservation significance	Currently not listed under the TSC Act although <i>Poplar Box Grassy Woodland on Alluvial Plains</i> has been nominated for an Endangered listing under the EPBC Act {Department of the Environment and Energy, 2013 #7639}. Scientific assessment of the nomination by the Department of the Environment and Energy has not been completed.		
Extent and distribution within the site	Occurred consistently along the road corridor as both isolated patches and linear patches with some connectivity to riparian vegetation. This plant community type formed 28%, whilst derived native grasslands formed 49% of vegetation within the study area.		
Moderate to Good condition			
Strata	Height	PFC (%)	Dominant Species
Canopy	12-15	15-30	<i>Eucalyptus populnea subsp. bimbil</i> (Poplar Box), <i>Casuarina cristata</i> (Belah)

ATTRIBUTE	STUDY AREA		
Sub-canopy	6-10	5-10	<i>Eremophila mitchellii</i> (Budda), <i>Geijera parviflora</i> (Wilga), <i>Exocarpos aphyllus</i> (Leafless Ballart)
Shrub stratum	1-2	2-5	<i>Myoporum montanum</i> (Western Boobialla), <i>Notelaea macrocarpa</i> (Native Olive)
Ground layer	0.1-1.0	40-50	<i>Panicum effusum</i> (Hairy Panic), <i>Einadia trigonos</i> (Fishweed), <i>Einadia hastata</i> (Berry Saltbush), <i>Tetragonia moorei</i> (Annual Spinach), <i>Oxalis chnoodes</i> (Plains Wood-sorrel)
Low Condition			
Strata	Height	Plant Foliage Cover (%)	Dominant Species
Canopy	-	-	Absent
Sub-canopy	-	-	Absent
Shrub stratum	1.0-1.5	15-20	<i>Vachellia farnesiana</i> (Mimosa Bush)
Ground layer	0.1-1.5	40-80	<i>Dichanthium sericeum</i> (Queensland Bluegrass), <i>Sporobolus mitchellii</i> (Rats Tail Couch), <i>Sclerolaena muricata</i> (Black Roly-poly), <i>Einadia hastata</i> (Berry Saltbush), <i>Solanum esuriale</i> (Quena), <i>Panicum effusum</i> (Hairy Panic), <i>Rhagodia spinescens</i> (Hedge Saltbush), <i>Bothriochloa biloba</i>



Photo 3.2 PCT 56/BR 186 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW in moderate to good condition (left and above) and low condition (below)

3.3.3 PCT 78/BR 196 RIVER RED GUM RIPARIAN TALL WOODLAND/OPEN FOREST WETLAND IN THE NANDEWAR BIOREGION AND BRIGALOW BELT SOUTH BIOREGION

PCT78/BR196 River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion was restricted to ephemeral waterways within the study area, namely Gil Gil Creek, Skinners Creek and Marshalls Pond Creek.

This community does not form any threatened ecological communities. This community is illustrated in Photo 3.3 below and summarised in Table 3.5. The extent and locality within the study area is shown in Figure 3.1.

Table 3.5 Summary of PCT78/BR196 River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion

ATTRIBUTE	STUDY AREA		
Vegetation formation	KF_CH9 Forested Wetlands		
Vegetation class	Inland Riverine Forests		
NSW PCT/BVT	PCT 78/BVT BR196		
% cleared in CMA	This plant community type is estimates to be 75% cleared within the Border Rivers Gwydir CMA		
Vegetation mapping	This plant community type aligns closely to the Border Rivers-Gwydir Catchment vegetation description of River Red Gum riverine Woodlands and forests, Darling Riverine Plains, Brigalow Belt South and Nandewar (Eco Logical Australia, 2009)		
Conservation significance	Not listed		
Extent and distribution within the site	Restricted to ephemeral waterways within the study area such as Gil Gil Creek, Skinners Creek and Marshalls Pond Creek This plant community type formed 0.7% of vegetation within the study area.		
Strata	Height	PFC (%)	Dominant Species
Canopy	10-12	5-20	<i>Eucalyptus camaldulensis</i> (River Red Gum)
Shrub stratum	1-1.5	15-20	<i>Vachellia farnesiana</i> (Mimosa Bush)
Ground layer	0.1-1.8	50-60	<i>Dichanthium sericeum</i> (Queensland Bluegrass), <i>Leptochloa digitata</i> (Umbrella Canegrass), <i>Einadia nutans subsp. oxycarpa</i> , <i>Einadia trigonos</i> (Fishweed), <i>Paspalidium caespitosum</i> (Brigalow Grass) <i>Xanthium italicum</i> * (Hunter Burr), <i>Cyperus eragrostis</i> * (Umbrella Sedge)



Photo 3.3 PCT 78/BR 196 River Red Gum riparian tall woodland/open forest wetland occurring within the study area

3.3.4 MISCELLANEOUS ECOSYSTEMS: HIGHLY DISTURBED AREAS WITH LIMITED OR NO NATIVE VEGETATION

Within the study area several Miscellaneous Ecosystems were identified, these ecosystems do not form recognised NSW Plant Community Types and have been grouped into the following categories.

3.3.4.1 EXOTIC GRASSLANDS

Exotic grasslands were recorded in areas where the majority (>50%) of ground stratum species recorded were exotic. Typically, dominate species included perennial grasses and herbs such as *Cenchrus ciliaris** (Buffel Grass), *Hyparrhenia hirta** (Coolatai Grass), *Sorghum halepense** (Johnson Grass), *Medicago sativa** (Lucerne) and *Gossypium hirsutum** (Cotton).



Photo 3.4 Miscellaneous Ecosystem: Exotic grasslands

3.3.4.2 PLANTED NATIVE VEGETATION

Planted native vegetation was recorded within close proximity to Moree township occurring near and within residential dwellings where understoreys were managed. Species included planted specimens of *Eucalyptus blakelyi* (Blakeys Red Gum). This plant community type formed <1% of vegetation within the study area.

3.4 FAUNA RECORDED

A total of 52 species of bird were recorded in the study area during field surveys (Appendix C). Of these, three species were exotic and one, Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), is listed as Vulnerable under the TSCAct.

3.5 FAUNA HABITATS

Fauna habitat observed within the study area occurs as disjunct remnant patches of modified woodland, scattered across a fragmented landscape. The majority of fauna habitat within the study area consisted of Eucalypt woodland and grasslands. These areas of native and non-native vegetation were recorded in a largely cleared and fragmented landscape, dominated by agricultural land use (i.e. cropping and agricultural grazing). Those marginal areas of

connectivity exist along water courses and road reserves where canopy has been retained and grazing excluded. The study area does not form part of, or exist within any regional wildlife corridors or connectivity.

Fauna habitat observed was dominated by a remnant eucalypt canopy, often with varying levels of disturbance in the understorey, in some cases structural complexity was limited. Eucalypt canopy may provide opportunistic blossom resources for mobile species able to cross a disturbed and majority cleared landscape. Flowering resources include Weeping Myall woodland (with recorded mistletoe resources), Poplar Box, and River Red Gums. Scattered hollow bearing trees were observed which may be utilised by various hollowing dwelling species, which are mobile and adapted to a fragmented landscape.

No structural complexity in habitat was observed (i.e. no shrubby understorey) influencing the likely habitat for ground-dwelling species. Little fallen timber and rock outcrops were present, limiting fauna sheltering habitat. The fauna most likely to utilise this habitat are species that are mobile and adapted to fragmented environment.

3.6 AQUATIC HABITATS

Whilst no surface water was recorded, several ephemeral creeks intersect the study area. One of the objectives of the *Fisheries Management Act 1994* (FM Act) is to conserve Key Fish Habitat s. Creeks, whether permanently or intermittently flowing, are considered Key Fish Habitat under the FM Act (Department of Primary Industries, 2013)

Department of Primary Industries has outlined Key Fish Habitat within proximity to the study area as habitats which are important to the 'sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species' (Department of Primary Industries, 2017).

The FM Act applies to the proposed upgrades to North Moree as it crosses over four ephemeral creeks; Nee Nee Creek, Gil Gil Creek, Marshall Ponds Creek and Skinners Creek (Department of Primary Industries, 2017c). These watercourses are classified as supporting minimal Key Fish Habitat watercourses (Class 3) as they are ephemeral aquatic habitat which are not supporting native aquatic or wetlands vegetation (Department of Primary Industries, 2013). The occurrence of Key Fish Habitat within the study area was obtained from NSW Department of Primary Industries "Key Fish Habitat Maps" (2017) and is provided in Figure 3.1.

Database searches did not identify any threatened aquatic species, populations or ecological communities listed under the FM Act which are known or would likely utilise the study area. The observed aquatic habitats were identified as being of low quality for any threatened aquatic species. Consequently, no detailed aquatic surveys or habitat based assessment were conducted, and it was concluded that there would be no materially significant impact within the definitions of the above Act. Nonetheless, as a precautionary approach, watercourse crossings would be designed to ensure that they meet the minimum requirements for fish passage recommended for the classes of 'fish habitat' found at the stream crossings.

Within the locality, water reservoirs (farm dams) associated with agricultural land use are present. These dams were generally small in extent and scattered with no connectivity between water bodies or remnant vegetation. Fauna utilising these water bodies are generally species which are mobile and well adapted to moving across fragmented landscapes (e.g. wetland birds).

3.7 GROUNDWATER DEPENDANT ECOSYSTEMS

The presence and characteristics of groundwater dependent ecosystems in the study area is described in this section.

Groundwater dependant ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater (Department of Land and Water Conservation, 2002). When considering GDEs, groundwater is generally defined as the saturated zone of the regolith (the layer of loose rock resting on

bedrock, constituting the surface of most land) and its associated capillary fringe, however it excludes soil water held under tension in soil pore spaces (the unsaturated zone or vadose zone) (Eamus *et al.*, 2006).

GDEs include a diverse range of ecosystems as shown in Figure 3.2. These ecosystems range from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e. ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water) (Hatton and Evans, 1998). Eamus *et al.* (2006) considers the following broad classes of these ecosystems:

Aquifer and cave ecosystems, where stygofauna (groundwater-inhabiting organisms) may reside within the groundwater resource. The hyporheic zones (see ecosystem 5 in Figure 3.2) of rivers and floodplains are also included in this category because these ecotones often support stygobites (obligate groundwater inhabitants).

All ecosystems dependent on the surface expression of groundwater. This category includes base-flow rivers and streams, wetlands (see ecosystems 2 and 3 in Figure 3.2), some floodplains and mound springs and estuarine seagrass beds. While it is acknowledged that plant roots are generally below ground, this class of groundwater dependant ecosystems requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots.

All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the saturated zone of the water table) when roots penetrate this zone. This class includes terrestrial ecosystems such as River Red Gum (*Eucalyptus camaldulensis*) forests on the Murray–Darling basin (see ecosystems 1 and 4 in Figure 3.2). No surface expression of groundwater is required in this class of groundwater dependant ecosystems.

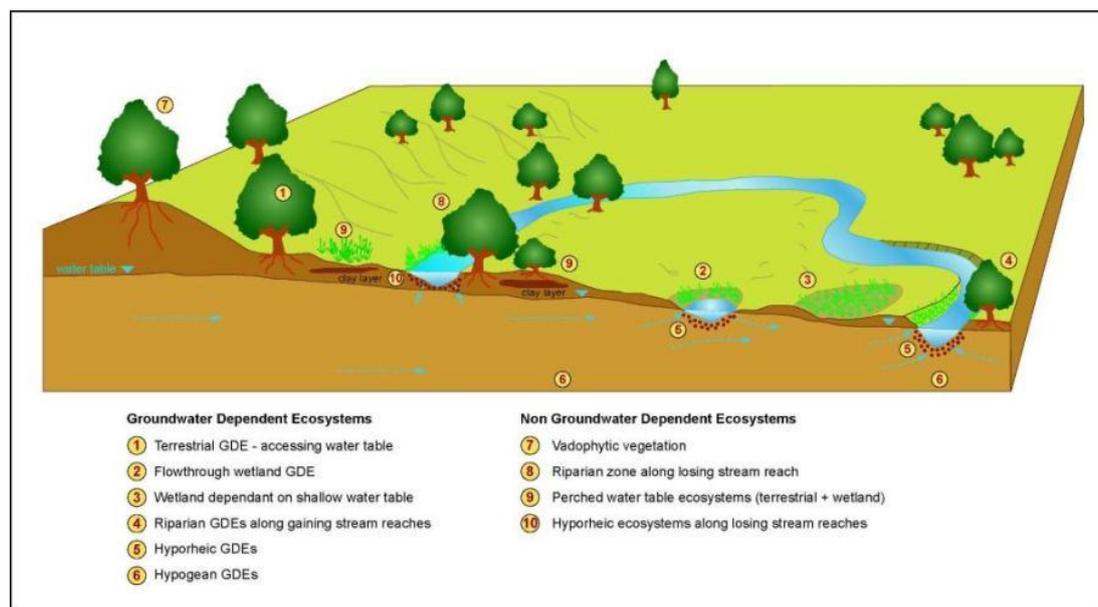


Figure 3.2 Conceptual biophysical model of groundwater dependent ecosystems

GDEs possess a range of values, including being important and sometimes rare ecosystems in themselves, as well as providing important ecosystem services such as water purification (Department of Land and Water Conservation, 2002). Groundwater is also an increasingly important resource for human uses in Australia (there was a 90 per cent increase in groundwater extraction between 1985 and 1997 (National Land and Water Resources Audit, 2001). Nationally groundwater is extracted for uses including irrigation (48%), urban and industrial use (33%) and stock watering and rural use (19%) (Department of the Environment and Heritage, 2001).

The potential for groundwater extraction to exceed recharge has resulted in awareness of the effects of groundwater availability or regimes that may result in adverse impact to groundwater dependent ecosystems (2003), and thereby threaten the values they provide.

The study area is located within the Great Artesian Basin, a shallow groundwater reservoir which feeds a number of creeks within the study area including Gil Gil Creek, Skinners Creek and Marshalls Pond Creek. This sub-surface water influences the presence of River Red Gum riparian tall woodland/open forest wetland which was recorded along watercourses.

4 THREATENED BIODIVERSITY

4.1 BIODIVERSITY LISTED UNDER TSC ACT

4.1.1 THREATENED ECOLOGICAL COMMUNITIES

Database searches identified nine threatened ecological communities listed under the TSC Act as occurring within locality of the study area. Based on field verification of existing vegetation mapping, one of the plant community types recorded was consistent with TSC Act listed threatened ecological community. The recorded plant community type and its aligning threatened ecological community is outlined in Table 4.1.

Table 4.1 Threatened ecological communities recorded within the study area

PLANT COMMUNITY TYPE	THREATENED ECOLOGICAL COMMUNITY	TSC ACT STATUS
PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	<i>Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions</i>	Endangered

4.1.2 THREATENED FLORA

Database searches revealed five species of threatened flora as being known to occur or considered likely to occur within locality of the study area. Of these five threatened flora species are considered to have a moderate or higher likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the absence of suitable habitat. Table 4.2 outlines those TSC Act listed flora species with a moderate or higher likelihood of occurring within the study area whilst Appendix B provides the complete likelihood of occurrence assessment.

Table 4.2 TSC listed threatened flora species considered to have a moderate to high likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	LIKELIHOOD OF OCCURRENCE ASSESSMENT
<i>Desmodium campylocaulon</i>	Creeping Tick-trefoil	E1	Moderate. Brown clay soils, plant community types and several understorey species associated with <i>Desmodium campylocaulon</i> were recorded within the study area. Potential habitat in form of BR233 recorded within the study area.
<i>Dichanthium setosum</i>	Bluegrass	V	Moderate. Though not previously recorded within locality, associated habitat presents within study area. Potential habitat in the form of BR196 and BR233 recorded within the study area.
<i>Digitaria porrecta</i>	Finger Panic Grass	E1	Moderate. Associated habitat and soils type present within the study area. Recent records within the locality.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	LIKELIHOOD OF OCCURRENCE ASSESSMENT
			Potential habitat in the form of BR186 and BR233 recorded within the study area.
<i>Homopholis belsonii</i>		E1	Moderate. Previously recorded within locality, associated vegetation recorded within the study area. Potential habitat in the form of BR186 and BR233 recorded within the study area.
<i>Swainsona murrayana</i>	Slender Darling Pea	V	Moderate. Associated soils types and vegetation present within the study area. Potential habitat in the form of BR233 recorded within the study area.

(1) TSC Act Status: V = Vulnerable E1 = Endangered species

Further assessment in the form of targeted surveys and habitat assessment are recommended to determine the presence of these species and suitability of vegetation assumed to provide habitat. Appropriate survey timing for each threatened flora species likely to occur is outlined in Table 4.3.

Table 4.3 Recommended survey timing for threatened flora species

SCIENTIFIC NAME	COMMON NAME	SURVEY TIMING	ASSOCIATED HABITAT (BVT)
<i>Desmodium campylocaulon</i>	Creeping Tick-trefoil	December - May	BR233
<i>Dichanthium setosum</i>	Bluegrass		BR196, BR233
<i>Digitaria porrecta</i>	Finger Panic Grass		BR186, BR233
<i>Homopholis belsonii</i>		December - April	BR186, BR233
<i>Swainsona murrayana</i>	Slender Darling Pea	September – February	BR233

4.1.3 THREATENED FAUNA

Results of threatened species database searches identified 22 threatened fauna species listed under the TSC Act as being known to occur or considered likely to occur within locality of the study area. Of these one Vulnerable species, the Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*), was recorded. A further seven species were considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the absence of suitable habitat. Table 4.4 outlines those TSC Act listed fauna species with a moderate likelihood of occurring within the study area whilst Appendix D provides the complete likelihood of occurrence assessment.

Table 4.4 TSC listed threatened fauna with a moderate or high likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	LIKELIHOOD OF OCCURRENCE ASSESSMENT
Birds			
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	Moderate. Records within the locality. Marginal and fragmented woodland habitat available. Records within the locality. Marginal and fragmented woodland habitat available.
<i>Circus assimilis</i>	Spotted Harrier	V	Moderate. Records within the locality and potential habitat recorded.
<i>Neophema pulchella</i>	Turquoise Parrot	V	Moderate. Records within the locality. Marginal and fragmented habitat recorded within the study area.
<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)	V	Recorded. Species was recorded within small group in the Northern section of the study area (Segment 3).
Mammals			
<i>Chalinolobus picatus</i>	Little Pied Bat	V	Moderate. Records within locality. Roosting habitat very limited.
<i>Phascolarctos cinereus</i>	Koala (NSW, ACT & QLD - excluding SE QLD)	V	Moderate. Previously recorded within locality. Vegetation within landscape highly fragmented and limited connectivity to larger bushland areas. Marginal suitable habitat recorded. Rare occurrences cannot be discounted
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	Moderate. Previously recorded within locality. Marginal and fragmented habitat, and hollow-bearing trees recorded within study area.

(1) TSC Act status: V = Vulnerable

4.1.4 ENDANGERED POPULATIONS

The results of background research did not identify any TSC Act listed endangered population known or likely to occur within the locality.

4.2 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (LISTED UNDER EPBC ACT)

4.2.1 THREATENED ECOLOGICAL COMMUNITIES

Database searches identified five threatened ecological communities listed under the EPBC Act as being considered likely to occur within locality of the study area, of these one community, *Weeping Myall Woodlands*, was recorded.

4.2.1.1 WEEPING MYALL WOODLANDS

One Commonwealth listed threatened ecological community was recorded within the study area being *Weeping Myall Woodlands*. This community is listed as Endangered under the EPBC Act and corresponds with PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion.

In respect to *Weeping Myall Woodlands* condition thresholds each patch must fit the following criteria to qualify for EPBC listing:

- The tree canopy is dominated (at least 50% of trees present) by living, dead or defoliating Weeping Myall trees; and
- The overstorey must have at least 5% tree canopy cover or at least 25 dead or defoliated mature Weeping Myall trees/ha; and
- The area is at least 0.5ha in size; and
- The 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 4m tall and of the vegetative cover present, 50% is comprised of native species.

The occurrence of PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion within the study area is restricted to isolated patches and linear strips fringing Newell Highway.

Rapid assessments of PCT 27/BR233 revealed the occurrences within the study area to have a structurally intact canopy cover where 50% is comprised of native species being dominated by *Acacia pendula* (Weeping Myall) however due to the variable area of vegetation patches, only the larger patches of PCT 27/BR233 met the EPBC Act listing criteria and will be considered to form *Weeping Myall Woodlands EEC*. Further assessment is required to determine the amount of PCT27/BR233 which meets EPBC Act status.

4.2.2 THREATENED FLORA

Results of threatened species database searches identified six threatened plant species listed under the EPBC Act as being known to occur or considered likely to occur within locality of the study area. Of these, four species were considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the absence of suitable habitat. Table 4.5 outlined those EPBC listed flora species with a moderate likelihood of occurring within the study area whilst Appendix B provides the complete likelihood of occurrence assessment. Targeted surveys are recommended to confirm the presence or inform likelihood of the below species occurring, Table 4.3 outlines appropriate timing for targeted threatened flora surveys.

Table 4.5 EPBC listed species of flora considered to have a moderate to high likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS ¹	LIKELIHOOD OF OCCURRENCE ASSESSMENT
<i>Dichanthium setosum</i>	Bluegrass	V	Moderate. Brown clay soils, plant community types and several understorey species associated with <i>Dichanthium setosum</i> were recorded within the study area.
<i>Digitaria porrecta</i>	Finger Panic Grass	E	Moderate. Though not previously recorded within locality, associated habitat presents within study area.
<i>Homopholis belsonii</i>		V	Moderate. Associated habitat and soils type present within the study area. Recent records within the locality.
<i>Swainsona murrayana</i>	Slender Darling Pea	V	Moderate. Previously recorded within locality, associated vegetation recorded within the study area.

(1) EPBC Act Status: V = Vulnerable, E = Endangered

4.2.3 THREATENED FAUNA

Results of threatened species database searches identified 21 threatened fauna species listed under the EPBC Act as being known to occur or considered likely to occur within locality of the study area. Of these one species; the Koala (*Phascolarctos cinereus*) was considered to have a moderate likelihood of occurring within the study area based on recorded occurrence within the locality and the availability of potential habitat. The remaining species are considered to have a low likelihood of occurrence within the study area due to the absence of suitable habitat. Table 4.6 outlines those EPBC listed fauna species with a moderate likelihood of occurring within the study area whilst Appendix D provides the complete likelihood of occurrence assessment.

Table 4.6 EPBC listed species of fauna considered to have a moderate to high likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS	LIKELIHOOD OF OCCURRENCE ASSESSMENT
<i>Phascolarctos cinereus</i>	Koala	V	Moderate.

(1) EPBC Act Status: V = Vulnerable

4.2.4 ENDANGERED POPULATIONS

The results of background research of the likely occurrence of threatened species did not identify any EPBC Act listed endangered population known or likely to occur within the locality.

4.2.5 MIGRATORY SPECIES

Fauna records database searches returned nine species of threatened migratory birds for which there are records and/or potential habitat occurring within the locality. Of these species, though acknowledged that rare or intermittent occurrences are possible, all were assessed as having a low likelihood of occurrence within the study area due to the lack of suitable habitat recorded.

4.2.6 WORLD AND NATIONAL HERITAGE

Database searches revealed Moree Baths and Swimming Pool, a National Heritage property within locality of the study area. Moree Baths and Swimming Pool is located within Moree township and opened in 1895 when the first bore that tapped into the Great Artesian Basin was completed. The site is listed as National Heritage item as the place where student protests in 1965 highlighted the legalised segregation and racism experienced by Aboriginal people in outback Australia (Department of the Environment and Energy, 2017a).

4.2.7 WETLANDS OF INTERNATIONAL IMPORTANCE

Database searches revealed no wetlands of international importance within the locality of the study area. Gwydir Wetlands, listed as a RAMSAR wetland is situated 23 km to the West of Moree.

4.3 CRITICAL HABITAT

Database searches revealed no critical habitat listed under either the TSC or EPBC Act as occurring with the locality.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

This PEI summarises the findings of the desktop study and initial phases of field surveys completed to identify the broad-scale distribution of key ecological attributes, including associated values and constraints across the study area.

Key ecological attributes include:

- The presence of the Endangered ecological community, *Weeping Myall Woodlands* which is:
 - listed under the EPBC Act as *Weeping Myall Woodlands*
 - listed under the TSC Act as *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions*
- The presence of a community nominated for listing under the EPBC Act, Poplar Box Grassy Woodland on Alluvial Plains
- The presence of Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*) within the study area
- Potential habitat for:
 - five threatened flora species listed under the TSC Act
 - seven threatened fauna species listed under the TSC Act
 - four threatened flora species listed under the EPBC Act
 - one fauna species listed under the EPBC Act.
- The presence of Class 3 Key Fish Habitat (Nee Nee Creek, Gil Gil Creek, Marshall Ponds Creek and Skinners Creek)

The potential risks on the ecological values include:

- Increased habitat fragmentation through widening Newell Highway
- Potential weed invasion and spread into adjacent sensitive habitats (Large patches of EPBC listed *Weeping Myall Woodlands* within close proximity)
- Introduction of pathogens into the environment such as *Phytophthora cinnamomi* and *Uredo rangelii* (Myrtle Rust).

5.2 RECOMMENDATIONS

The recommendations to reduce the biodiversity impacts of the development are to:

- Where possible, avoid areas of:
 - PCT 27/BR233 Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion which are/may be consistent with:
 - TSC Act listed Weeping Myall Woodlands and Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions

- EPBC Act listed *Weeping Myall Woodlands*
 - PCT 56 Poplar Box Grassy Woodland on Alluvial Plains, a community nominated for listing as Endangered under the EPBC Act. Condition thresholds assessment may be required if this nomination is adopted.
 - Key Fish Habitat where possible as temporary or permanent blockage (detailed further in Section 219 of the *Fisheries Management Act*) may warrant a Part 7 approval under FM Act.
 - Develop site specific mitigation measures to ameliorate any residue indirect impacts to biodiversity.
-

5.3 FUTURE ASSESSMENT

Once the detailed design is finalised, the ecological value and expected impacts to flora and fauna species and areas of high ecological value should be confirmed by a specialist including targeted surveys for threatened flora and fauna and detailed vegetation surveys to verify vegetation boundaries.

Measures to minimise the above impacts should be progressed through design. Offset calculations and strategies should be developed early in the design and assessment process.

Residual impacts of the proposal on native vegetation and habitats are most likely to require biodiversity offsets in accordance with the NSW Biodiversity Conservation Act 2016 and Draft Biodiversity Conservation Legislation 2017 subject to assessment under the Draft Biodiversity Assessment Methodology (BAM) 2017.

6 LIMITATIONS

6.1 SCOPE OF SERVICES

This environmental site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

6.2 RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

6.3 ENVIRONMENTAL CONCLUSIONS

In accordance with the scope of services, WSP has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

6.4 REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client (and no other party), but may be relied upon by the Environment Protection Authority acting in its capacity as the administering authority (as defined in the Environmental Protection Act 1994 (QLD) (EP Act). WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

The Environment Protection Authority in its capacity as the administering authority (as defined in the EP Act) may consider and rely upon the report for the purposes of making a decision under Section 396 of the EP Act and for the administration of matters under and in accordance with that section.

6.5 OTHER LIMITATIONS

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

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APPENDIX A

RECORDED FLORA



FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet				0.4/5				
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern				2/50				
Aizoaceae	<i>Tetragonia moorei</i>	Annual Spinach				5/50	2/50			
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed			0.4/10					
Amaranthaceae	<i>Alternanthera nodiflora</i>	Common Joyweed							0.4/2	
Amaranthaceae	<i>Alternanthera spp.</i>									x
Apiaceae	<i>Ammi majus*</i>	Bishops Weed								x
Apocynaceae	<i>Alstonia constricta</i>	Quinine Bush								x
Apocynaceae	<i>Nerium oleander*</i>	Oleander								x
Asclepiadaceae	<i>Gomphocarpus fruticosus*</i>	Narrow-leaved Cotton Bush								x
Asteraceae	<i>Aster sp.*</i>				0.4/3				0.4/1	
Asteraceae	<i>Aster subulatus*</i>	Wild Aster								x
Asteraceae	<i>Bidens pilosa*</i>	Cobblers Pegs								x
Asteraceae	<i>Brachyscome ciliaris</i>	Variable Daisy						2/50		
Asteraceae	<i>Brachyscome ciliocarpa</i>	Showy Daisy					1/25			
Asteraceae	<i>Chrysocephalum apiculatum</i>	Common Everlasting						2/15		
Asteraceae	<i>Cirsium vulgare*</i>	Spear Thistle								x
Asteraceae	<i>Conyza albida*</i>	Tall Fleabane				0.4/1				
Asteraceae	<i>Craspedia sp.</i>				2/30					
Asteraceae	<i>Craspedia variabilis</i>	Variable Billy-buttons								x
Asteraceae	<i>Cymbonotus lawsonianus</i>	Bears Ear			0.4/6					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Asteraceae	<i>Galinsoga parviflora</i> *	Gallant Soldier								x
Asteraceae	<i>Gamochaeta calviceps</i> *	Silky Cudweed								x
Asteraceae	<i>Helianthus annuus</i> *	Common Sunflower			5/15				0.4/3	
Asteraceae	<i>Hypochaeris glabra</i> *	Smooth Catsear			1/6				0.4/1	
Asteraceae	<i>Ixiolaena brevicompta</i>							1/20		
Asteraceae	<i>Onopordum acanthium</i> *								0.4/5	
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed								x
Asteraceae	<i>Silybum marianum</i> *	Variiegated Thistle								x
Asteraceae	<i>Sonchus oleraceus</i> *	Common Sowthistle					1/15		0.4/3	
Asteraceae	<i>Vittadinia sulcata</i>	Furrowed New Holland Daisy				0.4/3				
Asteraceae	<i>Xanthium italicum</i> *	Hunter Burr							1/20	
Boraginaceae	<i>Echium plantagineum</i> *	Paterson's Curse			10/50			0.4/3	0.4/3	
Brassicaceae	<i>Brassica rapa</i> *	White Turnip						0.4/10		
Brassicaceae	<i>Brassica sp.</i> *				1/10					
Brassicaceae	<i>Capsella bursa-pastoris</i> *	Shepherds Purse				0.4/10				
Brassicaceae	<i>Rapistrum rugosum</i> *	Turnip Weed					5/50			
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear					3/25			
Cactaceae	<i>Opuntia stricta</i> *	Prickly Pear				2/1	1/1			
Campanulaceae	<i>Wahlenbergia communis</i>	Tufted Bluebell			3/100	0.4/15		1/60		
Capparaceae	<i>Capparis lasiantha</i>	Nepine						1/1		
Capparaceae	<i>Capparis mitchellii</i>	Native Orange				0.4/1				
Casuarinaceae	<i>Casuarina cristata</i>	Belah				30/20		2/1		

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Celastraceae	<i>Maytenus cunninghamii</i>	Yellow-berry Bush				15/3				
Chenopodiaceae	<i>Atriplex prostrata*</i>	Hastate Orache					0.4/1			
Chenopodiaceae	<i>Chenopodium desertorum</i>	Frosted Goosefoot								x
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush			2/10	2/20	1/1			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush							1/10	
Chenopodiaceae	<i>Einadia nutans subsp. nutans</i>						2/100			
Chenopodiaceae	<i>Einadia nutans subsp. oxycarpa</i>						1/5		1/5	
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed				1/10	3/20		1/4	
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush				1/20	2/10			
Chenopodiaceae	<i>Maireana decalvans</i>	Black Cotton Bush								x
Chenopodiaceae	<i>Rhagodia spinescens</i>	Hedge Saltbush			1/10		2/50	0.4/2	1/3	
Chenopodiaceae	<i>Sclerolaena divaricata</i>	Tangled Copperburr								x
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Roly-poly			5/3		2/10			
Chenopodiaceae	<i>Sclerolaena muricata var. muricata</i>	Black Roly-poly								x
Chenopodiaceae	<i>Sclerolaena muricata var. semiglabra</i>	Dark Roly-poly								x
Commelinaceae	<i>Commelina sp.</i>						0.4/5			
Convolvulaceae	<i>Convolvulus sp.</i>						0.4/2			
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed				0.4/10				
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine								x
Cyperaceae	<i>Bulbostylis barbata</i>				0.4/3					

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Poaceae	<i>Eleusine indica</i> *	Crowsfoot Grass								x
Poaceae	<i>Enteropogon acicularis</i>	Spider Grass			3/25		1/15			
Poaceae	<i>Eragrostis curvula</i> *	African Lovegrass				1/15				
Poaceae	<i>Eragrostis sp.</i>									x
Poaceae	<i>Eriochloa sp.</i>								0.4/10	
Poaceae	<i>Hyparrhenia hirta</i> *	Coolatai Grass						1/25		
Poaceae	<i>Lachnagrostis filiformis</i>	Common Blown-grass								x
Poaceae	<i>Leptochloa digitata</i>	Umbrella Canegrass							2/40	
Poaceae	<i>Lolium sp.</i>				1/10					
Poaceae	<i>Panicum decompositum</i>	Native Millet			0.4/3					
Poaceae	<i>Panicum effusum</i>	Hairy Panic			20/100	15/100	2/25			
Poaceae	<i>Paspalidium caespitosum</i>	Brigalow Grass				0.4/10		2/50	1/20	
Poaceae	<i>Paspalidium sp.</i>					0.4/10				
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum								x
Poaceae	<i>Rytidosperma bipartitum</i>					0.4/5				
Poaceae	<i>Rytidosperma caespitosum</i>	Ringed Wallaby Grass						1/10		
Poaceae	<i>Rytidosperma erianthum</i>	Hill Wallaby-grass								x
Poaceae	<i>Sorghum halepense</i> *	Johnson Grass								x
Poaceae	<i>Sporobolus actinocladius</i>	Katoora Grass					4/50			
Poaceae	<i>Sporobolus mitchellii</i>	Rats Tail Couch			1/15					
Poaceae	<i>Sporobolus sp.</i>									x
Poaceae	<i>Urochloa sp.</i>							0.4/15	1/20	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Poaceae	<i>Walwhalleya prolata</i>						15/50	2/80		
Polygonaceae	<i>Rumex crispus*</i>	Curled Dock			1/20					
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed								x
Primulaceae	<i>Anagallis arvensis*</i>	Scarlet/Blue Pimpernel							0.4/3	
Proteaceae	<i>Grevillea robusta</i>	Silky Oak								x
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff			1/15				0.4/10	
Rubiaceae	<i>Galium sp.</i>									x
Rubiaceae	<i>Richardia brasiliensis*</i>	Mexican Clover								x
Rutaceae	<i>Geijera parviflora</i>	Wilga				1/1				
Santalaceae	<i>Exocarpos aphyllus</i>	Leafless Ballart				15/1				
Sapindaceae	<i>Alectryon oleifolius</i>	Western Rosewood, Bonaree								x
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood						4/1		
Solanaceae	<i>Lycium ferocissimum*</i>	African Boxthorn				1/6				
Solanaceae	<i>Physalis ixocarpa*</i>	Ground Cherry							0.4/10	
Solanaceae	<i>Solanum esuriale</i>	Quena			5/15		1/15			
Solanaceae	<i>Solanum nigrum*</i>	Black-berry Nightshade								x
Solanaceae	<i>Solanum parvifolium</i>					0.4/5				
Urticaceae	<i>Urtica incisa</i>	Stinging Nettle								x
Verbenaceae	<i>Glandularia aristigera*</i>				2/25	0.4/5		2/60		
Verbenaceae	<i>Verbena bonariensis*</i>	Purpletop								x
Verbenaceae	<i>Verbena officinalis*</i>	Common Verbena							0.4/10	

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS	EPBC ACT STATUS	PCT 56	PCT 56	PCT 27	PCT56	PCT78	RANDOM MEANDER
					Q1	Q2	Q3	Q4	Q5	
Zygophyllaceae	<i>Tribulus terrestris</i> *	Catshead					0.4/5			

* denotes exotic species

Species marked with 'x' were recorded during random meanders

Cover and abundance for each species was recorded in the following format, cover/abundance eg. 2/25

A cover of 0.4% indicates less than 1%

This flora species list was recorded between Narrabri and North of Moree and was used to ground-truth vegetation communities across study areas for the Newell Highway Preliminary Ecological Investigation of both Narrabri to Moree and North Moree.

APPENDIX B

THREATENED FLORA LIKELIHOOD OF OCCURRENCE



FAMILY NAME	SPECIES NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
Surianaceae	<i>Cadellia pentastylis</i>	Ooline	V	V	Occurs west from near Tenterfield and north from Terry Hie Hie (Royal Botanic Gardens, 2005). Grows mainly in vine thickets or dry rainforest, and more rarely occurs in woodlands. It is a relict rainforest species and tends to favour upper and mid slope positions, often with a northerly aspect. It commonly occurs on sandy-loam to clay soils of low to medium fertility. It can occur in pure stands or in a mixed community on the slopes of residual sandstone ranges and scarps (Department of Environment and Conservation, 2007).	PMST	Low. Preferred habitat not within study area.
Fabaceae (Faboideae)	<i>Desmodium campylocaulon</i>	Creeping Tick-trefoil	E1		Occurs chiefly in the Collarenebri and Moree districts in the north-western plains of NSW. Also occurs in the NT and Darling Downs district of south-eastern Queensland. It grows in grassland on brown clay soil plains, often in gilgais, usually with <i>Astrebla</i> and <i>Iseilema</i> species. Found in crop pasture on cracking black clay. Associated species include <i>Acacia harpophylla</i> , <i>Astrebla pectinata</i> and <i>Sorghum</i> , <i>Dichanthium</i> and <i>Panicum</i> species (Department of Environment and Conservation, 2005).	BioNet	Moderate. Brown clay soils, plant community types and several understorey species associated with <i>Desmodium campylocaulon</i> were recorded within the study area.
Poaceae	<i>Dichanthium setosum</i>	Bluegrass	V	V	Grows in woodland and grassland (Harden, 1993). On the New England Tablelands and North West Slopes it grows on stony red-brown hard-setting soils over basalt, or on black soil (Department of Environment and Conservation, 2007).	PMST	Moderate. Though not previously recorded within locality, associated habitat present within study area.
Poaceae	<i>Digitaria porrecta</i>	Finger Panic Grass	E1	E	In NSW it occurs in north western slopes and north western plains subdivisions (Royal Botanic Gardens, 2004) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Department of Environment and Conservation, 2007).	BioNet	Moderate. Associated habitat and soils type present within the study area. Recent records within the locality.

FAMILY NAME	SPECIES NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
Poaceae	<i>Homopholis belsonii</i>		E1	V	Occurs north from the Warialda district. It grows in dry woodland on poor soils such as belah (Royal Botanic Gardens, 2005, Department of Environment and Conservation, 2007)	BioNet, PMST	Moderate. Previously recorded within locality, associated vegetation recorded within the study area.
Fabaceae (Faboideae)	<i>Swainsona murrayana</i>	Slender Darling Pea	V	V	Found throughout NSW, it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated. (Office of Environment & Heritage, 2014).	PMST	Moderate. Associated soils types and vegetation present within the study area.

FAMILY NAME	SPECIES NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
Asclepiadaceae	<i>Tylophora linearis</i>		E1	E	Majority of records occur in the central western region. Records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Also has been recorded Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of <i>Eucalyptus fibrosa</i> , <i>Eucalyptus sideroxylon</i> , <i>Eucalyptus albens</i> , <i>Callitris endlicheri</i> , <i>Callitris glaucophylla</i> and <i>Allocasuarina luehmannii</i> . Also grows in association with <i>Acacia hakeoides</i> , <i>Acacia lineata</i> , <i>Melaleuca uncinata</i> , <i>Myoporum</i> species and <i>Casuarina</i> species. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later (Office of Environment & Heritage, 2015).	PMST	Low. Not previously recorded within locality, no associated plant community types were recorded within the study area.

(1) TSC Act Status: V= Vulnerable, E1= Endangered Species

(2) EPBC Act Status: V= Vulnerable, E=Endangered

(3) PMST = Protected Matters Search Tool

APPENDIX B REFERENCES

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APPENDIX C

RECORDED FAUNA



SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS
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Birds			
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		
<i>Acridotheres tristis</i> *	Common Myna*		
<i>Anas superciliosa</i>	Pacific Black Duck		
<i>Anhinga melanogaster</i>	Darter		
<i>Aquila audax</i>	Wedge-tailed Eagle		
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		
<i>Cacatua roseicapilla</i>	Galah		
<i>Cacatua sanguinea</i>	Little Corella		
<i>Cisticola exilis</i>	Golden-headed Cisticola		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		
<i>Corcorax melanorhamphos</i>	White-winged Chough		
<i>Corvus coronoides</i>	Australian Raven		
<i>Corvus orru</i>	Torresian Crow		
<i>Cracticus nigrogularis</i>	Pied Butcherbird		
<i>Cracticus tibicen</i>	Australian Magpie		
<i>Cracticus torquatus</i>	Grey Butcherbird		
<i>Dacelo novaeguineae</i>	Laughing Kookaburra		
<i>Dicaeum hirundinaceum</i>	Mistletoebird		
<i>Egretta novaehollandiae</i>	White-faced Heron		
<i>Elanus axillaris</i>	Black-shouldered Kite		
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater		
<i>Falco cenchroides</i>	Nankeen Kestrel		
<i>Geopelia humeralis</i>	Bar-shouldered Dove		
<i>Geopelia striata</i>	Peaceful Dove		
<i>Grallina cyanoleuca</i>	Magpie-lark		
<i>Lichenostomus flavicollis</i>	Yellow-throated Honeyeater		
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater		
<i>Lichmera indistincta</i>	Brown Honeyeater		
<i>Malurus cyaneus</i>	Superb Fairy-wren		
<i>Malurus lamberti</i>	Variiegated Fairy-wren		
<i>Malurus leucopterus</i>	White-winged Fairy-wren		

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS
<i>Manorina flavigula</i>	Yellow-throated Miner		
<i>Milvus migrans</i>	Black Kite		
<i>Northiella haematogaster</i>	Blue Bonnet		
<i>Nymphicus hollandicus</i>	Cockatiel		
<i>Ocyphaps lophotes</i>	Crested Pigeon		
<i>Pardalotus punctatus</i>	Spotted Pardalote		
<i>Pelecanus conspicillatus</i>	Australian Pelican		
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant		
<i>Platycercus adscitus</i>	Pale-headed Rosella		
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater		
<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)	V	
<i>Psephotus haematonotus</i>	Red-rumped Parrot		
<i>Rhipidura leucophrys</i>	Willie Wagtail		
<i>Sericornis frontalis</i>	White-browed Scrubwren		
<i>Struthidea cinerea</i>	Apostlebird		
<i>Sturnus vulgaris</i> *	Common Starling*		
<i>Taeniopygia bichenovii</i>	Double-barred Finch		
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		
<i>Turdus merula</i> *	Common Blackbird*		
Mammals			
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		

* denotes exotic species

(1) TSC Act Status V = vulnerable

APPENDIX D

THREATENED FAUNA LIKELIHOOD OF OCCURRENCE



SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
Birds						
<i>Actitis hypoleucos</i>	Common Sandpiper		M	The Common Sandpiper frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Geering et al., 2007, Higgins and Davies, 1996). Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks (Higgins and Davies, 1996).	PMST	Low. Limited suitable habitat within the study area, occurrences after heavy rainfall cannot be discounted.
<i>Anseranas semipalmata</i>	Magpie Goose	V		The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation (Office of Environment and Heritage, 2017).	BioNet	Low. No suitable habitat within study area, intermittent occurrence during periods of heavy rainfall cannot be discounted.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Anthochaera phrygia</i> (syn. <i>Xanthomyza phrygia</i>)	Regent Honeyeater	CE	EM	Occurs mostly in box-ironbark forests and woodland and prefers wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with <i>Casuarina cunninghamiana</i> and <i>Amyema cambagei</i> are important for feeding and breeding. Spotted Gum and Swamp Mahogany forests are also important feeding areas in coastal areas. Important food trees include <i>Eucalyptus sideroxylon</i> (Mugga Ironbark), <i>E. albens</i> (White Box), <i>E. melliodora</i> (Yellow Box) and <i>E. leucoxyton</i> (Yellow Gum) (Garnett and Crowley, 2000).	PMST	Low. Not previously recorded within locality and important food trees not recorded. Intermittent occurrences in scattered woodland cannot be discounted.
<i>Apus pacificus</i>	Fork-tailed Swift		M	Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land (Higgins, 1999).	PMST	Low. Though limited habitat is available within the study area, fly-overs cannot be discounted.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Ardea (Bulbulcus) ibis</i>	Cattle Egret		M	Widespread and common according to migration movements and breeding localities surveys. Breeds in colonies, either mono-specific or with other Egrets/Herons. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The Cattle Egret is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (Department of the Environment, 2016a).	PMST	Low. Limited suitable habitat within the study area, occurrences after heavy rainfall cannot be discounted.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Ardea alba</i> (syn. <i>Ardea modesta</i>)	Eastern Great Egret		M	Eastern Great Egrets are widespread in Australia. They occur in all states/territories of mainland Australia and in Tasmania. In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the Top End of the Northern Territory. The Channel Country of south-western Queensland and north-eastern South Australia have at least 12 breeding colonies, and colonies are also known in the Darling Riverine Plains region of NSW and the Riverina region of NSW and Victoria. Minor breeding sites are widely scattered across the species' distribution and include sites in western Cape York Peninsula, the central coast of Queensland, north and north-eastern NSW, south-eastern South Australia, south-western Western Australia, the Kimberley region of Western Australia and the Barkly Tablelands in the Northern Territory. Non-breeding birds have been recorded across much of Australia, but avoid the driest regions of the western and central deserts. The Eastern Great Egret inhabits a wide range of wetland habitats which include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (Department of the Environment and Energy, 2017).	PMST	Low. Limited suitable habitat within the study area, occurrences after heavy rainfall cannot be discounted.
<i>Ardeotis australis</i>	Australian Bustard	E1		The ground-dwelling bird mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. Forages on insects, young birds, lizards, mice, leaves, seeds and fruit. Dispersive, with irregular widespread movements over long distances; movements are thought to be in response to habitat and climatic conditions; known to converge on areas with high mice numbers and in recently burnt areas (Marchant and Higgins, 2004)	BioNet	Low. Records within study area are 25 years old. Potential marginal habitat available, but project location is at the very eastern part of the species distribution. Rare occurrences cannot be discounted.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper		M	Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields (Pizzey and Knight, 2007).	PMST	Low. Limited suitable habitat.
<i>Calidris ferruginea</i>	Curlew Sandpiper	E1	M	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes (Morcombe, 2003).	PMST	Low. Limited suitable habitat.
<i>Calidris melanotos</i>	Pectoral Sandpiper		M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species frequents coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It is usually found in coastal or near coastal habitat but occasionally further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands (Higgins and Davies, 1996).	PMST	Low. Limited suitable habitat.
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V		The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites (Office of Environment & Heritage, 2015).	BioNet	Moderate. Records within the locality. Marginal and fragmented woodland habitat available. Records within the locality. Marginal and fragmented woodland habitat available.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Circus assimilis</i>	Spotted Harrier	V		Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. (Office of Environment & Heritage, 2012b)	BioNet	Moderate. Records within the locality and potential habitat recorded.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		The Varied Sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (Office of Environment & Heritage, 2016b).	BioNet	Low. Marginal Woodland habitat recorded. One record (1978) within locality.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1		Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). (Office of Environment & Heritage, 2014a)	BioNet	Low. No suitable habitat within study area.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Falco subniger</i>	Black Falcon	V		Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna (NSW Scientific Committee, 2013)	BioNet	Low. Records within locality (2001). Marginal Woodland habitat recorded.
<i>Gallinago hardwickii</i>	Latham's Snipe		M	Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed (Garnett and Crowley, 2000).	PMST	Low. No suitable habitat within study area, occurrences after heavy rainfall cannot be discounted.
<i>Geophaps scripta</i>	Squatter Pigeon	E1		Occurs in grassy woodlands and plains, preferring sandy areas and usually close to water. Feed on the ground, on seeds of grasses, herbs and shrubs, as well as insects. Nest on the ground (Department of the Environment, 2015).	PMST	Low. Marginal suitable habitat within study area, not previously recorded within locality.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Lives in dry forests and woodlands. Primary food is the mistletoes in the genus <i>Amyema</i> , though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett and Crowley, 2000).	BioNet, PMST	Low. Although the primary food source is present within the study area, the vegetation generally occurs in strips where this species is less likely to be found. Records within the locality are associate with larger patches of vegetation.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		M	Occurs in coastal areas including islands, estuaries, inlets, large rivers, inland lakes and reservoirs. Builds a huge nest of sticks in tall trees near water, on the ground on islands or on remote coastal cliffs (Pizzey and Knight, 2007).	BioNet, PMST	Low. Project location is outside the species known distribution. Rare occurrences cannot be discounted.
<i>Hirundapus caudacutus</i>	White-throated Needletail		M	Occurs in airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. Breeds in the northern hemisphere and migrates to Australia in October-April (Pizzey and Knight, 2007).	PMST	Moderate. Species is likely to occur within the study area as a fly-over occurrences.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (South-Eastern)	V		Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of species that has declined in woodland areas in south-eastern Australia (Traill and Duncan, 2000, Garnett and Crowley, 2000). The species appears unable to survive in remnants smaller than 100-200ha (Department of Environment and Conservation, 2005).	BioNet	Low. Vegetation generally occurs as isolated strips with limited or no connectivity to larger bushland areas.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Merops ornatus</i>	Rainbow Bee-eater		M	Usually occur in open or lightly timbered areas, often near water. Breed in open areas with friable, often sandy soil, good visibility, convenient perches and often near wetlands. Nests in embankments including creeks, rivers and sand dunes. Insectivorous, most foraging is aerial, in clearings (Higgins, 1999).	PMST	Low. Marginal suitable habitat within study area, not previously recorded within locality.
<i>Motacilla flava</i>	Yellow Wagtail		M	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA (Higgins et al., 2006).	PMST	Low. Marginal suitable habitat within study area, not previously recorded within locality.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		M	Widespread in eastern Australia. In Queensland, it is widespread but scattered in the east. In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. In Victoria, the species is widespread in the south and east, in the area south of a line joining Numurkah, Maldon, the northern Grampians, Balmoral and Nelson. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Satin Flycatchers mainly inhabit eucalypt forests, often near wetlands or watercourses. They generally occur in moister, taller forests, often occurring in gullies. They also occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline (Department of the Environment, 2016d, Pizzey and Knight, 2007).	PMST	Low. Marginal suitable habitat within study area, not previously recorded within locality.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Neophema pulchella</i>	Turquoise Parrot	V		The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby understorey, often in undulating or rugged country, or on footslopes. It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath. The Turquoise Parrot requires live or dead trees, stumps and logs for nesting, trees and shrubs for shelter, and seeding grasses and forbs (often beneath trees) for food. The Turquoise Parrot's nest is a cavity in a live or dead tree, stump or log, or even fence post often within 1-2 m of the ground. Hollows average about 0.5 m deep, with an entrance hole of 10 x 7 cm, and a nest chamber 12 x 9 cm in diameter (Higgins, 1999, Garnett and Crowley, 2000).	BioNet	Moderate. Records within the locality. Marginal and fragmented habitat recorded within the study area.
<i>Pomatostomus temporalis temporalis</i>	Grey-Crowned Babbler (Eastern subspecies)	V		The eastern form of the species formerly ranged throughout eastern Australia from South Australia, through Victoria and broadly through NSW and central Queensland but is now extinct in South Australia, coastal Victoria and the ACT. In NSW, it occurs on the western slopes and plains but is less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers et al., 1984, Schodde and Mason, 1999). Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. The species builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson, 1992). Grey-crowned Babblers are insectivorous and forage in leaf litter and on bark of trees (NSW Scientific Committee, 2001).	BioNet	Recorded.
<i>Rostratula australis</i> (syn. <i>R. benghalensis</i>)	Australian Painted Snipe (Painted Snipe)	E1	VM	Inhabits shallow, vegetated, temporary or infrequently filled wetlands, including where there are trees such as <i>Eucalyptus camaldulensis</i> (River Red Gum), <i>E. populnea</i> (Poplar Box) or shrubs such as <i>Muehlenbeckia florulenta</i> (Lignum) or <i>Sarcocornia quinqueflora</i> (Samphire). Feeds at the water's edge and on mudflats on seeds and invertebrates, including insects, worms, molluscs and crustaceans. Males incubate eggs in a shallow scrape nest (Garnett and Crowley, 2000).	PMST	Low. Intermittent occurrences cannot be discounted during periods of heavy rainfall.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
Fish						
<i>Maccullochella peelii</i>	Murray Cod		V	The Murray Cod was historically distributed throughout the Murray-Darling Basin (the Basin), which extends from southern Queensland, through New South Wales (NSW), the Australian Capital Territory (ACT) and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution, up to approximately 1000 m above sea level. It utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures. (Department of the Environment, 2016c)	PMST	Low. No available habitat within study area.
Mammals						
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats, mainly in areas with extensive cliffs and caves and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Churchill, 1998, Office of Environment and Heritage, 2011). Breeding habitat (maternity roosts) is located in roof domes in sandstone caves (Office of Environment and Heritage, 2011). Thought to forage below the forest canopy for small flying insects (Churchill, 1998).	PMST	Low. Little suitable habitat within the study area. Marginal and fragmented wooded foraging habitat recorded.
<i>Chalinolobus picatus</i>	Little Pied Bat	V		The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria and has been recorded in dry open forest, open woodland, Mulga woodlands, chenopod shrublands, Callitris forest and mallee (Churchill, 1998, Shelly, 1998). The species roosts and breeds in tree hollows, fissures or cracks, buildings, powerpoles, fenceposts, caves, cliff crevices, mine shafts and tunnels. Roost sites in caves are usually warm and dry but the species can tolerate roost temperatures of more than 40 degrees Celsius (Office of Environment and Heritage, 2017).	BioNet	Moderate. Records within locality. Roosting habitat very limited.

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Nyctophilus corbeni</i> (syn. <i>N. timoriensis</i>)	South-eastern Long-eared Bat (Corben's Long-eared Bat & Greater Long-eared Bat)	V	V	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke (<i>Allocasuarina leuhmanni</i>) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. (Department of the Environment, 2016b) (Office of Environment & Heritage, 2012a) (Churchill, 2008).	PMST	Low. Little suitable habitat within the study area. Marginal and fragmented Box woodland habitat was recorded, rare occurrences cannot be discounted.
<i>Phascolarctos cinereus</i>	Koala (NSW, ACT & QLD - excluding SE QLD)	V	V	The Koala 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. Inhabits eucalypt woodlands and forests. Koalas Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The preferred tree species vary widely on a regional and local basis. Some preferred species include Forest Red Gum <i>Eucalyptus tereticornis</i> , Grey Gum <i>E. punctata</i> . In coastal areas, Tallowwood <i>E. microcorys</i> and Swamp Mahogany <i>E. robusta</i> are important food species, while in inland areas White Box <i>E. albens</i> , Bimble Box <i>E. populnea</i> and River Red Gum <i>E. camaldulensis</i> are favoured (NSW National Parks and Wildlife Service, 1999, NSW National Parks and Wildlife Service, 2003, Department of the Environment and Energy, 2016). Hawks Nest and Tea Gardens Population and population in the Pittwater LGA listed as Endangered under the NSW TSC Act(Office of Environment & Heritage, 2016a, Office of Environment & Heritage, 2013).	BioNet	Moderate. Previously recorded within locality. Vegetation within landscape highly fragmented and limited connectivity to larger bushland areas. Marginal suitable habitat recorded. Rare occurrences cannot be discounted

SCIENTIFIC NAME	COMMON NAME	TSC ACT STATUS ¹	EPBC ACT STATUS ²	HABITAT	DATA SOURCE ³	LIKELIHOOD OF OCCURRENCE
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V		This species is widespread through tropical Australia and migrates to southern Australia in summer. Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts and breeds in tree hollows but has also been recorded roosting under exfoliating bark, in burrows of terrestrial mammals, in soil cracks and under slabs of rock and in the nests of bird and sugar gliders (Churchill, 2008, Office of Environment & Heritage, 2014b).	BioNet	Moderate. Previously recorded within locality. Marginal and fragmented habitat, and hollow-bearing trees recorded within study area.
Reptiles						
<i>Anomalopus mackayi</i>	Five-clawed Worm-skink	E1	V	Close to or on the lower slopes of slight rises, in grassy White Box Woodlands on moist black soils and River Red Gum-Coolabah-Bimble Box woodland on deep cracking loose clay soils. May also occur in grassland areas and open paddocks with scattered trees. Lives in deep tunnel-like burrows and deep soil cracks, coming close to the surface under fallen timber and litter, especially partly buried logs (Swan et al., 2004).	PMST	Low. Not previously recorded within locality. Marginal associated habitat recorded within the study area.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V		A partly arboreal, nocturnal species found in a range of habitats from rainforest and wet sclerophyll forest to the drier eucalypt forests of the western slopes. Feeds largely on frogs and lizards (Cogger, 2000).	BioNet	Low. Records within the locality, unlikely to occur within study area due to absence of prey items.

(1) TSC Act Status: V=Vulnerable, E1=Endangered Species, CE=Critically Endangered

(2) EPBC Act Status: V=Vulnerable, M=Migratory, VM=Vulnerable Migratory, EM=Endangered Migratory

(3) PMST = Protected Matters Search Tool

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APPENDIX E

EPBC PROTECTED MATTERS SEARCH





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: 26/06/17 13:35:05

[Summary](#)

[Details](#)

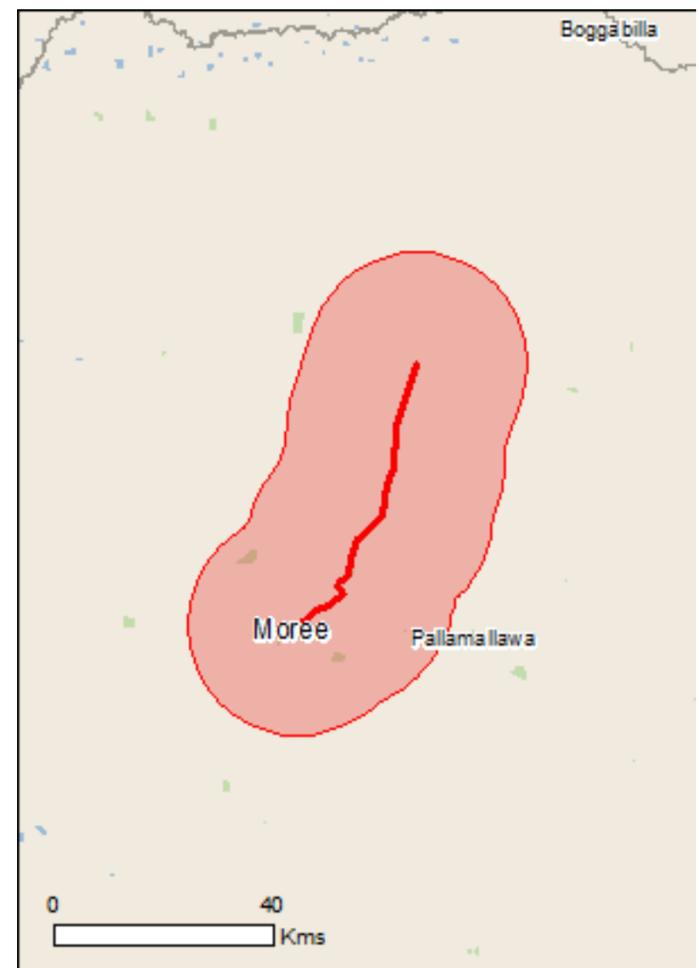
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

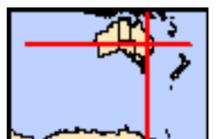
[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 20.0Km



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:	1
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	15
Listed Migratory Species:	9

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:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	14
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:	1
Regional Forest Agreements:	None
Invasive Species:	25
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Indigenous		
Moree Baths and Swimming Pool	NSW	Listed place

Wetlands of International Importance (Ramsar)		[Resource Information]
Name	Proximity	
Banrock station wetland complex	1000 - 1100km	
Gwydir wetlands: gingham and lower gwydir (big leather) watercourses	30 - 40km upstream	
Riverland	900 - 1000km upstream	
The coorong, and lakes alexandrina and albert wetland	1100 - 1200km	

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
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	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 likely to 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 may 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 may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat known 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
Plants		
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Homopholis belsonii Belson's Panic [2406]	Vulnerable	Species or species habitat may 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 may occur within area
Reptiles		
Anomalopus mackayi Five-clawed Worm-skink, Long-legged Worm-skink [25934]	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 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 may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may 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 - Telstra Corporation Limited

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		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
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 may 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 may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Midkin	NSW

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		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
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
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		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
Frogs		
Rhinella marina Cane Toad [83218]		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
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 within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		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		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		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.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

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

-29.454136 149.847152,-29.44921 149.859896,-29.434416 149.876883,-29.427012 149.8967,-29.418376 149.912273,-29.410983 149.922188,-29.406042 149.917945,-29.397416 149.912273,-29.392475 149.917945,-29.386312 149.929261,-29.362868 149.933518,-29.334487 149.944834,-29.299918 149.985895,-29.256699 149.991553,-29.231991 150.005712,-29.175147 150.008555,-29.082393 150.04253,-29.082393 150.04253

Acknowledgements

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- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-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](#)
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- [-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, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-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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