Species Impact Statement

Bellingen Shire Bridge Replacement

Bellingen Shire Council

9 August 2024

→ **The Power of Commitment**

Project name		Hobarts, Justins and Joyces Bridges Environmental Assessment					
Document title		Species Impact Statement | Bellingen Shire Bridge Replacement					
Project number		12611463					
File name		12611463-REP_Bellinger River Snapping Turtle Species Impact Statement.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	0	T. Moeser A Weatherall	N Clark S Lawer		A Oliver		29/08/23
S4	1	E. Odner T. Moeser N. Fokes	K Dalton		A Oliver		22/01/24
S4	2	N. Fokes	S Lawer		A Oliver		09/02/24
S4	3	N. Clark	S Lawer		A Oliver		31/05/24
S4	4	N. Clark	S Lawer		A Oliver		23/04/24
S4	5	N. Clark	S Lawer		A Oliver		09/08/24

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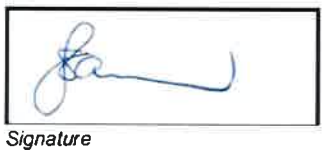
Declaration

This Species Impact Statement (SIS) has been prepared by GHD Pty Ltd in accordance with the requirements of Sections 7.20 and 7.21 of the *Biodiversity Conservation Act 2016* (BC Act), Section 7.6 of the *Biodiversity Conservation Regulation 2017*, and the requirements issued on behalf of the Chief Executive (CE) of the then Office of Environment and Heritage (OEH) dated 29 March 2019 (Appendix A).

The SIS was prepared principally by Shawn Lawer of GHD, on behalf of the applicant, Bellingen Shire Council. The applicant has read and understands the implications of the recommendations made in the statement and accepts that the recommendations may be placed as conditions of consent or concurrence for the proposal.



Signature

Shaun Lawer,

B. Urban and Regional Planning, MBA, MPIA

Technical Director, Planning and Environment

GHD Pty Ltd

I, John Fyfe, from Bellingen Shire Council, being the applicant for the replacement of Hobarts Bridge, Duffys Bridge, Justins Bridge, and Joyces Bridge in the Bellinger River have read and understood this Species Impact Statement. I understand the recommendations made in the statement and accept that they may be imposed as conditions of consent or concurrence for the action proposed.

Signature

John Fyfe

Group Leader, Infrastructure Services

Bellingen Shire Council

Qualifications and Experience of Author

Team Member	Qualifications	Relevant Experience
Dr Natalie Clark 	Doctor of Philosophy, University of Queensland, 2008 Honours, University of Queensland, 2004 Bachelor of Science majoring in Zoology and Marine Biology, University of Queensland, 2002	Natalie is the Business Group Leader of the South Queensland Natural Resource Management Group with over 15 years' experience in ecosystem monitoring, impact assessment and environmental management. She has a strong understanding of Commonwealth and State legislative requirements applicable to natural environments and projects. Natalie has recently delivered draft technical reports and EIS chapters for two PHES projects and has a detailed understanding of the design and operational aspects of PHES and major water infrastructure projects. Natalie was the technical lead for the flora, fauna and fish passage components of Urannah Water Scheme Project EIS, which included two PHES and a major water storage dam within Eungella. Technical reports and EIS chapters were produced for each component of the Project and include description of impacts, proposed avoidance and mitigation measures, assessment of significance and calculation of biodiversity offsets. Natalie engaged extensively with Commonwealth and State regulators during this project. Natalie was also the Project Manager for ecology surveys and early approvals support for the Capricornia Energy Hub PHES within Eungella. Natalie was the fishway scientist and environmental approvals lead for the Rookwood Weir Project over the 12-year period of the Project design and construction. In addition to leading the delivery of the ecology EIS chapters and technical reports, Natalie supported Sunwater with obtaining secondary approvals, and biodiversity offsets. Natalie led the design process for the development of an innovative fishway as well as the first specifically designed turtle ramp in Australia. Other major water infrastructure projects that Natalie has led within the local region include Big Rocks Weir EIS and Burdekin Fall Dam ecology surveys, Fitzroy Barrage and Tartus Weir environmental assessments.
Tim Moeser 	Central Queensland University BSc Aquatic Resource Management 2007	Tim is an Aquatic Ecologist with GHD based in Southeast Queensland. His background includes targeted surveys for threatened aquatic species, water quality monitoring, sediment and benthic sampling, habitat assessments and river restoration projects. Tim has worked in several regions in the field including North Queensland, Central Queensland, and Western Australia.

Team Member	Qualifications	Relevant Experience
Nicole Fokes 	Bachelor of Environmental Science (Ecological Conservation) Charles Sturt University 2021 Diploma Conservation and Land Management – NSW TAFE 2016	Nicole is a northern New South Wales ecologist with four years of experience within the environmental sector, with a particular focus on flora and fauna surveys, vegetation and habitat mapping, and environmental approvals, and ecological impact assessments. Nicole has developed strong field identification skills and is experienced in undertaking targeted flora and fauna surveys across a range of Queensland and New South Wales ecosystems. Nicole is skilled in surveys of birds, reptiles, mammals, frogs, and vegetation.
Elise Odner 	Bachelor of Science – Biology & Environmental Science, USQ 2022 Bachelor of Business, QUT 2019 Bachelor of Creative Industries, QUT 2019	Elise is a graduate ecologist with one year experience. She has been gaining experience in both terrestrial and aquatic projects and field work. The field opportunities that Elise has been involved in include water monitoring, protected plant survey, fauna trapping and translocation, pre-clearing fauna surveys, fauna spotting, habitat assessments, and environmental audits. Elise has undertaken fieldwork in several regions including, Queensland, New South Wales, and Western Australia.

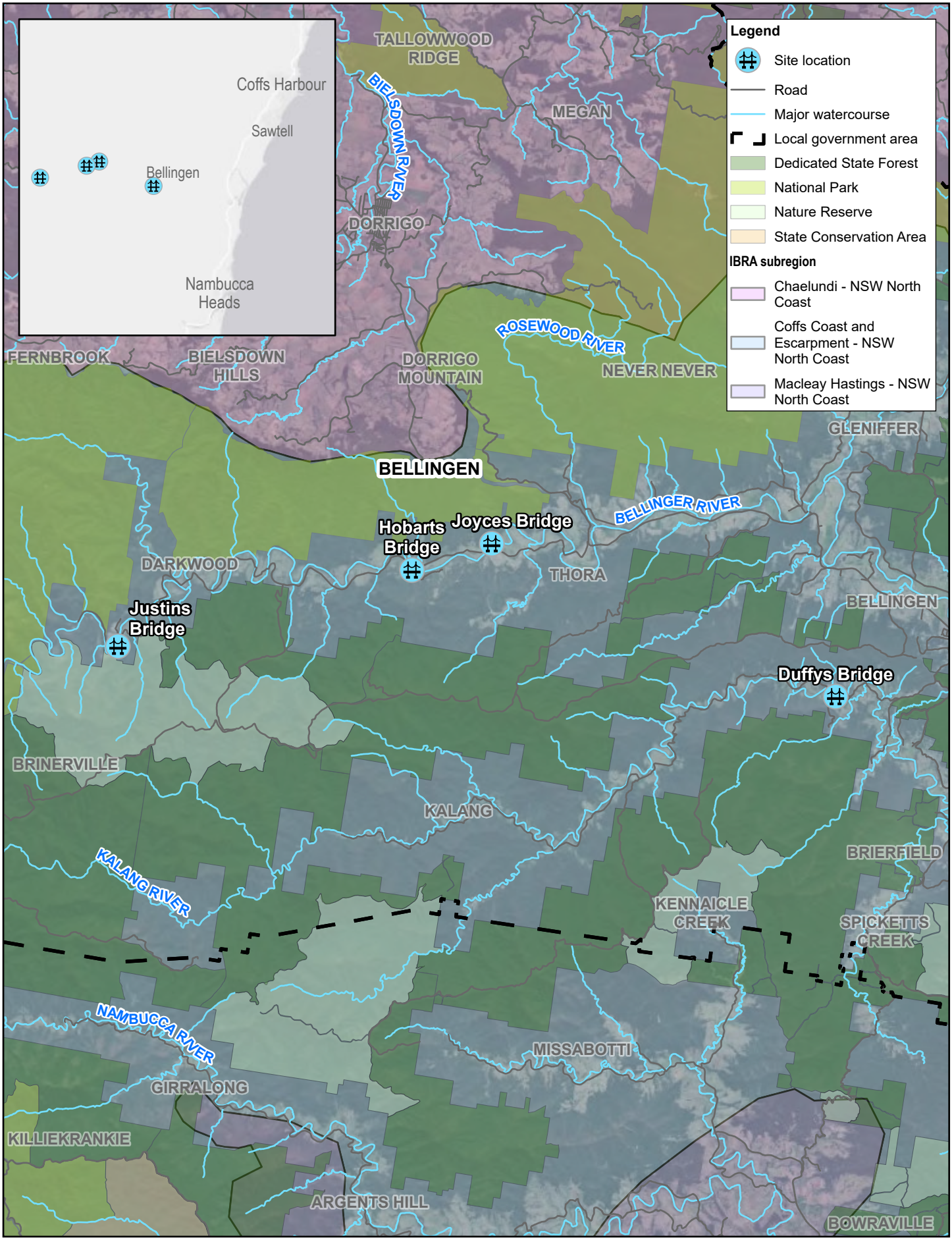
Abbreviations and definitions

Abbreviation	Definition
AHD	Australian Height Datum
ALA	Atlas of Living Australia
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BSC	Bellingen Shire Council
Environment Agency Head (EAH)	Secretary of the NSW Department of Planning and Environment (or delegate)
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Conservation status	Is regarded as the degree of representation of a species or community in formal conservation reserves
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DP	Deposited Plan, the plan number given to a subdivision that is registered by the Land Property Information.
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
LGA	Local Government Area
NSW	New South Wales
PCT	Plant community type - derived using the NSW PCT classification system
PMST	Protected Matters Search Tool
SIS	Species Impact Statement
SPRAT	Species Profile and Threats Database
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1. Contextual information

1.1 Project overview

Bellingen Shire Council (BSC) is responsible for managing road related transport infrastructure and providing safe and efficient access for the Local Government Area's (LGA's) road network. BSC has identified the existing structures at Hobarts, Justins, Joyces and Duffys Bridges within the Bellinger catchment are nearing the end of their useful life and require replacement to provide a safe and reliable crossing point for local traffic and emergency vehicles. Project overview is presented in Figure 1.1. BSC has since received government funding to replace these four bridges.



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Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Project overview

FIGURE 1.1

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Print date: 29 Jul 2024 - 10:44

Data source: World Imagery: Earthstar Geographics
World Light Gray Canvas Base: Esri, HERE, Garmin, USGS. GHD: site locations (2023); NSWSS: roads, watercourse, suburbs (2023); DCCEEW: IBRA (2023); DFSI: reserves (2024); SEED: state forest (2018).
Created by: mvandermerwe

1.2 Species Impact Statement Requirements

BSC is assessing the Project under Part 5 Division 5.1 of the *Environment Planning and Assessment Act 1979* (EP&A Act) and Part 7 of the *Biodiversity Conservation Act 2016* (BC Act). Through this process the potential for significant impacts to the Bellinger River Snapping Turtle (*Myuchelys georgesi*) were identified.

In 2023 a Species Impact Statement (SIS) was issued to the Biodiversity and Conservation Division of the Department of Planning and Environment (DP&E) as part of assessment of these proposed works. The focus of this SIS was an assessment of potential impacts to the Bellinger River Snapping Turtle (DPE 2023). Subsequently, BCD advised that a revised SIS was required that addressed potential impacts to known or potentially present threatened species or communities listed under the NSW BC Act or their habitat.

The purpose of a Species Impact Statement (SIS) is to:

– Allow the proponent to identify threatened species, ecological communities, or their habitats, assess the likely effect of impact from the activity on threatened species, ecological communities, or their habitats, and provide appropriate amelioration for adverse impacts resulting from the activity.
– Assist the Environment Agency Head (EAH) in assessing the activity in accordance with Part 7 of the Biodiversity Conservation Act 2016 (BC Act).

The EAH requirements for this SIS are attached at Appendix A.

Ecological values that are protected under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and which are not also protected under the NSW BC Act have not been included within this SIS and are expected to be addressed in a separate report detailing the potential impacts to Matters of National Environmental Significance.

The EAH requirements for this SIS identify the following species must be considered as candidate threatened species as they have either been recorded in the general area, are within the species' known geographic limits or their broad habitat preferences may be present in the study area (Table 1.1). Additional threatened species and communities are addressed throughout the report as relevant.

Table 1.1 Subject threatened species identified in the EAH requirements

Scientific Name	Common name	BC Act status
Birds		
Pandion cristatus	Eastern Osprey	Vulnerable
Ptilinopus magnificus	Wompoo Fruit-dove	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable
Mammals		
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable
Myotis macropus	Southern Myotis	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Reptiles		
Myuchelys georgesi	Bellinger River Snapping Turtle	Critically endangered

Scientific Name	Common name	BC Act status
Amphibians		
Mixophyes iteratus	Giant Barred Frog	Vulnerable

The EAH requirements for this SIS and the section within which they are addressed in this SIS are outlined in Table 1.2.

Table 1.2 EAH requirements for this SIS

EAH Requirements Section	EAH Requirement	SIS Section	SIS Heading
1	Form of the Species Impact Statement		Declaration
2. Contextual Information			
2.1	Description of the activity and study area	Section 1.1	Project overview
2.1.1	Describe the activity	Section 1.6	Proposed site activities
2.1.2	Define the study area	Section 1.5	Study site
2.2	Relevant maps and figures	Throughout report	
2.3	Vegetation	Section 2.3.3	Vegetation and flora
3. Initial assessment			
3.1	Identifying candidate threatened species	Section 2.2	Likelihood of occurrence
3.2	Identify subject threatened species	Section 2.2	Likelihood of occurrence
3.2.1	Habitat assessment to confirm suitable habitat	Section 4.2	Habitat assessment
3.2.2	Targeted survey	Section 4.3	Targeted threatened fauna surveys
3.2.3	Final review of the list of subject threatened species	Section 4.1	Fauna species
4. Assessment of likely impacts on threatened species			
4.1	Assessment of species likely to be affected	Section 5	Assessment of likely impacts on threatened species
4.2	Discussion of conservation status	Section 5	Assessment of likely impacts on threatened species
4.3	Discussion of local and regional abundance and distribution	Section 5	Assessment of likely impacts on threatened species
4.3.1	Discussion of other known local populations	Section 5	Assessment of likely impacts on threatened species
4.3.2	Discussion of habitat utilisation	Section 5	Assessment of likely impacts on threatened species
4.4	Assessment of habitat	Section 5	Assessment of likely impacts on threatened species
4.4.1	Description of habitat values	Section 5	Assessment of likely impacts on threatened species
4.4.2	Impacts on threatened species and/or population in the national park estate	Section 5	Assessment of likely impacts on threatened species
4.5	Discussion of the likely effect of the activity at local and regional scales	Section 5	Assessment of likely impacts on threatened species
4.5.1	Significance within a local context	Section 5	Assessment of likely impacts on threatened species

EAH Requirements Section	EAH Requirement	SIS Section	SIS Heading
4.5.2	Discussion of connectivity	Section 5	Assessment of likely impacts on threatened species
4.5.3	Consideration of threatening processes	Section 5	Assessment of likely impacts on threatened species
4.6	Description of feasible alternatives	Section 6.1	Feasible alternatives
5. Assessment of likely impacts on threatened ecological communities			
5.1	Assessment of ecological communities (both endangered and critically endangered) likely to be affected	N/A	
5.2	Discussion of conservation status	N/A	
5.2.1	Significance within a local context	N/A	
5.2.2	Discussion of corridor values	N/A	
5.2.3	Discussion of regional significance	N/A	
5.2.4	Impacts on Ecological Communities in the national park estate	N/A	
5.3	Assessment of habitat	N/A	
5.3.1	Description of disturbance history	N/A	
5.3.2	Extent of habitat removal	N/A	
5.4	Description of feasible alternatives	N/A	
6. Ameliorative measures			
6.1	Description of ameliorative	Section 6	Avoidance measures
6.1.1	Biodiversity impact amelioration strategy	Section 7	Impact assessment, mitigation and management measures
6.1.2	Long-term management strategies	Section 7	Impact assessment, mitigation and management measures
7	Statement of long-term viability	Section 5	Assessment of likely impacts on threatened species
8. Additional information			
8.1	Qualifications and experience		Qualifications and experience of author
8.2	Other approvals required for the development or activity	Section 8	Other approvals required for the Project
8.3	Licensing matters relating to the survey		

1.3 Terminology

Table 1.3 outlines the Terminology used throughout the SIS.

Table 1.3 Terminology used in the SIS

Term	Definition
Study area	Area or areas that were included in desktop searches and field ecology surveys. The Study area surround each bridge structure, primarily comprising the bridge, roads and road verges and the cleared land.
Project area	The extended area within 10 km of each of the bridge sites.
Project footprint	The exact area impacted by the construction of each bridge.
Project works	The construction of the bridges.

Term	Definition
Conservation significant species	Species listed as Extinct, Extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent under the EPBC act.
Threatened species	Species defined as critically endangered, endangered, vulnerable under the *Biodiversity Conservation 2017* (BC Act).

1.4 Purpose and scope of this report

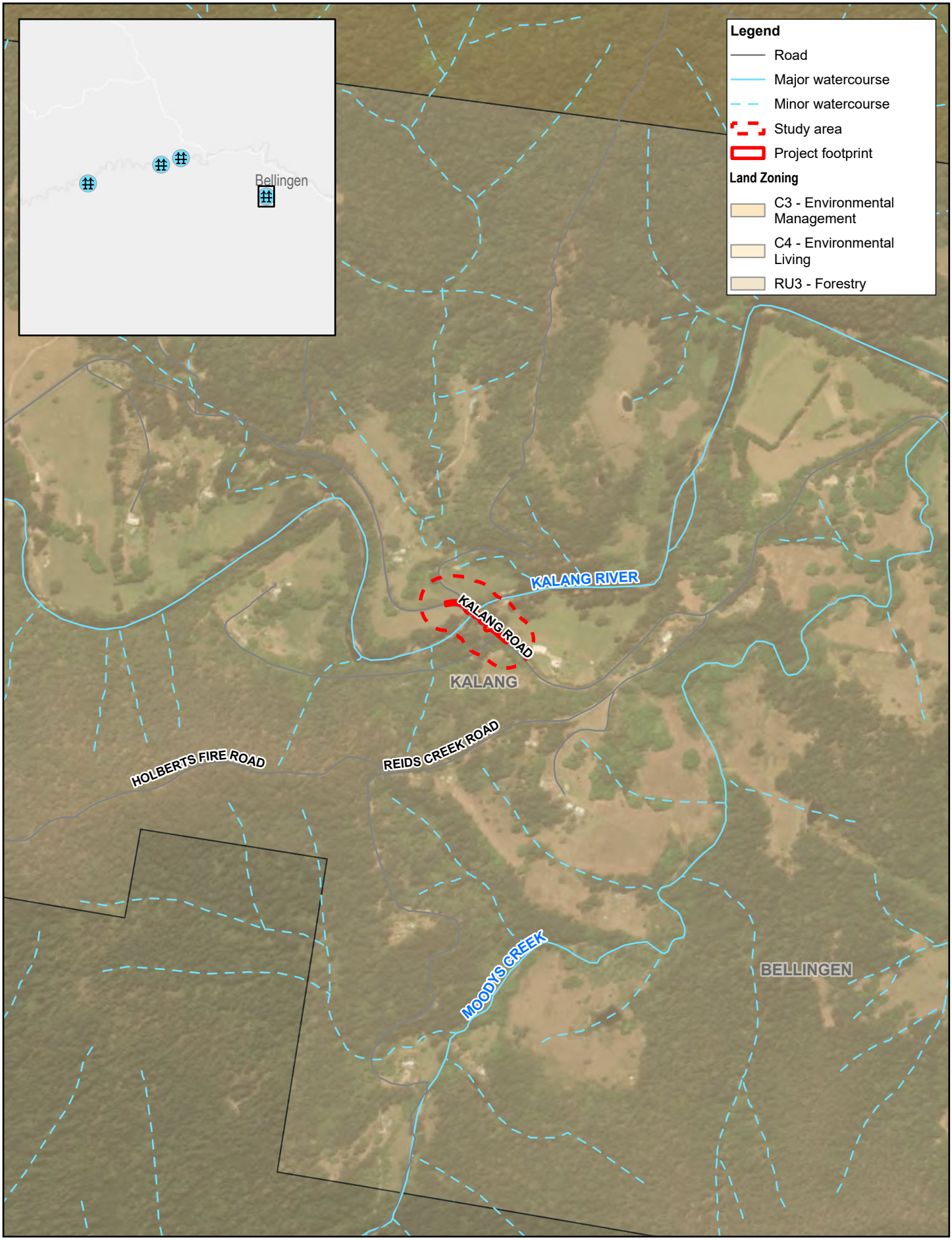
This SIS has been prepared by GHD Pty Ltd (GHD) on behalf of BSC to assess the potential impacts to conservation significant, and threatened, species and communities, from the proposed bridge replacements and identify management actions to be implemented during construction and operation. The report should be read in conjunction with assumptions and limitations outlined within Appendix B. The assessment has been undertaken in accordance with Section 7 of the *Biodiversity Conservation Regulation 2017* and includes:

– Description of the proposed development for Hobarts, Justins, Joyces and Duffys Bridge replacements.
– Description of the potential conservation significant species impacted by development works including:
  - A general description of the species and study area that is likely to be affected by the action.
  - An assessment of the species presence within the study area likely to be affected by the action.
  - Details of the species local, regional and State-wide conservation status, the key threatening processes and habitat requirements.
  - An estimate of the local and regional abundance of the threatened biota.
  - An assessment of whether the threatened biota is adequately represented in conservation reserves (or other similar protected areas) in the region.
  - An assessment of whether any of the threatened biota is at the limit of its known distribution.
  - A full description of the type, location, size and condition of the habitat of the threatened biota and details of the distribution and condition of similar habitats in the region.
– Assessment of potential impacts to the threatened biota as a result of Project construction and operation.
– Description of avoidance, mitigation and management measures to be adopted during construction and operation.

1.5 Project Area

The Project occurs generally within the New South Wales North Coast Bioregion, Northern Rivers Catchment Management Authority and the BSC LGA. The Project overview is shown in Figure 1.1 and each bridges locality is show in Figure 1.2, Figure 1.3, Figure 1.4 and Figure 1.5.

The Project Area referred to in this assessment is a larger area within 10 km of each of the bridge sites (i.e. includes areas that are outside the proposed impact areas). The additional information captured for the Project Area has been used to provide context to determine the significance of ecological features identified within the Study Area. For example, whether the ecological features are part of a larger area, or whether there are potential impacts on other ecological features outside the Study Area. The Project Area was only assessed at a desktop level.



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Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project locality

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Figure 1.2

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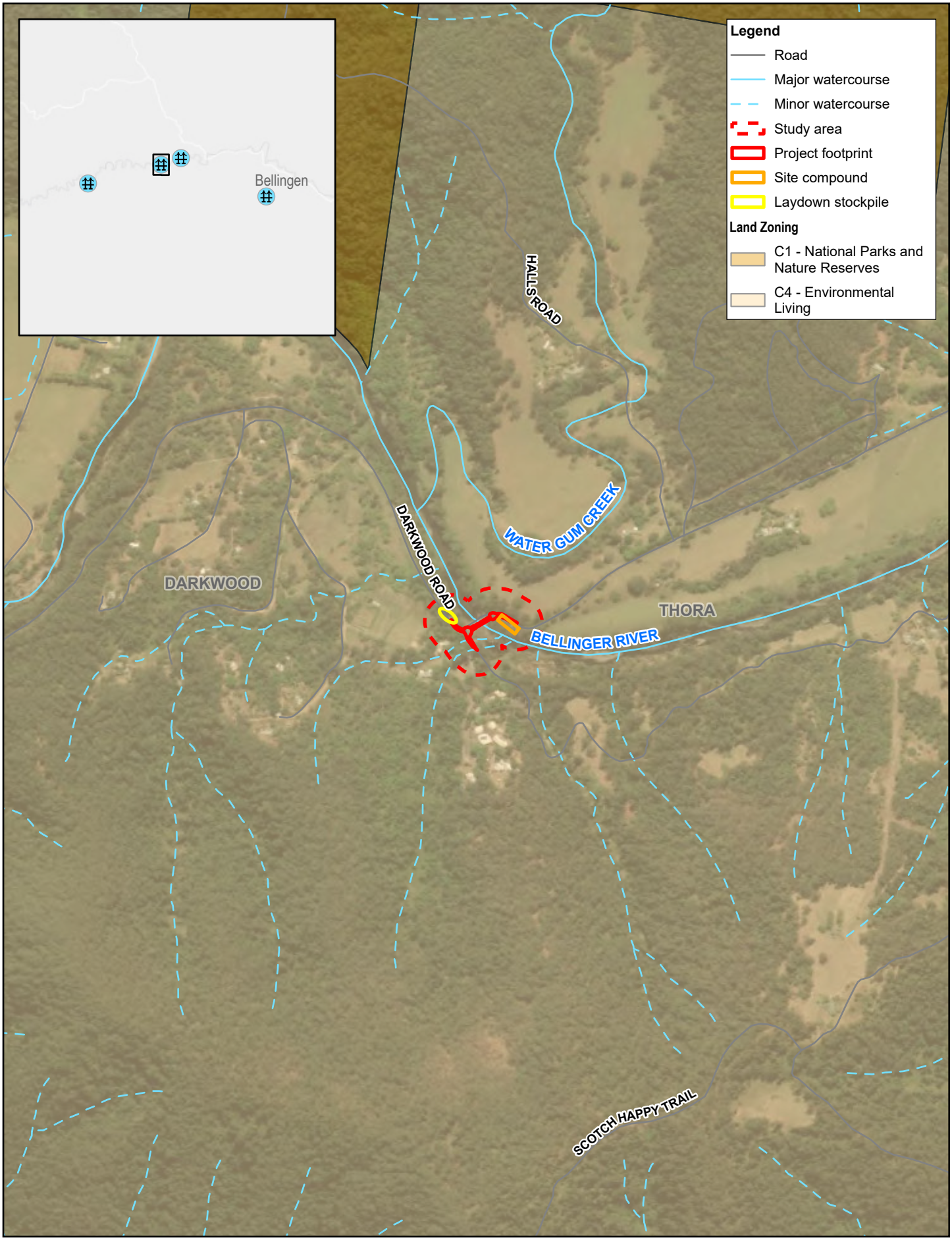
Created by: mvandermerwe



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Bellingen Shire Council
Bellinger River Species Impact Statement
Hobarts Bridge

Project locality

Project No.	**12611463**
Revision No.	**0**
Date	**29/07/2024**

Figure 1.3

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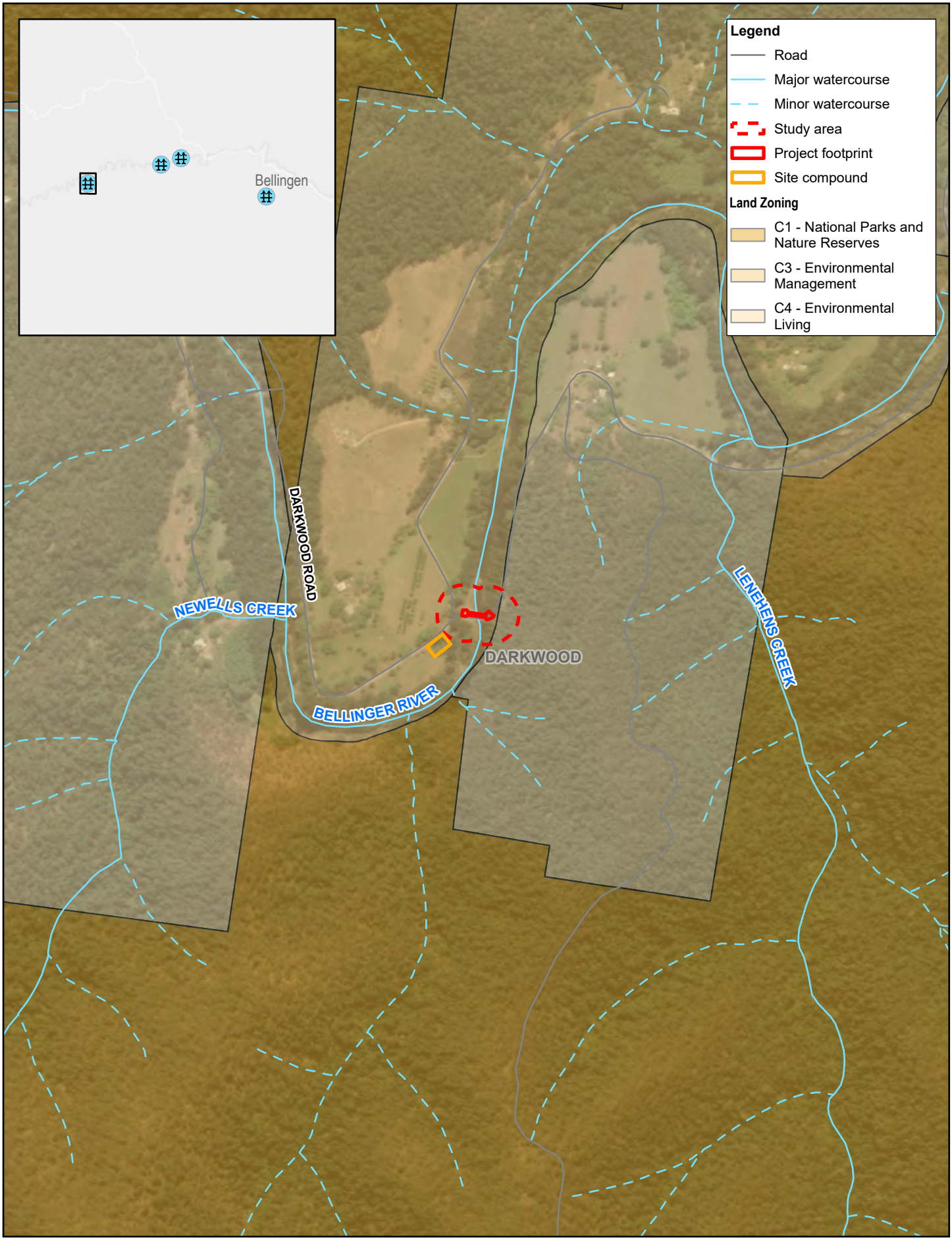

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Bellingen Shire Council
Bellinger River Species Impact Statement
Justins Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Project locality

Figure 1.4

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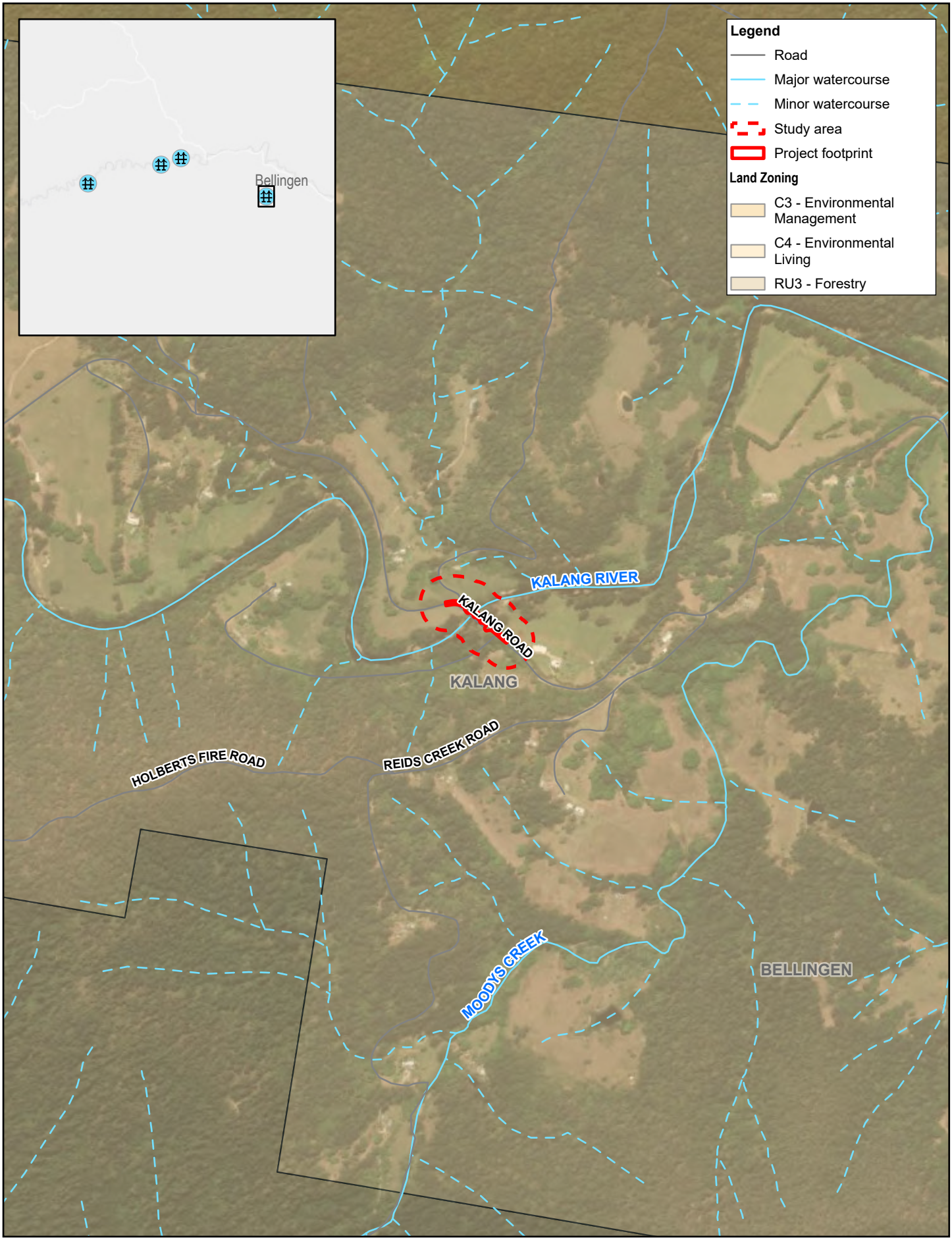

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Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project locality

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Figure 1.5

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Created by: mvandermerwe

1.6 Proposed site activities

1.6.1 Overview

The proposed Project works at each of the bridge sites will involve the following general construction activities:

– Vegetation clearing
– Installation of piers and rock anchors
– Construction of bridge substructure
– Construction of abutments and placement of decking units (superstructure)
– Installation of rock scour protection
– Realignment of approach roads
– Finishing of ancillary bridge components at road level (i.e. signages, road sealing, concreting in controlled areas)
– Demolition of existing timber bridges
– Rehabilitation of site

Construction works are expected to be carried out over a 7-month period. Instream and associated bank footprints are estimated to impact approximately 0.41 ha. Further details on proposed site activities for each bridge are provided in the following sections.

	In-stream works Vegetation clearing / earthworks on river bank, installation of piers and rock anchors, instream substructure works	Embankment works Construction of abutments outside of waterway low flow channel, construction of superstructure and road approaches	Fishing works – roads and ancillary bridge components Construction at road level only including barriers signage, road sealing, concreting.	Demolition of existing timber bridges and rehabilitation
Joyces Bridge	Works to occur outside of breeding season of Bellinger River Snapping Turtle and peak breeding season of Giant Barred Frog. No works to occur July to February Works permissible March – June	Works to occur outside nesting season for Bellinger River turtle and peak breeding season of Giant Barred Frog. No works to occur October to January Works permissible March to September	Works permissible any time	No bridge removal during southern myotis breeding period. No works
Hobarts Bridge	Works to occur outside of peak breeding season of Bellinger River Snapping Turtle and Giant Barred Frog. No works to occur July to February Works permissible March – June	Works to occur outside nesting season for Bellinger River turtle and peak breeding season of Giant Barred Frog. No works to occur October to January Works permissible March to September	Works permissible any time	
Justins Bridge	Works to occur outside of peak breeding season of Bellinger	Works to occur outside nesting season for Bellinger River turtle	Works permissible any time	

	River Snapping Turtle and Giant Barred Frog. No works to occur July to February Works permissible March – June	and peak breeding season of Giant Barred Frog. No works to occur October to January Works permissible March to September		
Duffys Bridge	Works to occur outside of peak breeding season of Bellinger River Snapping Turtle and Giant Barred Frog. No works to occur July to February Works permissible March – June	Works permissible any time		Works permissible any time

1.6.2 Joyces Bridge

Joyces Bridge (Plate 1.1) is located on Darkwood Road, crossing the Bellinger River approximately 18 kilometres (km) west of Bellingen. The proposed Project works involve upgrading the road realignment and removing the existing 48 metre (m) four span, timber bridge and installing a new 49.5 m four span, concrete bridge structure on an improved alignment immediately downstream and adjacent to the current footprint. The form of construction will include:

– Foundations will be bored, cast in-situ 600 millimetre (mm) diameter concrete piles.
– Piers one and two will be located in the low-flow section of Bellinger River. Pier three is located on the existing gravel bank outside of the flow channel.
– The substructure will consist of cast in-situ concrete abutments and precast concrete headstocks. Rock scour protection will be placed on the banks surrounding the abutments.
– The super structure is made up of two spans of 12 m precast bridge beams, one longer span of 18 m pre-stressed bridge planks and one shorter 7 m plank span at the western end. The two plank spans will require cast in-situ deck pours. Trafficable bridge width of 4.2 m.
– All spans will use bolt on concrete kerbs. The two plank spans will be cast in-situ deck pours.
– Road approaches will be rebuilt, include 35 m of road works on the eastern side and 60 m on the western side to tie into the existing Darkwood Road.
– The bridge will be raised approximately 1.7-2.0 m in height to increase flood immunity.

The Project footprint for the proposed activities at this location are approximately 0.11 ha.

The concept design for Joyces Bridge is shown in Figure 1.6.

A full design and construction methodology report is provided in Appendix C.

Plate 1.1 Joyces Bridge – existing timber structure

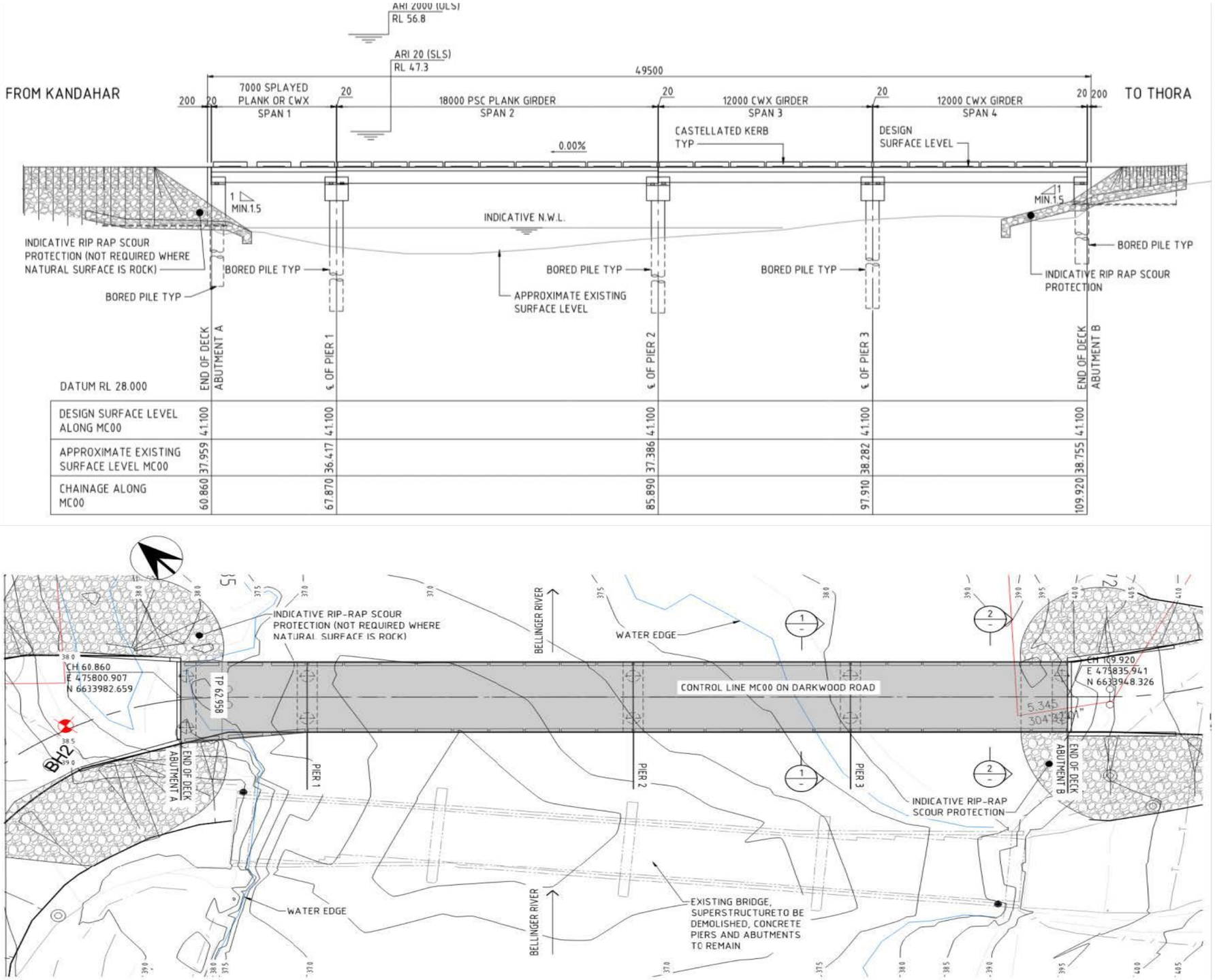


Figure 1.6 Joyces Bridge concept design

1.6.3 Hobarts Bridge

Hobarts Bridge (Plate 1.2) is located on Darkwood Road, crossing the Bellinger River at Darkwood, approximately 17 km west of Bellingen.

Plate 1.2 Hobarts bridge – existing timber structure

The proposed Project works involve upgrading the road realignment, removing the existing 48 m five span timber bridge and installing a new 54.5 m four span, concrete bridge structure of increased height on an improved alignment immediately upstream and adjacent to the current footprint.

The form of construction will include:

– Foundations will be bored, cast in-situ 600 mm diameter concrete piles at Abutment B and Pier 3, and rock anchors for the remainder of the bridge.
– Piers two and three will be located on the edge of the low-flow section of Bellinger River. Pier one is located on the banks outside of the flow channel.
– The substructure will consist of cast in-situ concrete abutments and precast concrete headstocks. Rock scour protection will be placed on the banks surrounding the abutments.
– The super structure is made up of three spans of 12 m precast bridge beams and one longer span of 18 m pre-stressed bridge planks. The plank span will require a cast in-situ deck pour. Trafficable bridge width of 4.2 m.
– All spans will use bolt on concrete kerbs.
– Road approaches will be rebuilt, include 40 m of road works on the eastern side and 50 m on the western side to tie into the existing Darkwood Road.
– The bridge will be raised approximately 2.0 m in height to increase flood immunity.

The Project footprint for the proposed activities at this location are approximately 0.12 ha. The concept design for Hobarts Bridge is shown in Figure 1.7.

A full design and construction methodology report is provided in Appendix D.

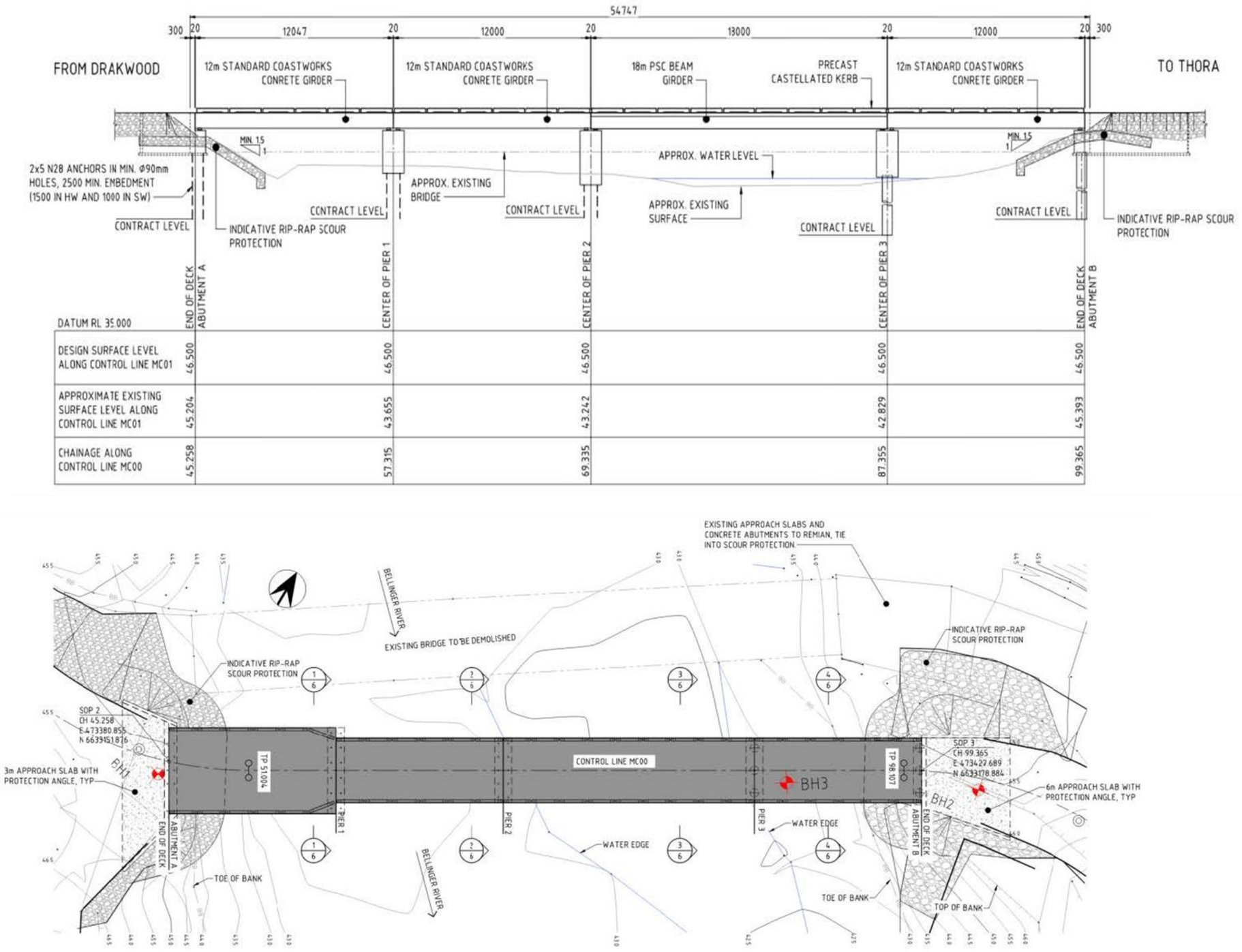


Figure 1.7 ***Hobarts Bridge concept design***

1.6.4 Justins Bridge

Justins Bridge (Plate 1.3) is located on Darkwood Road, crossing the Bellinger River approximately 26 km west of Bellingen.

Plate 1.3 Justins Bridge – existing timber structure

The proposed Project works involve removing the existing 42.5 m four span timber bridge and installing a new 42 m two span, steel/concrete composite bridge structure of increased height on an improved alignment immediately downstream and adjacent to the current footprint.

The form of construction will include:

- Foundations will be bored, cast in-situ 600 mm diameter concrete piles for Abutment A and Pier 1, and rock anchors for Abutment B.
- The pier and western abutment (Abutment A) are located on the outer edge of the flow channel. The eastern abutment is located on the bank outside of the flow channel (Abutment B).
- The substructure will consist of cast in-situ concrete abutments and precast concrete in-situ headstocks. Rock scour protection will be placed on the banks surrounding the abutments.
- The super structure is made up of one 12 m bridge beam span and one 30 m spliced steel girder span.
- Trafficable bridge width of 4.5 m.
- All spans will use bolt on concrete kerbs.
- Road approaches will be rebuilt, include 35 m of road works on the eastern side and 60 m on the western side to tie into the existing Darkwood Road.
- The bridge will be raised approximately 1.5 m in height to increase flood immunity.

The Project footprint for the proposed activities at this location are approximately 0.05 ha. The concept design for Justins Bridge is shown in Figure 1.8.

A full construction design and methodology report is provided in Appendix E.

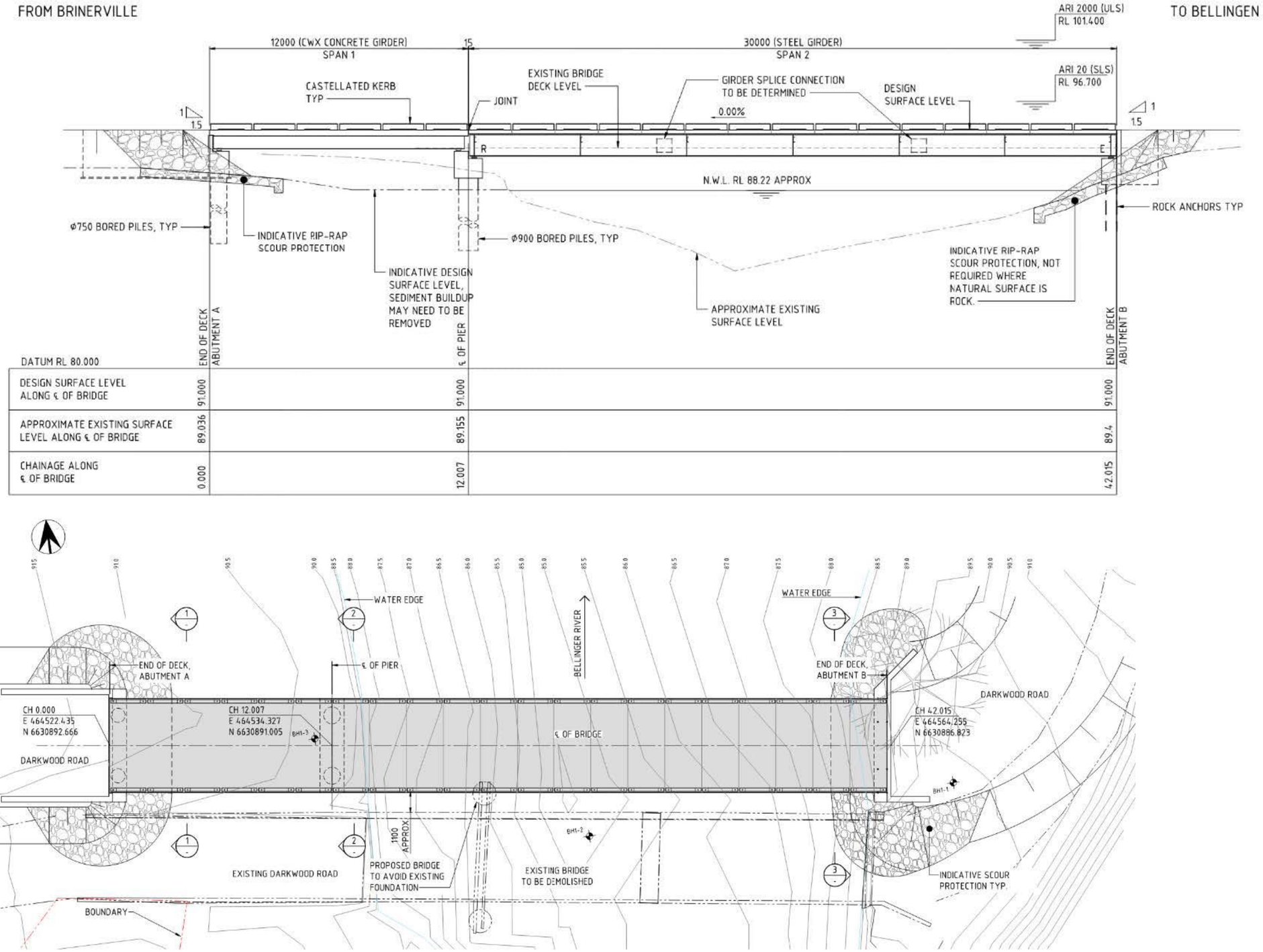


Figure 1.8 Justins Bridge concept design

1.6.5 Duffys Bridge

Duffys Bridge (Plate 1.4) is located on Kalang Road, Kalang NSW, crossing the Kalang River, and provides local access for the community. Council intends to replace the existing timber structure due to its current condition. The existing Duffys Bridge is a four-span timber bridge approximately 44 m long with a 4 m wide carriageway. The bridge is a low-level crossing with a deck height at approximately 19.8 m AHD (Australian Height Datum) based on previous survey.

The proposed concept bridge design is a 44 m concrete dual lane bridge with an overall bridge width of 7.2 m, providing an approximately 7.1 m carriageway. The bridge deck will have a level of 21.5 m (AHD datum) which is approximately 1.7 m higher than the existing bridge level to provide increased flood immunity to residents. The new bridge is to be constructed to the downstream of the existing so that access along Kalang Road can be maintained during construction. Typical reinforced concrete abutment and driven piles would be utilised as abutments and piers due to the dense alluvial gravel deposits potentially creating early refusal for driven piles.

The proposed Project works involve removing the existing 44 m four span timber bridge and installing a new dual lane 51 m (3x17m) three span, concrete bridge structure of increased height on an improved alignment immediately downstream and adjacent to the current footprint. The form of construction will include:

- Foundations driven steel piles, for Abutments and Piers.
- The abutments are located on the bank outside of the flow channel.
- Pier 2 is located outside of the low flow channel.
- Pier 1 is located on the edge of the low flow channel and bank toe.
- The substructure will consist of cast in-situ concrete abutments, in-situ pile caps, in-situ pier columns and in-situ pier headstocks.
- Rock scour protection will be placed on the banks surrounding the abutments.
- The super structure is made up of three spans of 17 m Pre-Stressed Concrete planks.
- Trafficable bridge width of 7.2 m.
- All spans will use traffic barriers.
- Road approaches will be rebuilt, include approximately 50 m of road works on the to tie into the existing Kalang Road on both sides of the bridge.
- The bridge will be raised approximately 1.5 m in height to increase flood immunity.

Plate 1.4 Duffys Bridge – existing timber structure

The Project footprint for the proposed activities at this location are approximately 0.14 ha. The concept design for Duffys Bridge is shown in Figure 1.9.

The construction methodology and mitigation measures will be consistent with best practice similar to that detailed within the attached construction methodology reports.

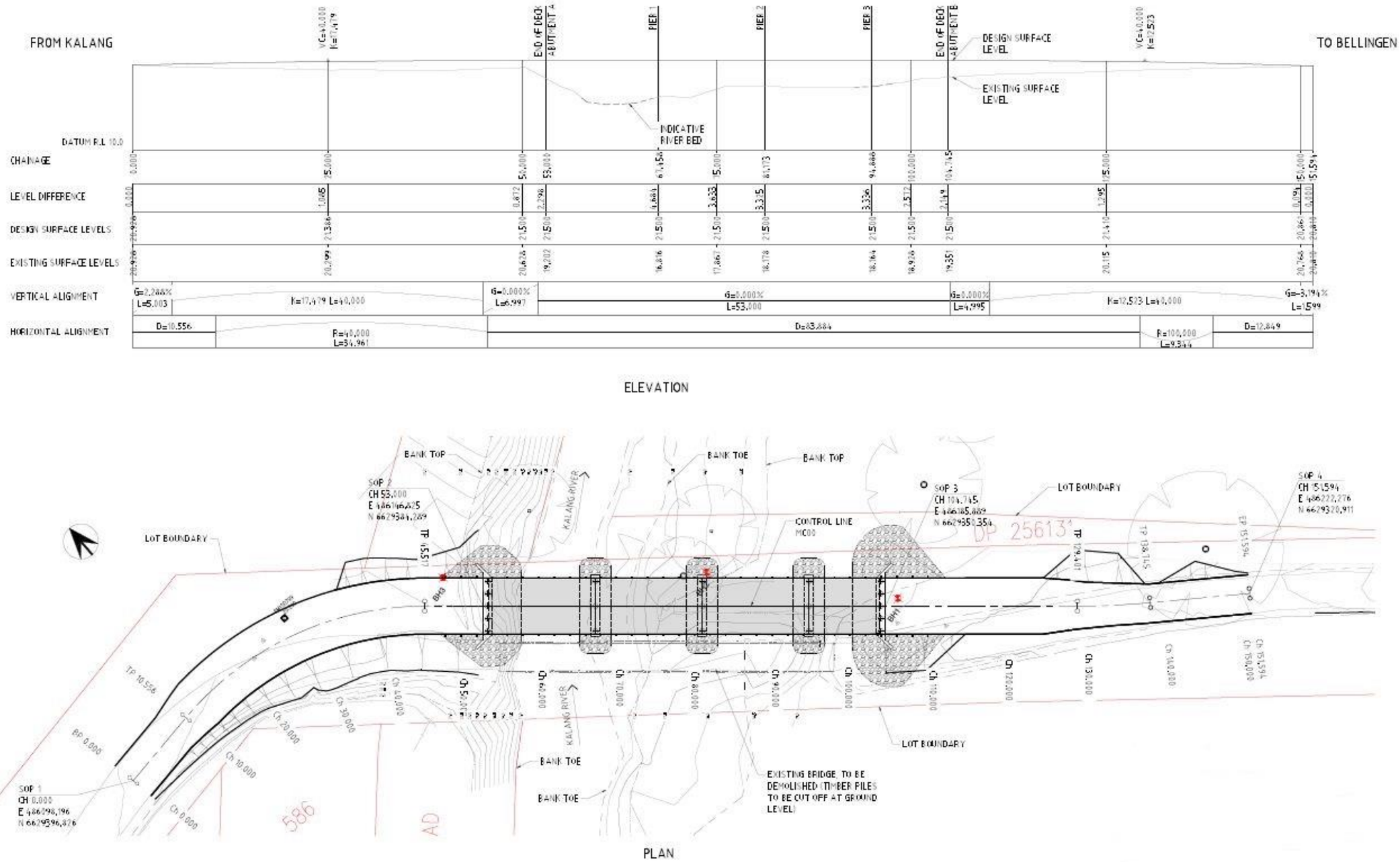


Figure 1.9 Duffys Bridge Concept Design

1.6.6 Road and other ancillary works

As part of each bridge upgrade, a new road alignment will be required. This road alignment has been included in each of the Project Footprints, presented in Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4.

A temporary construction compound is anticipated to be established nearby to the Project Footprints within the road corridor as well as partially on private property, with access to be negotiated with private residents. The location of the compound would be determined by the contractor and would be dependent on the order in which works are undertaken.

The compound area is likely to consist of the following:

– Small site shed.
– Equipment laydown area.
– Waste receptacles.
– Construct material.
– The compound area would not be established under the dripline of any existing trees. Due to the rural nature of the Projects, there is no high human activity expected within the area.

Refuelling, fuel decanting and vehicle maintenance work, if required, would take place in a designated sealed and bunded area within the construction compound area or offsite.

The Project would require a range of construction plant and equipment. The following is an indicative list of equipment that would be required for the project:

– Heavy vehicles associated with earthwork activities and construction including excavator, backhoe, skid steer, tipper, spreaders, roller and delivery trucks, etc.
– Machinery required for the works would include an excavator mounted drilling rig, small excavator, mobile shotcrete plant, small mobile crane, various hand tools.

2. Methods

2.1 Desktop assessment

Prior to the field survey, a desktop assessment was undertaken to identify relevant ecological values and facilitate an informed approach to the field survey. The following subsections describe the information that was reviewed to provide an understanding of the ecological values that should be considered as part of this assessment.

2.1.1 Database searches

The desktop assessment incorporated a review of the government records and mapping layers including the *Threatened Biodiversity Data Collection* and other relevant databases. Databases and desktop mapping utilised during the desktop assessments are summarised in Table 2.1. These resources were used to determine the presence of threatened species and communities relevant to this assessment.

Table 2.1 Desktop assessment information sources

Desktop search	Purpose
Atlas of Living Australia (ALA) Database	The ALA database was searched to retrieve historical records of conservation significant flora and fauna species assessed as likely to occur within 10 km of each Project footprint.
BioNet Atlas NSW	BioNet Atlas NSW was used to search threatened species sightings and their species biodiversity profiles within 10 km of each Project footprint.
DPI threatened species lists and distribution maps	DPI threatened species lists and distribution maps were used to identify threatened species sightings within the study area.
Protected Matters Search Tool (PMST)	The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) PMST search was conducted to identify MNES protected under the EPBC Act that have the potential to occur within 10 km of each Project footprint.
Species Profile and Threats Database (SPRAT)	The DCCEEW SPRAT profiles were assessed to determine habitat requirements and ecology of potentially occurring conservation significant species.

2.1.2 Previous studies

Idyll Spaces Environmental Consultants conducted a baseline survey to detect and / or quantify the presence of conservation significant fauna and their required habitats (Idyll Spaces Environmental Consultants 2023). This involved a combination of fauna and flora habitat assessments and active searches. Where relevant the results of this assessment have been incorporated into this SIS.

Subsequent surveys involved more targeted approaches where specific methodologies were selected with respect to the species of interest. Methodologies for these additional surveys are provided in Section 2.3.

2.2 Likelihood of occurrence

Following collation of database records and review of species and community profiles, a ‘likelihood of occurrence’ assessment was prepared with reference to the habitats contained within the Project footprint at each bridge. Identification of potential habitat for threatened, and conservation significant species was based on information provided in the species profiles (DoEE 2020, OEH 2020), recovery plans, journal articles, and the field staffs’ knowledge of species habitat requirements. The likelihood of occurrence assessment was further refined following field surveys. The likelihood of threatened biota occurring in the Project footprint was assessed based on presence of records from the Project Area for the last 20 years (since 2000), species distribution and habitat preferences, and the suitability of potential habitat present in the Project footprint.

Species were classified as ‘may occur’, if the suitable habitat was present within the Project footprint however due to their highly mobile behaviours or large home ranges, any impact is likely to be negligible due to more suitable habitat available surrounding the Project footprint.

Table 2.2 provides a key to the likelihood of occurrence in the Project footprints of threatened biota. Following completion of a likelihood of occurrence assessment, species that were 'likely to occur' or 'confirmed present' as well as candidate species identified during field surveys were the focus of assessments of significance, as outlined in the **Declaration** and Section 4.

Table 2.2 Key to likelihood of occurrence for threatened species

Likelihood	Definition
Confirmed present	The species or community was observed in the study area during field surveys.
Likely to occur	It is highly likely that a species inhabits the Project footprint and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources) or has been recorded recently in the Project Area (10 km) and is known or likely to maintain resident populations in the Project footprint. Also includes species known or likely to visit the Project footprint during regular seasonal movements or migration.
May occur	Potential habitat is present in the Project footprint. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the Project footprint opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the Project footprint, 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.
Unlikely to occur	It is unlikely that the species inhabits the Project footprint and has not been recorded in the Project Area (10 km). It may be an occasional visitor, but habitat similar to the Project footprint is widely distributed in the local area. Specific habitat is not present in the Project footprint or the species is a non-cryptic perennial flora species that was specifically targeted by surveys and not recorded.

2.3 Field assessment

2.3.1 Survey effort summary

Field surveys of the Project footprints were conducted in July and in November to December 2023 to identify and assess threatened species impact for flora and fauna from the proposed remediation works on Joyces, Hobarts, Justins and Duffys Bridges. The first field survey was undertaken by Idyll Spaces Environmental Consultants with 1 ecologist for a flora and fauna habitat survey on 12 July 2023. The second field survey was undertaken by 2 ecologists from GHD for a targeted fauna survey between 27 November to 1 December 2023. There were no access limitations during this field survey. A summary of the survey effort for both flora and fauna surveys within the four bridge sites are outlined in Table 2.3 and presented in Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4.

Table 2.3 Overview of survey effort within the Project area

Field survey dates	Company	Team & scope	Flora survey effort	Fauna survey effort
12 July 2023	Idyll Spaces Environmental Consultants	1 ecologist Flora and fauna habitat survey	PCT verification Identifying presence of threatened flora	– Opportunistic observations – Aural (visual) and audial surveys – Habitat assessments – Diurnal bird surveys
27 November – 1 December 2023	GHD	2 ecologists Targeted fauna survey		– Targeted fauna searches – Aural (visual) and audial surveys – Anabat detectors – Remote cameras – Diurnal bird surveys – Habitat assessments – Opportunistic observations – Spotlight area searches

2.3.2 Fauna field survey methods

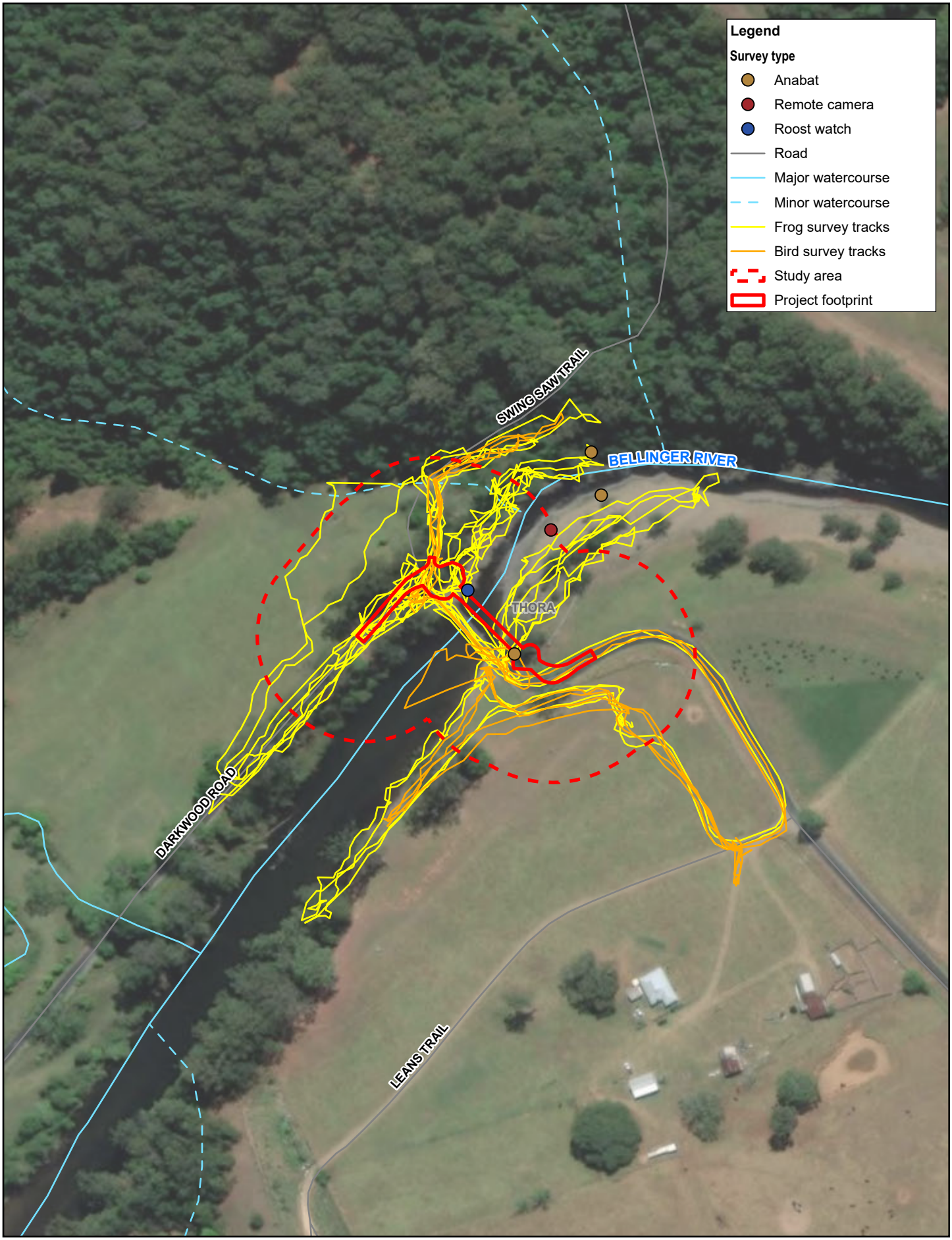
Techniques use for fauna surveys within the study area aimed to assess habitat values present for potentially occurring threatened species. The field surveys included a variety of methods at each bridge site including diurnal bird surveys, diurnal roost checks, dusk roost watches and targeted Giant Barred Frog call play back. Detailed descriptions of survey techniques are included in Table 2.4. Detailed targeted fauna methodology is provided in Section 2.3.2. All observations were recorded on proforma field datasheets.

Table 2.4 Fauna field survey methodology

Assessment type	Survey dates	Detailed survey methodology	NSW guidelines
General field assessment			
Habitat assessment	**Field survey 1:** 12 July 2023 **Field survey 2:** Rotation of all bridges: 27 November – 1 December 2023	Habitat assessments were undertaken at the four bridges along Bellinger River as shown in Figure 4.5, Figure 4.6, Figure 4.7 and Figure 4.8. and discussed in Section 4.2. At each of the survey sites, the value of habitats for terrestrial fauna was assessed based on the presence of key resources and microhabitats. This was determined by the structural complexity of vegetation and the presence of features such as hollow-bearing trees, nests and roosts, rocky outcrops, dens, caves, leaf litter and woody debris. Key habitat features important for all threated species were recorded.	Conduct a comprehensive habitat assessment across the whole site, identifying key habitat features which include, location, size, landscape features, biometric vegetation, and condition of habitat (including critical habitat) for all threated species and populations that are assumed present. All native and introduced vegetation to be recorded.
Opportunist searches for wildlife and traces	**Field survey 1:** All bridges - 12 July 2023 **Field survey 2:** Rotation of all bridges: 27 November – 1 December 2023	All incidental observations of fauna during surveys were recorded. All secondary fauna traces were recorded including bones, feathers, skulls, sloughed skins, faecal pellets, tracks, burrows and scratches.	No NSW species-specific guideline, however, it is advised that thorough searches at each site to justify the level of effort and include information on the size of the site and the duration.
Spotlighting area searches	**Field survey 2:** Rotation of all bridges: 27 November – 1 December 2023	Spotlight area searches were conducted at the four bridges. Spotlighting area searches were conducted by two ecologists with flashlights surveying one bridge per night. Spotlighting surveys were conducted to target nocturnal and arboreal mammals.	Spotlighting activities are completed with a minimum of 200 lumens light, and the surveyor(s) are to move slowly and quietly through the habitat to observe active and non-active individuals.
Remote cameras	**Field survey 2:** Rotation of all bridges: 27 November – 1 December 2023	Remote surveillance cameras (Reconyx Hyperfire 2.0) were deployed at each bridge (Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4.) Remote cameras were deployed in representative habitat types to target conservation significant species. Each camera was left in situ and baited with chicken wings to target the Spotted-tailed Quoll.	No NSW species-specific guidelines.

Assessment type	Survey dates	Detailed survey methodology	NSW guidelines
Anabat detectors	**Field survey 2:** Rotation of all bridges: 27 November – 1 December 2023	Full-spectrum acoustic monitoring devices (Anabat Swift – Titley's Scientific) were utilised to detect the echolocation calls of microchiropteran species within the Project area. Anabat detectors were deployed at two locations in mature Eucalypt vegetation that provided suitable roosting structures for microbats (e.g. tree hollows, stumps and old stags). Anabats were deployed at least 1 m off the ground and situated along potential flyways like tracks, watercourses or cleared easements. Recordings were analysed by specialist sub-consultant Greg Ford from Balance Environmental. The Anabats were deployed at each bridge (Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4.)	No NSW species-specific guidelines.
Targeted fauna surveys – Refer to sections 2.3.2.1 to 2.3.2.4 for detailed survey methodology			
Mixophyes iteratus (Giant Barred Frog)	**Field survey 2** Rotation of all bridges: 27 November – 1 December 2023	Visual surveys in 500m transects at each site over four nights to achieve at least 480 survey minutes. Initial survey conducted by Idyll Spaces Environmental Consultants to be proposed as the initial survey to meet the requirement for the first and last surveys to be at least 14 days apart. Refer to Section 2.3.2.3.	Aural – visual surveys in 500 m transect undertaken for a total of 480 min in four repeat surveys (where individual nights count as repeats provided first and last survey are at least 14 days apart). Survey months: October – March.
Myotis macropus (Southern Myotis)	**Field survey 2** Joyces Bridge – 30/11/2023 Hobarts Bridge – 29/11/2023 Duffys Bridge – 27/11/2023 Justins Bridge – 28/11/2023	One Anabat set over four nights at each bridge site (16 detector nights in total). 30-minute roost search per structure (bridge or building) 20-minute survey at dusk per bridge for exiting bats. Refer to Section 2.3.2.1.	30-minute roost search per structure (bridge or building) Four Anabats set over four nights (total of 16 detector nights) (OEH 2018). Survey months: October – March.
Dasyurus maculatus maculatus (Spotted-tailed Quoll)	**Field survey 2** 27 November – 1 December 2023	One baited remote camera set at each site for four nights. Searches for signs (latrines etc). Refer to Section 2.3.2.3.	No NSW species-specific guideline.
Ptilinopus Magnificus (Wompoo Fruit-dove) and *Ptilinopus superbus* (Suburb Fruit-dove)	**Field survey 2** Joyces Bridge – 28/11/2023 Hobarts Bridge – 29/11/2023 Duffys Bridge – 30/11/2023 Justins Bridge – 28/11/2023	One 20-minute census prior to dusk at each bridge site. Incidental surveys during diurnal habitat assessments. Refer to Section 2.3.2.4.	No NSW species-specific guideline. One 20-minute census at dawn or dusk for water sources.

Assessment type	Survey dates	Detailed survey methodology	NSW guidelines
White-bellied Sea-eagle (*Haliaeetus leucogaster*) and Eastern Osprey (*Pandion cristatus*)	**Field survey 2** Joyces Bridge – 28/11/2023 Hobarts Bridge – 29/11/2023 Duffys Bridge – 30/11/2023 Justins Bridge – 28/11/2023	Searches for stick nests or other evidence of breeding. Refer to Section 2.3.2.4.	Searches for large stick nests within tree canopy; or presence of an adult with nest material; or adults observed duetting within breeding period. Survey months: July – December (sea-eagle), April – November (osprey).
Grey-headed Flying-fox (*Pteropus poliocephalus*)	**Field survey 2** Joyces Bridge – 30/11/2023 Hobarts Bridge – 29/11/2023 Duffys Bridge – 27/11/2023 Justins Bridge – 28/11/2023	Searches for evidence of roost camps. Opportunistic observations and targeted 20-minus census at dusk at each bridge site. Refer to Section 2.3.2.1.	Search for camps and roosting habitat. If a camp is located survey for breeding females. Camps used for breeding must be mapped. Use GPS to map outer perimeter of the camp. Survey months: October – December.
Stephens's Banded Snake (*Hoplocephalus stephensii*)	**Field survey 2** Rotation of all bridges: 27 November – 1 December 2023	Spotlighting searches for evidence of breeding in tree-hollows, under woody debris or loose bark, and on ground cover. Refer to Section 2.3.2.3.	Search for suitable habitat, active individuals, non-active individuals (searching under suitable shelter habitats). Walking through suitable habitat should be slow (2 km/h), stopping every 10 m to observe active individuals.
Bellinger River Snapping Turtle (*Myuchelys georgesi*)	**No targeted survey required – see Section 4.3.11.4**	N/A	N/A



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Bellingen Shire Council
Bellinger River Species Impact Statement
Joyces Bridge

Survey effort

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

FIGURE 2.1

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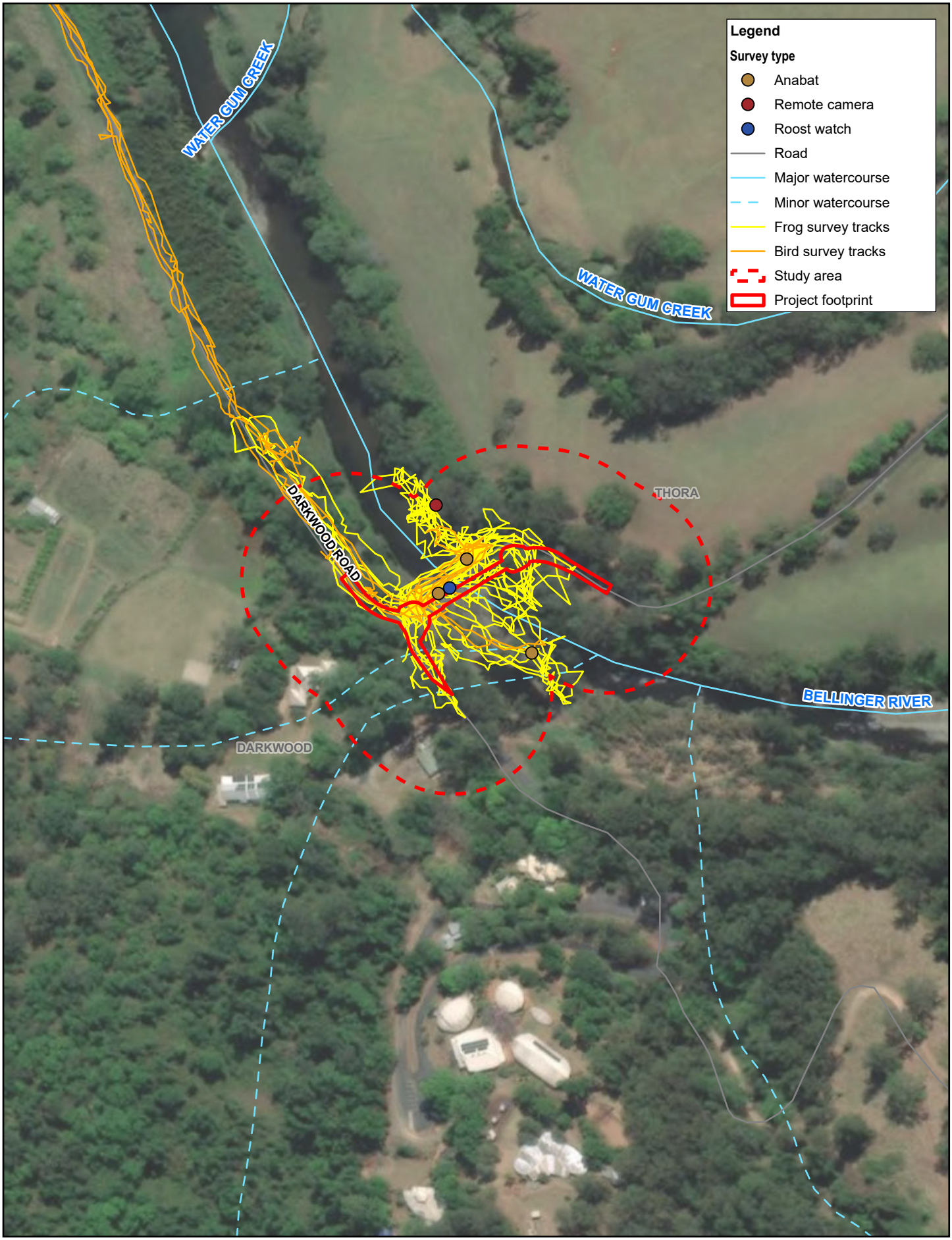
Created by: mvandermerwe



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Bellingen Shire Council
Bellinger River Species Impact Statement
Hobarts Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey effort

FIGURE 2.2

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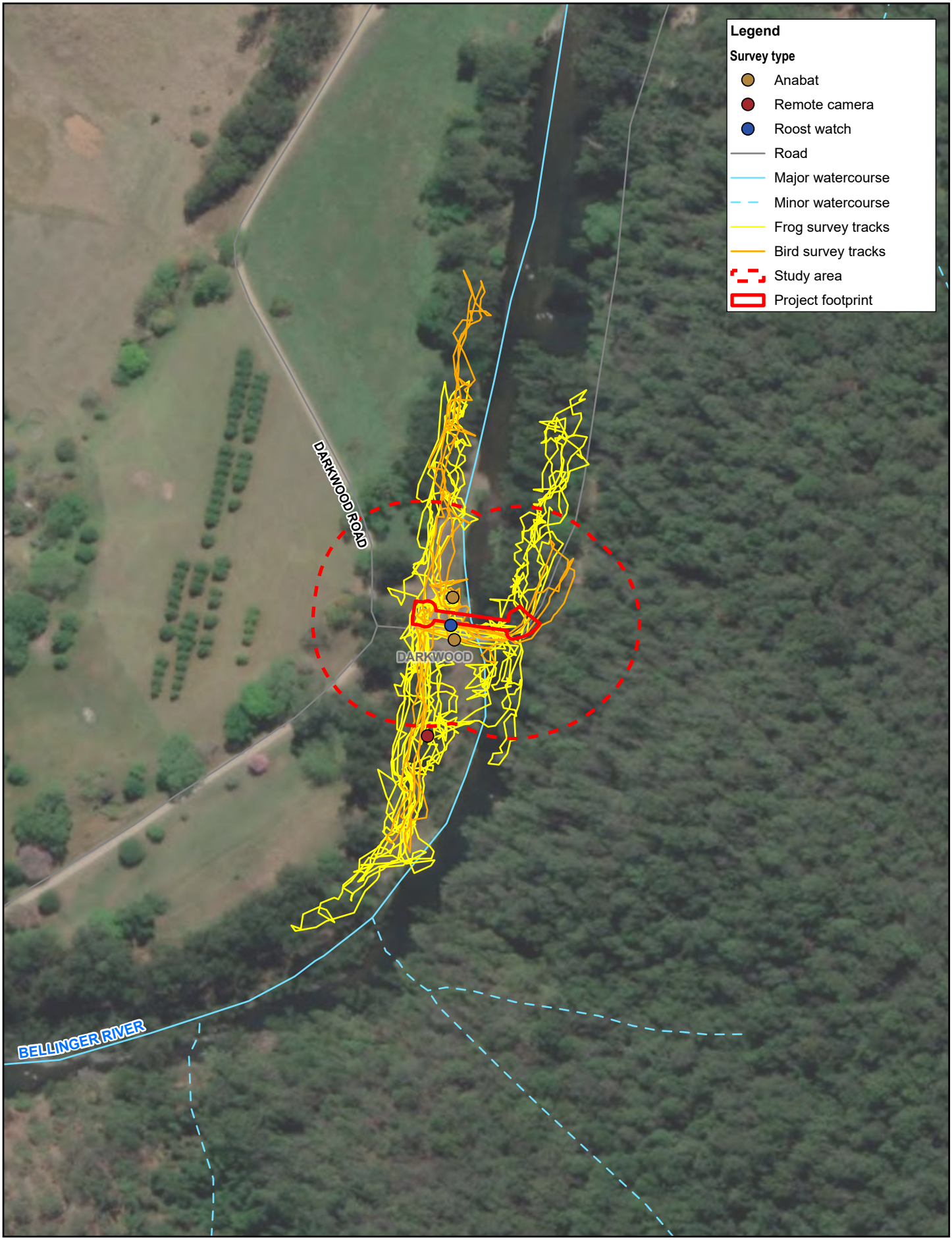

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N

GHD

Bellingen Shire Council
Bellinger River Species Impact Statement
Justins Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey effort

FIGURE 2.3

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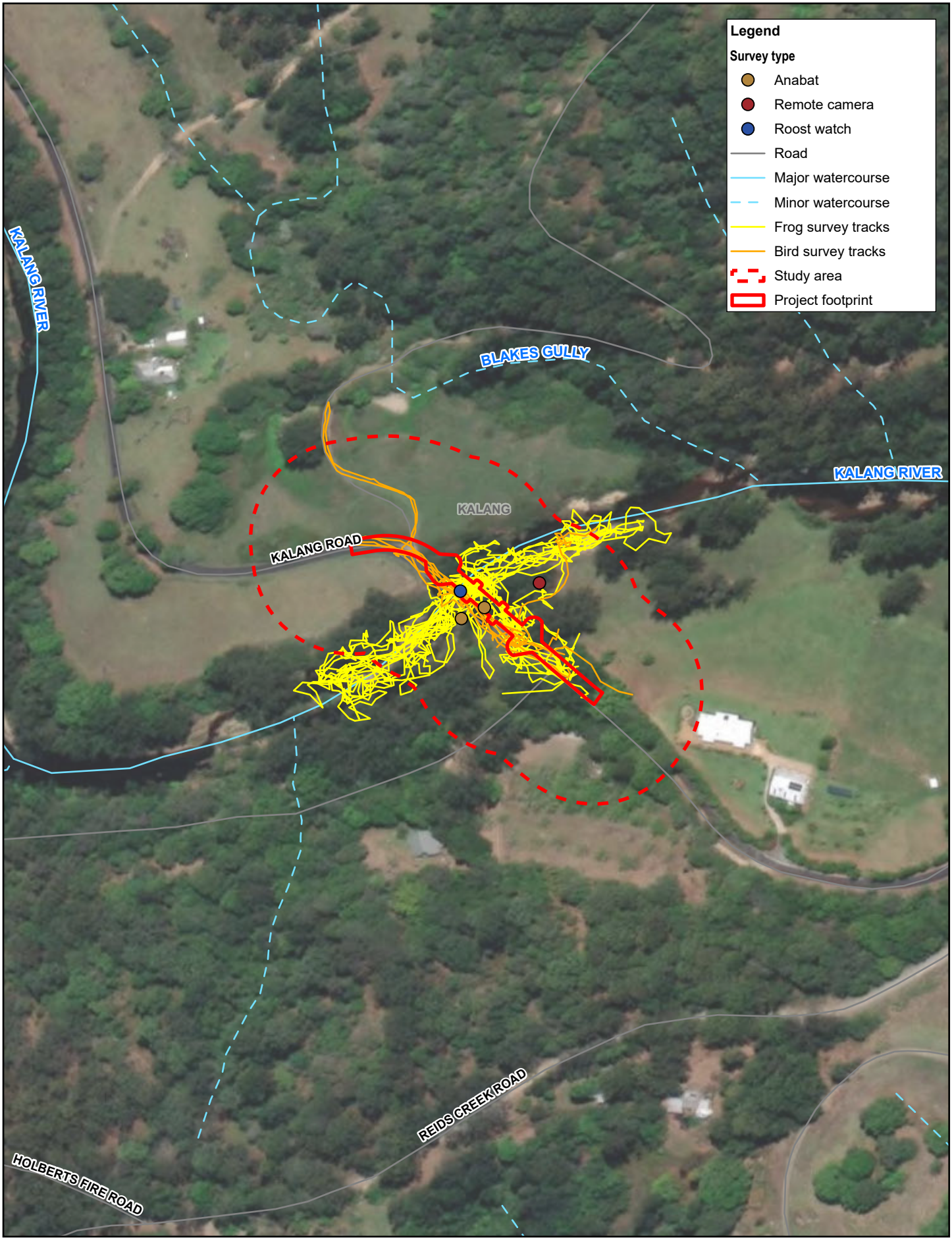

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GHD

Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey effort

FIGURE 2.4

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Created by: mvandermerwe

2.3.2.1 Microbat surveys

Targeted Southern Myotis (*Myotis macropus*) field survey methodology

The underside of each bridge was scanned for roosting microbats during the day, where possible, to identify suitable roosting habitat underneath each wooden structure in line with the 'New South Wales Species credit threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method' (OEH 2018). Each bridge has old timber materials associated with the structural integrity and original engineering, which often provides small suitable roosting habitat for microbats in the cracks and crevices. Given the high water levels at some of the sites, some areas of the bridge were inaccessible. Two ecologists conducted a dusk roost watch for 30-40 minutes at each bridge site to observe if any microbats were emerging from roost sites in the bridge.

Microbat ultrasonic echolocation call recordings (Anabat surveys) were undertaken using four Anabat units over four nights. Anabats were deployed adjacent to the waterway and in potential flyways (Plate 2.1). Recorded calls were analysed by a Senior Scientist Craig Grabham. Calls were identified using zero-crossing analysis and AnalookW software (version 4.1t, Chris Corben 2015). *The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay *et al*. 2004) was used to assist call analysis. Call identification was assisted by consulting records from the Atlas of NSW Wildlife (OEH 2020a).

Plate 2.1 Anabat detector positioning (L: Joyces Bridge. R: Justins Bridge)

2.3.2.2 Terrestrial fauna surveys

Targeted Spotted-tail Quoll (*Dasyurus maculatus*) field survey methodology

Targeted surveys for the Spotted-tail Quoll (*Dasyurus maculatus*) were conducted from 27 November – 1 December 2023. Field survey utilised a combination of baited cameras and active searches for latrine sites and refuge habitat. In total, four baited remote cameras were deployed for the species, one at each bridge site.

Spotted-tail quoll study sites were selected in accessible locations within close proximity to the bridge sites. Due to the small scale of the project, baited cameras and spotlighting were the two survey methods used in targeted spotted-tail quoll surveys. There is no NSW species-specific guideline so field survey methodologies were conducted in accordance with the Survey Guidelines for Australia's Threatened Mammals (DSEWPC, 2011).

Grey-headed Flying-fox (*Pteropus poliocephalus*) field survey methodology

Targeted surveys for the Grey-headed Flying-fox (*Pteropus poliocephalus*) were conducted from 27 November – 1 December 2023. Field surveys utilised a combination of active searches for camps and roosting habitat, and breeding females within those camps. Identified roosting camps outer perimeters were mapped using GPS coordinates. Active searches for evidence of roost camps and opportunistic observations and targeted 20-minute census were conducted at dusk at each bridge site.

There is no NSW species-specific guideline for the Grey-headed Flying-fox so field survey methodologies were conducted in accordance with the CSIRO's 'A monitoring method for the for the grey-headed flying-fox, *Pteropus poliocephalus*' (Westcott, et al 2011).

Spotlighting surveys

Spotlighting was conducted around the Project footprint and broader Project area each night. Spotlighting involved walking along the riparian zone and waterway, as well as the interface between forest/woodland vegetation and cleared areas and scanning trees and vegetation for fauna species. Any eye shine was checked using binoculars to identify the species, as necessary. Any fauna species observed flying over or foraging within vegetation within the study area was identified and counted where possible.

Opportunistic observations

Opportunistic observations of fauna species were recorded at all times during field surveys.

2.3.2.3 Amphibian and reptile surveys

Targeted Giant Barred Frog (*Mixophyes iteratus)* field survey methodology

Visual and aural frog surveys were undertaken within suitable habitat identified at each of the watercourse crossings. At each location, a one hour period was spent in the nighttime conducting visual and aural surveys for the target species (refer to Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4). Visual surveys involved looking for frogs within suitable microhabitats at the shoreline of the waterway, around the base of sedges, rushes and grasses, under leaf litter and in the shallows of standing water. Opportunistic observations of non-target frog and tadpole species were also recorded.

Call playback was used to target Giant Barred Frog and encourage additional calling activity of common amphibian species. Call playback is regarded as having a low impact on the targeted species, as the individuals are responding to a natural situation (DEWHA, 2010). Call playback involved broadcasting a pre-recorded call of each of the targeted species, through a handheld speaker at each monitoring location. Each species call was broadcast for two minutes and followed by two minutes of silence, listening for a response call from the target species. This technique was used in conjunction with five minutes of active searching during and following call play back. During the field surveys, the number of frogs of each species calling was estimated. It should be noted that this is an unreliable method of assessing abundance but is the best method available in a rapid assessment, provided environmental conditions are suitable for response calling. While useful in assessing the extent of breeding habitat and the presence or absence of the targeted species, this approach is likely to underestimate the extent of habitat used by non-calling or non-breeding individuals.

2.3.2.4 Diurnal bird surveys

Targeted Wompoo Fruit-dove (*Ptilinopus magnificus*) and Suburb Fruit-dove (*Ptilinopus superbus*) field survey methodology

Surveys for these rainforest dwelling doves were conducted in the late afternoon. As there are no New South Wales species-specific guidelines, surveys were conducted in accordance with Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010). Area searches targeting all bird species were performed in the late afternoon within and around riparian vegetation associated with Bellinger River and Kalang River. The survey comprised an area search of at least 30 min duration (refer to Figure 2.1, Figure 2.2, Figure 2.3 and Figure 2.4). Species were identified by sight and call. Incidental observations of all birds were also recorded throughout the day during general surveys.

Targeted White-bellied Sea-Eagle (*Haliaeetus leucogaster*) and Eastern osprey (*Pandion cristatus*) field survey methodology

Surveys for these large raptor species were conducted in the late afternoon at each bridge site. Ecologists were looking for large stick nests within tree canopies, the presence of an adult with nest material or adults observed duetting. There are no NSW species-specific guidelines, so surveys were conducted in accordance with Survey Guidelines for Australia's Threatened Birds (DEWHA, 2010).

2.3.3 Flora field survey methods

A terrestrial flora survey was undertaken on 12 July 2023 by a suitably qualified ecologist from Idyll Spaces Environmental Consultants by involving a flora assessment as described in Table 2.5.

Table 2.5 Flora field survey methodology

Survey method	Detailed survey methodology
Threatened Ecological Communities (TEC) assessments	TEC assessments were conducted within areas of vegetation with the potential to conform with Commonwealth-listed TECs. Assessments were conducted in accordance with the diagnostic criteria and conditions thresholds outlined in the individual Conservation Advice for individual TECs. Variables included: – Canopy crown cover – Dominance of non-native species (% in 1 m quadrats) – Groundcover species diversity – Canopy species dominance. – Canopy cover species diversity Abundance of large trees (per hectare).
Vegetation mapping	Plant Community Types (PCT) held in the BioNet Vegetation Classification database (DPE 2023a) were ground-truthed during field surveys. Field surveys were undertaken in accordance with the methodologies outlined in the Biodiversity Assessment Method (BAM) manual (DPIE 2020). Based on the assessment of the floristic assemblage, vegetative strata, landscape position, soil type and other diagnostic features, vegetation communities were assigned to the most likely PCT.
Identification of plant species	All plant species were identified to the species level in the field.
Threatened flora searches	Opportunistic surveys were conducted for threatened flora species shortlisted during desktop assessments.
Recording of invasive species	The field survey involved traversing the survey areas identifying any introduced plant species visible listed under the NSW *Biosecurity Act* 2015. The identity, precise location and relative abundance was recorded.

3. Flora

3.1 Vegetation communities

3.1.1 Existing habitat

Joyces Bridge

The vegetation surrounding Joyces Bridge is mostly comprised of exotic weeds and grasses, with isolated individuals of *Lomandra hystrix* and occasional stands of *Casuarina cunninghamiana.* Two mature *Casuarina c.* (15 m in height) with fissures and/or hollows are within two metres of the proposed works and may be impacted either directly (removal) or indirectly (earthworks within critical root zone). The bed and bank composition are a combination of cobble and moist soil with perennial water sources present. Intensive cattle grazing is also present in the area. The vegetation surrounding Joyces Bridge occurs in hinterland riparian. The proposed Project footprint will impact approximately 200 m^2 of native vegetation (Idyll Spaces Environmental Consultants 2023). The existing environment at Joyces Bridge is presented in Figure 3.1. Refer to Appendix I for a full species list of Joyces Bridge.

Hobarts Bridge

The vegetation surrounding Hobarts Bridge is dominated by flood-affected juvenile *Casuarina cunninghamiana* (approximately 3 m tall) on shallow rocky soils, indicating alluvial substrates. *Lomandra hystrix.* and other exotic weeds were present along the banks. Hobarts Bridge occurs in hinterland riparian vegetation, with the proposed Project Footprint impacting approximately 250 m^2 of native vegetation (Idyll Spaces Environmental Consultants 2023). The bed and bank composition are made up of bedrock cobble and moist soil, with perennial water sources being present. The existing environment at Hobarts Bridge is presented in Figure 3.2. Refer to Appendix I for a full species list of Hobarts Bridge.

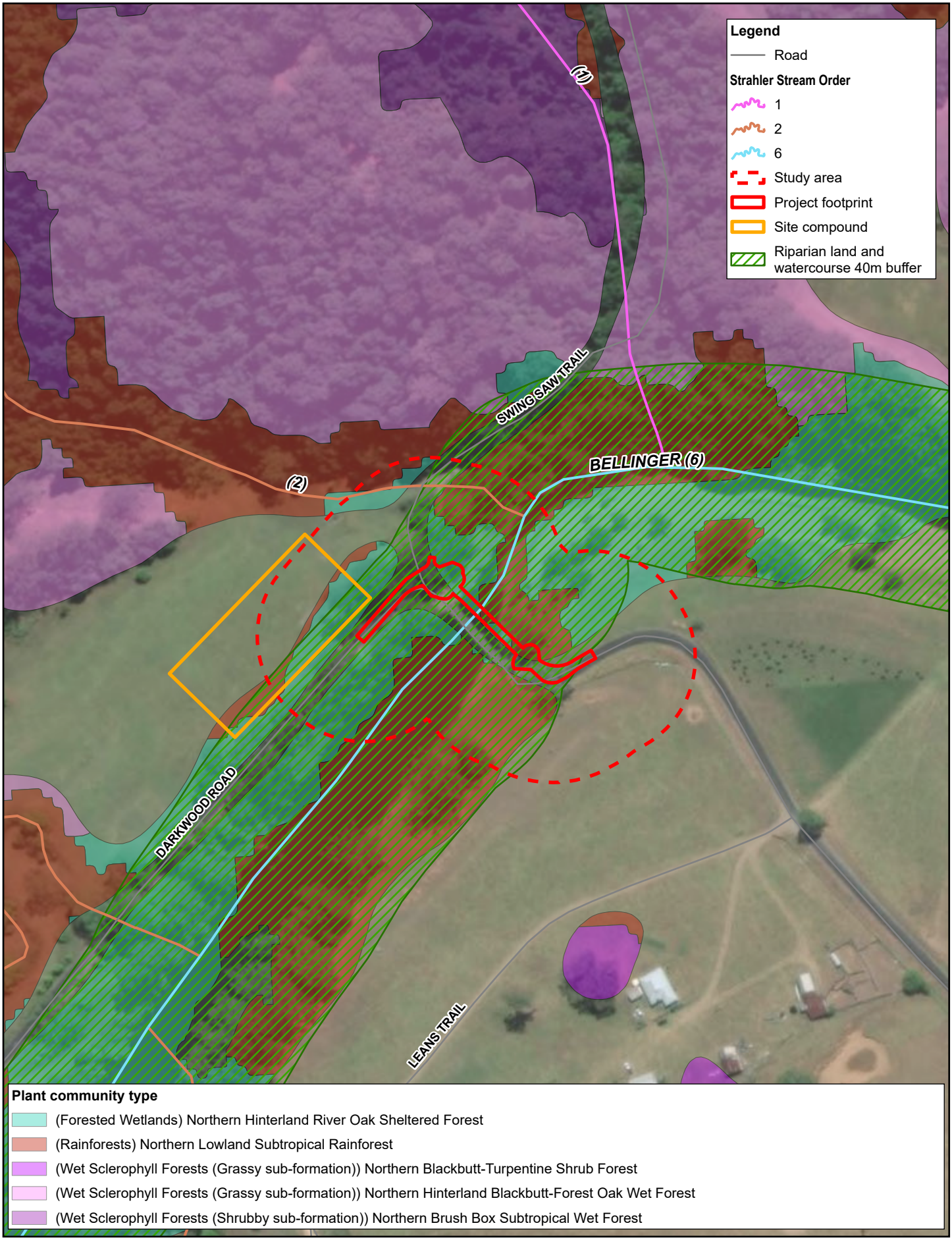
Justin's Bridge

Justins Bridge is a timber bridge supporting cracks and crevices. The bed and bank composition are similar to Joyces and Duffys Bridge with a combination substrate of cobble and moist soil with permanent water sources present. Cattle grazing was observed during the survey. The habitat identified in Justins Bridge is dominated by *Casuarina c.* (up to 15 m tall). Other vegetation is limited to weeds and isolated tufts of non-woody plants such as *Lomandra hystrix.* and *Solanum mauritianum*. Similar to the other three bridges, Justin's Bridge occurs in hinterland riparian with the proposed Project footprint impacting approximately 100m^2, mostly occupied by exotic grasses. It is likely a large *Casuarina c.* maybe be removed on the eastern approach (Idyll Spaces Environmental Consultants 2023). The existing environment at Justins Bridge is presented in Figure 3.3. Refer to Appendix I for a full species list of Justin's Bridge.

Duffys Bridge

The vegetation observed around Duffys Bridge has high density of exotic species, dominated by *Ligustrum sinense, Paspalum mandiocanum* and *Ageratum houstonianum.* The native vegetation present consists of occasional small plants of *Casuarina c.*, *Ficus coronata, Leptospermum brachyandrum*, and *Lomandra hystrix*. Duffys Bridge occurs in hinterland riparian with the proposed Project footprint will impacting approximately 200 m^2 of vegetation (Idyll Spaces Environmental Consultants 2023). The bed and bank composition is comprised of a mixed substrate of cobble and moist soil and perennial water sources. Intensive cattle grazing is also present in the broader Study Area. The existing environment at Duffys Bridge is presented in Figure 3.4. Refer to Appendix I for a full species list of Duffys Bridge.

A summary of the PCT identified from the flora survey and vegetation communities is detailed in Section 3.1.2.



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Joyces Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Existing environment

FIGURE 3.1

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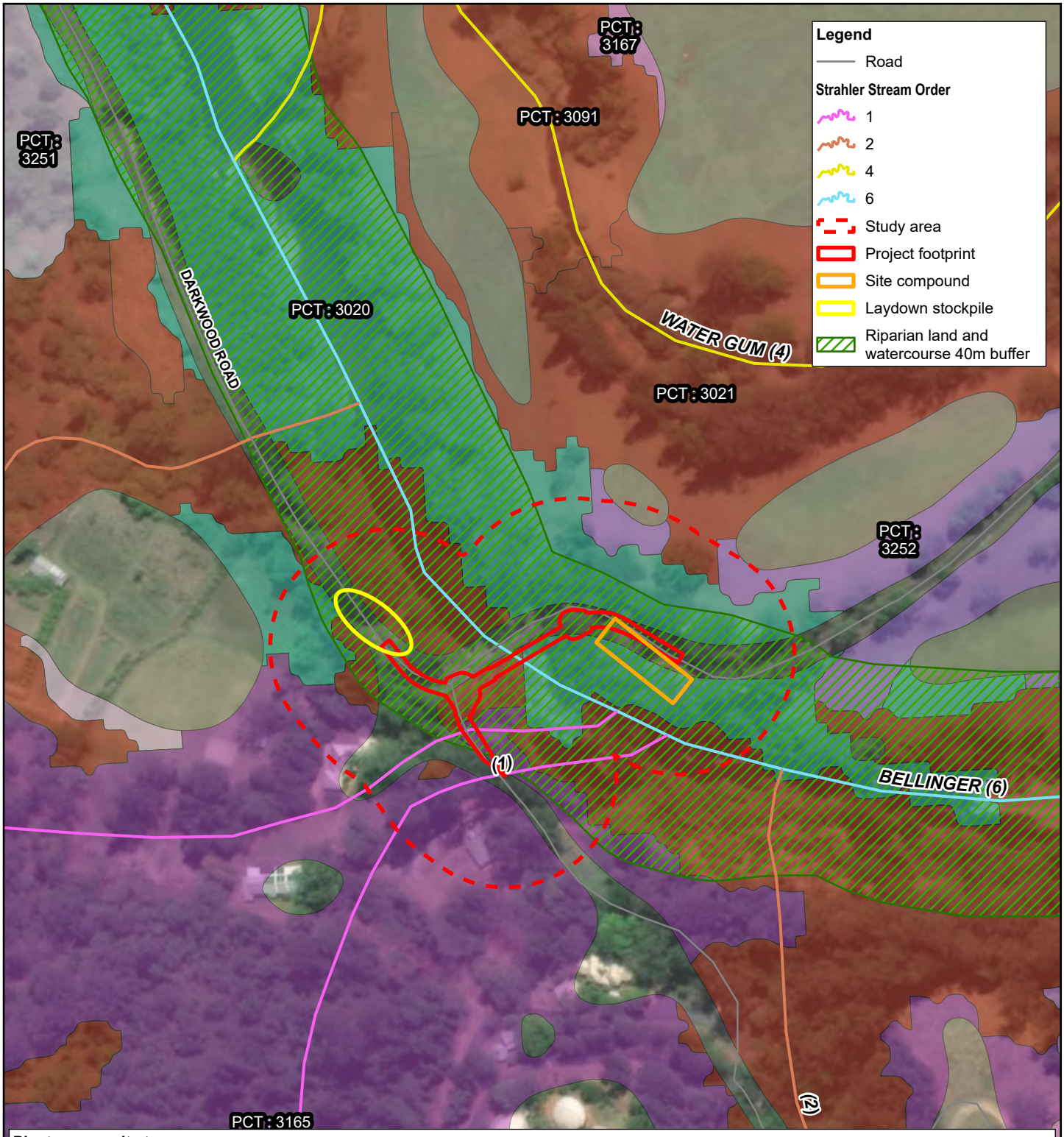
Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: riparian buffer (2023), study area, project footprint (2024); NSWSS: roads, watercourse, suburbs (2023); DPE: plant community (2023).
Created by: mvandermerwe



Plant community type

- (Forested Wetlands) Northern Hinterland River Oak Sheltered Forest
- (Rainforests) Lower North Waterhousea-Water Gum Rainforest
- (Rainforests) Northern Lowland Subtropical Rainforest
- (Wet Sclerophyll Forests (Grassy sub-formation)) Northern Gorges Diverse Grassy Forest
- (Wet Sclerophyll Forests (Grassy sub-formation)) Northern Hinterland Blackbutt-Forest Oak Wet Forest
- (Wet Sclerophyll Forests (Grassy sub-formation)) Northern Hinterland Grey Gum-Mahogany Grassy Forest
- (Wet Sclerophyll Forests (Shrubby sub-formation)) Northern Brush Box Subtropical Wet Forest
- (Wet Sclerophyll Forests (Shrubby sub-formation)) Northern Ranges Brush Box-Flooded Gum Wet Forest

Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Hobarts Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Existing environment

FIGURE 3.2

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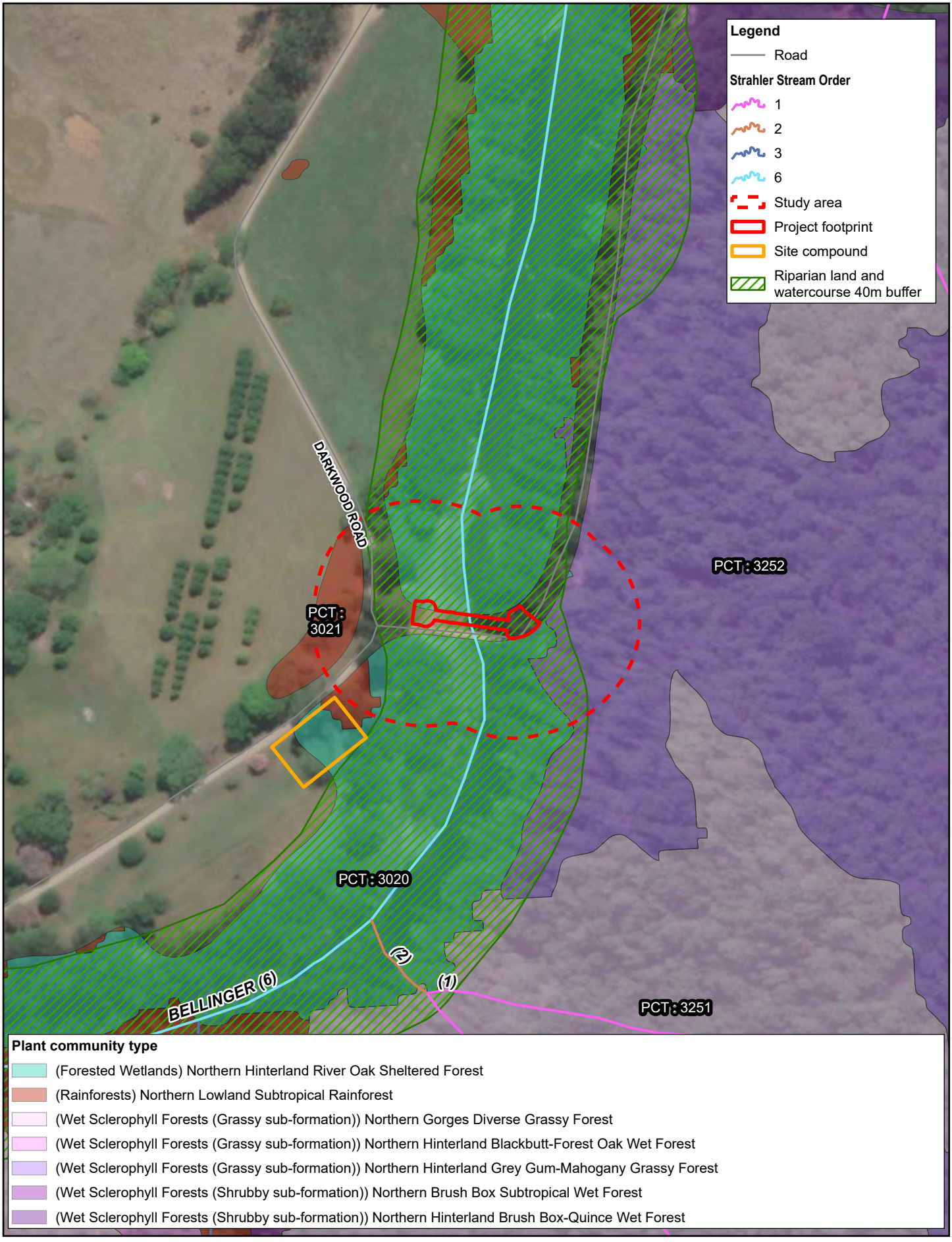

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Justins Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Existing environment

FIGURE 3.3

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Print date: 29 Jul 2024 - 12:04

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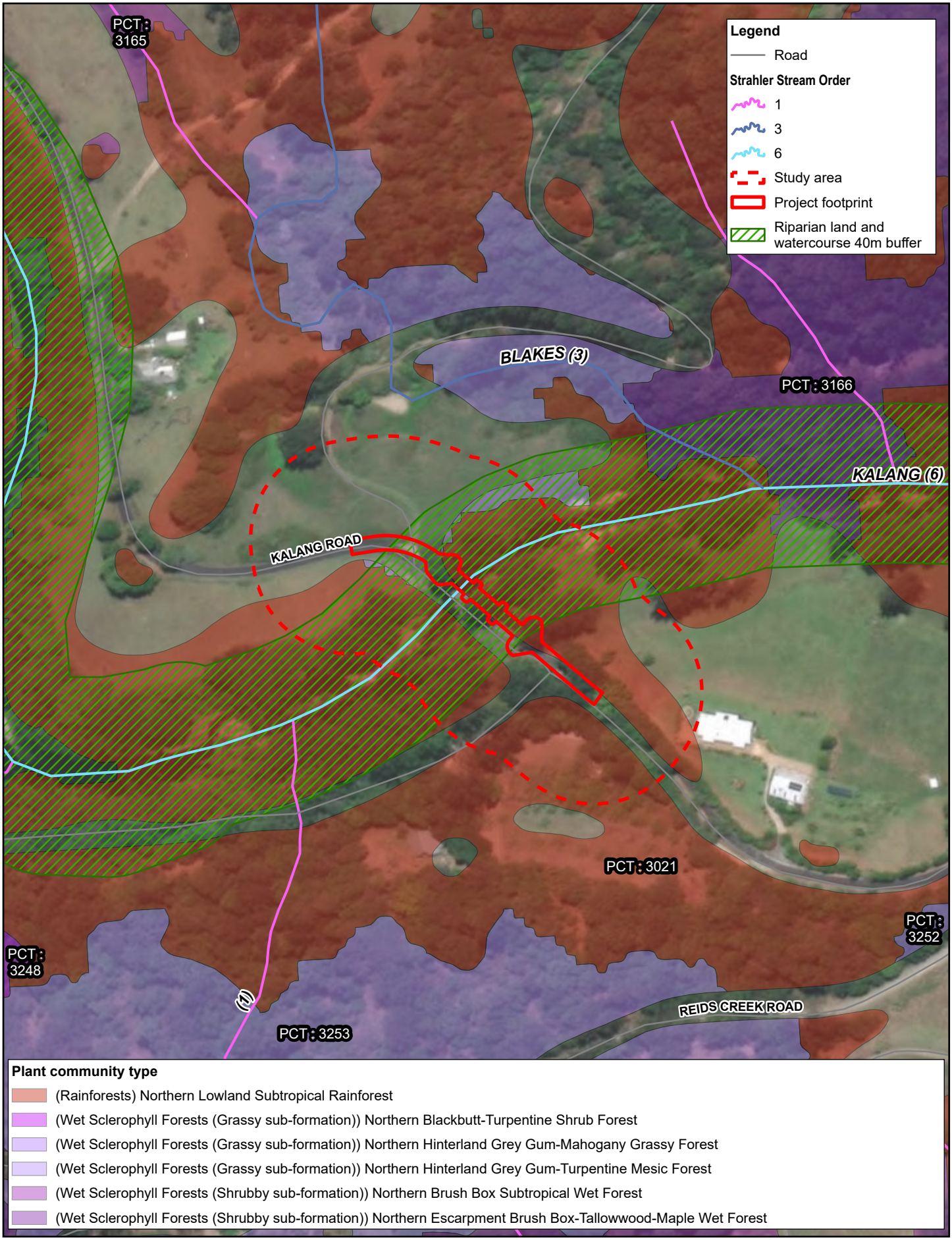
Created by: mvandermerwe



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Existing environment

FIGURE 3.4

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Print date: 29 Jul 2024 - 12:04

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: riparian buffer (2023), study area, project footprint (2024); NSWSS: roads, watercourse, suburbs (2023); DPE: plant community (2023).
Created by: mvandermerwe

3.1.2 Plant Community Type Classification (PCT)

Idyll Spaces Environmental Consultant conducted a flora survey to identified vegetation communities across Joyces, Hobarts, Justins and Duffys Bridge. The purpose of this survey was to assist in the quantification of any potential impacts that could occur from the proposed remediation works. Idyll Spaces Environmental Consultants deemed the PCT for the four bridges to be remnants of NSW plant community type classification (PCT) 3020 Northern Hinterland River Oak Sheltered Forest (Idyll Spaces 2023).

In alignment with the characteristics for the PCT 3020, the vegetation communities at all four bridges were dominated by juvenile *Casuarina c.* individuals. Duffys Bridge also supported exotic species, with a notably less abundance of *Casuarina c.* The vegetation around Duffys Bridge also comprised of native *Ficus coronata*, and *Lomandra hystrix.* Based on of the observed vegetation communities and the location of the four bridges on alluvial substrates, the PCT has been classified as 3020 Northern Hinterland River Oak Sheltered Forest (DPIE 2023).

3.2 Threatened Ecological Communities

The PCT identified within the study area (3020 Northern Hinterland River Oak Sheltered Forest) is not commensurate with any listings of Threatened Ecological Communities (TEC) under the BC or EPBC Act.

Desktop assessments did not identify any other TECs listed under the NSW BC Act as relevant to the study area.

3.3 Threatened flora species

Database searches identified 14 flora species listed under the BC Act as relevant to the study area Appendix J. A likelihood of occurrence assessment determined that there is potential habitat for nine of these species at one or more of the four bridge locations (Table 3.1).

Targeted flora surveys were undertaken for flora species identified as having the potential to occur. No threatened flora species were detected within the study area during the targeted flora survey. As no threatened flora species were recorded within or adjacent to any of the Project sites, none are considered candidate species within this SIS.

A complete inventory of flora species identified for each bridge site are provided in Appendix I.

Table 3.1 Threatened flora identified as having potential habitat within the Project areas.

Species	Conservation status		Source	Likelihood of occurrence			
	EPBC Act	BC Act		Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Native Guava, *Rhodomyrtus psidioides*	CE	CE	PMST, BioNet	Unlikely to occur	Unlikely to occur	Unlikely to occur	May occur
Scrub Turpentine, *Rhodamnia rubescens*	CE	CE	PMST, BioNet	May occur	May occur	May occur	May occur
Slender Marsdenia, *Marsdenia longiloba*	E	V	PMST, BioNet	May occur	Unlikely to occur	Unlikely to occur	May occur
Milky Silkpod, *Parsonsia dorrigoensis*	E	V	PMST, BioNet	May occur	May occur	May occur	May occur

Species	Conservation status		Source	Likelihood of occurrence			
	EPBC Act	BC Act					
Clear Milkvine, *Leichhardtia longiloba* (Note: listed as *Marsdenia longiloba* under EPBC)	V	E	PMST, BioNet	Unlikely to occur	Unlikely to occur	Unlikely to occur	May occur
Red Boppel Nut, *Hicksbeachia pinnatifolia*	V	V	PMST, BioNet	May occur	Unlikely to occur	Unlikely to occur	May occur
Hairy Jointgrass, *Arthraxon hispidus*	V	V	PMST, BioNet	Unlikely to occur	May occur	May occur	May occur
Rainforest cassia, *Senna acclinis*	-	E	BioNet	May occur	May occur	May occur	May occur
Rusty Plum, Plum Boxwood, *Niemeyera whitei*	-	V	BioNet	May occur	Unlikely to occur	Unlikely to occur	May occur

3.4 Introduced flora species

There were three exotic flora species under the *NSW Biosecurity Act 2015* that were confirmed present at Joyces bridge and Duffys Bridge. Hobarts bridge did not contain any flora species under the NSW Biosecurity Act 2015.

Joyces Bridge contained Giant Parramatta Grass (*Sporobolus fertilis*) while Duffys Bridge had Camphor Laurel (*Cinnamomum camphora*) and Small-leaved Privet (*Ligustrum sinense*). All of these species are declared noxious weeds under the *NSW Biosecurity Act 2015.*

All species are relatively common and observed in scattered locations through the Study area.

4. Fauna

4.1 Fauna species

A total of 87 fauna species were recorded during the survey, comprising 55 birds, 12 mammals, 12 frogs, five reptiles and two fish. (Appendix H). Two introduced species were recorded.

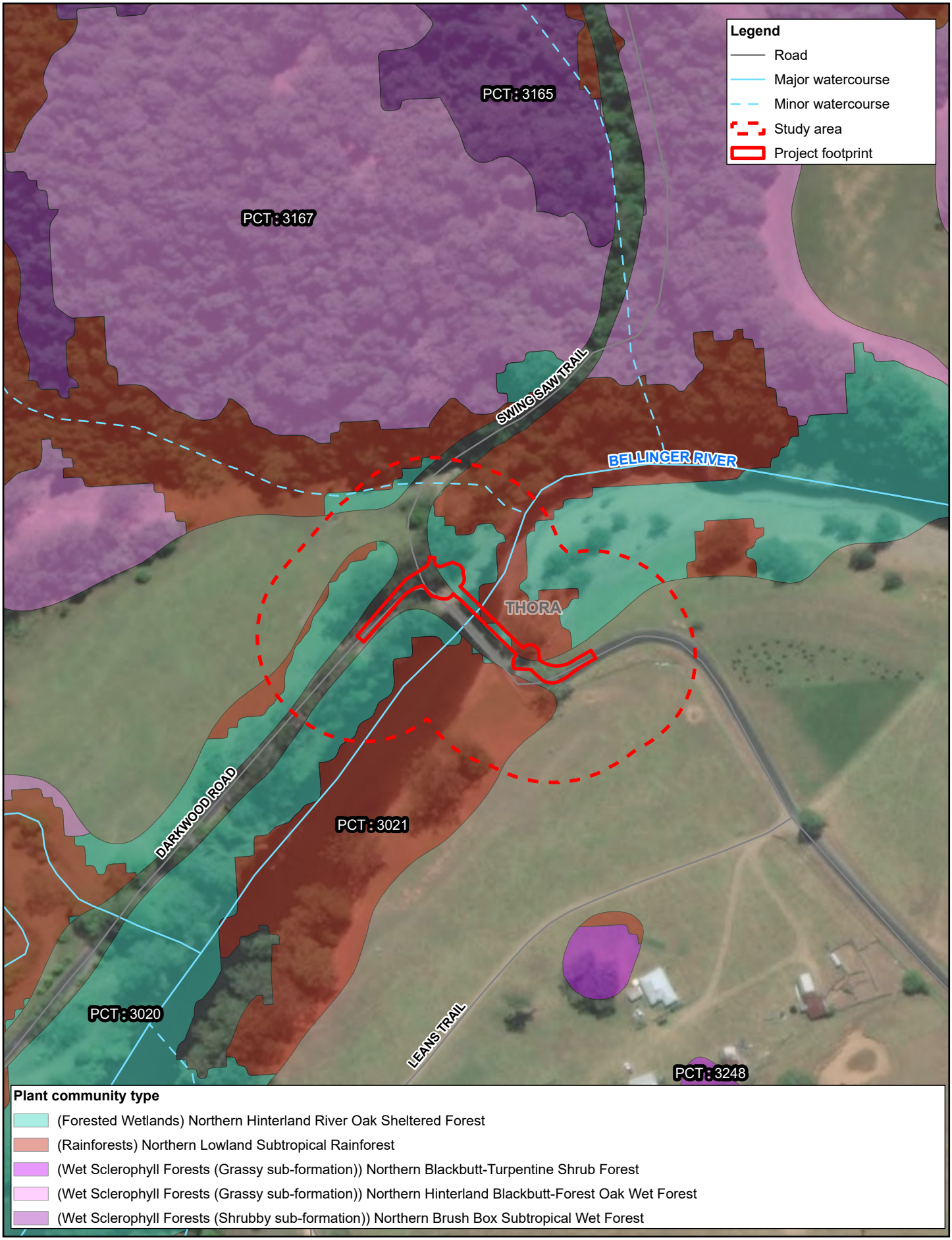
The majority of species recorded were common, widespread and adaptable species, characteristic of agricultural and rural habitats however other species was associated with rainforest habitats.

One threated fauna species was observed within 10 km of the Project Footprint at each site; Giant Barred Frog (*Mixophyes iteratus*).

Several threatened microbat species may be roosting within the structures though this can't be confirmed and as a minimum are expected to be roosting nearby.

An account of threatened fauna species is presented in Section 4.3.

Figure 4.1, Figure 4.2, Figure 4.3 and Figure 4.4 illustrates the conservation significant fauna recorded during field surveys at each bridge.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Joyces Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey field results

FIGURE 4.1

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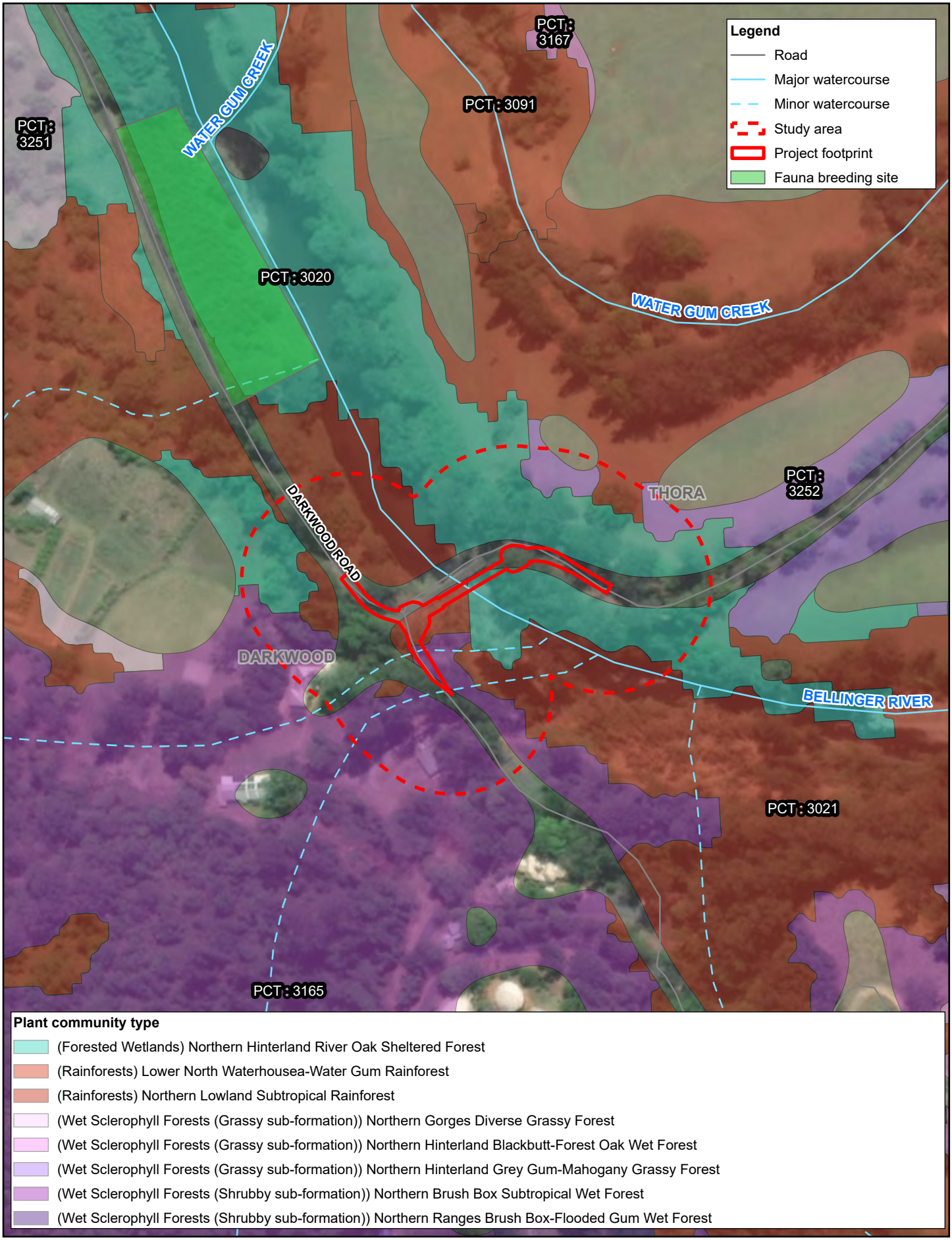

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Hobarts Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey field results

FIGURE 4.2

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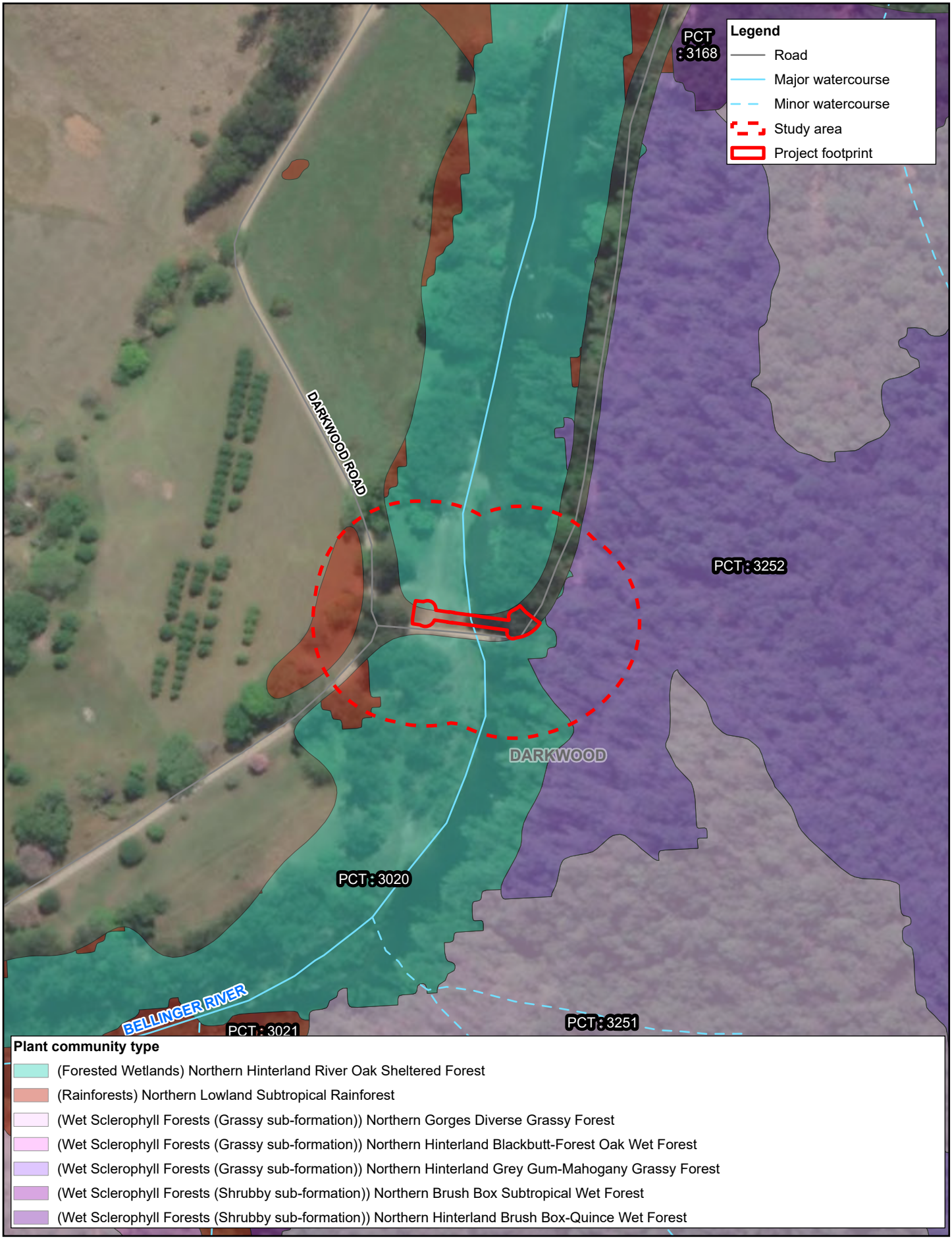

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

Bellingen Shire Council
Bellinger River Species Impact Statement
Justins Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey field results

FIGURE 4.3

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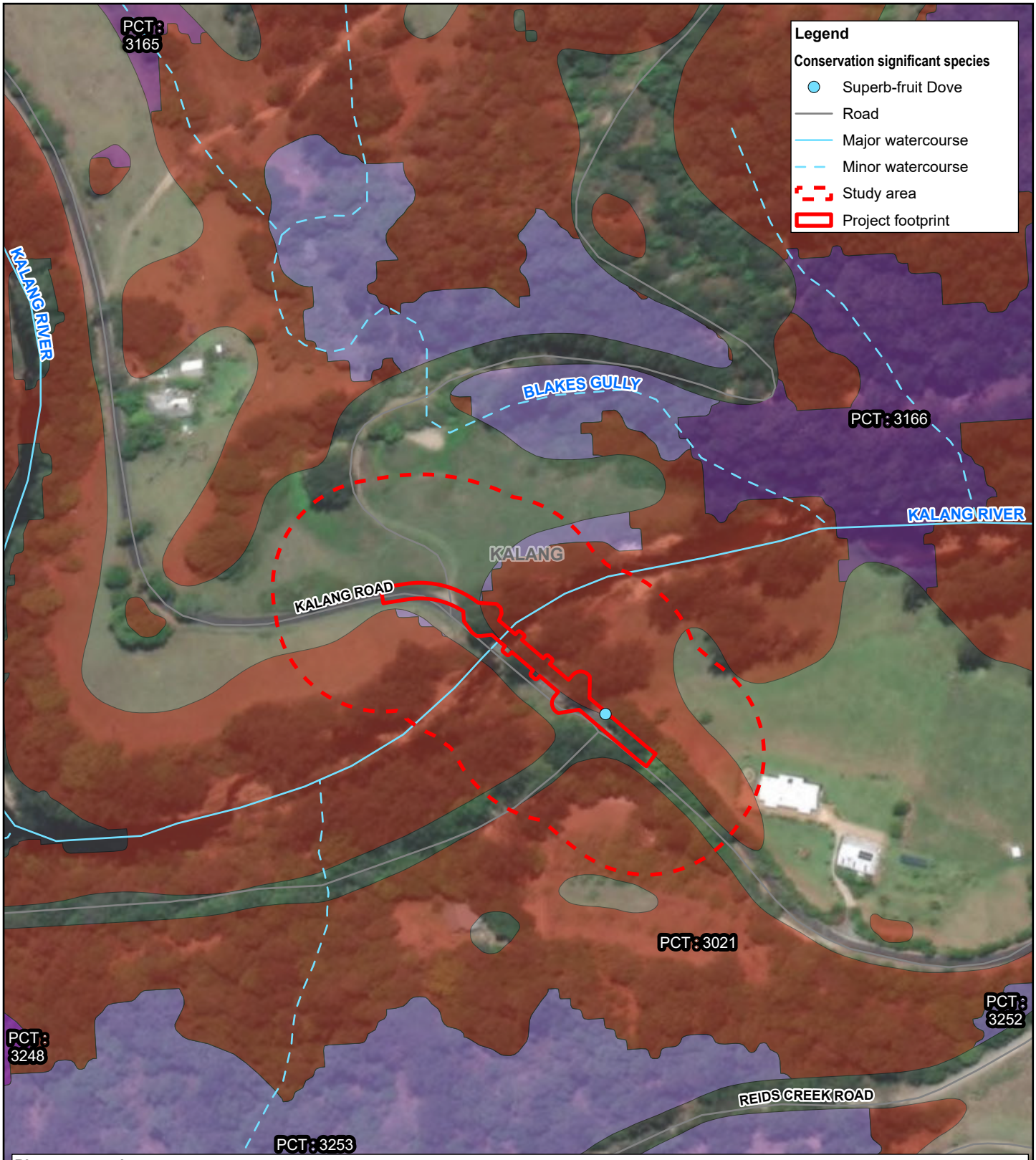

Paper Size ISO A4

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Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Survey field results

FIGURE 4.4

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Print date: 29 Jul 2024 - 15:04

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: project area, project footprint, survey data (2024); NSWSS: roads, watercourse, suburbs (2023).
Created by: mvandermerwe

4.2 Habitat assessment

Habitat values within the Project footprint at each site varied.

Historically, the land within each bridge Project footprint has been subject to low intensity clearing or grazing, though much of the area still retains high ecological value. The Project area occurs within two valley's in the Bellingen hinterland. These areas contain large tracts of native vegetation which connect north to Bellinger River National Park, south to New England National Park and east and west to various state forests and conservation reserves.

Potential habitat for threatened species within the Project footprint comprises some disturbed and roadside vegetation in a narrow road reserved, generally within 30 m of Darkwood Road and Kalang Road as well as existing agricultural pastures and regenerating PCT 3020 Northern Hinterland River Oak Sheltered Forest. The canopy vegetation within the study area is present as regenerating PCT 3020 with mature trees up to 25 m tall.

Threatened species are also likely to utilise the cracks and crevices within the existing bridge structures.

PCT 3020 Northern Hinterland River Oak Sheltered Forest occurring within riparian vegetation along both waterways provide suitable habitat for rainforest dwelling amphibians (including Giant Barred Frog) by providing a dense cover of Casuarina needle leaf-litter.

The alluvial flats contain mature woodland and open woodland, often with a weedy understory. Permanent waterbodies and large pools with fringing riparian woodland occur along both waterways. These watercourses and adjoining riparian vegetation provide drinking, breeding and foraging habitat for a range of birds, mammals, amphibians and reptiles. Remnant canopy vegetation remains largely intact. There are occasional hollow-bearing trees which provide roosting and foraging habitat for a variety of hollow-dependent fauna species.

The lower alluvial flats experienced low density livestock grazing at Joyce Bridge, resulting in degradation of ground-level microhabitats. At all other bridge's there are areas subject to exotic weeds (i.e. *Lantana camara)* which have reduced habitat values in those areas for ground-dwelling birds, mammals, reptiles and amphibians. The riparian corridors were observed to be relatively intact, particularly those in the upper reaches towards Justins Bridge, providing valuable foraging, breeding and connecting habitat for a range of fauna.

The broader landscape has been impacted by historical agriculture, particularly low intensity cattle grazing, exotic pasture sowing, vegetation clearing and intrusion by invasive weeds. These processes have impacted local ecosystem composition and processes, reducing in places the density of native vegetation. Subject to climate change, the region may experience predicted increases in the frequency, magnitude and duration of heatwaves, conditions which may result in fire becoming more frequent within the region (New South Wales Government 2024). Nonetheless, the prevalence of large tracts of remnant vegetation within which disturbance is relatively limited does provide the foundations for a system of high ecological integrity, where essential processes like connectivity and resilience are supported. On the latter and noting the potential for increased fire impacts as the climate continues to change, the connected and heterogeneous nature of the landscape embeds an inherent resilience – in other words, flora and fauna of this landscape are more likely to respond or adapt to change and recover after catastrophic disturbance (e.g. wildfire).

The Project footprint does not contain any caves or substantial rock outcrops, sandstone escarpment, beaches, rocky shoreline or marine environments and does not contain any habitat resource for threatened fauna of these environments.

Aquatic habitat include deep waterholes (> 2 m), permanent water sources, rocky substrates and ample vegetation cover. There are plenty of fallen wooden debris along the banks and within the main channel of both the Bellinger River and Kalang River. This aquatic habitat provides suitable foraging and sheltering habitat for amphibians and reptiles.

Five broad habitat types were identified across each bridge Project footprint:

– Permanent watercourse
– Fringing riparian vegetation
– Cleared grazing land
– Bamboo plantation

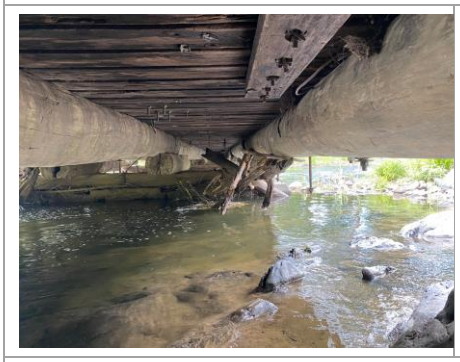
– Bridge structure

Habitat types are described in Table 4.1 and presented in Figure 4.5, Figure 4.6, Figure 4.7and Figure 4.8.

Table 4.1 Habitat types observed at each bridge

Habitat types	Characteristics	Ecological value
Joyces Bridge		
Permanent watercourses		
	Permanent water sources Cobble and rocky substrate, suitable for burrowing Cobble and soil banks Fallen wooden debris within the waterway	Drinking sites for birds and mammals Refuges and breeding habitat for Giant Barred Frog and other amphibians Foraging habitat and flyway for Southern Myotis Flyway for Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle and other bats Flyway for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Movement corridors for fish, amphibians and aquatic fauna
Fringing riparian vegetation		
	Mature canopy trees present in low to moderate abundance Low abundance of hollow bearing trees Patches of dense shrubs Casuarina needle leaf-litter Small tree hollows and fissures suitable for roosting Fallen trees and woody debris	Roosting sites for arboreal mammals Roosting habitat for Southern Myotis, Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat and Eastern False Pipstrelle Refuges and breeding for Giant Barred Frog and other amphibians Foraging and roosting habitat for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Sheltering and hunting habitat for Stephens's Banded Snake and other snakes and reptiles Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Nesting and foraging habitat for canopy, shrub and ground-dwelling birds Movement corridors for other terrestrial fauna
Bridge structure		
	Cracks, crevices and fissures within wooden logs Double layer bridge decking creating larger crevices	Suitable roosting habitat for Southern Myotis Suitable diurnal and temporary roosting habitat for Large Bent-wing Bat Suitable diurnal and temporary roosting habitat for Little Bent-wing Bat Suitable diurnal and temporary roosting habitat for Eastern Coastal Free-tailed Bat

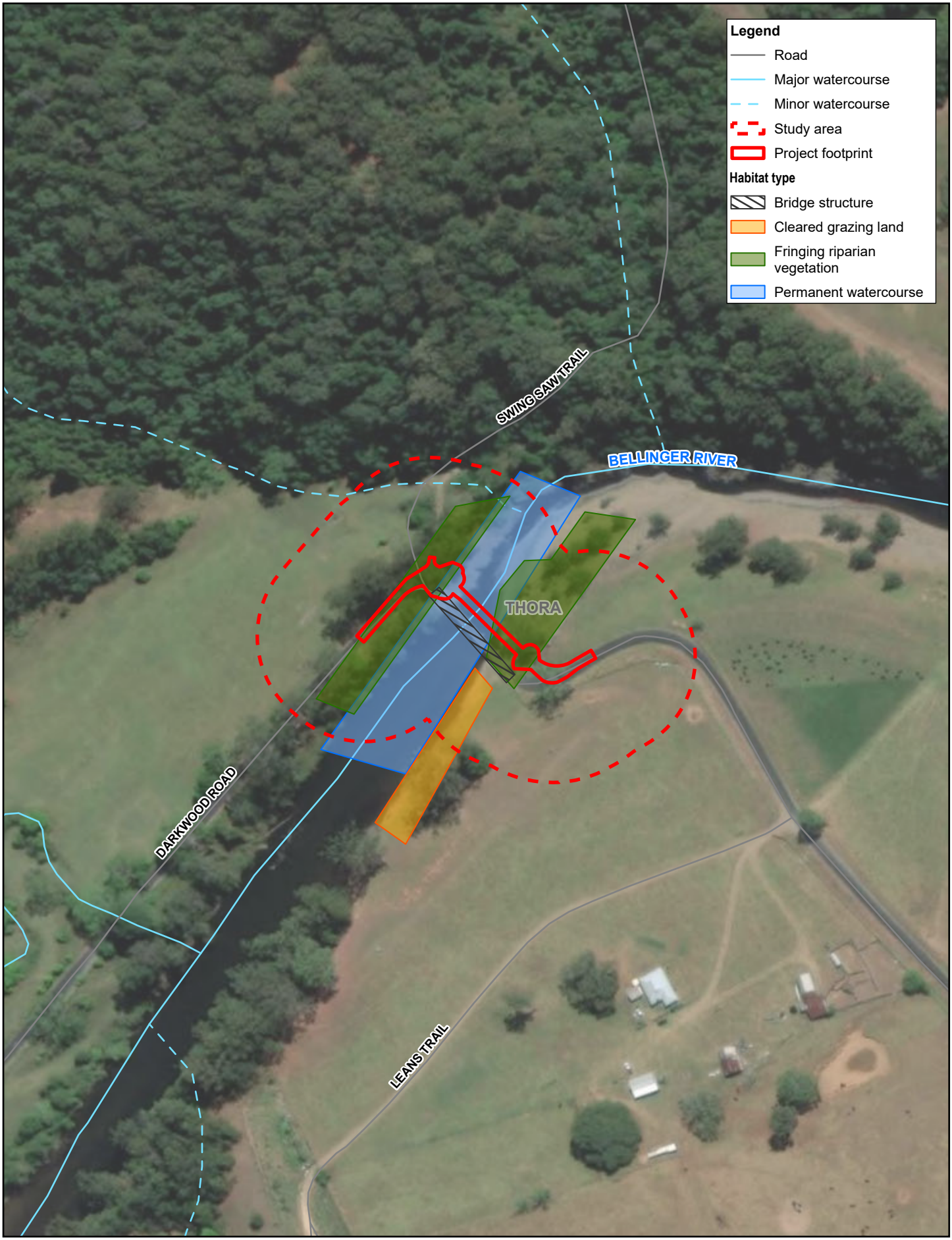
Habitat types	Characteristics	Ecological value
Cleared grazing land		
	Canopy and shrub-level vegetation generally cleared Occasional isolated trees Ground-level habitats cleared and lacking structural complexity Ground layer dominated by exotic pasture grasses Fallen trees and woody debris	Foraging habitat for raptors Refuge for quails and other ground-dwelling birds Suitable foraging habitat for all microbats
Hobarts Bridge		
Permanent watercourses		
	Permanent water sources Bedrock and cobble substrate Bedrock and cobble banks Watercourse is shallow with deep pools with fast flow Fallen wooden debris within the	Drinking sites for birds and mammals Refuges and breeding habitat for Giant Barred Frog and other amphibians Foraging habitat and flyway for Southern Myotis Flyway for Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle and other bats Flyway for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Movement corridors for fish, amphibians and aquatic fauna
Fringing riparian vegetation		
	Mature canopy trees present in low to moderate abundance Low abundance of hollow bearing trees Patches of dense shrubs Casuarina needle leaf-litter	Roosting sites for arboreal mammals Roosting habitat for Southern Myotis, Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat and Eastern False Pipstrelle Refuges and breeding for Giant Barred Frog and other amphibians Foraging and roosting habitat for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Sheltering and hunting habitat for Stephens's Banded Snake and other snakes and reptiles Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Nesting and foraging habitat for canopy, shrub and ground-dwelling birds Movement corridors for other terrestrial fauna

Habitat types	Characteristics	Ecological value
Bridge structure		
	Cracks, crevices and fissures within wooden logs Double layer bridge decking creating larger crevices suitable for roosting	Suitable roosting habitat for Southern Myotis Suitable diurnal and temporary roosting habitat for Large Bent-wing Bat Suitable diurnal and temporary roosting habitat for Little Bent-wing Bat Suitable diurnal and temporary roosting habitat for Eastern Coastal Free-tailed Bat
Bamboo plantation		
	Dense stands of bamboo Low abundance of hollow bearing trees Low abundance of mature canopy species Close proximity to permanent water source	Suitable roosting habitat for Grey-Headed Flying-Fox which was observed approximately 120 m up from the existing bridge Black Flying-Foxes were also observed
Justins Bridge		
Permanent watercourses with fringing riparian vegetation		
	Permanent water sources Bedrock and cobble substrate Bedrock cobble and soil banks Watercourse is shallow with deep pools with fast flow Fallen wooden debris within the	Drinking sites for birds and mammals Refuges and breeding habitat for Giant Barred Frog and other amphibians Foraging habitat and flyway for Southern Myotis Flyway for Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle and other bats Flyway for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Movement corridors for fish, amphibians and aquatic fauna

Habitat types	Characteristics	Ecological value
Fringing riparian vegetation		
	Mature canopy trees present in low to moderate abundance Low abundance of hollow bearing trees Patches of dense shrubs Casuarina needle leaf-litter	Roosting sites for arboreal mammals Roosting habitat for Southern Myotis, Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat and Eastern False Pipstrelle Refuges and breeding for Giant Barred Frog and other amphibians Foraging and roosting habitat for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Sheltering and hunting habitat for Stephens's Banded Snake and other snakes and reptiles Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Nesting and foraging habitat for canopy, shrub and ground-dwelling birds Movement corridors for other terrestrial fauna
Bridge structure		
	Cracks, crevices and fissures within wooden logs	Suitable roosting habitat for Southern Myotis Suitable diurnal and temporary roosting habitat for Large Bent-wing Bat Suitable diurnal and temporary roosting habitat for Little Bent-wing Bat Suitable diurnal and temporary roosting habitat for Eastern Coastal Free-tailed Bat
Cleared grazing land		
	Canopy and shrub-level vegetation generally cleared Occasional isolated trees Ground-level habitats cleared and lacking structural complexity Ground layer dominated by exotic pasture grasses Casuarina needle leaf-litter	Foraging habitat for raptors Refuge for quails and other ground-dwelling birds Giant Barred Frog habitat in pasture grass stands, nearby Casuarina needle leaf-litter

Habitat types	Characteristics	Ecological value
Duffys Bridge		
Permanent watercourse		
	Permanent water sources Cobble substrate Watercourse is shallow with deep pools and slow flow Fallen wooden debris within the waterway	Drinking sites for birds and mammals Refuges and breeding habitat for Giant Barred Frog and other amphibians Foraging habitat and flyway for Southern Myotis Flyway for Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle and other bats Flyway for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Movement corridors for fish, amphibians and aquatic fauna
Fringing riparian vegetation		
	Mature canopy trees present in low to moderate abundance Low abundance of hollow bearing trees Patches of dense shrubs Casuarina needle leaf-litter	Roosting sites for arboreal mammals Roosting habitat for Southern Myotis, Large Bent-wing Bat, Little Bent-wing Bat, Eastern Coastal Free-tailed Bat and Eastern False Pipstrelle Refuges and breeding for Giant Barred Frog and other amphibians Foraging and roosting habitat for Grey-headed Flying-fox and Superb Fruit-dove and other flying mammals Sheltering and hunting habitat for Stephens's Banded Snake and other snakes and reptiles Foraging habitat for Bellinger River Snapping Turtle and other aquatic fauna Nesting and foraging habitat for canopy, shrub and ground-dwelling birds Movement corridors for other terrestrial fauna
Bridge structure		
	Cracks, crevices and fissures within wooden logs Double layer bridge decking on some bridges creating larger crevices	Suitable roosting habitat for Southern Myotis Suitable diurnal and temporary roosting habitat for Large Bent-wing Bat Suitable diurnal and temporary roosting habitat for Little Bent-wing Bat Suitable diurnal and temporary roosting habitat for Eastern Coastal Free-tailed Bat

Habitat types	Characteristics	Ecological value
Cleared grazing land		
	Canopy and shrub-level vegetation generally cleared Occasional isolated trees Ground-level habitats cleared and lacking structural complexity Ground layer dominated by exotic pasture grasses	Foraging habitat for raptors Refuge for quails and other ground-dwelling birds Giant Barred Frog habitat on the fringe of a cleared paddock and the riparian vegetation



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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GHD

Bellingen Shire Council
Bellinger River Species Impact Statement
Joyces Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Habitat types

FIGURE 4.5

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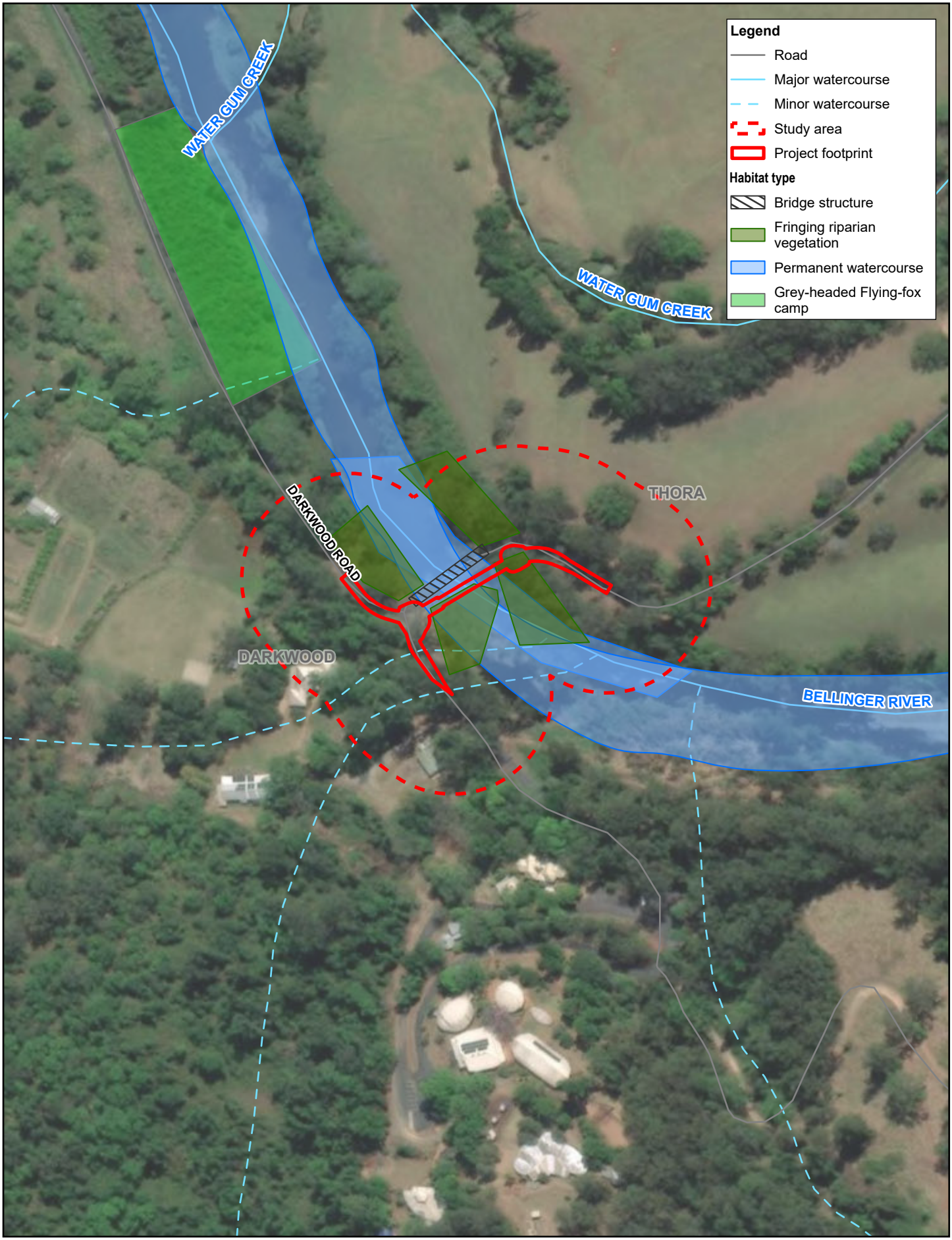
Print date: 29 Jul 2024 - 15:14

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: project area, project footprint, habitat type (2024), survey data (2023); NSWSS: roads, watercourse, suburbs (2023).
Created by: mvandermerwe



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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Hobarts Bridge

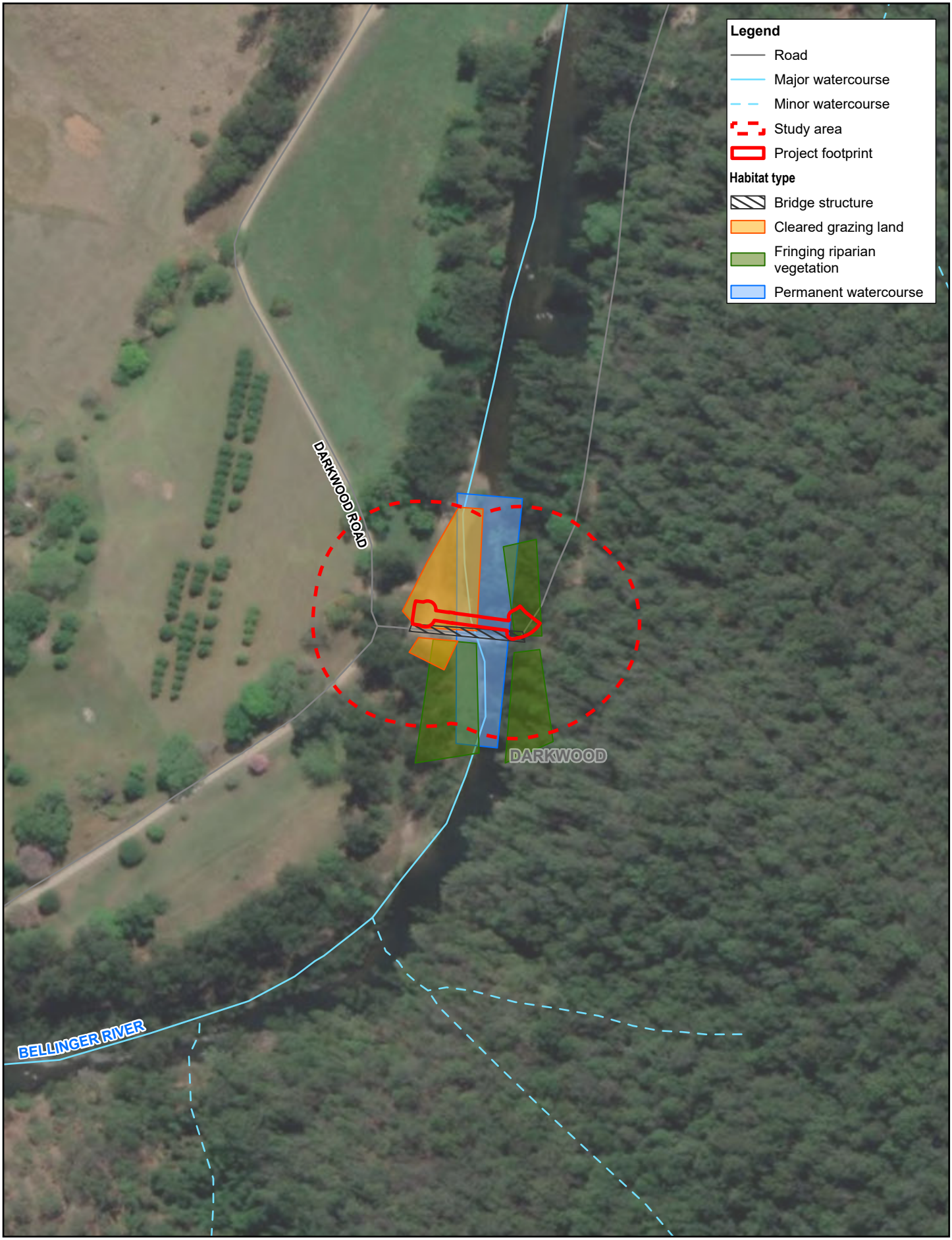
Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Habitat types

FIGURE 4.6

\\ghdnet\ghd\AU\Brisbane\General\Services\GIS\Projects\12611463\GIS\Maps\Deliverables\12611463_SpeciesImpactStatement.aprx - 12611463_006_HabitatTypes
Print date: 29 Jul 2024 - 15:11

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: project area, project footprint, habitat type (2024), survey data (2023); NSWSS: roads, watercourse, suburbs (2023).
Created by: mvandermerwe



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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Bellingen Shire Council
Bellinger River Species Impact Statement
Justins Bridge

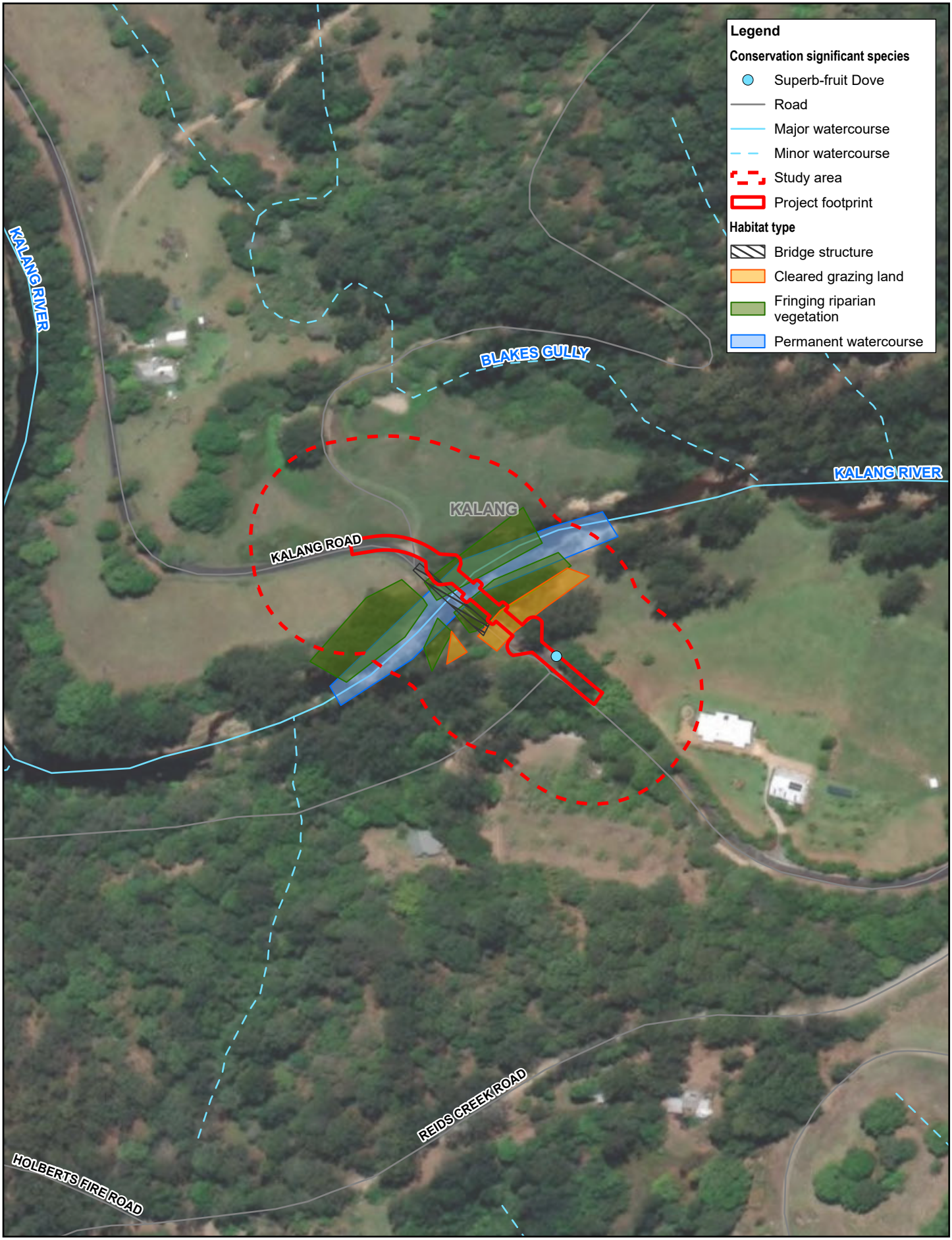
Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Habitat types

FIGURE 4.7

\\ghdnet\ghd\AU\Brisbane\General\Services\GIS\Projects\12611463\GIS\Maps\Deliverables\12611463_SpeciesImpactStatement.aprx - 12611463_006_HabitatTypes
Print date: 29 Jul 2024 - 15:10

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: project area, project footprint, habitat type (2024), survey data (2023); NSWSS: roads, watercourse, suburbs (2023).
Created by: mvandermerwe



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

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GHD

Bellingen Shire Council
Bellinger River Species Impact Statement
Duffys Bridge

Project No. **12611463**
Revision No. **0**
Date **29/07/2024**

Habitat types

FIGURE 4.8

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Print date: 29 Jul 2024 - 15:10

Data source: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community. GHD: project area, project footprint, habitat type (2024), survey data (2023); NSWSS: roads, watercourse, suburbs (2023).
Created by: mvandermerwe

4.3 Threatened fauna species

Based on the results of the desktop review, 48 fauna species listed under the NSW BC Act as relevant to the study area, including 18 birds, 21 mammals, three reptiles, four frogs and two invertebrates have been previously recorded in the Project Area or are predicted to occur. A likelihood of occurrence assessment determined that these threatened fauna species has the potential to occur at one or more of the four bridge locations including:

– 38 fauna species that ”may occur” within the Project footprint. These species were classified as “may occur” if suitable habitat was present within the Project footprint but the species were known to be highly mobile, or they have large home range. Any impacts to these species are negligible and therefore classified as ‘may occur’.
– Three fauna species that are considered “likely to occur” within the Project footprint.
– Seven fauna species that were “confirmed present” within the Project footprint during the assessment.

The full likelihood of occurrence assessment is shown in Appendix J.

A large number of the species known or predicted to occur in the Project Area can be excluded from occurring in the Project footprint, given their specific habitat requirements (refer Appendix J). Many previous records of threatened species in the Project Area are associated with Dorrigo National Park, the Bellinger River National Park, Baalijin Nature Reserve, Oaks State Forest, Diehappy State Forest and Scotchman State Forest, including vegetated creek lines outside the Project footprint elsewhere in the Project Area.

Eight fauna species previously recorded or predicted to occur in the Project Area could occur in habitats associated with the Project footprint (Table 4.2). The Project footprint has suitable habitat, local records in close proximity to the Project and/or is closely associated with specific habitat resources that are present for 10 species. As such, these species have been considered as present or likely to occur in the study area. Assessments of Significance have been prepared for these species (see Section 5 and Appendix J).

A summary of the 10 species that were confirmed present or were considered “likely to occur” at one or more of the four bridge locations is presented within Table 4.2. These species are discussed further below in Sections 4.3 to 5.6.1.5.

Table 4.2 Threatened fauna confirmed present or likely to occur in the study area

Species	Conservation status		Likelihood of occurrence			
	EPBC Act	BC Act	Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Mixophyes iteratus Giant Barred Frog	E	V	**Likely to occur**	**Likely to occur**	**Likely to occur**	**Likely to occur**
Myotis macropus Southern Myotis	-	V	**Confirmed present**	**Likely to occur**	**Confirmed present**	**Likely to occur**
Miniopterus orianae oceanensis Large Bent-winged Bat	-	V	**Confirmed present**	**Likely to occur**	**Likely to occur**	**Likely to occur**
Miniopterus australis Little Bent-winged Bat	-	V	**Confirmed present**	**Likely to occur**	**Likely to occur**	**Likely to occur**

Species	Conservation status		Likelihood of occurrence			
	EPBC Act	BC Act				
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	-	V	**Confirmed present**	**May occur**	**Confirmed present**	**May occur**
Falsistrellus tasmaniensis Eastern False Pipistrelle	-	V	**Confirmed present**	**Likely to occur**	**Likely to occur**	**Likely to occur**
Pteropus poliocephalus Grey-headed Flying-fox	V	V	**May occur**	**Confirmed present**	**May occur**	**May occur**
Ptilinopus superbus Superb Fruit-dove	-	V	**May occur**	**Confirmed present**	**May occur**	**May occur**
Hoplocephalus Stephens'sii Stephens's Banded Snake	-	V	**Likely to occur**	**Likely to occur**	**Likely to occur**	**Likely to occur**
Myuchelys georgesi Bellinger River Snapping Turtle	CE	E	**Likely to occur**	**Likely to occur**	**Likely to occur**	**Likely to occur**

Key: red = confirmed present, orange = likely to occur, yellow = may occur

4.3.1 Giant Barred Frog (*Mixophyes iteratus*)

4.3.1.1 Species description

The Giant Barred Frog (*Mixophyes iteratus*) is a powerful large frog that is up to 115 mm in length (OEH 2017). The species is well-camouflaged in leaf litter with botched dark olive green, light to dark brown, and black colourings (OEH 2017) (DCCEEW 2023). The limbs have dark crossbars, and the thighs hind side are black with yellow spots. The snout is pointed, and dark spots are present as a broad lateral band dividing the white from the dark dorsal and the pale yellow ventral surface (DCCEEW 2023). Compared to other barred frog, the Giant Barred Frog can be distinguished by its golden iris eyes with vertical pupils (OEH 2017).

4.3.1.2 Conservation status

The Giant Barred Frog conservation status is listed Endangered under the EPBC Act (DCCEEW 2023) and Vulnerable under the BC Act (TSSC 2024). Populations of the species are now recognisably small and are isolated to patches of forest. Due to genetic variation, threat response, and general health, the species viability has continued to decline (DCCEEW 2023). The Giant Barred Frog is a Category 2 species on the NSW Sensitive Species Data Policy. For species in this category, known records will be supplied ‘denatured’, to generalise the Project Area.

4.3.1.3 Habitat utilisation

The Giant Barred Frog is usually found at low altitudes with a preference for riparian habitats and is usually associated with wet sclerophyll forest or rainforest where clean, flowing streams occur (Robinson 1993; White 1994). The Giant Barred Frog deposits its eggs out of the water, under overhanging banks or on steep banks of large pools (Knowles et al. 1998). Tadpoles are present throughout the year and probably over-winter in streams (Hero and Fickling 1996).

The Giant Barred Frog forages in riparian and adjacent forest habitats (White 1994). Individuals are known to shelter during the day either inactive under leaf litter or alert but sheltered under vegetation where frogs could avoid predators by jumping away. The species tends to move within a 20 m wide band either side of streams and has been recorded moving over 100 m in a night (Lemckert and Brassill 2007). In Queensland, the species has been recorded moving a maximum distance of 268 m along a stream and 50 m away from a stream (Streatfield 1999). The breeding season occurs from Spring to Autum with peak activity in November and February (TSSC 2024).

4.3.1.4 Results of targeted survey

This species has been recorded within 10 km of the Project footprint and is considered ‘likely to occur’ at each of the four sites. Habitat for the Giant Barred Frog was found to occur at each of the four Project footprints in the form of abundant leaf litter, considered suitable for both sheltering and foraging and suitable breeding habitat (represented in Plate 4.1, Plate 4.2, Plate 4.3, Plate 4.4) (pools in larger streams) (TSSC, 2021). Relatively low levels of disturbance were observed at each watercourse (excluding Joyce’s Bridge which support cattle grazing on the south-eastern bank), despite evidence of infestation of weeds (Plate 4.3).


Plate 4.1 *Aquatic habitat across Joyces Bridge Project footprint (L: southeastern bank looking west to bridge. R: south bank looking east to bridge)*


Plate 4.2 *Aquatic habitat across Hobarts Bridge Project footprint (L: eastern bank looking south. R: western bank looking north).*


Plate 4.3 *Aquatic habitat across Justins Bridge Project footprint (L: western bank looking south to bridge. R: vegetation and leaf litter on eastern bank, south of the bridge).*


Plate 4.4 ***Aquatic habitat across Duffys Bridge Project footprint (L: northeastern bank looking south to bridge. R: northeastern bank, behind riparian vegetation and in cattle paddock. Looking south to bridge).***

4.3.2 Southern Myotis (*Myotis macropus*)

4.3.2.1 Species description

The Southern Myotis (*Myotis macropus*) is a large, disproportionately, footed bat, with its feet being approximately between 8 to 12 mm in size (OEH 2020a). The species is currently referred to as Southern Myotis, however, it previously has been known as the large-footed myotis. It is roughly 50 mm in body length and 28 cm in wingspan, with the dark grey to reddish brown on the back and grey on the belly (OEH 2020a).

4.3.2.2 Conservation status

The Southern Myotis (*Myotis macropus*) is listed as 'vulnerable' under the BC Act 2016. However, the species is not listed under the EPBC Act (OEH 2020a). Although the species distribution appears to be widespread, the population has continued to decline. Females can produce up to two young each year, one in early October and the other in late January (OEH 2020a; Australian Museum 2020; BCD pers. comm.). The latter young are likely non-volant until March (BCD pers. comm.) The conservation of roosting and foraging sites is essential in the species longevity (OEH 2020a).

4.3.2.3 Habitat requirements

The Southern Myotis is typically found in close proximity of suitable waterways for foraging (Campbell 2009). They have high intensity utilisation of flyways, reflecting their specialised foraging habitat (Lam 2021). This species has been known to inhabit caves and other artificial structures including disused railway tunnels and bridges and tree hollows (Lam 2021).

Riparian vegetation and their associated waterways significantly influence the population size of Southern Myotis due to their diet (Lam 2021). The Southern Myotis forages along waterways as their predominately prey on small vertebrate, lepidoptera and diptera (Lam 2021).

4.3.3 Large Bent-wing Bat (*Miniopterus orianae oceanensis*)

4.3.3.1 Species description

The Large Bent-wing bat (*Miniopterus orianae oceanensis*) has chocolate to reddish brown fur on its back with lighter fur on its belly (OEH 2019). The species has a wing span of between 30 – 35 cm with a short snout and domed head. Its body is approximately 6 cm long. It has recently been renamed from the Eastern Bent-wing Bat (*Miniopterus schreibersii subsp. oceanensis*).

4.3.3.2 Conservation status

The Large Bent-wing Bat (*Miniopterus orianae oceanensis*) is listed as 'vulnerable' under the BC Act 2016 and the species is not listed under the EPBC Act (OEH 2019). This species has been declining by loss of high productivity foraging habitat and disturbance to roosting habitat. The species needs very specific temperature and humidity regimes in maternity caves. The conservation of roosting and foraging sites is essential in the species longevity (OEH 2019).

4.3.3.3 Habitat requirements

The Large Bent-wing Bat is primarily a cave dwelling species, as they prefer a steady microclimate without significant temperature fluctuations (Lam 2021). Roosting in caves is particularly important for breeding females which create large maternity roosting colonies throughout its known range in spring and summer (Mills 2021). This bat is known to continuously move between several nearby roosting sites due to external disturbance and bad weather conditions during autumn, winter and spring (Lam 2021). During this activity, the bats are either searching for new roosting sites or looking for social interactions (Lam 2021),

The Large Bent-Wing Bat are known to mate but not give birth in Transport for New South Wales structures (i.e. culverts and bridges) and need to be considered when construction/demolition or maintenance occurs within these structures) (TfNSW 2023).

The Large Bent-wing Bat feeds on insects so is known to forage along flyways above waterways, forest clearings and above forest canopies (Roberts 2012).

4.3.4 Little Bent-wing Bat (*Miniopterus australis*)

4.3.4.1 Species description

The Little Bent-wing Bat (*Miniopterus australis*) is a small insectivorous bat up to 45 mm in length (OEH 2020b). The species has chocolate brown, long and thick fur, more obvious around the neck and on the crown of the head. They have short muzzles and rounded, triangular shaped ears. At rest, their long third finger is folded back and bent under their wing (OEH 2020b).

4.3.4.2 Conservation status

The Little Bent-wing Bat is listed as 'vulnerable' under the BC Act 2016 and not listed under the EPBC Act (OEH 2020b). Only five known nursery sites / maternity colonies are known in Australia and the disturbance of known colonies may be catastrophic to the survival of this species (OEH 2020b).

4.3.4.3 Habitat requirements

The Little Bent-wing Bat the species has been observed to increasingly favour man-made structures as roosting sites in peri-urban areas (Lam 2021). However, this species has also been found roosting in caves and tree-hollows (Australian Museum 2020). This species has been found roosting in tunnels between February and April (Lam 2021). The breeding season extends from November to March.

The Little Bent-wing Bat is insectivorous and typically forages in densely vegetated areas, undulating between canopy and shrub layers (Lam 2021).

4.3.5 Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)

4.3.5.1 Species description

The Eastern coastal free-tailed bat (*Micronomus norfolkensis*) is a small bat with a hairless face and long bare tail protruding from its tail membrane (OEH 2022). The species weighs up to 10 g and has dark brown/reddish fur on its back with paler fur below.

4.3.5.2 Conservation status

The Eastern Coastal Free-Tailed Bat is listed as ‘vulnerable’ under the BC Act 2016 and is not listed under the EPBC Act (OEH 2022). This species roosts predominately in tree hollows but is known to roost under bark or in man-made structures. The conservation of roosting sites is essential in the species longevity (OEH 2022).

4.3.5.3 Habitat requirements

The Eastern Coastal Free-Tailed Bat is found in productive floodplain areas, and they typically favour dry sclerophyll forest and woodland where they can use flyways and upper slopes (McConnville 2013). This species has been recorded in other habitat types including wet sclerophyll forest. The Eastern Coastal Free-Tailed Bat has been observed roosting in hollows singularly, or in small groups because they offer a stable microclimate (McConville et al 2013). The limited data available suggests the Eastern Coastal Free-Tailed Bat roosts in tree hollows, buildings, telegraphs poles (McConnville 2013).

Studies have surmised that the Eastern Coastal Free-Tailed Bat is insectivorous and will forage above tree canopies and the edges of forests. They are adapted to open and edge microhabitats which suite their foraging and dietary requirements i.e. area where capturing insect/prey by aerial inception (McConnville 2013). Females are thought to give birth from November to December.

4.3.6 Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

4.3.6.1 Species description

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is a relatively large microbat, up to about 65 mm in length (OEH 2017a). It weighs up to approximately 30 g and has long pointed ears and sparse hair on its nose. It has dark to reddish-brown fur above with paler grey on its underside (Taylor et al 1987).

4.3.6.2 Conservation status

The Eastern False Pipistrelle is listed as ‘vulnerable’ under the BC Act 2016 and is not listed under the EPBC Act (OEH 2017a). Thie species typically roosts in hollow-bearing eucalypt trees but is also known to roost under loose bark on trees or in buildings. The conservation of roosting and foraging sites is essential in the species longevity (OEH 2017a).

4.3.6.3 Habitat requirements

The Eastern False Pipistrelle typically roost in hollows or large eucalypts in tall, wet forests and coastal mallee has been found roosting in tree hollows (Australian Museum 2020, Taylor et al 1987).

The Eastern False Pipistrelle is a selective insectivorous feeder, favouring Coleopterans (Taylor et al 1987). They typically feed in the upper layers of a forest canopy, or above the top of the canopy (O'Neill & Taylor 1989).

4.3.7 Results of targeted microbat survey

Five threatened microbat species were detected on Anabats during the field surveys:

– Southern Myotis (*Myotis macropus)*
– Large Bent-wing Bat (*Miniopterus orianae oceanensis*)
– Little Bent-wing Bat *(Miniopterus australis)*
– Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), and
– Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

Unidentified microbats were observed at each bridge site during roost watch. Detailed Anabat analysis confirmed records at Joyce and Justins Bridge however Anabat detectors at Duffys and Hobarts Bridge suffered from technical issues (e.g. faulty power supply or possible faulty microphone) so no suitable data was captured at these sites.

All bridges may comprise potential roosting habitat for the Southern Myotis, Large Bent-winged Bat and Little Bent-winged Bat. The Eastern Coastal Free-Tailed Bat and Southern Myotis may roost in hollow-bearing trees within the study area. All threatened microbat species (with the exception of Southern Myotis) are likely to forage along the Bellinger River and Kalang River in riparian vegetation and amongst other patches of native vegetation and also vegetation along Darkwood Road and Kalang Road. The Southern Myotis would forage over pools of water within Bellinger River and Kalang River and adjacent farm dams in the broader study area.

Southern Myotis

– Justins Bridge - A small number of calls (< 15) each night was recorded for the evening emergence period for two of the four survey nights (27-28/11/23) including calls from the species group *Myotis macropus/Nyctophilus sp.* No calls were recorded for this same period for the 29-30/11/23. A small number of calls (< 10) each night was also recorded for the early morning re-entry period near sunrise for three of the four survey nights (28, 29, 30/11/23). This data suggests some bat species may be roosting within the bridge, most likely at a location nearby the site of the detector, for the detector dates 27-28/11/23 or between the two detector sites.
– Joyces Bridge - A small number of calls (< 3) each night were recorded for the evening emergence period for two non-consecutive nights of the four survey nights (27 and 30/11/23) including calls from the species group *Myotis macropus/Nyctophilus* sp. No calls were recorded or the early morning re-entry period near sunrise for any survey night. The few calls recorded indicate emergence from a nearby roost however the source of the calls cannot be confidently placed within bridge structure.

Large Bent-Wing Bat

– Joyces Bridge - A small number of calls (< 3) each night were recorded for the evening emergence period for two non-consecutive nights of the four survey nights (27 and 30/11/23) including calls from *M.o.oceanensis/Vespadelus* sp. No calls were recorded or the early morning re-entry period near sunrise for any survey night. The few calls recorded indicate emergence from a nearby roost however the source of the calls cannot be confidently placed within bridge structure.

Little Bent-Wing Bat

– Joyces Bridge - This species was recorded from approximately 28 definite call records Joyces Bridge across three consecutive nights of 27/11/23- 29/11/2023.

Eastern Coastal Free-tailed Bat

– Joyces Bridge - Recorded from approximately 145 (definite and probable combined) files across four consecutive survey nights (27/11/23-30/11/2023).
– Justins Bridge – Recorded from approximately 145 (definite and probable combined) files across three consecutive survey nights (28/11/23-30/11/2023).

Eastern False Pipistrelle

– Justins Bridge - A small number of calls (< 15) each night were recorded for the evening emergence period for two of the four survey nights (27-28/11/23) including calls from the species group *Myotis macropus/Nyctophilus sp.*and two probable *Falsitrellus tasmaniensis* calls. No calls were recorded for this same period for the 29-30/11/23.
– Justins Bridge - A small number of calls (< 15) each night were recorded for the evening emergence period for two of the four survey nights (27-28/11/23) including two probable *Falsitrellus tasmaniensis* calls. No calls were recorded for this same period for the 29-30/11/23. A small number of calls (< 10) each night were also recorded for the early morning re-entry period near sunrise for three of the four survey nights (28, 29, 30/11/23). This data suggests some bat species may be roosting within the bridge, most likely at a location nearby the site of the detector, for the detector dates 27-28/11/23 or between the two detector sites.

A detailed bat call analysis report is presented in Appendix G.

4.3.8 Grey-headed Flying-fox (*Pteropus poliocephalus*)

4.3.8.1 Species description

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is Australia's largest bat, with a wing span up to 1 m and a body up to 29 cm in length (Menkhorst & Knight 2011; OEH 2020). Males can weight up to 1000 g while females can weigh up to 800 g (DAWE 2021). The species has long dark grey fur on their body and their fur on the head is also grey but varies in shade from near black to silver (DAWE 2021). They have a distinct, broad and complete collar of golden-orange fur (Menkhorst & Knight 2011). Compared to other fly-fox species, it is distinguished by its black wing membranes and leg fur extending to the ankle (OEH 2020).

4.3.8.2 Conservation status

The Grey-headed Flying-fox (*Pteropus poliocephalus)* is listed as 'vulnerable' under the BC Act 2016 and 'vulnerable' under the EPBC Act (OEH 2020b). Although the species distribution appears to be widespread, the population has continued to decline. The protection of roost sites, avoidance of disturbance to camps between September and November, protecting key foraging areas and managing licenced shooting is essential in the species longevity (OEH 2020b).

4.3.8.3 Habitat requirements

Grey-headed Flying-foxes forage on the nectar and pollen of native trees and roost in large aggregations of up to tens of thousands of animals (OEH 2020). Females give birth to a single young each October/November after a 6-month gestation. At around 3 months, young are able to fly and forage outside the camp (OEH 2020b).

Within the Project Area there are estimated to be several thousand Grey-headed flying fox that utilise the Study area for foraging and roosting. There is one known Nationally Important Flying-fox camp (ID 10) and a second known camp (ID 783) occurring within the broader Project Area in Bellingen, approximately 20 km from Joyces Bridge, 22 km from Hobarts Bridge, 40 km from Justins Bridge and 6 km from Duffys Bridge.

There are 40 records of Grey-headed Flying-fox recorded within 10 km of Joyce Bridge (ALA 2023). The nearest records are within 2 km.

There are 43 historical records of Grey-headed Flying-fox within 10 km of Hobarts Bridge (ALA 2023). Grey-headed Flying-fox were observed flying overhead at dusk as they were leaving the roost during the site assessment. However, this is likely to be a drastic underestimate of the number of individuals as an active maternity roost of Grey-headed Flying-fox and Black Flying-fox was recorded approximately 120 from Hobarts Bridge which is known to support at least 1000 individuals.

There are 12 records of Grey-headed Flying-fox within 10 km of Justins Bridge (ALA 2023). The nearest record is approximately 3 km.

4.3.8.4 Results of targeted survey

Within 10 km of Duffys Bridge are 195 records of Grey-headed Flying-fox, however a large proportion of these records occur in Bellingen where there are known camps (including one Nationally Important Flying-fox camp) (ALA 2023; DCCEEW 2023b). The nearest record to Duffys Bridge is approximately within 3 km. Results of targeted survey

This species has been recorded in large numbers in the Project Area and was recorded at Hobarts Bridge during the field surveys. A camp of grey-headed flying-fox was recorded within 120 m of the existing bridge along Darkwood Road. Black flying-foxes (*Pteropus alecto*) were also recorded in this camp. This is a maternity camp (for both species; dependant young observed) comprising at least 1000 individuals and restricted to a bamboo plantation (Plate 4.5). The indicative extent of this camp is presented in Figure 4.2. The Project footprint at Hobarts Bridge would provide foraging habitat for this species when shrubs and trees are in flower.

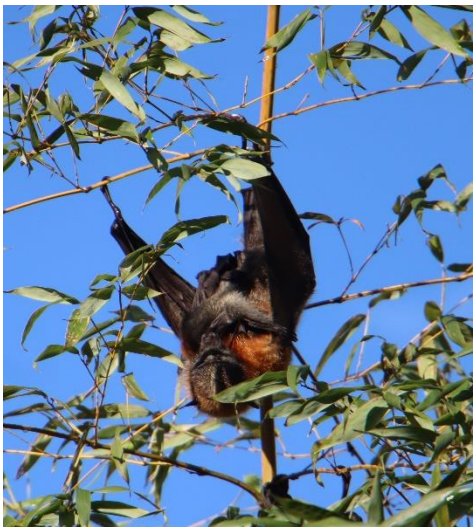


Plate 4.5 ***Top Left: Grey-headed Flying-fox nursing mother. Top Right: Black Flying-fox amongst roosting Grey-headed Flying-fox. Bottom: Snapshot of population roosting in bamboo plantation***

4.3.9 Superb Fruit-dove (*Ptilinopus superbus*)

4.3.9.1 Species description

The Superb Fruit-dove (*Ptilinopus superbus)* is a small, brightly coloured pigeon with a purple crown, pale green cheeks, an orange collar on its hind neck, spotted black tail with a white tip and green on its upper wings with green barred flanks (OEH 2022; Simpsons & Day, 2010). The throat and breast are blue-grey with a black breast-band and white belly (Simpsons & Day 2010). The bird is approximately 24 cm in length.

4.3.9.2 Conservation status

The Superb Fruit-dove (*Ptilinopus superbus)* is listed as 'vulnerable' under the BC Act 2016. However, the species is not listed under the EPBC Act (OEH 2022). The species distribution is restricted to north-eastern Queensland to north-eastern New South Wales however clearing and fragmentation of low-elevation rainforest resulting in irregular food availability has caused the species to decline (OEH 2022). The retention and protection of remnant patches of rainforest is essential in the species longevity (OEH 2022).

4.3.9.3 Habitat requirements

The Superb Fruit-dove habitat preferences include rainforest, adjacent mangroves, eucalypt forest and scrubland with native fruits (Simpsons & Day 2010). They are arboreal and feed almost exclusively on fleshy fruits (Birdlife Australia 2023). In New South Wales they are associated with several vegetation formations including (OEH 2022):

– Dry sclerophyll forests (shrub/grass and shrubby sub-formation).
– Forested wetlands.
– Grassy woodlands.
– Heathlands.
– Rainforest.
– Wet sclerophyll forests (grassy and shrubby sub-formation).

Part of the population is known to be nomadic or migratory (OEH 2022). Superb Fruit-doves build a nest of twigs in bushy trees from 5 m - 30 m above the ground with the breeding season occurring from September to January (Australian Museum 2022).

4.3.9.4 Results of targeted survey

This species was recorded during the diurnal bird survey calling in the vicinity of Hobarts Bridge (Figure 4.2). The bird was unable to be visually recorded due to the dense surrounding vegetation however this species is known to forage in rainforest and other closed forest habitats. This species may forage within the Study Area of each bridge site.

4.3.10 Stephens's Banded Snake (*Hoplocephalus stephensii*)

4.3.10.1 Species description

The Stephens's Banded Snake (*Hoplocephalus stephensii)* is a medium size, slender and venomous snake growing up to 1 m in length (Fitzgerald, et al 2005). It can be brown or yellow-brown with a series of broad, dark crossbands (OEH 2018). The head is typically black with a brown crown with brown or cream path on either side of the nape. The lips are barred with black and cream (OEH 2018).

4.3.10.2 Conservation status

The Stephens's Banded Snake (*Hoplocephalus stephensii)* is listed as 'vulnerable' under the BC Act 2016 and not listed under the EPBC Act. The species distribution is restricted to the coast and ranges from south-east Queensland with ongoing threats and reduction of suitable habitat linked to the decline in population. The retention and protection of stands of native vegetation, particularly with old and dead trees, retention of hollow bearing trees and large, mature trees and management of grazing are all essential actions for the species longevity (Fitzgerald et al 2005; OEH 2018).

4.3.10.3 Habitat requirements

This partly tree-dwelling snake is found in rainforest and eucalypt forests and rocky areas up to 950 m in altitude (OEH 2018). It uses loose bark and tree trunks amongst vines, or in hollow trunk limbs, rocky crevices to shelter during the day. Studies have found they can be almost entirely arboreal, spending nearly 50% of their time inside hollow limbs or trunks of standing trees (Fitzgerald et al 2005). They are typically found within 1 km of forested habitat and have been observed utilising a variety of habitats with the one common requirement for hollow standing trees (Fitzgerald et al 2005). It has a broad tolerance to other habitat factor is (i.e. climate, vegetation communities, food types) which allows a population to persist in larges of forest as long as there are high numbers of hollow bearing trees (Fitzgerald, et al 2005). Mating is thought to occur in Spring with females only gravid every two years (ALA 2024).

4.3.10.4 Results of targeted survey

This species was recorded along Darkwood Road approximately 1.8 km north-east of Hobarts Bridge (not shown on survey results figure as record is outside survey area). This species inhabits wet sclerophyll forest and rainforest which occurs at and around all bridge sites.

4.3.11 Bellinger River Snapping Turtle *(Myuchelys georgesi)*

4.3.11.1 Species description

The Bellinger River Snapping Turtle (*Myuchelys georgesi*) is a medium sized, short necked, freshwater turtle (NSW Scientific Committee 2016). The species, in particularly their young, are mostly distinguished by a distinct yellow stripe travelling angularly down their jawline (NSW Scientific Committee 2016). The plastrons bridge tapers to the rear and front lobes, with the plastron being long yet not as broad in size. The neck and head are significantly shorter than the shell and the tails are absent of any bright colourings. The Bellinger River Snapping Turtle tails are short; however, adult males can be identified by having sustainably longer tails than the adult female (TSSC 2016; NSW Scientific Committee 2016).

The Bellinger River Snapping Turtle utilises cloacal respiration through cloacal burse, allowing partial respiration through the use of aquatic oxygen (TSSC 2016). The Bellinger River Snapping Turtle is mainly an omnivore although does have aspects of carnivory preferences (Cann et al. 1997). The species food source is mostly communities of benthic macro-invertebrates, although the turtle does consume some types of aquatic vegetation and terrestrial fruit (Spencer et al 2014; Cann et al. 1997). The diet can vary depending on prey availability and competition between other Australian freshwater turtles that adapt their diets to water quality and various habitats (NSW Scientific Committee 2016). According to Blamires et al. (2005), a model and table analysis was integrated to determine the life expectancy and the reproductive age of the Bellinger River Snapping Turtle. The results indicated that the species is expected to live 28.9 years, while the minimum reproductive age was 7.9 years (Blamires et al. 2005; TSSC 2016).

4.3.11.2 Conservation status

The Bellinger River Snapping Turtle currently listed as critically ‘endangered’ under the NSW Biodiversity Conservation Act 2016 (BC) and Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (DCCEEW 2023). The Bellinger River Snapping Turtle follows the type III survivorship with fatalities reducing with age resulting in populations with a higher number of large adults (Blamires et al. 2005). Consequently, the turtle population is sensitive to changes in adult survivorship.

It is evident that since 2015, a major decline of population has occurred due to an unknown disease that impacted the Bellinger River Snapping Turtle by causing a mass mortality of individuals in the autumn and summer months of 2015 (Chessman et al. 2020). These fatalities resulted in a significant reduction in the abundance and distribution of the species throughout the catchment.

The Bellinger River Snapping Turtle is a Category 2 species on the NSW Sensitive Species Data Policy. For species in this category, known records will be supplied ‘denatured’, in order to generalise the Project Area.

4.3.11.3 Habitat requirements

The preferred habitat of the Bellinger River Snapping Turtle is moderate to deep pools with rock substrates (Spencer et al 2007). Their habitat is patchily distributed within their distribution; however, the species can disperse up and downstream during standard river flow and flood conditions (Cann et al. 2015; NSW Scientific Committee 2016; TSSC 2016; Blamires and Spencer 2013). The Bellinger River Snapping Turtle rarely disperses overland as the species is primarily aquatic, however, the turtle has been observed to utilise fallen trees on the river and the bank to bask (Cann et al. 2015; NSW Scientific Committee 2016).

4.3.11.4 Results of targeted survey

Surveys for Bellinger River Snapping Turtle have been undertaken in the Bellinger River since 2015 by the New South Wales Biodiversity and Conservation Division (BCD) of the Department of Planning and Environment (DPE 2022). BCD estimates there are approximately 200 wild Bellinger River Snapping Turtle within 60 – 70 km of the Bellingen River (DPE 2022). There is an active captive-bred program where immature turtles are released into the river. DPE believe that there is a Bellinger River Snapping Turtle population persisting in the Kalang River, albeit it small (DPE 2022). Since 2018, 179 captive-bred immature Bellinger River Snapping Turtle have been released into Bellinger River. The location, health and movement of some of these turtles are monitored by DPE through radio tracking (DPE 2022). [redacted] NSW BCD has advised they are unsure how many wild or captive-bred turtles occur near the Project area as they can be cryptic and difficult to locate (DPE 2022).

5. Assessment of likely impacts on threatened species

5.1 Giant Barred Frog (*Mixophyes iteratus*)

5.1.1.1 Local and regional abundance and distribution

In New South Wales, the Giant Barred Frog is sparsely distributed south from the border of Queensland to Warrimoo in the Blue Mountains (TSSC 2021). They are more populous around northeastern New South Wales, particularly in the Coffs Harbour to Dorrigo Catchment (TSSC 2021). Subpopulations have been gradually increasing in this region (TSSC 2021).

Habitat utilisation

Both foraging and breeding habitat have the potential to be present at each bridge location Across the four sites a variety of suitable habitats occurred along the Bellinger River and Kalang River, with the consistent habitat niche across each bridge site being heavy leaf litter. The field survey habitat results are summarised below:

- **Joyces Bridge:** *Lantana camara* and broad-leaved privet leaf litter. This site is likely to also provide breeding habitat for the species.
- **Hobarts Bridge:** This site provides breeding habitat for the species. The location is also likely to provide foraging and refuge habitat for the species.
- **Justins Bridge:** Leaf litter of *Casuarina cunninghamiana* needles. This site is likely to provide breeding habitat for the species.
- **Duffys Bridge:** Leaf litter of *Casuarina cunninghamiana* needles and in a paddock on the edge of the bridge. This site is likely to provide breeding habitat for the species.

5.1.1.2 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Giant Barred Frog and may be relevant for the Project works (OEH 2017):

- Clearing of vegetation is a major threat as the species inhabits the lower reaches of streams have been subject to development pressures including clearing for residential development and agricultural practices
- Dense, tall weed infestations (in particularly *Lantana* spp. and exotic grasses) can decrease the habitat quality and its availability, affecting habitat suitability for the species
- Water quality reduction and flow patterns alterations can cause tadpoles and embryos to be vulnerable to siltation
- Insufficient protection of riparian habitat through clearing activities
- The fungal pathogen *Batrachochytrium dendrobatidis*, is a threat to the species that causes chytridiomycosis, which has the potential to cause population decline
- Predation from feral pigs consuming eggs, individuals, or disturbing habitat
- Grazing and movement of domestic livestock causing disturbance in riparian habitat, and
- Stochastic event susceptibility and loss of genetic variation

5.1.1.3 Giant Barred Frog recovery plans

The Giant Barred Frog was included in the recovery plan for stream frogs of south-east Queensland 2001-2005 developed by the Queensland state government and adopted under the EPBC Act in 2003. However, the recovery plan has since expired in 2022. The Committee recommended that following expiry of the existing recovery plan, a new national recovery plan for Giant Barred Frog is not required as it would not have a significant conservation benefit above existing mechanisms. The approved conservation advice provides sufficient direction to implement

priority actions and mitigate against key threats. The conservation advice identified several key actions for the preservation of the species. These include (TSSC 2021):

Habitat loss, disturbance and modifications

- Minimise human disturbance to the Giant Barred Frog and its habitat. Designate protection zones around known site locations to ensure habitat is not fragmented by roads, timber harvesting or clearing of freehold land. Activities permitted in protection zones should be dictated by further research into the effects of disturbance on the Giant Barred Frog.
- Assess the effectiveness of current forestry management practices in ameliorating disturbance to the habitat of the Giant Barred Frog, and revise management practices if necessary.
- Identify key sites and implement a program ensuring enough suitable habitat is maintained to ensure the species' viability in the wild.
- Identify and conserve landscape characteristics that facilitate movement between subpopulations.
- Educate landowners and managers of the importance of maintaining riparian habitat, and the integration of habitat protection into land management regulations.
- Manage flow regimes to enhance breeding opportunities for the Giant Barred Frog to minimise impacts from any potential stream works (diversions and impoundments) and maintenance works (de-silting of water storages) impinging upon Giant Barred Frog habitat, do not degrade water quality, and do not substantially affect current flow regimes.

Invasive species

- Monitor and control damage to riparian areas by feral pigs. This may require a collaborative strategy with land holders and local government authorities to control numbers and potentially fence key sites, where feasible.
- Use fencing, or other measures where applicable, to reduce the access of domestic stock to stream banks.
- Assess the impact of exotic weeds on habitat suitability for the Giant Barred Frog. If impact is shown to be significant, develop a strategy for control or elimination of the invasive weeds. Note: cutting and pasting/painting methods should be used to control weeds as herbicide formulations can be toxic to frogs and tadpoles, particularly if they contain glyphosate and surfactants.

Disease

- Minimise the spread of *Batrachochytrium dendrobatidis* (Bd):
    - Implementing suitable hygiene protocols.
    - Provide disease identification and prevention protocols (methods of handling, diagnostic keys, etc.) to researchers and land managers for use in the field.

5.1.1.4 Long term viability

Both foraging and breeding habitat has the potential to be present at each bridge location. In the absence of mitigation measures, there is the potential for the species to be displaced due to disrupted connectivity terrestrial during construction, however, waterway connectivity is expected to be maintained through implementing mitigation measures outlined in Section 6.

Potential impacts to the species life cycle will be minimised through permitting construction activities outside of the species known breeding season (approximately spring to autumn, after rain) (Frog ID 2024). Adhering to these measures will prevent any impacts to the life cycle of the species to the degree that it would jeopardise the viability of the local population.

Design of the new bridge will span the river and piers will be located outside or on the margins of the low flow channels. The construction of the bridges has potential to disrupt the banks of the river which provide habitat for the species. To mitigate this, alignment of the new bridges will utilise existing disturbed areas such that vegetation and disturbances of the river banks will be minimal. This will also mean no major changes are expected to the riparian zones or the river banks which allows for foraging habitat of the frog to be maintained. Based on these avoidance and mitigation measures, habitat removal and disturbance are expected to be minimal and limited to areas of existing disturbance.

The proposed works are not expected to result in fragmentation or isolation of habitat for the Giant Barred Frog as the works do not result in permanent change to the movement of this frog. During construction this species may be less inclined to visit the construction zone due to noise, presence of people and machinery. Construction will be kept to daylight hour to avoid disturbance at night when adults are active.

Key threatening processes most relevant to the proposed work include a reduction in water quality, clearing of vegetation and the introduction or spread of *Batrachochytrium dendrobatidis*. The Project is expected to manage the potential for any key threatening processes (i.e. a reduction in water quality, clearing of vegetation and the introduction or spread of *Batrachochytrium dendrobatidis*) by keeping works to within existing cleared areas. While individuals were found in cleared areas at Justins Bridge, there was better quality habitat further up or downstream. The species are likely to leave the construction zone to avoid activities through the implementation of best practise management and mitigation measures to manage water quality degradation and pathogen control (as outlined within Section 6 and 7).

The proposed Project works are not expected to impact habitat important to the long-term survival of the species.

5.2 Microbats

5.2.1 Southern Myotis (*Myotis macropus*)

5.2.1.1 Local and regional abundance and distribution

The Southern Myotis is found in the broad coastal band from in the northern and eastern areas of Australia. It is rare for the species to be found over 100 km inland except along major rivers (OEH 2020). The species is closely connected with areas that contain waterways due to their preferred roosting and foraging behaviours. The Southern Myotis has been recorded in 2003 in DieHappy Creek, near one of the entrance passages of the Bellinger River, approximately 3km from Hobarts Bridge (ALA 2023).

Habitat utilisation

The Southern Myotis is likely to utilise each bridge structure for roosting and/or breeding. The following habitat niches were observed across the four bridge sites:

- **Joyces Bridge -** The bridge has a few observable cracks, crevices and fissures within wooden logs. No microbats recorded during diurnal roost inspection and dusk roost emergence watch however data from the Anabats placed at this bridge collected calls from the Southern Myotis which indicate they are foraging in the area. As this species is a hollow-obligate species, it often roosts in bridge structures in the absence of suitable hollow-bearing trees. The bridge may comprise roosting and breeding habitat for Southern Myotis. There are historical records of Southern Myotis occurring within 10 km of the site, with the nearest being approximately 8 km to the west.
- **Hobarts Bridge** - Up to 10 microbats were recorded flying under bridge during dusk roost emergence watch. There are cracks and fissures in the wooden logs comprising the underside of the bridge which may comprise occupied roosting habitat. Technical issues with the Anabat at this site restricted data collection. They have the potential to roost and breed in this bridge. There are historical records of Southern Myotis occurring within 10 km of the site, with the nearest being approximately 1 km to the west.
- **Justins Bridge –** No microbats were recorded during diurnal roost inspections and roost emergence watch at dusk, however data from Anabats indicate the species is known to forage and potentially roosting at this site. The bridge may comprise temporary roosting habitat for Southern Myotis. There are historical records of Southern Myotis occurring within 10 km of the site, with the nearest being approximately 8 km to the east.
- **Duffys Bridge -** A microbat was recorded flying under bridge during dusk roost emergence watch. There are cracks and fissures in the wooden logs comprising the underside of the bridge which is likely to be comprise occupied roosting and breeding habitat. Technical issues with the Anabat at this site restricted data collection. There are historical records of Southern Myotis occurring within 10 km of the site, with the nearest being approximately 1 km to the south.

5.2.1.2 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Southern Myotis (*Myotis macropus*) and may be relevant for the proposed activities (OEH 2020a):

– Loss or disturbance of roosting sites
– Clearing adjacent to foraging areas
– Application of pesticides in or adjacent to foraging areas, and
– Reduction in stream water quality affecting food resources

The Southern Myotis is most susceptible to threats associated with clearing and fragmentation that will impact roosting and foraging areas (DCCEEW 2023). The species roosts under bridges, hollow-bearing trees, caves culverts, mines, dense foliage, and are often nearby water features (Australian Museum 2020) (OEH 2020a). This is a hollow-obligate species which relies upon hollows. In the absence of hollows, it readily uses bridge structures. The Southern Myotis relies on riverine environments for food sources. In a highly productive environment (Campbell 2012), Southern Myotis have been known to have more than one breeding event per year. The species has the potential to roost and breed in each structure. This species has been known to breed in bridges, culverts and other assets associated with road infrastructure (TfNSW 2023). The proposed activities will result in all four bridges being modified, potentially impacting the roosting, breeding and foraging for the species. The impacts are outlined below for each proposed bridge remediation works:

– **Joyces Bridge -** There are two mature Casuarina trees with hollows and/or fissures that are within two metres of the proposed activities which are likely to be impacted during construction either directly (removal) or indirectly (impact of root zones) (Idyll Spaces Environmental Consultants 2023). The roosting for the Southern Myotis has the potential to be affected by the disturbance to the hollow-bearing trees and from removal of the bridge. The species feeds on small fish and aquatic insects by flying close to water features, so the construction works has the potential to impact flyways for this species foraging activity. Data was captured from Anabats from this site which may indicate this species may be roosting nearby.
– **Hobarts Bridge -** Potential impacts of the Hobarts Bridge remediation work include approximately 200 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal of hollow bearing trees and/or suitable habitat (e.g. cracks, crevices or holes) in the bridge structure can possibly affect the roosting of the Southern Myotis (Idyll Spaces Environmental Consultants 2023). There will be impacts to this species roosting habitat and foraging habitat during the construction period but otherwise the overall impact will be limited during operational phase. The species feeds on small fish and aquatic insects by flying close to water features, consequently any construction works on the Hobarts Bridge has the potential to impact food resources and flyways during construction.
– **Justins Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). Depending on confirmed Project footprint this may include the removal of several Casuarina trees that may provide crevices or hollows for roosting microbats. The bridge structure may be utilised by this species however it would only constitute temporary roosting habitat. Data collected from echolocators at this site indicate that some of this species may be roosting within the bridge.
– **Duffys Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). Within this impact area there are potential hollow-bearing trees which the Southern myotis may inhabit. The removal of hollow-bearing trees and bridge structures has the potential to impact the species roosting behaviours.

5.2.1.3 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the Southern Myotis. However, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS for the Southern Myotis aims to extend or maintain its geographic range, secure the species longevity in the wild, and maintain or improve its conservation status listed under the BC Act. The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

– Preserve and protect live and dead hollow bearing trees

– Facilitate future tree replacement by regeneration processes or replanting in areas the species are known to occur
– When undertaking major works, replace wooden bridges with concrete bridges, and a wooden structure should be placed under the new bridge constructions where bats have been known to roost
– Encourage land management agreements to restore, protect, and retain suitable hollow bearing trees
– Ensure caves entrances are free from blockages that are utilised by bats and monitor vegetation densities nearby the entrance to maintain access
– Discourage recreational personnel utilising roosting areas such as culverts, caves, and storm water drain with appropriate signage
– Integrate and promote artificial roosting habitat structures within the species range and monitor
– Remove and control exotic weeds that can degrade and alter the habitat and communities
– Liaise with relevant personal to discourage destruction on caves. If bats are found in the caves, the species should not be removed during breeding season
– Raise awareness amongst landholders of the impacts of using harmful chemical and pesticides preventing the species to forage
– Promote land management that minimises disturbances on foraging habitat and monitor water quality in areas the species are known to forage within, and
– Remove aquatic weeds within foraging areas

5.2.1.4 Long term viability

The Southern Myotis predominately roosts in hollow-bearing trees, however in the absence of these, they readily roost in bridge structures (Campbell 2009). The removal of these bridges may lead to the destruction of available habitat, however there are large numbers of hollow-bearing trees in the broader Project Area which present suitable roosting habitat for this species. Southern Myotis may recolonise the new bridge structures following the completion of construction.

Construction activities are likely to temporarily impact foraging habitat and flyways for Southern Myotis. The Bellinger and Kalang River systems are long which allows for alternat foraging opportunities during construction.

The replacement of the bridge will involve two phases; the construction of the new bridge and the decommission of the existing bridge. The removal will have the largest impact on this species as it will remove a specific habitat that is utilised. To minimise this impact, demobilisation of the existing bridges will occur outside of the breeding season of the Sothern Myotis (refer to Section 6.3) and replacement roosting habitat features, such as wooden structures, will be installed under the new bridges to incorporate purpose-built breeding and roosting habitat to provide long-term habitat for threatened microbat species.

Due to the high mobility of these species, it is unlikely that the bridge replacements will result in fragmentation or isolation of their habitat. A temporary non-physical barrier may occur during construction which could temporarily reduce flyway and foraging habitat. This may temporarily displace the Southern Myotis, resulting in them needing to fly further to access food.

The Project has the potential to impact key threatening processes of this bat species through roosting habitat modification, adjacent habitat modification as well as nearby water modification resulting in food loss. The footprint at each study site is in the vicinity of 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023) however alternative habitat (i.e. hollow-bearing trees) occurs in the broader Project Area. Key threatening processes are not expected to be exacerbated to the point that it impacts at a species level.

Given the large distribution of this species, it is unlikely that any long-term impacts will be placed on the Southern Myotis due to the replacement of these bridges.

5.2.2 Large Bent-wing Bat (Miniopterus orianae oceanensis)

5.2.2.1 Local and regional abundance and distribution

The Large Bent-wing Bat occurs along the eastern coast of New South Wales, with its distribution in northern New South Wales reaching from the coast to as far west as Bingara (Australia Bat Society 2024).

5.2.2.2 Habitat utilisation

- **Joyces Bridge -** No microbats recorded during diurnal roost inspection and dusk roost emergence watch, however data collected from the Anabat at this site captured calls from Large Bent-wing Bat. As no calls were recorded during the re-entry period near sunrise, the data indicates the species are likely roosting nearby and/or utilising this site for foraging activity. There are historical records of the Large Bent-wing bat occurring within 10 km of this site, with the nearest record being approximately 6 km to the north.
- **Hobarts Bridge** - Up to 10 microbats were recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. This species is less likely to roost in bridges however they may use a bridge as a temporary diurnal roost. There are records of Large Bent-wing Bat occurring within 10 km of this site, with the closest being approximately 6 km to the north.
- **Justins Bridge –** No microbats were recorded during diurnal roost inspections and roost emergence watch at dusk. The Anabat at this site was functional during the survey period, however this species was not recorded. This species is less likely to roost in bridges however they may use a bridge as a temporary diurnal roost. There are records of Large Bent-wing bat occurring within 10 km of this site, with the closest being approximately 8 km to the east.
- **Duffys Bridge -** A microbat was recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. They have the potential to roost and breed in this bridge. There are cracks and fissures in the wooden logs comprising the underside of the bridge which is likely to be comprise occupied roosting habitat. This species is less likely to roost in bridges however they may use a bridge as a temporary diurnal roost. There are records of Large Bent-wing Bat occurring within 10 km of this site, with the closest being approximately 4 km to the east.

5.2.2.3 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Large Bent-Wing Bat and may be relevant for the proposed activities (OEH 2019):

- Loss of foraging habitat and roosting sites
- Introduction of exotic pathogens

The Large Bent-wing Bat primarily roost in caves but are known to roost in other man-made structures (OEH 2019). Bridges are typically used for diurnal roosting for this species. They are highly unlikely to use a bridge structure as a maternity roost. If they are known to roost within a bridge structure, it is likely they will be roosting in low numbers (Lam 2012). This species forages above canopy trees while hunting for flying insects (Australian Museum 2022). The proposed activities will result in all four bridges being modified, potentially impacting the roosting and foraging habitat for the species. The impacts are outlined below for each proposed bridge remediation works:

- **Joyces Bridge -** Roosting for the large bent-wing bat has the potential to be affected by the removal of the bridge structure that may be utilised by the species. Impacts to native vegetation and terrestrial fauna habitat extend over 200 m^2 (Idyll Spaces Environmental Consultants 2023). Data collected from this site indicate this species may be roosting near the Project footprint. During the construction phase, foraging habitat for this species may be temporarily impacted.
- **Hobarts Bridge** – Potential impacts of the Hobarts Bridge remediation work include approximately 200 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal of cervices in the bridge structure can possibly affect the roosting of the Large Bent-Wing Bat. During the construction phase, foraging habitat for this species may be temporarily impacted.
- **Justins Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). The removal of the bridge

structure has the potential to impact the species roosting behaviours. During the construction phase, foraging habitat for this species may be temporarily impacted.

– **Duffys Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). The removal of the bridge structure has the potential to impact the species roosting behaviours. During the construction phase, foraging habitat for this species may be temporarily impacted.

5.2.2.4 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the large bent-wing bat, however, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS for the large bent-wing bat aims to minimise impacts of recreational activities on roosting habitat, ensure unrestricted access to appropriate species habitat and reduce impacts of pest species. The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

– Minimise impacts to recreational activities in caves.
– Ensure cave entrances and other roosting habitat is not restricted by humans or exotic species.
– Reduce impacts of predation by feral cats.
– Track species abundance and condition over time by doing flyout counts at cave entrances of known roosting sites.

5.2.2.5 Long term viability

The Large Bent-wing Bat predominately roosts in caves, old mines, stormwater tunnels and occasional man-made structures (Australian Museum 2022). They are less likely to roost in bridges however they are often considered when planning activities around road infrastructure in New South Wales (i.e. culverts, bridges) (TfNSW 2023). The removal of these bridges may lead to the removal of potential temporary roosting habitat. As the species was recorded, at Joyces Bridge, they are likely roosting nearby which indicate there is suitable habitat in the broader Project Area.

Construction activities are likely to temporarily impact foraging habitat and flyways for Large Bent-wing Bat. The Bellinger and Kalang River systems are long which allows for alternat foraging opportunities during construction.

The replacement of the bridge will involve two phases; the construction of the new bridge and the decommission and removal of the existing bridge. The removal may have an impact on this species if they are utilising any bridge structures. To minimise this impact replacement roosting habitat features, such as wooden structures, will be installed under the new bridges to incorporate purpose-built breeding and roosting habitat to provide long-term habitat for threatened microbat species.

Due to the high mobility of these species, it is unlikely that the bridge replacements will result in fragmentation or isolation of their habitat. A temporary non-physical barrier may occur during construction which could temporarily reduce flyway and foraging habitat. This may temporarily displace the Large Bent-wing Bat, resulting in them needing to fly further to access food.

The Project has the potential to impact key threatening processes of this bat species through roosting habitat modification, adjacent habitat modification as well as nearby water modification resulting in food loss. The footprint at each study site is in the vicinity of 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023) however this species is likely roosting in the broader Project Area. Key threatening processes are not expected to be exacerbated to the point that it impacts at a species level.

Given the large distribution of this species, and its specific requirements of caves for breeding habitat, it is unlikely that any long term impacts will be placed on Large Bent-wing Bat due to the replacement of these bridges.

5.2.3 Little Bent-wing Bat (*Miniopterus australis*)

5.2.3.1 Local and regional abundance and distribution

The Little Bent-wing Bat is typically confined to the subtropical coastal belt of the east coast of Australia (Dwyer 1968). In New South Wales they are distributed south from the border of Queensland to approximately

Wollongong (OEH 2020b). In New South Wales the largest maternity colony of the Little Bent-wing Bat is associated with a large maternity colony of Eastern Bent-wing Bat (*Miniopterus schreibersii*), which help thermoregulate the colony during birthing and nursing (OEH 2020b).

Habitat utilisation

- **Joyces Bridge -** The bridge has a few observable cracks, crevices and fissures within wooden logs. No microbats recorded during diurnal roost inspection and dusk roost emergence watch. The bridge may comprise temporary roosting habitat for microbats. There are historical records of Little Bent-wing Bat within 10km of this site, with the closest being approximately 5 km to the east of the site.
- **Hobarts Bridge -** Up to 10 microbats were recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. They have the potential to roost and breed in this bridge. There are cracks and fissures in the wooden logs comprising the underside of the bridge which is likely to be comprise occupied roosting habitat. There are historical little bent-wing bat records occurring within 10 km of this site, with the closest record being approximately 1 km to the north.
- **Justins Bridge –** No microbats were recorded during diurnal roost inspections and roost emergence watch at dusk, however data from Anabats indicate the species is known to forage and potentially roosting at this site.. The wooden logs comprising the bridge are not sufficiently degraded to create cracks and fissures which microbats may roost in. The bridge may comprise temporary roosting habitat for microbats. There are historical Little Bent-wing Bat records occurring within 10km of this site, with the closest record being approximately 7 km to the west.
- **Duffys Bridge -** A microbat was recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. They have the potential to roost and breed in this bridge. There are cracks and fissures in the wooden logs comprising the underside of the bridge which is likely to be comprise occupied roosting habitat. There are historical Little Bent-wing Bat records occurring within 10 km of this site, with the closest record being approximately 2 km to the north and east.

5.2.3.2 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Little Bent-wing Bat and may be relevant for the proposed activities (OEH 2020b):

- Changes to habitat, especially surrounding maternity or nursery caves and winter roosts
- Introduction of exotic pathogens
- Infestation of woody weeds which may block flight path access
- Disturbance to roosting habitat (i.e. man-made structures)

The Little Bent-wing Bat forage for small insects beneath densely vegetated canopies and may roost under bridges, culverts and hollow-bearing trees (OEH 2020b). This species forages beneath the canopy layer of forested areas (Australian Museum 2022). The proposed activities will result in all four bridges being modified, potentially impacting the roosting habitat for the species. The impacts are outlined below for each proposed bridge remediation works:

- **Joyces Bridge -** Impacts to native vegetation and terrestrial fauna habitat extend over 200 m^2 (Idyll Spaces Environmental Consultants 2023). Roosting for the Little Bent-Wing Bat has the potential to be affected by the disturbance to the hollow-bearing trees and from removal of bridge structure that has been utilised by the species.
- **Hobarts Bridge -** Potential impacts of the Hobarts Bridge remediation work include approximately 200 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal of hollow bearing trees or cervices in the bridge structure may impact roosting habitat for this species.
- **Justins Bridge –** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). Depending on confirmed Project footprint this may include the removal of several Casuarina trees that may provide crevices or hollows for roosting microbats. The bridge structure may be utilised by this species however it would only constitute temporary roosting habitat.

– **Duffys Bridge** - The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). Within this impact area there are potential hollow-bearing trees the little bent-wing bat may inhabit. The removal of hollow-bearing trees and bridge structures has the potential to impact the species roosting behaviours.

5.2.3.3 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the little bent-wing bat. However, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS for the Little Bent-wing Bat aims to protect and conserve roosting and foraging habitat.

The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

– Monitor density of vegetation at roosting sites to ensure species access to suitable roosting habitat is not impacted.
– Identify important maternity or hibernation roost sites (including bridges, drains and culverts) and protect from disturbance or degradation.
– Discourage recreational users (i.e. cavers) from known roosting sites.
– Ensure location and sensitivity of roosting and key foraging areas are known so that existing lighting impacting these areas can be modified or managed.
– Investigate if species wintering roosting habitat (i.e. banana trees and tree hollows).
– Encourage private land owners to protect and restore key areas (i.e. swamps and habitat adjacent to caves and other known roosting sites).
– Facilitate future tree replacement by regeneration processes or replanting in areas the species are known to occur.
– When undertaking major works, replace wooden bridges with concrete bridges, and a wooden structure should be placed under the new bridge constructions where bats have been known to roost.
– Encourage land management agreements to restore, protect, and retain suitable hollow bearing trees.

5.2.3.4 Long term viability

The Little Bent-wing Bat is known to predominantly roost in caves, old mines, stormwater tunnels, and occasionally in man-made structures (Australian Museum, 2022). While they are less likely to roost in bridges, they are still considered when planning activities around road infrastructure in New South Wales, such as culverts and bridges (TfNSW, 2023). Removing these bridges may lead to the loss of potential temporary roosting habitats. The presence of this species at Joyces Bridge indicates that there is suitable habitat in the broader Project Area nearby.

Construction activities during the bridge replacement Project are likely to temporarily impact the foraging habitat and flyways for the Little Bent-wing Bat. However, the Bellinger and Kalang River systems are long enough to allow for alternative foraging opportunities during construction.

The bridge replacement will involve two phases: the construction of the new bridge and the decommission and removal of the existing bridge. The removal of the existing bridge may have an impact on this species if they are using any bridge structures for roosting. To minimise this impact, replacement roosting habitat features, such as wooden structures, will be installed under the new bridges to incorporate purpose-built breeding and roosting habitat to provide long-term habitat for threatened microbat species.

Although there may be a temporary non-physical barrier during construction that could temporarily reduce flyway and foraging habitat, it is unlikely that the bridge replacement will result in fragmentation or isolation of their habitat. If the Little Bent-wing Bat is displaced, it may need to fly further to access food.

The bridge replacement Project has the potential to impact key threatening processes of this bat species through roosting habitat modification, adjacent habitat modification, as well as nearby water modification, which could result in food loss. Although the footprint at each study site is in the vicinity of 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023), this species is likely roosting in the broader Project Area. However, key threatening processes are not expected to be exacerbated to the point that it impacts the species level.

Considering the large distribution of this species and its specific breeding habitat requirements (i.e. caves), it is unlikely that any long-term impacts will be placed on the Little Bent-wing Bat due to the replacement of these bridges.

5.2.4 Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)

5.2.4.1 Local and regional abundance and distribution

The Eastern Coastal Free-tailed Bat is distributed along the coastal region of New South Wales (OEH 2022). They are known to occur within the Coffs Coast and Escarpment IBRA sub-region (OEH 2022). The species is rarely captured and most available information on their distribution and ecology is based on observations and limited data (McConville 2013).

Habitat utilisation

- **Joyces Bridge –** No microbats were observed during the roost watch at this bridge. However, data collected from the Anabat captured calls from the Eastern Coastal Free-tailed Bat each night. They prefer to roost in hollows or under loose bark, however they may roost in bridge structures. The Eastern Coastal Free-tailed Bat is likely foraging in the area and may temporarily roost in the bridge. There are no historical records within 10 km of the bridge.
- **Hobarts Bridge -** Up to 10 microbats were recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. This species preference is to roost in hollows or under loose bark however they may roost temporarily in bridge structures. The Eastern Coastal Free-tailed Bat is likely foraging in the area and may temporarily roost in the bridge. There are no historical records within 10 km of the bridge.
- **Justins Bridge –** No microbats were recorded during diurnal roost inspections and roost emergence watch at dusk, however data from Anabats indicate the species is known to forage in the area. They prefer to roost in hollows or under loos bark, however they may roost in bridge structures temporarily. There are no historical records within 10 km of the bridge.
- **Duffys Bridge -** A microbat was recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. There is a low have the potential to roost and breed in this bridge. The Eastern Coastal Free-tailed Bat is likely foraging in the area and may temporarily roost in the bridge. There are historical records of Eastern Coastal Free-tailed Bat occurring within 10 km of the site, with the nearest being approximately 10 km to the northeast.

5.2.4.2 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Eastern Coastal Free-tailed Bat and may be relevant for the proposed activities (OEH 2022):

- Loss of hollow-bearing trees
- Loss of foraging habitat during the construction phase
- Artificial light sources spilling onto foraging and/or roosting habitat

The species roosts under bridges, hollow-bearing trees, culverts. The Eastern Coastal Free-tailed Bat forages above the canopy of forested areas hunting flying insects (Australian Museum 2022). The proposed activities will result in all four bridges being modified, potentially impacting the roosting and foraging habitat for the species. The impacts are outlined below for each proposed bridge remediation works:

- **Joyces Bridge -** Impacts to native vegetation and terrestrial fauna habitat extend over 200 m^2 (Idyll Spaces Environmental Consultants 2023). Roosting for the Eastern Coastal Free-tailed Bat has the potential to be affected by the disturbance to the hollow-bearing trees and from removal of bridge structure that has been utilised by the species. During the construction phase, foraging habitat for this species may be temporarily impacted.
- **Hobarts Bridge -** Potential impacts of the Hobarts Bridge remediation work include approximately 250 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal or disturbance of hollow bearing trees or cervices in the bridge structure may impact roosting habitat for this species. During the construction phase, foraging habitat for this species may be temporarily impacted.
- **Justins Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). Depending on confirmed Project footprint this may include the removal of several Casuarina trees that may provide crevices or hollows for roosting microbats. The bridge structure may be utilised by this species however it would only constitute temporary roosting habitat. During the construction phase, foraging habitat for this species may be temporarily impacted.
- **Duffys Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). Within this impact area there are potential hollow-bearing trees which may be utilised by the Eastern coastal free-tailed bat. The removal of hollow-bearing trees and bridge structures has the potential to impact the species roosting behaviours. During the construction phase, foraging habitat for this species may be temporarily impacted.

5.2.4.3 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the Eastern Coastal Free-tailed Bat. However, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

- Raise public awareness of the importance of hollow-bearing trees.
- Negotiate with landowners that promote the retention, connectivity and restoration and sensitive management of suitable habitat.
- Raise public awareness of the damage that can be caused to habitat by slashing, under scrubbing, thinning, weed encroachment and inappropriate grazing.
- Implement bush regeneration to projected known roosting and foraging habitat.
- Liaise with appropriate land managers to ensure there are no artificial light sources close to known roosting or foraging areas.
- Conduct targeted research into the species.

5.2.4.4 Long term viability

The Eastern Coastal Free-tailed Bat is a hollow-roosting species, favouring tree hollows, most commonly in Eucalyptus species (McConville 2013). The removal of the bridge structures and a few hollow-bearing Casuarinas at some of the sites may temporarily displace any Eastern Coastal Free-tailed Bat that might be using these habitats as roosts. The availability and abundance of hollow-bearing trees within the broader Project Area present more suitable and widely available habitat for this species.

As these species as ‘open space foragers’ and ‘edge and gap foragers’ (McConville 2013), construction activities may temporarily restrict or impact foraging habitat and flyways for the Eastern Coastal Free-tailed Bat. The Bellinger and Kalang River systems are expansive which allows for alternative foraging opportunities during construction.

The replacement of the bridge will involve two phases; the construction of the new bridge and the decommission and removal of the existing bridge. If roosting within any of the bridge structures, the removal will have the largest impact on this species. To minimise this impact, demobilisation of the existing bridges will occur outside of the breeding season of the species (refer to Section 6.3) and replacement roosting habitat features, such as wooden structures, will be installed under the new bridges to incorporate purpose-built breeding and roosting habitat to provide long-term habitat for threatened microbat species.

Due to the high mobility of these species, it is unlikely that the bridge replacements will result in fragmentation or isolation of their habitat. A temporary non-physical barrier may occur during construction which could temporarily reduce flyway and foraging habitat. This may temporarily displace the Eastern Coastal Free-tailed Bat, resulting in them needing to fly further to access food.

The Project has the potential to impact key threatening processes of this bat species through the loss of hollow-bearing trees, temporary impact to foraging habitat during the construction phase and artificial light sources impacting foraging and/or roosting habitat. The removal of hollow-bearing trees will be limited where possible. The Project Footprint at each site ranges between 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023), however there is abundance suitable habitat available for the species to utilise in the broader Project Area. Key threatening processes are not expected to be exacerbated to the point that it impacts at a species level.

Given the large distribution of this species, it is unlikely that any long term impacts will be placed on the Eastern Coastal Free-tailed Bat due to the replacement of these bridges.

5.2.5 Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

5.2.5.1 Local and regional abundance and distribution

The Eastern False Pipstrelle distribution within New South Wales ranges predominately along the coastal and marginally inland regions of New South Wales (Australasian Bat Society 2024). They range from the border of Queensland, south along to the border of Victoria (OEH 2017a). The species has been recorded on the south coast and ranges of the Shoalhaven region in New South Wales (Daly & Hoye 2023).

5.2.5.2 Habitat utilisation

– **Joyces Bridge -** No microbats were observed during the roost watch at this bridge. However, data collected from the Anabat captured calls from the Eastern False Pipstrelle on one night across the four consecutive survey nights. There is no data to support this species roosts in bridges as they prefer to roost in hollows. The Eastern False Pipstrelle is likely foraging in the area. There are no historical records within 10 km of the bridge.
– **Hobarts Bridge -** Up to 10 microbats were recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. This species preference is to roost in hollows and is unlikely to be roosting in the bridge. The Eastern Coastal Free-tailed Bat may forage in the area. There are no historical records within 10 km of the bridge.
– **Justins Bridge** - No microbats were recorded during diurnal roost inspections and roost emergence watch at dusk, however data from Anabats indicate the species may forage in the area. This species preference is to roost in hollows and is unlikely to be roosting in the bridge. There are no historical records within 10 km of the bridge.
– **Duffys Bridge -** A microbat was recorded flying under bridge during dusk roost emergence watch. Technical issues with the Anabat at this site restricted data collection. There is a low have the potential to roost and breed in this bridge. The Eastern Coastal Free-tailed Bat may forage in the area. There are no historical records within 10 km of the bridge.

5.2.5.3 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for the Eastern False Pipistrelle and may be relevant for the proposed activities (OEH 2017a):

– Disturbance to winter roosting and breeding sites

– Loss of roosting habitat
– Loss and fragmentation of foraging habitat

The species roosts in hollow-bearing trees, under loose barks on trees or in buildings. There is no information to support or suggest this species would readily roost in bridges as they are hollow-obligate species c The proposed activities will result in all four bridges being modified, potentially impacting the roosting and foraging for the species. The impacts are outlined below for each proposed bridge remediation works:

– **Joyces Bridge -** Impacts to native vegetation and terrestrial fauna habitat extend over 200 m^2 (Idyll Spaces Environmental Consultants 2023). Roosting habitat may be impacted by the disturbance to the hollow-bearing trees. During the construction phase, access to foraging habitat for this species may be temporarily impacted.
– **Hobarts Bridge -** Potential impacts of the Hobarts Bridge remediation work include approximately 250 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal of hollow bearing may possibly affect the roosting habitat. During the construction phase, access to foraging habitat for this species may be temporarily impacted.
– **Justins Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). Depending on confirmed Project footprint this may include the removal of several Casuarina trees that may provide crevices or hollows for roosting. During the construction phase, foraging habitat for this species may be temporarily impacted.
– **Duffys Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). Within this impact area there are potential hollow-bearing trees which may be utilised by this species. The removal of hollow-bearing trees has the potential to impact the species roosting behaviours. During the construction phase, foraging habitat for this species may be temporarily impacted.

5.2.5.4 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the Eastern false pipistrelle. However, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

– Ensure roosting bats are not present before removing or disturbing hollow-bearing trees in winter.
– Protect and maintain areas of high quality habitat, particularly areas of extensively tall (>20 m) forests which include areas of high productivity foraging habitat around creeks, rivers and wetlands.
– Encourage landowners to retain and protected hollow-bearing trees in suitable habitat.
– Undertake revegetation programs to develop tall forests.

5.2.5.5 Long term viability

The Eastern False Pipstrelle is a hollow-obligate species, typically roosting in tree hollows (Australian Museum 2022) and there is no information to support that the species is known to roost in bridges (O'Neil & Taylor 1898). Impacting the few hollow-bearing Casuarinas at some of the sites may temporarily displace any Eastern False Pipstrelle that might be using these habitats as roosts. The availability and abundance of hollow-bearing trees within the broader Project Area present more suitable and widely available habitat for this species.

As these species diet is primarily insects in the upper layers of the forest canopy (Taylor et al 1987), construction activities are unlikely to significant restrict or impact foraging habitat however there may be minor impacts to flyways for the Eastern False Pipstrelle. The expansive Bellinger and Kalang River systems allow for alternative foraging opportunities during construction.

It is unlikely that the replacement of the bridges will cause any fragmentation or isolation of the habitat of these species, as they are highly mobile. However, during the construction, there may be a temporary barrier that may limit their flyway and reduce access to foraging habitat. This could lead to a temporary displacement of the Eastern False Pipistrelle, which would need to fly further to access food.

The Project has the potential to impact key threatening processes of this bat species through the potential disturbance of winter roosting habitat, loss of roosting habitat and fragmentation of foraging habitat. The Project Footprint at each site ranges between 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023). however, there is an abundance suitable habitat available for the species to utilise in the broader Project Area. Key threatening processes are not expected to be exacerbated to the point that they impact at a species level.

Given the large distribution of this species, it is unlikely that any long-term impacts will be placed on the Eastern False Pipstrelle due to the replacement of these bridges.

5.3 Grey-headed Flying-fox (*Pteropus poliocephalus*)

5.3.1.1 Local and regional abundance and distribution

The Grey-headed Flying-fox is endemic to Australia with populations ranging from Ingman in Queensland down to Adelaide in South Australia (DAWE 2021). They are typically found in coastal lowlands and the slopes of eastern Australia below 200 m altitude (DAWE 2021). In New South Wales they are found from the coastal, to tablelands and western slopes. Their distribution and relative abundance varies seasonally and temporally, depending on seasons of flowering and fruiting species within their diet (DAWE 2021).

The National Flying-fox Monitoring Viewer (DCCEEW 2023b) present other known camps within the Project Area (Figure 5.1). The camp near Hobarts Bridge is mapped as an 'Other' Flying-fox camp however there are two camps at Bellingen (one Nationally Important Flying-fox Camp).

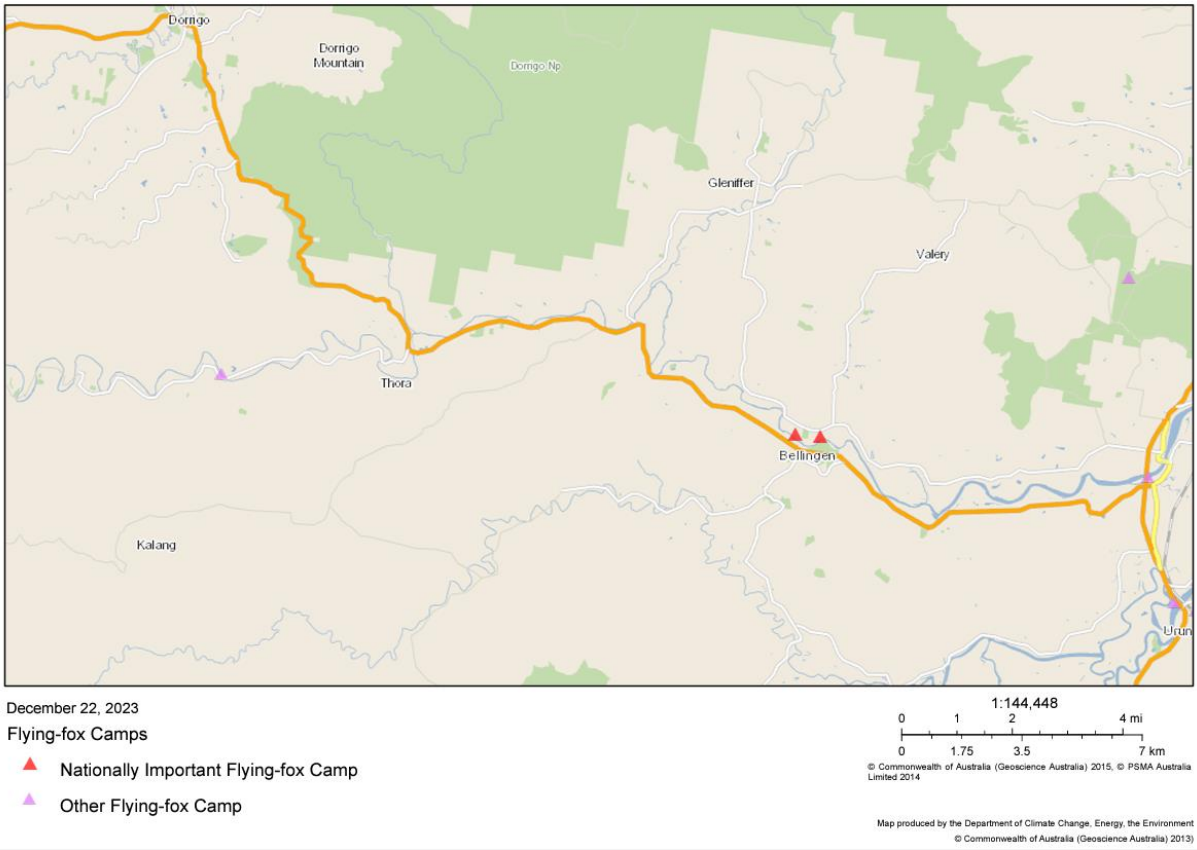


Figure 5.1 National Flying-fox Monitoring Viewer (DCCEEW 2023b)

5.3.1.2 Habitat utilisation

Foraging habitat

The foraging habitat values of the Grey-headed Flying-fox vary in response to native food sources. They migrate in response to the changes in quantity and location of food (DAWE 2021). They forage at dusk and into the night over expansive areas, with records showing they have flown over 40 km one way to find food before returning to roost. The average Grey-headed Flying-fox foraging distance per night, including its return trip to its roosting camp is reported as 10.9 km (DAWE 2021). Their preferred food source is eucalypt blossom and rainforest fruits.

Two foraging periods of the year are identified as particularly important for the Grey-headed Flying-fox. The breeding period, which occurs from October to January, includes the final weeks of gestation, and the weeks of birth, lactation, and conception. The 'food bottle neck', which occurs during the May to August period, is a time where foraging resources are limited. Resource demands during these periods are important to the Grey-headed Flying-fox.

Roosting habitat

Grey-headed Flying-fox roost in large camps which provide resting habitat, social interaction exchanges and refuge for individuals during significant phase of their annual cycle (i.e. birth, lactation and conception) (DAWE 2021). These camps often occur in dense riparian habitat.

The Grey-headed Flying-fox uses temporary and permanent camps. Temporary camps are not occupied throughout the year and are typically established during the summer period to access habitat resources as they become available. These camps may coincide with breeding activity. Permanent camps are occupied throughout the year and are generally central to all necessary foraging resources, particularly those that occur during the winter food bottlenecks.

There is a wide variety of known preferred vegetation for a camp ranging from continuous tracts of native vegetation to patches less than 1 hectare (DAWE 2021).

A Grey-headed Flying-fox camp occurs approximately 120 m from the existing Hobarts Bridge and there are historical records scattered through the Project Area. The species is likely to forage in flowering eucalypts and fruit trees throughout this area. Grey-headed Flying-fox are seasonal breeders, with a single breeding event occurring each year and births ensue from October to December. This species is prone to aborting foetuses, mass abortion events and premature births in response to environmental stress, particularly anthropogenic stress such as disturbance to camps and habitat clearing (DAWE 2021).

5.3.1.3 Key threatening processes

The following key threatened process are listed in the *Commonwealth Grey-headed Flying-fox recovery plan* (DAWE 2021) under the EPBC Act and may be relevant for the proposed activities:

– Loss and degradation of foraging and roosting habitat
– Camp disturbance – becoming surrounded by urban and rural residential development
– Heat stress

The following key threatening processes are listed in NSW under the BC Act for the Grey-headed Flying-fox and may be relevant for the proposed activities (OEH 2020c):

– Habitat loss and degradation of habitat
– Heat stress caused by disturbance of maternity roost during construction activities

The Grey-headed Flying-fox is most susceptible to threats associated with clearing and habitat loss and camp disturbance that will impact their roosting and potential foraging areas (DAWE 2021). This species roost in exposed branches of trees in areas from continuous forest to patches less than a hectare. The proposed activities at Hobarts Bridge (which is within 120 m of a Grey-headed Flying-fox camp) may result in temporary disturbance to the camp during the day while construction activities are underway. The proposed works at Joyces Bridge, Justins Bridge and Duffys Bridge are each in excessive between 3 – 27 kms from the camp and consequently construction is not expected to impact the camp during the proposed works. Works at these locations are expected to be limited to negligible amounts of foraging habitat. The impacts are outlined below for the proposed works at Hobarts Bridge.

Hobarts Bridge

Potential impacts of the Hobarts Bridge remediation work include the disturbance of the maternity roost camp during diurnal construction activities. This has the potential to cause individual Grey-headed Flying-fox to leave camp during the day. The laydown area for the construction is within 120 m of the roosting camp and the increased heavy vehicle traffic associated with construction has the potential to result in temporary disturbances to the camp during construction, which persists approximately 3 - 5 m from the edge of Darkwood Road. Due to the rural nature of the area, the existing low traffic along Darkwood Road don't seem to impact the species. The increased traffic during the construction period may impact the roost during the day.

5.3.1.4 Recovery plans

There is a commonwealth *National Recovery Plan for the Grey-headed Flying-fox* (DAWE 2021) and a New South Wales Saving our Species (SOS) program for the Grey-headed Flying-fox. The recovery plan for the Grey-headed Flying-fox has identified several priority actions to help record the species, which include:

- Identify protect and increase native foraging habitat that is critical to the survival of the species.
- Identify, protect and increase roosting habitat for Grey-headed Flying-fox.
- Determine trends in the Grey-headed Flying-fox population to monitor species national distribution, habitat use and conservation status.
- Build community capacity to coexist with flying-foxes and minimise the impacts on human settlements from new and existing camps while avoiding interventions to move on or relocate entire camps.
- Increase public awareness and understanding of the Grey-headed Flying-fox and the recovery program and involve the community in the recovery program where appropriate.
- Improve management of Grey-headed Flying-fox camps in areas where interaction with humans is likely.
- Significantly reduce licenced harm to Grey-headed Flying-fox associated with commercial horticulture.
- Support research activities that will improve the conservation status and management of Grey-headed Flying-fox.
- Reduce the impact on Grey-headed Flying-fox of electrocution on powerlines and entanglement in netting and on barbed-wire.

5.3.1.5 Long term viability

Only one of the four bridges (Hobarts Bridge) was reported to be in close proximity (120 m) to a Grey-headed Flying-fox camp. This camp is used as roosting and maternity/nursery habitat during diurnal periods. The Grey-headed Flying-fox will leave during the night to forage in surrounding habitat. It is unlikely that any existing roosting trees will be removed. The largest issue is the use of loud machinery which has the potential to displace the population from the camp which may impact on nursing mothers within this camp. No construction works will occur during extreme temperatures (>40 °C) to avoid disturbance to heat stressed individuals.

The design and alignment of the bridges have been implemented in such a way to minimise effects on threatened species including the Grey-headed Flying-fox. The Project is utilising already cleared areas for works and laydown areas, it is unlikely that the roosting habitat will be removed or modified.

The proposed works will not result in the fragmentation or isolation of habitat for the Grey-headed Flying-fox. The proposed works will have no permanent change to flying fox movement. Construction works will be restricted to daylight hours to allow periods of non-disturbance at night which limits interaction with these species as they are predominately nocturnal.

The Project has the potential to impact key threatening processes of the Grey-headed Flying-fox through camp disturbance and heat stress. This is likely to be caused by loud noise during construction which may disrupt diurnal roosting, resulting in possible heat stress. Implementing known avoidance measures (outlined in Section 6) will limit this disturbance occurring.

Given the large distribution of the Grey-headed Flying-fox it is unlikely that any long term impacts will be placed on this flying fox due to the replacement of these bridges.

The potential impacts to the breeding colony of Grey-headed Flying-fox include impacts of construction of the proposed bridge upgrade near the camp site and its habitants. It is considered that the impacts will be limited to negligible amounts of removal of foraging habitat and potential disruption of roosting habitat during construction. The existing traffic light along Darkwood Road, typical of a rural area, does not appear to disrupt the colony (as observed during field surveys). Traffic relating to the construction of the bridge will slightly increase daily traffic. The turnaround area for heavy machinery will be required to be a sufficient distance from the camp to prevent unnecessary disturbance. The proposed works are expected to be constrained to daytime hours when the species is roosting so impacts to foraging activity is expected to be limited.

The activity is not likely to reduce the long-term viability for the Grey-headed Flying-fox at the local or bioregional scales.

5.4 Superb Fruit-dove (*Ptilinopus superbus*)

5.4.1.1 Local and regional abundance and distribution

The Superb Fruit-dove is found in rainforest habitat in New Guinea, Solomon Islands, Philippines, Sulawesi of Indonesia and Australia. In Australia it is found in lowland subtropical rainforest from Queensland to New South Wales (OEH 2022). They are found along the coast and nearby ranges in their preferred habitat which may include rainforest margins, mangroves, wooded stream-margins and isolated plantings of figs, lilly pillies, black-berries and pittosporums (Birdlife Australia 2023). The Superb fruit-dove is known to occur within the IBRA sub-region of Coffs Coast and Escarpment (OEH 2022).

5.4.1.2 Habitat utilisation

The Superb Fruit-dove are likely to be foraging in large tracts of rainforest within the Bellinger River National Park, New England National Park and the surrounding state forest and private forest supporting fruit-bearing tree species. These large tracts of vegetation supporting food resources provides connectivity for this species to move about easily. They are likely to utilise this habitat during breeding season between September to January (Birdlife Australia 2023).

Joyces Bridge – The Superb Fruit-dove is likely to be foraging within the Project Area of this bridge. There is a large tract of rainforest vegetation approximately 150 m to the northeast, which backs onto the Bellinger River National Park. The species is likely to utilise this stand of vegetation for foraging. There are seven records of Superb Fruit-dove within 10 km of Joyces Bridge (ALA 2023). The nearest records are approximately 1 km north of the Project footprint.

Hobarts Bridge - The Superb Fruit-dove was heard calling northwest along Darkwood Road of within the vicinity of Hobarts Bridge. The species is likely to utilise large stands of native vegetation occurring within private property along Darkwood Road as foraging habitat. There are five historical records of Superb Fruit-dove within 10 km of Hobarts Bridge, with the closest record being approximately 4 km from the Project footprint (ALA 2023).

Justins Bridge – New England National Park beings approximately 200 m to the south of the Project Footprint. While there are no records of Superb Fruit-dove within 10 km of Justins Bridge (ALA 2023), the species may forage within this national park and may occur temporarily within the Project Area in response to available food resources.

Duffys Bridge – There are large stands of rainforest vegetation occurring within private properties within the Study Area of this bridge. While no Superb Fruit-dove were recorded during surveys, there are four records of Superb Fruit-dove within 10 km of Duffys Bridge (ALA 2023). The nearest records are approximately 4 km from the Project footprint. The species is likely to utilise the large tracts of vegetation in the Project Area for foraging.

5.4.1.3 Key threatening processes

The following key threatening processes are listed in New South Wales under the BC Act for the Superb Fruit-dove (*Ptilinopus superbus)* and may be relevant for the proposed activities (OEH 2022):

– Clearing and fragmentation of low-elevation rainforest

The Superb Fruit-dove is most susceptible to threats associated with clearing and fragmentation of preferred rainforest habitat that impact food availability within the Project Area. The species forages in rainforest and similar closed forests, eating fruits of many trees including figs and palms. They are also known to forage in eucalypt or acacia woodland where there are fruit-bearing trees (OEH 2022). They are considered important species for seed dispersal in tropical and subtropical forests (Birdlife Australia 2023).

The proposed activities will result in the clearing of 100 – 250 m^2 vegetation across easy site, although this vegetation is analogous with PCT 3020: Northern Hinterland River Oak Sheltered Forest and unlikely to contain many fruit-bearing tree species. The proposed activities are unlikely to impact foraging habitat for the species.

5.4.1.4 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for the Superb fruit-dove. However, the species is managed under the Saving our Species (SoS) program (OEH 2022). The SoS for the Superb fruit-dove aims to identify and protect breeding habitat and foraging habitat, increase abundance of preferred native food tree species through bush regeneration, remove invasive weeds from core habitat sites and monitoring the threat of climate change to the species (i.e. from rainforest drying) (OEH 2022).

5.4.1.5 Long term viability

The design and alignment of the bridges have been implemented in such a way to minimise effects on threatened species including the Superb Fruit-dove. The Project has the potential to impact key threatening processes of the Superb Fruit-dove through the clearing of vegetation. Potential foraging may be impacted as a small stand (100 – 250 m^2 across each site) of vegetation will be removed (Idyll Spaces Environmental Consultants 2023). However, due to the abundance of suitable habitat within the Project Area and the highly mobile nature of this species, isolation and fragmentation are unlikely to occur.

The removal of vegetation may impact foraging habitat however due to the connectivity and abundance of suitable foraging habitat within the broader Project Area of each bridge, the impact from the loss of these trees is likely to be negligible. The proposed works will not result in the fragmentation or isolation of habitats for this species.

Due to the extensive distribution of the Superb Fruit-dove along the New South Wales coastline, it is unlikely that any long term impacts will be placed on this bird due to the replacement of this bridge.

5.5 Stephens's Banded Snake (*Hoplocephalus stephensii*)

5.5.1.1 Local and regional abundance and distribution

Stephens's Banded Snake is discontinuously distributed along the eastern part of the Great Dividing Range, found in the forested habitats in north-eastern New South Wales and south-east Queensland (Fitzgerald, et al 2004; 2004). They are known in cool escarpment areas near Tenterfield and Glen Innes, east of the dry New England Plateau to the cool, moist southern forests (Fitzgerald, et al 2005).

Stephens's Banded Snake is largely restricted to remnant forest in eastern Australia and is known to persist over a wide range of eastern New South Wales although the remaining populations are highly disjunct (Fitzgerald, et al 2005). Typically, they are found within relatively large forest patches with hollow trees.

They are widely distributed in areas without strong influence of local factors (i.e. climate or vegetation type) as long as they have shelter-sites, which is more important than a particular species of tree or plant community type (Fitzgerald, et al 2005).

5.5.1.2 Habitat utilisation

The Stephens's Banded Snake has been observed using a variety of habitats, however typically found within 1 km of forest habitat. Apart from a specific requirement for hollow standing trees, the Stephens's Banded Snake habitat preference is relatively generalised (Fitzgerald, et al 2005). They are known to inhabit different forest types and under a wide range of climatic conditions. To maintain connectivity, it is important to maintain and preserve large, interconnected patches of forest habitat with abundant hollow trees for the species to persist (Fitzgerald, et al 2005).

The Stephens's Banded Snake are likely to be residing in the large tracts of vegetation in Bellinger River National Park and all the surrounding state forest. They are likely to be foraging and hunting within the Project footprint temporarily as they move through the landscape. Individuals within proximity of the Project footprints may use the understorey vegetation and hollow trees for foraging and sheltering.

Joyces Bridge – Stephens's Banded Snake is likely to be sheltering and hunting within the Project Area of this bridge. There is a large tract of rainforest vegetation approximately 150 m to the northeast, which backs onto the Bellinger River National Park. The species is likely to utilise this stand of vegetation. There are 11 records of this species within 10 km of Joyces Bridge, with the closest being within 1 km (ALA 2023).

Hobarts Bridge - Stephens's Banded Snake was recorded on Darkwood Road, approximately 1.8 km north of Hobarts Bridge crossing the road. The species is likely to utilise large stands of native vegetation occurring within private property along Darkwood Road as sheltering and hunting habitat. There are 10 records within 10 km of Hobarts Bridge, the nearest being approximately 2 km from the Project footprint (ALA 2023).

Justins Bridge – New England National Park beings approximately 200 m to the south of the Project Footprint. The species may hunt and shelter within this national park and may occur temporarily within the Project Area in response to available arboreal habitat and prey. There are three records of Stephens's Banded Snake within 10 km of Justins Bridge, with the nearest being approximately 7 km to the east (ALA 2023).

Duffys Bridge – There are large stands of rainforest vegetation occurring within private properties within the Study Area of this bridge. While no Stephens's Banded Snake were recorded during surveys, there are four records within 10 km of Duffys Bridge, the nearest being approximately 4 km away (ALA 2023). The species is likely to utilise the large tracts of vegetation in the Project Area for hunting and sheltering.

5.5.1.3 Key threatening processes

The following key threatening processes are listed in NSW under the BC Act for Stephens's' banded snake and may be relevant for the proposed activities (OEH 2018):

– Clearing and fragmentation of vegetation is a threat as the species inhabits rainforest and eucalypt forests which occurs in the broader Project area. They favour forested rocky areas with intact ground and mid-storey vegetation, stags, tree hollows and recruiting hollow-bearing trees.
– The removal of old or dead trees.
– Grazing management which remove or disturb old or dead trees and understorey vegetation.

The impacts are outlined below for each proposed bridge remediation works:

– **Joyces Bridge -** There are two mature Casuarina trees with hollows within two metres of the proposed activities which are likely to be impacted during construction either directly or indirectly (Idyll Spaces Environmental Consultants 2023). Large hollows may be utilised by this species as a shelter-site.
– **Hobarts Bridge -** Potential impacts of the Hobarts Bridge remediation work include approximately 250 m^2 of terrestrial fauna habitat being disturbed (Idyll Spaces Environmental Consultants 2023). Within this area of impact, removal of hollow bearing trees can possibly impact safe arboreal crevices for this species to shelter in.

– **Justins Bridge** - The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 100 m^2 (Idyll Spaces Environmental Consultants 2023). There are hollow bearing trees and woody debris along each bank of the river at this site. These may act as shelter sites for this species. The removal of these has the potential to impact the species foraging and hunting behaviours.
– **Duffys Bridge -** The impact on native vegetation and terrestrial fauna habitat has been identified to extend over approximately 200 m^2 (Idyll Spaces Environmental Consultants 2023). Within this impact are potential hollow-bearing trees which may be utilised by this species for shelter. The removal of hollow-bearing trees has the potential to impact the species foraging and hunting behaviours.

5.5.1.4 Recovery plans

There are no current Recovery Plans or Threat Abatement Plan for Stephens's Banded Snake. However, the species is managed under the Saving our Species (SoS) program (NSW Government 2023). The SoS for the Stephens's' Banded Snake aims to promote retention and connectivity of suitable native vegetation, promote management practices minimising the removal of understorey vegetation, dead wood and litter and improve knowledge to better inform protection and management of appropriate habitat.

The SoS program by the NSW Government (2023) have identified several priority actions to help recover the species, these include:

– Conduct research into the distribution, population dynamics and habitat preferences to improve knowledge about the species.
– Liaise with land and fire managements to know where known population or habitat occurs to recommend that prescribed burns are conducted to limit impact to Stephens's Banded Snake habitat and keep patches of understorey structurally intact throughout the landscape.
– Negotiate agreements with relevant landholders to promote retention and connectivity of suitable native vegetation and appropriate habitat for the species.

5.5.1.5 Long term viability

Some habitats may be impacted as a small amount of habitat will be removed which may limit hunting and foraging habitat.

The design and alignment of the bridges have been implemented in such a way to minimise impacts to all threatened species, including the Stephens's Banded Snake. As this is an arboreal sheltering snake, some potential habitat, including hollow bearing trees may be removed. There may also be temporary impacts to hunting habitat during the construction period. The removal of vegetation may impact foraging habitat however due to the connectivity and abundance of suitable foraging habitat within the broader Project Area of each bridge, the impact from the loss of these trees is likely to be negligible. The proposed works will not result in the fragmentation or isolation of habitats for this species.

A key threatening process of the Stephens's Banded Snake is the clearing of habitat to allow for the new bridge alignment. If this clearing encompasses dead and larger trees, it may remove key habitat for this snake. However, the proposed Project Footprint at each site is relatively small, between 100 – 250 m^2 (Idyll Spaces Environmental Consultants 2023) without a large abundance of known hollow-bearing trees. Given the close proximity to more suitable habitat, the removal of this vegetation is likely to be negligible.

Given the distribution of the Stephens's Banded Snake it is unlikely that any long term impacts will be placed on this snake due to the replacement of these bridges.

5.6 Bellinger River Snapping Turtle *(Myuchelys georgesi)*

5.6.1.1 Local and regional abundance and distribution

The Bellinger River Snapping Turtle is endemic to the Bellinger River catchment in the coastal north of New South Wales, Australia. Within the catchment, bordering the Bellinger River and Dorigo National Parks, the species is restricted to Bellinger River, Kalang River, and the lower parts of Rosewood and Never Never Rivers (Blamires et al. 2005; NSW Scientific Committee 2016). During the winter season, the species activity is substantially reduced with individuals being rarely recorded (NSW Scientific Committee 2016).

5.6.1.2 Habitat utilisation

There is limited record data for the Bellinger River Snapping Turtle within public databases.

In the last five years between 2018 and 2022, the Bellinger River Snapping Turtle has been recorded during 48 different survey events within the catchment. Records were highest in 2018, with 23 sightings, while in 2019, turtle records significantly decreased to only three sightings (ALA 2023). Immature Bellinger River Snapping Turtles can be cryptic and hard to locate e.g. they hide under rocks, in banks, in water weed, in crevices, in leaf litter, buried under sand, under Casuarina sp. root balls, in flood debris etc (BCD 2022).

There is limited information available on the nesting and breeding patterns of the Bellinger River Snapping Turtle; however, it has been recognised that females can be gravid (with eggs) from September/October to December (Cann et al. 2015; NSW Scientific Committee 2016; TSSC 2016). Including courtship and an egg incubation period of a 60 -72-days, the full breeding season of the species extends from July to February inclusive. Based on the few nesting sites studied, eggs are thought to be laid in excavations on sandy river banks typically within 10 m of the water's edge in heavily vegetated areas (Blamires et al. 2005) . The species lays approximately 1-2 clutches per year with the eggs weight ranging between 4 to 6.1 grams (g) (Cann et al. 2015). The clutch size averages between 10 – 25 eggs.(Blamires et al. 2005; TSSC 2016; Coggers 2014).

Targeted surveys undertaken by BCD, have not caught any gravid females since surveys started in 2015 and there has been no evidence of any natural recruitment occurring during the survey period (BCD 2022). Although low levels of natural recruitment may be occurring, ongoing population recovery is thought to be currently dependent on captive breeding (BCD 2022).

5.6.1.3 Key threatening processes

The species' main threat has been a disease outbreak that caused mass mortality in 2015 and resulted in a substantial decline in the Bellinger River Snapping Turtle population and distribution (Zhang et al. 2018). Four hundred and thirty-three individuals are confirmed to have died following the outbreak (New South Wales Scientific Committee 2016), although the actual number is unknown and likely much higher as a majority of the infected individuals were found on shore close to the river. According to Chessman et al. (2020), an unknown virus now recognised as the 'Bellinger River virus', was responsible for the high mortality rate of the species and lead to the species being listed as critically endangered under the EPBC Act (DCCEEW 2023) and the BC Act.

Infected individuals (Plate 5.1) display symptoms of blindness resulting from growths around the eye (septicaemic cutaneous ulcerative disease) with a 100% mortality rate. No other animals, including the Murray River Turtle (*Emydura macquarii*), appeared to be affected. Nucleic acid sequencing of the virus isolate has identified the entire genome and indicates that this is a novel nidovirus (Zhang et al. 2018). While sources of the outbreak are unknown and difficult to determine with certainty, river conditions in the lead up to the event were reported to be 'extremely low flow rates' with rainfall well below average. A severe heat episode also occurred in early December 2014 resulting in elevated water temperatures (Moloney et al. 2015).

Plate 5.1 Infected individual from the Bellinger River virus (Rowan Simon 2015)

Prior to the outbreak, the turtle was considered ‘locally abundant'. It is estimated that the population size was previously in the order of 2500 individuals. After the spread of the disease, it is now unclear how many turtles remain within the population. Targeted surveys of the species over five years has indicated a large decrease in recorded sightings. New estimates show the population size is likely to be less than 100 – 200 animals present in the wild (Zhang et al. 2018; ALA 2023). Approximately 60 km of the Bellinger River is known to be affected by the disease, representing 100 percent of the known range of the species in Bellinger River (TSSC 2016). Survival of the species may be dependent on captive breeding programs due to the very small number of mature adults that have survived in the wild (Chessman et al. 2020).

Prior to the disease outbreak and the species being listed as critically endangered, the species main threats consisted of specific habitat requirements, predation, alteration to the quality of water, and competition with the Murray River Turtle (TSSC 2016). Interspecific competition and hybridisation are known to occur with Murray River turtle particularly in the Kalang River and is a threat to the Bellinger River Snapping Turtle. Alongside the continuation of the disease, these interactions with the Murray River turtle are identified as a significant threat that could lead to further declines in the species population (Chessman et al. 2020).

Additional threatening processes impacting the species including habitat modification from developments, pollution, other diseases, and predators (Cann et al. 2015; Chessman et al. 2020). The introduced red fox (*Vulpes vulpes*) are a major contributor to the predation of nests and nesting females. Blamires et al. (2005) reported a turtle nest predation rate of 72% from foxes and goannas (*Varanus varius*) along the Bellinger River. As there are limited numbers of the species remaining, studies have projected the importance of conservation management plans that protect the species where risks of impact occur from habitat degradation, disturbances and increased threat of predators (Cann et al. 2015).

Due to the impact of the disease, the species is considered highly suspectable to any risks that impact habitat conditions, nesting and recruitment and the health/survival of individuals.

5.6.1.4 Recovery plans

There is currently no recovery plan in place for the Bellinger River Snapping Turtle. A captive breeding program was established after the disease outbreak with 17 individuals placed into the program. Since 2018, turtle breeding

has been successful and the NSW Government has managed the trial release and monitoring of 179 captive-bred juveniles into the river. Results have been positive with majority of the turtles surviving in good health in the river (NSW DPE 2021). Radio transmitters attached to the released turtles are used to assist with monthly monitoring.

5.6.1.5 Long term viability

There have been no gravid female Bellinger River Snapping Turtles caught since targeted surveys began in 2015, and there is no evidence of any natural breeding happening within the population (BCD 2022). The viability of the population currently depends on captive breeding, and although low levels of natural breeding may be occurring, it is yet to be confirmed.

Considering the extremely small population size of the Bellinger River Snapping Turtle, any decrease in turtle numbers has the potential to impact the overall viability of the population. The risks of the Project include injury or death of individuals from works within the river channel, habitat degradation, and disturbance. To protect the species and its habitat, strict avoidance and mitigation/management controls will be implemented. Pre-clearance surveys will be conducted by experienced Bellinger River Snapping Turtle ecologists to ensure no turtles are present within the works' footprint.

The design and alignment of the bridges have been selected to avoid and minimise direct and indirect impacts to the habitat of the Bellinger River Snapping Turtle. The alignment of the new bridges utilises existing disturbed areas such that vegetation clearing, and disturbance of river banks will be minimal. Design of the new bridges will span the river and piers will be located outside, or on the margins, of the low flow channel The low flow channel concentrates flow allowing for ecological, during periods of low-flow to avoid permanent direct impact to the aquatic habitat and minimise temporary habitat disturbance during construction. Aquatic habitat loss will be restricted to the immediate footprint of the bridge piers.

The Project area contains potential nesting habitat for the Bellinger River Snapping Turtle, and the captive breeding program releases hatchlings throughout the Bellinger River. As such, embankment works on the river banks will only take place outside of the nesting season of the species, which takes place from September/October to December inclusive. As such, the Project is not expected to directly impact any breeding that may occur naturally in the Bellinger River. No substantial changes to the composition or quality of the riparian zone or river banks are expected and, as such, changes to foraging and sheltering resources for the Bellinger River Snapping Turtles are unlikely to occur. Best construction practices and equipment will be used to minimize the risks of noise and vibration disturbance and to protect water quality and habitat conditions within and downstream of the footprints. Temporary impacts to Bellinger River Snapping Turtle habitat during construction have been minimised through the use of rock bags, liners and blinding construction to create safe and dry work areas that prevent any discharge of sediment, drilling fluid or concrete into the waterway. This approach avoids the need for earth fill and minimises the need for sediment and erosion controls in the immediate area. Reducing the impact of adverse effects on the Bellinger River Snapping Turtle habitat within and downstream of each of the Project footprints.

Temporary disturbance as a result of noise and vibration from traffic, pier boring, rock anchoring and general construction machinery has been minimised through the selection of an excavator mounted boring machine and air rock anchoring machine.

A Project specific EMP and erosion and sediment control plan will be developed to outline management requirements during construction. Monitoring against the EMP will occur throughout construction to allow for adaptive management if required. Overall, based on the avoidance, mitigation and management measures proposed for the protection of Bellinger River Snapping Turtle habitat, the extent of habitat that will be impacted by the Project is not expected to result in adverse impacts to the species.

The Project has the potential to impact key threatening processes of the Bellinger River Snapping Turtle through the exacerbation of disease and habitat modification/degradation. Due to the impact of the disease, the species is considered highly suspectable to any risks that impact habitat conditions, nesting and recruitment and the health/survival of individuals. As such, a precautionary approach has been taken for the Project with regard to the design of the bridge structures and the proposed construction methodology, equipment and program. Best practice techniques have been selected for avoidance, mitigation and management of potential impacts. The methods proposed are known to be effective at protecting aquatic environment and species. Monitoring will be conducted throughout the construction works to assess actual risks against those expected and allow for adaptive management if required. Given the susceptibility of the species to disease and the risk that any impact on the species can have on the viability of the population, this SIS has been prepared to support the active management of risks throughout Project construction. Consequently, key threatened process is expected to be appropriately managed. Overall, the Project is not likely to have any adverse effects on the abundance of the Bellinger River Snapping Turtle or its habitat. Therefore, the Project is not expected to threaten the viability of the population or result in any extinction risk.

6. Avoidance measures

6.1 Feasible alternatives

The replacement of the bridges has been identified as the preferred option based on previous cost benefit analysis completed by BSC. The ‘do nothing’ option is not acceptable to Council or the community, as the site poses as a risk to users. Further damage can be expected if no action is undertaken.

6.2 Design

Throughout the design phase, consideration has been placed on reduction of impacts to surrounding environmental values through the selection of optimal bridge locations and improved bridge designs.

6.2.1 Bridge alignment

At all four sites, the new structures will be located on an elevated, improved alignment adjacent to the existing wooden bridge structures. This approach will allow continued access for residents during construction, avoiding the need for instream temporary crossings and providing an increase in flood immunity for the route.

The Project footprint for the bridges will be generally restricted to include the existing cleared road easement, reducing the area of impact to habitat and minimising degradation of habitat and associated runoff.

The environment within the Project footprint is currently subject to disturbance from the approach road, existing bridge structure including modified bank morphology and degraded riparian vegetation characteristics.

6.2.2 Bridge design

Designs for all four sites have been modified throughout the design process to reduce environmental impacts.

As far as practical with restricted access on Darkwood and Kalang Road, bridge spans have increased in all four bridge designs. Through the addition of longer spans, the low flow channel area can be generally spanned, reducing instream works. Additionally, increasing the length of the bridge spans and relocating the bridge piles to the outside margins of the low flow channel will substantially reduce the risk of habitat degradation and disturbance from noise and vibration, as well as potential impacts to hydrology and aquatic fauna movement following construction.

Areas of investigation and design consideration for each bridge are discussed below.

Joyces Bridge

– Piers one and two for Joyces Bridge have been relocated from within the low flow channel to the outside margins.
– To increase flood immunity, the bridge will be raised approximately 2 m in height.

Hobarts Bridge

– Piers for Hobarts Bridge have been removed completely from the channel with pier 1 relocated to the water edge margin.
– Piers two and three for Hobarts Bridge have been relocated from within the low flow channel to the outside margins.
– Bridge design to increase height by 2 m to improve flood immunity.
– Works also involves removing some vegetation on banks, this will be minimised where possible.

Justins Bridge

– Piers for Justins Bridge have been removed completely from the channel with pier 1 relocated to the water edge margin.

– Bridge raise of approximately 1.3 m to increase flood immunity.
– Works also involve removing some vegetation on banks, this will be minimised where possible.

Duffys Bridge

– Piers for Duffys Bridge have been removed completely from the channel with pier 1 relocated to the water edge margin.
– Increase of 1.7 m in bridge height to increase flood immunity.

6.2.3 Foundation design

An assessment was undertaken to identify the various foundation options available, based on the likely ground borne vibrations and underwater noise levels associated with installation methods. The combination of large cobbles and high strength rock at all sites requires bored piles and/or rock anchors.

To reduce impact during piling works the following is proposed:

– A condensed piling program reduced to 1-2 weeks of piling works.
– Avoidance of instream granular fill construction platforms through use of rock bags reducing the risk of introduced sediment and degradation of habitat.
– The use of pneumatic rock anchor installation has been identified as the preferred option for construction due to the smaller size of the machinery, increased efficiency and reduced noise.
– A foundation design (600 m bored piles) that can be constructed with an excavator mounter auger greatly reducing the piling pad for access of a conventional piling rig.

6.2.4 Bridge elements

Where practical, many elements of the bridges will be precast offsite, reducing potential impacts associated with onsite concrete works.

6.3 Construction methodology

Best practice construction techniques have been specifically selected to avoid direct works within Bellinger River wherever possible.

Construction access

Installation of the bridge superstructure will preferentially occur from existing banks, constructed road embankment or bridge spans, rather than working from constructed earth-fill/ rock fill pads within the river channel. Where this is not possible, contained rock bags are proposed to be used. These bags allow the placement and removal of rock with minimal impact to the underlying substrate or water quality. This approach will have a significantly lower impact than that associated with the construction of an instream pad whereby the placement of rock and other fill material within the low flow channel is required.

The use of existing structures and general restriction of works footprint to within previously disturbed areas will avoid direct impacts to the Bellinger and Kalang Rivers during superstructure construction and will minimise the clearing of adjacent native riparian vegetation.

Timing

Construction will occur concurrently between April 2024 and June 2025. All high-risk works will be completed within the dry season and/or a period of low rainfall and minimal flow. This period will minimise the risk of erosion, run-off and transport of sediment downstream during flooding events. High risk works include instream works for piling access and approaches and works to construct the bridge substructure.

The construction schedule has also been designed to avoid high and medium risk works during key threatened fauna breeding seasons as outlined in Table 6.1. In summary, the construction schedule will include:

– High risk works – Vegetation clearing / earthworks on river bank, installation of piers and rock anchors, instream substructure works. Works to be outside full breeding season of the Bellinger River Snapping Turtle (including courtship, incubation and hatching - July to February inclusive) and outside key breeding of the Giant Barred Frog (November and February). Works allowable March – June inclusive (4 months).
– Medium risk works – Construction of abutments outside of waterway low flow channel, construction of superstructure and road approaches. All construction Works to be outside nesting season of the Bellinger River Snapping Turtle (October to January inclusive) and outside key breeding of the Giant Barred Frog (November and February). Works allowable March-September inclusive (7 months).
– Low risk works - Finishing works - Construction of roads and ancillary bridge components at road level only including barriers signage, road sealing, concreting. No works on embankments or instream. Works allowable during any period.

Construction works will not occur during times of extreme heat (> 40°C) to avoid disturbance to heat stressed individuals such as the Grey-headed Flying-fox. Demolishing of the existing bridges will not occur during the breeding season of the Southern Myotis (October to March).

Table 6.1 Construction schedule avoidance of threatened fauna breeding seasons

Species	Description of Breeding	Breeding Period											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bellinger River Snapping Turtle	Females can be gravid (with eggs) from September/ October to December with an incubation time of 60 day. Full breeding season including courtship/mating extends from July to February inclusive.	■	■					▒	▒	■	■	■	■
Giant Barred Frog	Breeding season occurs from spring to autumn with peak periods in November and February.	■	■	▒	▒	▒				▒	▒	■	■
Southern Myotis	Females produce up to two young each year, one in early October and the other in late January. The latter young are likely non-volant until March .	■	■	■							■	■	■
Large Bent-wing Bat*	Maternity caves are used annually in spring and summer for the birth and rearing of young.	■	■							■	■	■	■
Little Bent-wing Bat*	Maternity caves are used from November to March for the birth and rearing of young.	■	■	■								■	■
Eastern Coastal Free-tailed Bat	Relatively unknown. Females are thought to give birth in November and December.	■	■									■	■
Eastern False Pipistrelle	Relatively unknown. Females are pregnant late Spring and early Summer.	■	■									■	■
Grey-Headed Flying-Fox	Females give birth to a single young each October/November after a 6-month gestation. At around 3 months, young are able to fly and forage outside the camp.	■	■								■	■	■
Fruit Doves	Nests in bushy trees from 5 m – 30 m above the ground between September and January.	■								■	■	■	■
Stephens's Banded Snake	Mating is thought to occur in Spring with females only gravid every two years.									■	■	■	■
Construction Activity	**Description of Works**	**Construction Schedule**											
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
High Risk	Instream work - Vegetation clearing / earthworks on river bank, installation of piers and rock anchors, instream substructure works.												
Medium Risk	Embankment and superstructure works - Construction of abutments outside of waterway low flow channel, construction of superstructure and road approaches.												
Low Risk	Finishing works - Construction of roads and ancillary bridge components at road level only including barriers signage, road sealing, concreting.												
High Risk	Demolition - Demolition of existing timber bridges.												

Black shading = peak breeding period. Back +grey shading = full breeding period. Red shading = construction works prohibited. Green shading = construction works permissible. * = no breeding habitat present within Project area.

7. Impact assessment, mitigation, and management measures

7.1 Overview of impacts

The proposed works will involve vegetation clearing, installation of piers and rock anchors, construction of abutments and placement of decking units, installation of rock scour protection, realignment of approach roads, demolition of existing timber bridges and rehabilitation. Construction works are expected to be carried out over a 7- month period. Instream and associated bank footprints are estimated to impact approximately 0.41 ha.

Potential impacts from the Project include:

– Loss or degradation of habitat (including potential foraging, roosting and breeding habitat).
– Injury/mortality of fauna.
– Noise and vibration disturbance.
– Water quality degradation.
– Restriction of instream connectivity.
– Exacerbation of infectious disease.

These potential impacts are discussed in detail in Sections 7.2 to Section 7.8. Potential impacts have been assessed based on the works described in Section 1.6 and the design and construction methodologies provided by BSC (Appendix C, Appendix D and Appendix E). In addition to the avoidance measures detailed in Section 6, mitigation measures are detailed for each potential impact to achieve further protection of the surrounding environment during Project construction and operation.

7.2 Loss or degradation of habitat

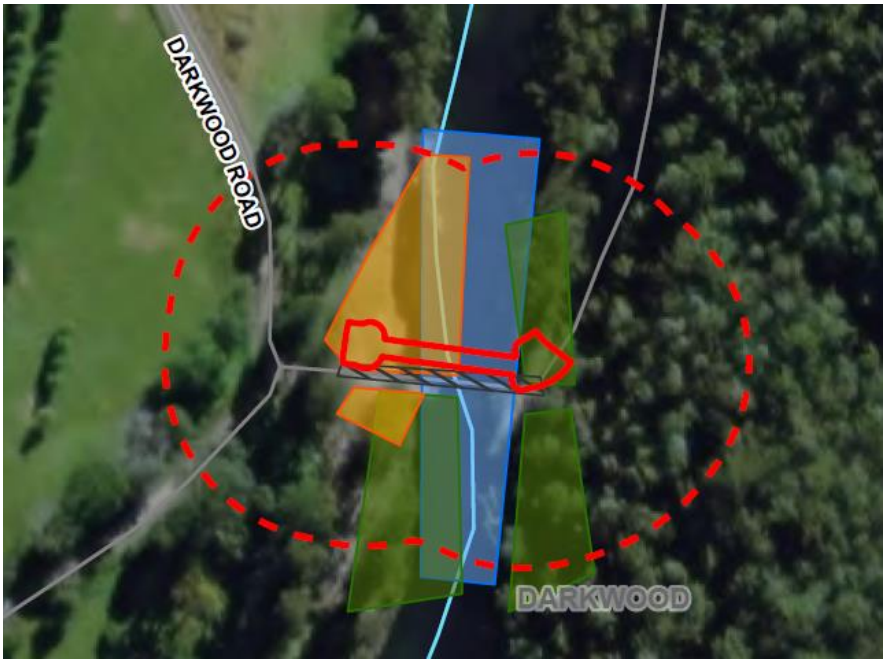
As discussed in Section 6.2, optimal bridge design and construction methodologies have been selected to avoid and minimise direct impacts to the surrounding habitat. With the implementation of these measures, direct works within the Bellinger and Kalang Rivers will be restricted to two piles located on the outside margins of the low flow channel at Joyces and Hobarts bridges respectively. Piers are located completely outside the low flow channel at Justins and Duffys Bridges.

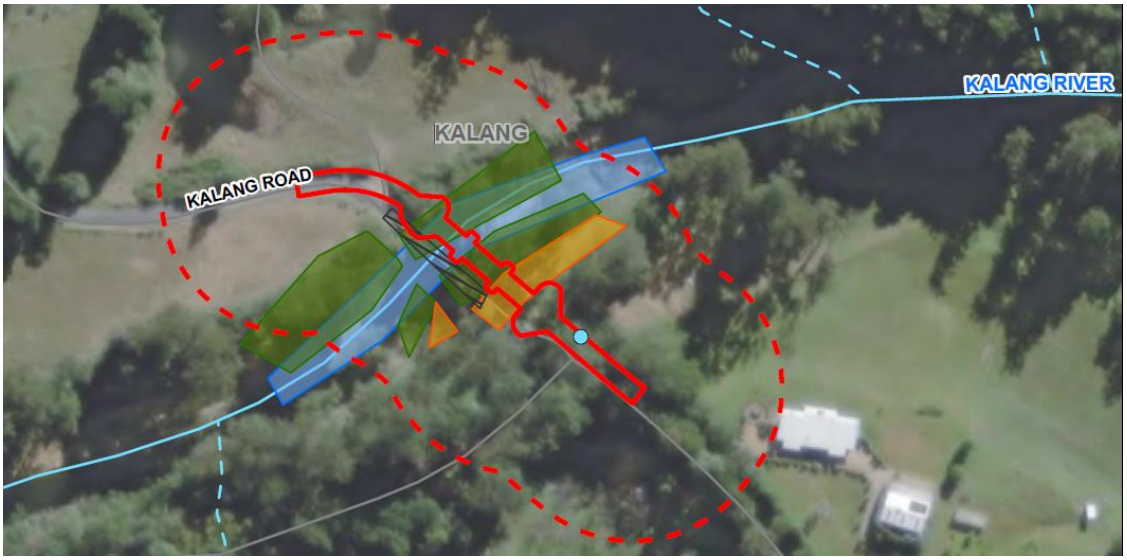
Vegetation clearing, substrate disturbance and movement of equipment within the Project footprint of the bridges have the potential to result in habitat loss, degradation, and disturbance. A change in habitat conditions through the alteration of river bank and river bank profiles, substrate composition and loss of riparian vegetation can degrade foraging and habitat resources in the immediate area of the bridge construction sites. Vegetation clearing can create favourable conditions for weed growth and has the potential for introduction of weeds to site from construction machinery (harbouring seeds from previous projects). This increased risk of weeds has the potential to degrade foraging, sheltering, and breeding habitat available for local fauna (i.e. Giant Barred Frog, Bellinger River Snapping Turtle, Stephens's Banded Snake and threatened microbats).

Strict environmental controls and management actions are proposed to avoid and minimise the potential for proposed construction works to degrade the surrounding environment. Habitat impacts associated with each of the four proposed bridges are detailed below (Table 7.1).

Table 7.1 Potential habitat impacts associated with Joyces, Hobarts, Justins and Duffys Bridge replacements

Bridge	Potential habitat impacts
Joyces Bridge	The Project footprint will mainly cover the existing road easement, reducing vegetation and habitat loss. Some mixed native and non-native ground covers along the left and right banks are to be removed with extra vegetation to be cleared on the right bank for an access track. Approximately 16 m of river bank is planned to be disturbed on the left side of the river from high bank to toe. Approximately 16 m of high bank on right side of the river will be disturbed in addition to the gravel bar that forms the low bank. Direct impacts to aquatic vegetation will be limited to disturbance of several small clumps of *Vallisneria nana* downstream of the existing bridge with a total area of approximately 1-2 m^2. Disturbance to the benthic substrate will be limited to footprints of the bridge piers, which is comprised of consolidated and unconsolidated rock, gravel, and sediment. Piers one and two have been relocated from within the low flow channel to the outside margins, minimising instream activities and impact to aquatic habitat. Snag removal within the Project footprint is unlikely to be required and therefore will not impact habitat resources for the species. The impact to river banks and riparian vegetation may remove habitat resources including trees, shrubs, logs, leaf litter, rocks and large debris which may provide foraging, sheltering, roosting and breeding habitat for fauna. Conservation significant species that may be impacted by this include the Giant Barred Frog (riparian habitat specialist), microbats (roost habitat in hollow-bearing trees, under tree bark and in existing bridge), Stephens's Banded Snake (shelter habitat in hollow-bearing trees), Superb Fruit-dove (sheltering and foraging habitat), Grey-headed Flying-fox (foraging resources), and Bellinger River Snapping Turtle (nesting habitat). Timing of construction works has been designed to avoid breeding periods for relevant conservation significant species.
	
Hobarts Bridge	Some native trees and mixed native and non-native shrubs and ground covers will be removed on the left and right banks with extra vegetation to be removed from the right bank gravel bar for access tracks. Approximately 12 m of river bank to be disturbed on left side of the river from high bank to toe. Approximately 15 m of high bank on right side of the river will be disturbed in addition to the gravel bar that forms the low bank. Direct impacts to aquatic vegetation are unlikely to occur. Disturbance to the benthic substrate will be limited to footprints of the bridge piers, which comprises consolidated and unconsolidated rock, gravel sediment. Piers two and three for Hobarts Bridge have been relocated from within the low flow channel to the outside margins minimising instream activities and impact to conservation significant species (i.e. Bellinger River Snapping Turtle and Giant Barred Frog). Snag removal within the Project footprint is unlikely to be required and therefore will not impact habitat resources for fauna. The impact to river banks and riparian vegetation may remove habitat resources including trees, shrubs, logs, leaf litter, large debris and rocks which may provide foraging, sheltering, roosting and breeding habitat for fauna. Conservation significant species that may be impacted by this include the Giant Barred Frog (riparian habitat specialist), microbats (roost habitat in hollow-bearing trees, under tree bark and in existing bridge), Stephens's Banded Snake (shelter habitat in hollow-bearing trees), Superb Fruit-dove (sheltering and foraging habitat), Grey-headed Flying-fox (foraging resources) and Bellinger River Snapping Turtle (nesting habitat). Howards Bridge is 210 m adjacent to an existing grey-headed flying-fox camp, and while construction of the bridge will not impact roost habitat, it has potential to impact foraging habitat for the species. Timing of construction works has been designed to avoid breeding periods for relevant conservation significant species.

Bridge	Potential habitat impacts
	
Justins Bridge	One native tree on the right bank and mixed native and non-native shrubs and ground covers are to be removed on the left and right banks. Approximately 8 m of river bank to be disturbed on both sides of the river from high bank to toe. Direct impacts to aquatic vegetation are unlikely to occur. No piers will be located within the low flow channel and therefore disturbance to the benthic substrate, consolidated and unconsolidated rock, gravel sediment, will be minimal. The existing bridge piers are planned to be removed to bed level and therefore will result in a small area of habitat disturbance during this process. It is proposed that one or two large snags may be removed to facilitate access and piling works. These snags will be relocated to adjacent habitat such that no loss of resources for fauna occurs. The impact to river banks and riparian vegetation may remove habitat resources including trees, shrubs, logs, leaf litter, rocks and large debris which may provide foraging, sheltering, roosting and breeding habitat for fauna. Conservation significant species that may be impacted by this include the Giant Barred Frog (riparian habitat specialist), microbats (roost habitat in hollow-bearing trees, under tree bark and in existing bridge), Stephens's Banded Snake (shelter habitat in hollow-bearing trees), Superb Fruit-dove (sheltering and foraging habitat),Grey-headed Flying-fox (foraging resources) and Bellinger River Snapping Turtle (nesting habitat). Timing of construction works has been designed to avoid breeding periods for relevant conservation significant species.
	

Bridge	Potential habitat impacts
Duffys Bridge	Mixed native trees (i.e. *Casuarina cunninghamia*) and native and non-native shrubs and ground covers are to be removed on the left and right banks. Approximately 7 m of river bank on the northeastern side of the existing bridge is estimated to be disturbed on both sides of the river, from high bank to the toe. No direct impacts to aquatic vegetation is expected. No piers will be located within the low-flow channel; therefore, disturbance to the benthic substrate, consolidated and unconsolidated rock, and gravel sediment, will be minimal. The existing bridge piers are planned to be removed to bed level, resulting in a small habitat disturbance during this process. It is proposed that one or two large snags may be removed to facilitate access and piling works. These snags will be relocated to adjacent habitat such that no loss of resources for fauna occurs. The impact to river banks and riparian vegetation may remove habitat resources including trees, shrubs, logs, leaf litter, rocks and large debris which may provide foraging, sheltering, roosting and breeding habitat for fauna. Conservation significant species that this may impact include the Giant Barred Frog (riparian habitat specialist), microbats (roost habitat in hollow-bearing trees, under tree bark and in existing bridge), Stephens's Banded Snake (shelter habitat in hollow-bearing trees), Superb Fruit-dove (sheltering and foraging habitat), Grey-headed Flying-fox (foraging resources) and Bellinger River Snapping Turtle (nesting habitat). Timing of construction works has been designed to avoid breeding periods for relevant conservation significant species.
	

Mitigation and management measures proposed to minimise the potential for habitat degradation include:

– Minimising the Project footprint to the smallest area needed for construction work.
– Locating the bridges within road easement and previously disturbed areas immediately adjacent to the existing bridges.
– Minimising instream works through bridge design and construction methodology (i.e. rock bags).
– Scheduling the duration of construction works within the low flow channel to the minimum time necessary and outside the wet season.
– Retaining large woody debris, rocks, root balls from within the Project footprint for reinstatement to the same site it was removed following the completion of construction.
– Demarcate no-go areas of ecological sensitivity both on site and in construction plans, including all vegetation not to be cleared. All vegetation to be retained should be surveyed and clearly demarcated.
– Keeping vehicle and machinery movements confined to designation access tracks and enforcing on-site speed limits.
– Providing environmental training to site personnel through a site induction and toolbox talks on conservation significant species local habitat, potential risks and avoidance, mitigation and management requirements.
– Rehabilitation and revegetating exposed surfaces and redundant road sections on completion of construction activities. Bank morphology will be restored to existing conditions.

7.3 Injury/mortality of fauna

The intensive nature of vegetation clearing has an elevated potential to adversely impact local fauna that shelter in hollows, nests, trees or ground habitat (logs, burrows, soil, leaf litter and beneath rocks). Fauna species most at risk include nocturnal species that are likely to be sheltering during the day when clearing activities are underway (e.g. microbats, flying-foxes), and slow-moving species or sedentary species that are less able to flee the clearing zone (e.g. reptiles and frogs). Increased vehicle movements during the construction phase may also increase the local incidence of fauna injury and mortality through vehicle strike and collision. Additional threats include the entrapment within open excavation areas. Conservation significant species with heightened risk of injury or mortality during construction include threatened microbats, Stephens's Banded Snake, Giant Barred Frog and Bellinger River Snapping Turtle. These species are at greater risk due to localised occurrence, potential breeding areas, nocturnal behaviour and relatively slow dispersal ability.

Aquatic habitats within the Project footprints consists of pool-riffle and pool-run habitats. Key construction activities that have potential to cause injury/mortality include clearing and earthworks within the river banks and the installation of rock bags within the low flow channel, bridge piers and rock anchoring. Conservation significant species Giant Barred Frogs may experience direct injury or mortality if individuals are present within the areas of disturbance at the time of works. Given the adult Giant Barred Frogs have low dispersal ability (potential to move 100 m per night), the species is susceptible to construction phase impacts. The Bellinger River Snapping Turtle may experience direct injury or mortality if individuals are present within the areas of disturbance at the time of works. Spencer et al. (2014) found that when disturbed, 50% of the time turtles remain motionless while 50% of the time they attempted to flee. In addition, the Bellinger River Snapping Turtle is often found partly buried in sand, silt or leaves and are usually found in the deepest part of the waterhole. These factors potentially decrease the detectability of the species within the Project footprints. To mitigation this risk, two pre-clearance surveys will be conducted prior to the commencement of instream construction works. Pre-clearance surveys will be conducted three (3) weeks prior and again one (1) week prior to the start of any construction works within the river channel or banks. No direct injury or mortality of turtle eggs is expected to occur as construction works within the river banks will occur outside of the nesting season.

Mitigation and management measures proposed to minimise the potential for turtle injury/mortality include:

– Avoiding high and medium risk construction activities within the key breeding seasons of aquatic-based conservation significant species including the Bellinger River Snapping Turtle and Giant Barred Frog (refer to Section 6.3).
– Avoiding construction works during times of extreme heat (> 40°C) to avoid disturbance to heat stressed individuals such as the Grey-headed Flying-fox.

- Avoiding demolition of the existing bridges during the breeding season of the Southern Myotis (October to March).
- Conducting pre-clearance surveys by a suitably qualified ecologist experienced to inspect Project footprints for the presence of conservation significant species, including in terrestrial and aquatic habitat. The pre-clearance surveys will include survey techniques suitable for the species and will target areas where individuals, including juveniles, may hide such as they hide under rocks, in banks, in water weed, in crevices, in leaf litter, buried under sand, under Casuarina sp. root balls, in flood debris. Two pre-clearance surveys for the Bellinger River Snapping turtle will be conducted by a suitably qualified ecologist prior to the commencement of instream construction works. Pre-clearance surveys will be conducted three (3) weeks prior and again one (1) week prior to the start of any construction works within the river channel or banks.
- All approvals and permits for Bellinger River Snapping Turtle pre-clearance surveys would be obtained prior to the start of construction and a procedure developed in consultation with BCD for additional avoidance and mitigation measures to be implemented in the event that a Bellinger River Snapping Turtles are found located within or immediately adjacent (i.e. within 100 m) of the Project footprint.
- Minimising instream works through bridge design and construction methodology (i.e. rock bags).
- Scheduling the duration of construction works and works within the low flow channel to the minimum time.
- Enforcing stringent wash down procedures for all machinery and materials used for the Project in accordance with the Department of Planning & Environment Bellinger River Snapping Turtle biosecurity protocol.
- Providing environmental training to site personnel through a site induction and toolbox talks on the Bellinger River Snapping Turtle, its habitat, potential risks and avoidance, mitigation, and management requirements.
- Keeping vehicle and machinery movements confined to designation access tracks and enforcing on-site speed limits.
- Informing BCD of any Bellinger River Snapping Turtles observed during the works and providing appropriately qualified veterinarian/wildlife carer assistant and/or rehabilitation to any turtles injured or suffering evidence of health concerns.

Microbat mitigation measures are detailed in Section 7.8.

7.4 Noise and vibration disturbance

Construction activities within the Project footprints have the potential to result in the temporary disturbance of fauna as a result of noise and vibration disturbance. During the construction period, noise and vibration levels will increase due to the use of construction machinery for vegetation clearing, earthworks, installation of the bridge piles and rock anchors, and bridge/road assembly. Construction activities can adversely impact native wildlife through the disruption of foraging, breeding, and nesting behaviours (Longcore and Rich 2004; Slabbekoorn et al. 2010; Popper and Hawkins 2016). The majority of construction related noise and vibration associated with the bridge replacements is expected to cause minor disturbance only. Fauna behavioural changes that may occur include habitat avoidance and evasive movement. This could result in movement of individuals away from the area.

Installation of the bridge piers and rock anchoring will pose the greatest risk of noise and vibration disturbance to turtles; however, these activities have been designed to occur over a minimal 1-2 week period. Geotechnical investigations were conducted to understand the foundation conditions and then the construction methodology designed to avoid and minimise the potential for noise and vibration disturbance. Specifically, an air rock anchor machine and excavator mounted bored piling machine have been selected as the preferred methodology. The use of an air rock anchor will funnel noise into the underground hole and minimise the sound immitted into the environment. In addition, the bored piling machine will produce sound pressure levels substantially lower than those emitted from pile driving. The bored piling machine has been assessed as this is likely to generate higher noise levels than the rock anchoring.

Noise and vibration impacts from the construction phase may disturb the microbats and Grey-headed Flying-foxes. A Grey-headed Flying-fox camp is located 210 m adjacent to Hobarts Bridge, individuals are likely to be affected by construction at Hobarts Bridge. Flying-foxes are prone to abort foetuses and mass abortions and premature births are known to occur in response to environmental stress. Anthropogenic stresses such as disturbance to camps and habitat clearing is likely to invoke a similar response (DAWE 2021). Microbats may abandon their pups from stress caused by high noise and vibration during intensive repair works (TfNSW 2023).

Anthropogenic noise from traffic has the potential to impact on amphibian breeding behaviours, impeding male call recognition by females and altering spacing between individuals. Anthropogenic noise can decrease the calling rate of some species, and potentially decreasing breeding success (Goosem et al. 2007). Given the noise and vibration output from construction activities are likely to be greater than traffic output, amphibian behaviours within the Project area have the potential to be impacted.

Aquatic fauna such as turtles use sound to navigate, communicate and forage effectively and, as such, many species are sensitive to anthropogenic noise. Artificially generated noise may impact on fauna in the following ways (McCauley et al. 2003):

– Disturbance, leading to behavioural changes or displacement from biologically important habitat areas (such as breeding, feeding, nesting and nursery sites).
– Masking or interference with other biologically important sounds such as communication.
– Physical injury to hearing or other organs.
– Indirectly by inducing behavioural and physiological changes in predator or prey species.

Mitigation and management measures proposed to minimise the potential for noise and vibration disturbance include:

– Using an air rock anchor machine and excavator mounted bored piling machine to minimise the noise and vibration generated within the river channel.
– Minimising the duration of rock anchoring and piling to the shortest period possible.
– Using noise dampening devices on machinery wherever practical and requiring that all equipment is maintained and serviced in accordance with manufacturer's instructions to reduce noise levels.
– Requiring soft starts for a period of five minutes so that individuals have a chance to move away from the area before more intense noise and vibrations start.
– Restricting construction activities to daylight hours to avoid excessive light levels at night.

Due the machinery selected for the rock anchoring and bored piling, combined with the short duration of these works and the requirement for pre-clearance surveys within 100 m upstream and downstream of the bridge locations, the construction works are not expected to cause noise and vibration disturbance at levels that significant impact the Bellinger River Snapping Turtle.

7.4.1 Turtle noise impacts

Research regarding noise impacts on aquatic turtles, especially freshwater turtles, is very limited. This area is an ongoing topic of research and is still evolving. The following sections outlines the current research related to noise impacts on turtles.

Measurements of piling activities were undertaken in the near-field (10 metres) and far-field (791 metres). The following results were obtained:

– SPL rms 166 dB at 10 metres
– SPL rms 154 dB at 791 metres

Based on the above results, calculations were undertaken to determine the noise level at 1 metre for comparison with the South Australian Guideline. Assuming cylindrical spreading (transmission loss = 15 x log (r)), the SPL rms at 1 metre is 181 dB. This lines up with the mid-point of the South Australian Guideline.

The South Australian Department of Planning, Transport and Infrastructure has produced the Underwater Piling Noise Guidelines (2012) which provides sound pressure levels (SPL) vibro-driving piling method (assumed for drilling and bored piling). The levels are provided in Table 7.2 below.

Table 7.2 Piling noise characteristics (Table 1 from the Underwater Piling Noise Guidelines (2012)

Piling method	Character	Noise descriptor	Source levels	Most energy
Vibro-driving	Continuous	SPL	160 – 200 dB re 1 uPa	100 Hz and 2 kHz

The sound pressure level (SPL) is described as:

> *Average noise level over the measurement period expressed in dB re 1 µPa. For impulsive sources, such as impact piling and blasts, the measurement period is the time period that contains 90% of the sound energy (Southall et al. 2007). Continuous sources, such as vibro-piling and shipping, are commonly described in terms of an SPL.*

In addition to the South Australian Guideline, further information has been obtained from a technical memorandum, Manette Bridge Vibratory Pile Driving Noise Measurements, prepared by the Washington State Department of Transport. The Memorandum details the results of underwater noise testing during vibratory pile driving.

7.4.1.1 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report (ANSI)

There is limited data available regarding potential noise impact on freshwater turtles. In lieu of this, data has been sourced from *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report* (prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI) which explores the effects of sound exposure on a range of animals, including the sea turtle. This research has been used to determine the effects of continuous noise sources (such as vibratory or bored piling) on the turtle in the near, intermediate and far distances (Table 7.3). Based on this, suitable buffer distances have been provided.

Table 7.3 Response to sounds and relative risk (extract from Table 7.7 of Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report)

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	Temporary threshold shift (TTS)	Masking	
Sea turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Notes: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).
Mortality and mortal injury – immediate or delayed death.

Recoverable injury – injuries, including hair cell damage, minor internal or external hematoma, etc. None of these injuries are likely to result in mortality.

TTS – short- or long-term changes in hearing sensitivity that may or may not reduce fitness. TTS, for these Guidelines, is defined as any change in hearing of 6 dB or greater that persists. This level is selected since levels less than 6 dB are generally difficult to differentiate. It is also the view of the Working Group that anything less than 6 dB will not be a significant effect from the standpoint of hearing.

Masking – impairment of hearing sensitivity by greater than 6 dB, including all components of the auditory scene, in the presence of noise.

Behavioural effects – substantial change in behaviour for the animals exposed to a sound. This may include long-term changes in behaviour and distribution, such as moving from preferred sites for feeding and reproduction, or alteration of migration patterns. This behavioural criterion does not include effects on single animals, or where animals become habituated to the stimulus, or small changes in behaviour such as a startle response or small movements.

The relative risk of an effect taking place is indicated as being “high”, “moderate” and “low”. The guideline provides the following related to three relative distances related to these risks:

> *While it would not be appropriate to ascribe particular distances to effects because of the many variables in making such decisions, “near” might be considered to be in the tens of meters from the source, “intermediate” in the hundreds of meters, and “far” in the thousands of meters.*

7.4.1.2 Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis

Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Finneran et al, 2017) was prepared by the US Navy and explored the impacts of explosive testing activities on marine mammals and sea turtles. Based on testing and investigations, the following levels were determined for Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS):

– Temporary Threshold Shift (TTS) – 200 dB (weighted)
– Permanent Threshold Shift (PTS) – 220 dB (weighted)

As animals are not equally sensitive to noise at all frequencies, auditory weighting functions were determined and presented in the paper. The paper states “Auditory weighting functions are mathematical functions used to emphasize frequencies where animals are more susceptible to noise exposure and de-emphasize frequencies where animals are less susceptible”.

The weighting curve for the sea turtle is provided in Figure 7.1 below.

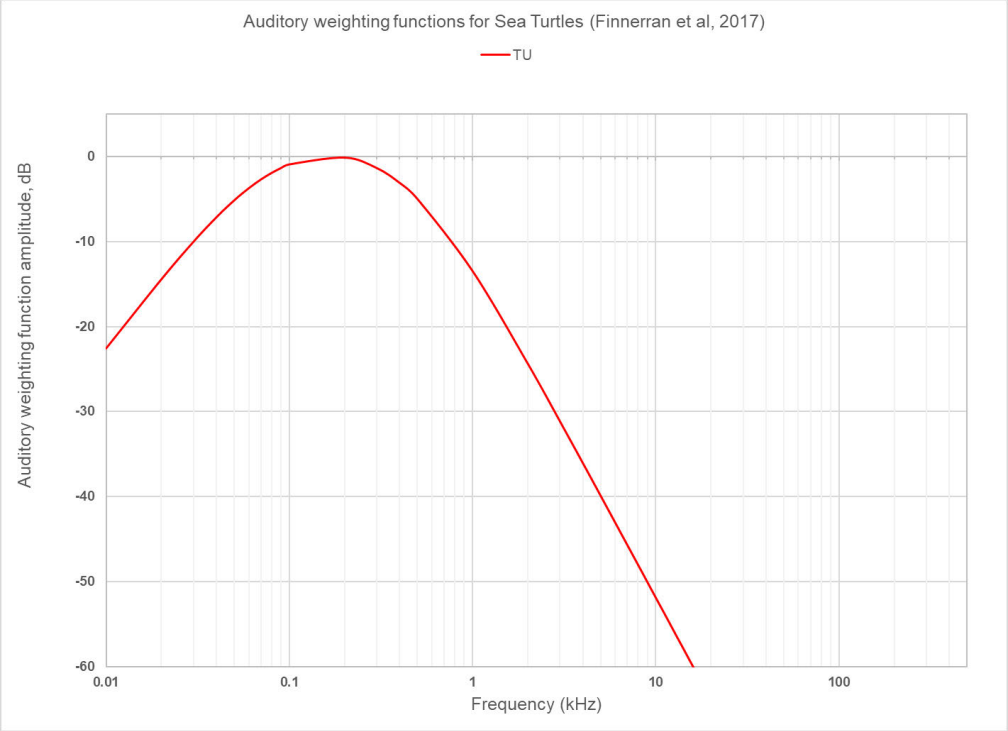


Figure 7.1 Auditory weighting curve for Sea Turtles (Finneran et al, 2017)

7.4.2 Estimated zones of impacts

Based on the measured unweighted noise level of 166 dB, the weighted level at 10 metres would be SPL rms 157 (using the sea turtle weighting) that is also equal to SEL(1sec) 157 dB (weighted) assuming the noise is continuous. Using 10 x log (seconds) to convert to SEL(24hr), the weighted levels at 10 metres would be roughly:

Duration of piling:

– 1 hour: SEL 193
– 2 hours: SEL 196
– 4 hours: SEL 199
– 8 hours: SEL 202
– 16 hours: SEL 205

Propagation of underwater noise is very complex to predict as the local bathymetry, salinity profile, temperature profile, current, seabed characteristics, scattering effects and absorption influence how noise travels.

However, assuming cylindrical propagation loss for shallow water (as opposed to deep ocean water where noise would spread spherically), a 15 x log (distance or R) can provide a rough guide of typical noise levels. This equals a 3 dB reduction for every doubling of distance.

Based on the calculations to determine SEL exposure, the TTS zone is approximately 20 metres. Note there is no PTS zone as noise levels are not calculated to be high enough.

Based on the guidance in the South Australian Guideline, the following buffer distance should be applied in conjunction with the relative risks in Table 7.3:

– Near – less than 100 metres
– Intermediate – 100 metres to 1000 metres
– Far – greater than 1000 metres

Rock anchoring and bored piling will occur over a very short period of up to two weeks and will be conducted outside of the nesting season. Based on the guidelines above, these activities will have no impact on turtles located greater than 1000 metres from the Project footprints. In addition to behaviour disturbance discussed above, any turtles located between 100 to 1000 m may be exposed to an impairing of hearing sensitivity (masking) during the period of the works. Any turtles located immediately adjacent to the construction works (within 20 m) may also experience short- or long-term changes in hearing sensitivity that may or may not reduce fitness (TTS). As such, pre-clearance surveys will be conducted 100 m upstream and downstream of each Project footprint to confirm no Bellinger River Snapping Turtles are present within this area during the rock anchoring and bored pilling works and ensure that they do not enter the 20 m zone. If turtles are identified within this area, then BCD will be contacted to identify the appropriate cause of action.

7.5 Water quality degradation

Construction activities have the potential to indirectly degrade the quality of adjacent habitats and habitat edges through exposure to increased dust, erosion and sedimentation. This can result in altered habitat composition (i.e. reduced flora diversity and simplified ecosystem structure) and quality (i.e. reduced availability of forage resources, increased predation pressure), thereby potentially affecting the composition and abundance of species in the altered habitat. Adverse weather conditions during construction can exacerbate the potential impact of erosion and sedimentation. High rainfall has the potential to remove exposed topsoil, destabilise creek beds and distribute sediment through creek lines. Strong winds have the potential to spread exposed topsoil, decreasing the likelihood of recolonization by vegetation and potentially distributing dust into nearby sensitive environments.

Release of sediments into aquatic habitats can result in altered water chemistry (including increased turbidity, decreased oxygen levels, reduced light penetration), changes in channel morphology (including filling of pools), alteration of substrate composition and smothering of habitat resources (Wood and Armitage 1997). For the proposed activities, these impacts may have a temporary and localised effect by reducing habitat value (e.g. amount of refuges, microhabitats and food availability) within the immediate and/or downstream area and influencing health and physiology. Degradation of potential habitat downstream of the footprint from increased sediments and may reduce the suitability for conservation significant species (i.e. turtle nesting, breeding habitat for Giant Barred Frog).

Bridge construction activities within and above Bellinger River also has the potential to result in the introduction of wastes and hazardous materials, such as fuels and lubricants. Key risk activities include construction of in-situ concrete elements (e.g. spillage of concrete and curing compounds). In severe cases, chemical pollution of the aquatic environment can result in long-term habitat degradation and widespread mortality of species.

Mitigation and management measures proposed to minimise the potential for water quality degradation include:

– Stringent wash down procedures for all machinery and materials used for the Project in accordance with the Project EMP and Department of Planning & Environment Bellinger River Snapping Turtle biosecurity protocol.
– Monitoring of water quality conditions (visual and *in situ* recordings) to identify the potential for water quality degradation and allow for adaptive management. Water quality monitoring will be conducted weekly during works within the low flow channel.
– Scheduling the duration of construction works during the dry season when rainfall and river flow volumes are low.

– Preparing and implementing a Project specific Erosion and Sediment Control Plan (ESCP) in accordance with International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines. The ESCP will be prepared by a highly experienced Certified Professional in Erosion and Sediment Control (CPESC). Key measures will include:
    - Installing erosion protection measures in the form of sediment fences where required to minimise the transport of sediment into the river.
    - Minimising erosion potential through scour protection treatments at abutments.
    - Minimising vegetation clearing and the area of bare ground required for construction to only that which is necessary.
    - Appropriately managing and protecting stockpiles. Stockpiles will be a maximum of 1.5 m high and will be set back at least 100 m from the Bellinger River and Kalang River.
– Implementing a site-specific Environmental Management Plan (EMP). Management measures will include:
    - Site management will in accordance with the waste management practices detailed in *Managing Urban Stormwater: Soils and Construction* (4th edition) (Landcom 2004), particularly:
        – Section 6: Sediment and Waste Control.
        – Section 8.2(a): Empty bins for concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter at least weekly and otherwise as necessary. Dispose of any waste in an approved manner.
        – Waste material, other than vegetation and tree mulch, will not to be left on site once the works have been completed.
        – Working areas will be maintained, kept free of rubbish and cleaned up at the end of each working day.
        – A closed system reverse cycle circulation system with sediment trap will be used to collect all water and sediment released during drilling.
        – Drilling support fluid will be biodegradable and a vacuum truck used to dispose of material at the completion of drilling.
        – Installing rock bags, liners and blinding construction to create bunded work platforms to prevent spills.
        – Requiring all auxiliary works activities, including chemical and waste storage, will be located at least 100 m from Bellinger River.

7.6 Restriction of connectivity

Construction works have been designed to avoid physical restriction of aquatic fauna movement. The low flow channel will remain open to flow throughout the duration of the works. Aquatic fauna (i.e. turtles) may be reluctant to move through the footprints due to noise, vibration and/or people/machinery activity levels. Construction works will be restricted to daylight hours to allow periods of non-disturbance at night and works within the river channel will be prioritised and best practice construction methods selected to minimise the duration of disturbance. All instream works are scheduled to occur outside of Bellinger River Snapping Turtle nesting season and Giant Barred Frog peak breeding season and therefore disturbance to breeding cycles are expected to be minimal.

Mitigation and management measures proposed to minimise the potential for restriction of aquatic fauna include:

– Avoiding the use of instream barriers during construction.
– Maintaining natural flow within the low flow channel throughout the duration of construction.
– Minimising instream works through bridge design and construction methodology (i.e. utilising rock bags).
– Scheduling the duration of construction works and works within the low flow channel to the minimum time necessary and outside the Bellinger River Snapping Turtle nesting season and Giant Barred Frog peak breeding season (refer to Section 6.3).
– Restricting construction works to daylight hours only.
– Informing BCD of any Bellinger River Snapping Turtles observed during the works.

7.7 Exacerbation of infectious disease

Bellinger River virus

Due to the impact of the disease, the species is considered highly suspectable to any risks that impact habitat conditions, nesting and recruitment and the health/survival of individuals. As such, a precautionary approach has been taken for the Project with regards to the design of the bridge structures and the proposed construction methodology, equipment and program.

Best practice techniques have been selected for avoidance, mitigation and management of potential impacts. The methods proposed are known to be effective at protecting aquatic environment and species. Monitoring will be conducted throughout the construction works to assess actual risks against those expected and allow for adaptive management if required. Given the susceptibility of the species to disease and the risk that any impact on the species can have on the viability of the population, this SIS has been prepared to support the active protection of the species throughout construction. Based on the avoidance and mitigation measures proposed, the Project is not expected to exacerbate the effects of the Bellinger River virus on the Bellinger River Snapping Turtle.

The following measures will be instigated to minimise the exacerbation of infectious disease throughout the Project for the Bellinger River Snapping Turtle:

– A biosecurity/hygiene protocol is to be established in consultation with DPI and to the satisfaction of BCS to prevent the spread of the Bellinger River virus. The protocol will include actions that will be undertaken in the event that an encountered turtle is suspected to be infected with the Bellinger River virus.
– The Bellinger River virus biosecurity/hygiene protocol will be implemented across all work sites for the entire construction period.
– Environmental training to be delivered to site personnel will include the Bellinger River virus biosecurity/hygiene protocol.
– Monitoring of water quality conditions (visual and *in situ* recordings) to identify the potential for water quality degradation and allow for adaptive management. Water quality monitoring will be conducted weekly during works within the low flow channel.
– BCD will be informed of any Bellinger River Snapping Turtles observed during the works.

Chytridiomycosis

Chytridiomycosis is stream-borne virus caused by the amphibian chytrid fungal pathogen *Batrachochytrium dendrobatidis* (Bd). Infected frog populations exhibit diverse susceptibility to chytrid, with some species being extremely vulnerable, resulting in mass die-off and extinction (TSSC 2021). The Giant Barred Frog is known to carry chronic infection of chytrid, it has been suggested that the species abundance has dropped largely as a result of the disease. It is uncertain whether the species is continuing to decline from chytrid. Transmission of chytridiomycosis can be exacerbated by the handling of multiple frogs by researchers. Any action that results in the capture and handling of multiple frogs has the potential to spread the disease within the local frog population. Given the Project is likely to directly impact on habitat for the Giant Barred Frog, there is potential for active management or translocation of frogs that would facilitate disease transmission.

The following measures will be instigated to minimise the exacerbation of infectious disease throughout the Project for the Giant Barred Frog:

– Implementing safe hygiene protocols when handling frogs (i.e. disposable gloves, samples bags, sterile equipment).
– Clean and dry all equipment and wet or muddy footwear before and between visiting frog sites. This may include cleaning the tyres of your vehicle before visiting known high-risk sites where threatened frog species may live.
– Avoid translocating Giant Barred Frog individuals further than necessary if individuals are located within the construction Project footprint to minimise the potential spread of chytrid.
– Carry cleaning utensils and a disinfectant for use between sites.
– Record any chytrid-infected frogs and contact Frogwatch Helpline on 0419 249 728.

7.8 Microbat mitigation measures

Mitigation measures specific to roosting microbats for a nearby bridge replacement. These include mitigation measures detailed by Eco Logical (2022). These have been adapted for this Project and include:

- Pre-clearance survey to understand how microbats are using the bridge roost (i.e. at Joyces Bridge) to inform the bat management plan and adaptive management options.
- The use of containment setups to block access in and out of microbat roosting crevices prior to decommissioning of the existing bridges.
- Demolition of the existing bridges will occur outside of the breeding season of the Sothern Myotis, which takes place from October to March (refer to Section 6.3).
- Monitoring of the roost colony within known roosting sites (i.e. known roost at Joyces Bridge) by a suitably qualified ecologist to assess the response of the bats to the disturbance from high-risk construction and provide adaptive management solutions when required.
- Placing noise dampening screens on the upstream side of the existing bridge to reduce noise levels during constructions. The screens will be required to be rolled up and removed at the end of each work day to allow maximum foraging capacity for the bats.
- If bats are observed to leave the roost during the day, work will need to stop and a suitably qualified ecologist will monitor the situation. Work cannot resume until the suitably qualified ecologist approves activities restarting.
- The use of pumps, generators and other noisy equipment should be discussed with the suitably qualified ecologist relating to specific position and/or the use of noise barriers (i.e. ply barriers).
- Works will be programmed to allow bats to habituate to the works i.e. use a progressive introduction of works, starting from further from the bridge and working closer.
- Routine daily pre-works microbat inspections will be required within the work area and surrounding 10 m buffer on the new bridge. An inspection of this nature should also be required during below deck works once the new bridge is at a stage where potential roosting habitat may be present.
- Controls need to be implemented to block potential roosting habitat during construction on the new bridge to prevent conflicts with construction activities. This is important during prolonged periods when construction activities have stopped.
- Under guidance from the suitably qualified ecologist, exclusion of localised areas of the existing timber bridge would be undertaken to move bats away from high-noise Project footprints.
- Construction materials are to be stored in such a way to prevent incidental roosting habitat for microbats (i.e. no gaps between materials).
- Replacement roosting habitat features, such as wooden structures, will be installed under the new bridges to incorporate purpose-built breeding and roosting habitat to provide long-term habitat for threatened microbat species.

7.9 Operational phase impacts and mitigation measures

The operation phase will have relatively minor, localised impacts on terrestrial ecological values. Ongoing traffic noise and vibration impacts associated with operation of the new bridges are expected to be reduced with the replacement of the existing timber structures with new concrete structures. Risk of mortality due to vehicle collision during operations is considered low. These impacts are expected to be negligible and unlikely to have any impact on the long-term viability of local fauna populations.

7.10 Environmental safeguards

Environmental safeguards for the Project are shown in Table 7.4.

Table 7.4 Environmental safeguards

Issue	Safeguard	Timing	Responsibility
Environmental management	A Construction Environmental Management Plan (CEMP) will be prepared, including the specific mitigation/management measures and sub-plans listed below along with work methods, contingencies, roles and responsibilities. The mitigation/management measures included in the CEMP and sub-plans would be implemented during pre-construction and construction stages.	Pre-construction	Construction contractor
Worker inductions	Ensure all workers are provided with an environmental induction prior to starting construction activities on site. This would include information on the ecological values of the Project footprint and protection measures to be implemented to protect biodiversity during construction.	Pre-construction	Construction contractor
Erosion and sediment	Erosion and sediment control measures would be established prior to construction in accordance with the principles and guidelines included in Managing Urban Stormwater: Soils and Construction - Volume 1 (Landcom, 2004) and Volume 2A of Managing Urban Stormwater: Soils and Construction (DECC 2008c). Erosion and sediment control plans would be established prior to the commencement of construction. Controls would be managed and maintained in accordance with the CEMP to ensure their ongoing functionality. Erosion and sediment controls would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment or contaminants entering waterways.	Pre-construction	Construction contractor
Dust	Specific measures will be incorporated into the CEMP to minimise the generation of dust and associated impacts on natural environments adjacent and downstream of the Project footprint.	Pre-construction/ construction	Construction contractor
Contaminants	Specific measures will be incorporated into the CEMP to minimise the potential for chemical spills and associated impacts on natural environments adjacent to and downstream of the Project footprint. Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.	Pre-construction/ construction	Construction contractor
Vegetation clearance and threatened species habitat	Disturbance and removal of native vegetation and habitat would be unavoidable during the construction phase. To reduce the potential for adverse impacts on ecologically sensitive areas the following measures are recommended: – Minimise vegetation clearance and disturbance, including impacts to the two hollow-bearing trees at Joyce's Bridge within the Project footprint, as far as possible. Where possible, limit clearing to trimming rather than the removal of whole plants. – Clearing of mature and hollow-bearing trees should be avoided. If possible, the two hollow-bearing trees should be avoided through corridor refinement during detailed design. – Any leaf litter and woody debris removed should be salvaged and replaced following construction.	Pre-construction/ construction	Construction contractor Site ecologist/ environmental officer

Issue	Safeguard	Timing	Responsibility
	– Prior to any clearing works, a suitably qualified ecologist or the Sydney Water Environmental Representative must physically delineate vegetation to be cleared and/or protected on site, and supervise installation of appropriate signage and high-visibility fencing. All vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid unnecessary vegetation and habitat removal. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities. – Sediment fences should be installed to prevent transfer of sediments into adjacent vegetation. – Hygiene protocols should be implemented to prevent the introduction and spread of weed propagules and soil pathogens. This would include exclusion zones around retained areas of native vegetation.		
Protection of trees and shrubs	An arborist should be engaged to supervise trenching in the vicinity of large trees, to advise on the ability to retain trees with protective measures. Protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites. If more than 10% of the Tree Protection Zone is to be affected, a suitably qualified and experienced arborist would be required to advise on the ability for the tree to be retained and survive. Where tree roots >50 mm are impacted within the Tree Protection Zone, an arborist to assess the ability to maintain structural integrity and tree health and advise on appropriate management measures.	Construction	Construction contractor
Fauna management	Pre-clearance surveys will be undertaken by a qualified ecologist and the required methodology will be developed for target species as part of the CEMP. Surveys should include: – An experienced, licenced wildlife carer or ecologist would be present to supervise vegetation clearing and capture and relocate fauna (if required). – All open trenching would be backfilled or covered (e.g. with boards) at the completion of construction each day to minimise the risk of injury or mortality to animals as a result of falling into the excavated trench line. – Open trenches would be checked each morning, before the start of construction, to salvage any fauna that have fallen in, and move them to a safe (and appropriate) nearby location. Protocols would be developed to deal with the removal of injured or dangerous animals (e.g. snakes). – Salvage and relocation of habitat features (e.g. leaf litter, hollow logs and branches).	Pre-construction/ construction	Construction contractor Site ecologist/ environmental officer
Biosecurity and weed management	Manage biosecurity in accordance with: – Biosecurity Act 2015 (see NSW Weedwise). – Contemporary bush regeneration practices, including disposal of sealed, bagged weeds to a licenced waste disposal facility. Weed management may include: – Manual weed removal in preference to herbicides. – Replacing non-target species removed/killed because of weed control activities. – Protecting non-target species from spray drift.	Pre-construction/ construction	Construction contractor

Issue	Safeguard	Timing	Responsibility
	– Using only herbicides registered for use within or near waterways for the specific target weed. – Applying herbicides during drier times when the waterway level is below the high water mark. – not Applying herbicide if it is raining or if rain is expected. – Mixing and loading herbicides, and cleaning equipment away from waterways and drains.		
Protection of native fauna	If native fauna is encountered on site, stop work and allow the fauna to move away un-harassed. A local wildlife rescue service or the ecologist responsible for pre-clearing surveys should be engaged to assist with fauna removal and rescue if fauna fails to move away on its own.	Pre-construction/ construction	Construction contractor
Protection of threatened species/ unexpected finds protocol	Pre-clearance surveys will be conducted by a suitably qualified ecologist experienced to inspect Project footprints for the presence of conservation significant species, including in terrestrial and aquatic habitat. Two pre-clearance surveys for the Bellinger River Snapping turtle will be conducted by a suitably qualified ecologist prior to the commencement of instream construction works. Pre-clearance surveys will be conducted three (3) weeks prior and again one (1) week prior to the start of any construction works within the river channel or banks. All approvals and permits for Bellinger River Snapping Turtle pre-clearance surveys would be obtained prior to the start of construction and a procedure developed in consultation with BCD for additional avoidance and mitigation measures to be implemented in the event that a Bellinger River Snapping Turtles are found located within or immediately adjacent (i.e. within 100 m) of the Project footprint.	Pre-construction / Construction	Construction contractor / Sydney Water Environmental Representative
Damage to vegetation	If any damage occurs to vegetation outside of the Project footprint, notify the Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.	Construction	Construction contractor / Sydney Water Environmental Representative
Pathogen management	Manage plant and animal disease and pathogens such as Phytophthora, Myrtle Rust and Chytrid fungus. Mitigation measures would include: – Exclusion zones around retained areas of native vegetation. – ‘Clean on entry, clean on exit’ policy. – Provision of machine and footwear washdown stations for all equipment and personnel working in areas of native vegetation. Protocols to prevent introduction or spread of chytrid fungus should be implemented following OEH Hygiene protocol for the control of disease in frogs (DECCW, 2008), in particular for any areas where trenching will occur around drainage lines or ephemeral water bodies.	Construction	Construction contractor
Bellinger River virus management	A biosecurity/hygiene protocol is to be established in consultation with DPI and to the satisfaction of BCS to prevent the spread of the Bellinger River virus. The protocol will include actions that will be undertaken in the event that an encountered turtle is suspected to be infected with the Bellinger River virus. The Bellinger River virus biosecurity/hygiene protocol will be implemented across all work sites for the entire construction period. Environmental training to be delivered to site personnel will include the Bellinger River virus biosecurity/hygiene protocol.	Pre-construction / Construction	Construction contractor

8. Other approvals required for the Project

8.1 Environmental Planning and Assessment Act 1979

An Review of Environmental Factors (REF) has been prepared by GHD on behalf of Bellingen Shire Council (Council) for each of the four bridges. The REF for each Project has been undertaken in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Each REF has been undertaken in the context of:

– Clause 171 of the Environmental Planning and Assessment (EP&A) Regulation 2021.
– The factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (DUAP, 1995/1996).
– *Roads and Related Facilities EIS Guideline* (DUAP 1996).
– NSW *Biodiversity Conservation Act 2016* (BC Act).
– NSW *Fisheries Management Act 1994* (FM Act).
– The Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of each REF is to describe the project, document the likely impacts of the Project on the environment, and to detail mitigation and management measures to be implemented. In doing so, each REF helps to fulfil the requirements of:

– Section 5.5 of the EP&A Act including that Council examine and consider to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of each REF would be considered when assessing:

– Whether the Project is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act.
– The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report.
– The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and whether offsets are required and able to be secured.
– The potential for the Project to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Government Department of Agriculture, Water and the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

8.2 Roads Act 1993

Consent under Section 138 of the *Roads Act 1993* is required for any works or activities in a public reserve, public road or footpath (nature strip). A Section 138 permit is required for the Project however Council are both the proponent and road authority as defined by the *Roads Act 1993*.

8.3 Fisheries Management Act 1995

The *Fisheries Management Act 1995* (FM Act) provides for the protection, conservation, and recovery of threatened species, populations and ecological communities of fish and marine vegetation and fish habitats, as well as promoting the development and sharing of fishery resources in NSW.

The FM Act provides for the protection, conservation, and recovery of threatened species, populations and ecological communities of fish and marine vegetation and fish habitats, as well as promoting the development and sharing of fishery resources in NSW.

Dredging and Reclamation Permit

Dredging is the removal of any material from the waterway and the action of digging within the waterway and its banks. Reclamation is the placement of material into the waterway or onto the waterway bed and banks. For bridges dredging will include excavation for abutments, removal of old bridge components and other associated earthworks. Reclamation will include reinstatement of new abutments, placement of scour protection and the construction of temporary waterway crossings.

Under s200 of the FM Act, a permit is required for dredging work carried out by a local government authority, unless these works are authorised under the *Crown Land Management Act 2016*. The maximum penalty for unauthorised dredging is $220,000 for local government authorities. If works are carried out in contravention of these sections, the Minister for Primary Industries may, under s203, order remedial works to be carried out to rectify any damage caused to fisheries or fish habitat. Permits and approvals may also be necessary from other public authorities (e.g. DPE - Environment Energy and Science (EES), the regional Local Land Services) and advice should be sought from these agencies where applicable.

The proposed works will require a S200 permit under this Act because the works involve reclamation.

9. Conclusion

This SIS has been developed to provide an overview of the ecological values and constraints present within the four bridge Project locations within the Bellinger Shire. The report identifies the presence and likelihood of occurrence of threatened species listed under the BC Act. The outcome of the desktop assessment and field verification identified a total of 10 listed fauna species as likely or known to occur in the Project areas. These species include the Southern Myotis, Large Bent-Wing Bat, Little Bent-Wing Bat, Eastern False Pipistrelle, Eastern Cave Bat, Giant Barred Frog, Grey Headed Flying Fox, Stephens's Banded Snake, Superb Fruit Dove and the Bellinger River Snapping Turtle. Vegetation across each bridge site was classified as remnants of PCT 3020 Northern Hinterland River Oak Sheltered Forest. The PCT is not listed as a Threatened Ecological Community. No threatened flora species were detected by a targeted flora survey.

Due to the impact of the 'Bellinger River virus', the Bellinger River Snapping Turtle is considered highly susceptible to any risks that impact habitat conditions, nesting and recruitment and the health/survival of individuals. As such, a precautionary approach has been taken for the Project with regard to the design of the bridge structures and the proposed construction methodology, equipment, and program. Best practice techniques have been selected for avoidance, mitigation, and management of potential impacts.

The methods proposed are known to be effective at protecting aquatic environment and species. Monitoring will be conducted throughout the construction works to assess actual risks against those expected and allow for adaptive management if required. Given the susceptibility of the species to disease and the risk that any impact on the species can have on the viability of the population, this SIS has been prepared to support the active management of risks throughout Project construction.

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Appendices

Appendix A

Environment Agency Head's Requirements – Species Impact Statement

Department of Planning and Environment

Your Ref: e-mail dated 18 September 2023
Our Ref: DOC23/829361-32

General Manager
Bellingen Shire Council
PO BOX 117
BELLINGEN NSW 2454

Attention: Mr Marc Rouqueirol

Dear Mr Griffioen

ENVIRONMENT AGENCY HEAD'S REQUIREMENTS FOR A SPECIES IMPACT STATEMENT FOR THE BRIDGE REPLACEMENT PROJECTS – HOBARTS BRIDGE, JOYCES BRIDGE AND JUSTINS BRIDGE

Thank you for your e-mail dated 18 September 2023 to the Biodiversity and Conservation Division (BCD) of the Department of Planning and Environment seeking Environment Agency Head's (EAH's) Requirements for a Species Impact Statement (SIS) for the projects to replace Hobarts Bridge, Joyces Bridge and Justins Bridge in accordance with Section 7.21 of the *Biodiversity Conservation Act 2016* (BC Act).

The Department understands the Bellingen Shire Council is assessing the project under Part 5 Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Part 7 of the BC Act.

In response to your request, please find attached the EAH's Requirements for a SIS (**Attachment A)** to address threatened species (known or likely to be present in the area), ecological communities (potentially present in the area), or their habitats present in the area.

The SIS must be submitted to the Department as part of a request for concurrence within 12 months of the date of this letter.

If concurrence is requested outside the 12-month timeframe, then the Department must be consulted to determine whether the EAH Requirements for the SIS need to be modified to reflect, amongst other things, changes to the listings of threatened species, populations and ecological communities, new information on threatened species, populations and ecological communities, or changes to relevant legislation.

Please note that the issuing of EAH's Requirements is a statutory requirement and should not be construed as support or endorsement of the activity.

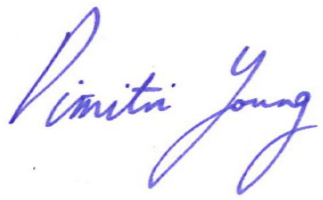
When lodging a request to the Department seeking concurrence, the Department must be provided with the SIS, any submissions made in response to the SIS, a Submissions Report prepared by the

proponent, and any further assessment report for the activity prepared by or on the behalf of the proponent, including a determination and determination conditions.

The further assessment report should, amongst other matters, set out how the activity facilitates ecologically sustainable development.

If you require any further information about these requirements, please contact please contact Mr Gene Mason, Senior Conservation Planning Officer, on 8289 6315 or gene.mason@environment.nsw.gov.au.

Yours sincerely



DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Biodiversity and Conservation

16/10/2023

ATTACHMENT A

ENVIRONMENT AGENCY HEAD'S REQUIREMENTS - SPECIES IMPACT STATEMENT - BRIDGE REPLACEMENT PROJECTS – HOBARTS BRIDGE, JOYCES BRIDGE AND JUSTINS BRIDGE - DARKWOOD

PURPOSE

The purpose of a Species Impact Statement (SIS) is to:

- allow the proponent to identify threatened species, ecological communities, or their habitats, assess the likely effect of impact from the activity on threatened species, ecological communities, or their habitats, and provide appropriate amelioration for adverse impacts resulting from the activity.
- assist the Environment Agency Head (EAH) in assessing the activity in accordance with Part 7 of the *Biodiversity Conservation Act 2016* (BC Act).

Sections 7.20 and 7.21 of the BC Act and clause 7.6 of the *Biodiversity Conservation Regulation 2017* (BC Regulation) describe the form and content of a SIS. The matters listed in sections 7.20 and 7.21 of the BC Act and clause 7.6 of the BC Regulation have been incorporated into the Environment Agency Head's requirements provided below.

DEFINITIONS

The definitions below are relevant to these requirements:

- **Abundance** means a quantification of the population of the species or community.
- **Action** means the proposed activity.
- **Activity** has the same meaning as in the EP&A Act.
- **Affected species** means subject species likely to be affected by the activity.
- **BC Act** means the Biodiversity Conservation Act 2016
- **BC Regulation** means the Biodiversity Conservation Regulation 2017
- **Environment Agency Head** means the Secretary of the Department of Planning and Environment (or delegate).
- **EP&A Act** means the Environmental Planning and Assessment Act 1979
- **Conservation status** is regarded as the degree of representation of a species or community in formal conservation reserves.
- **Department** means the Department of Planning and Environment (or any name it may be known by in the future)
- **Development** has the same meaning as in the EP&A Act.
- **DP** means Deposited Plan which is the plan number given to a subdivision that is registered by the Land Property Information.
- **LGA** means Local Government Area.
- **Locality** means the area within a 5 km radius of the study area.
- **PCT** means a NSW plant community type derived using the PCT classification system
- **Study area** is the subject land and any additional areas which are likely to be affected by the activity, either directly or indirectly.
- **Subject land** means the area which is proposed for activity.
- **Subject species** means those threatened species and ecological communities which are known or considered likely to occur in the study area.
- **Threatening process** has the same meaning as that contained in the BC Act; the definition is not limited to key threatening processes.

All other definitions are the same as those contained in the BC Act.

MATTERS WHICH HAVE BEEN LIMITED OR VARIED

The Environment Agency Head may vary the matters otherwise required to be included in a species impact statement in a particular case (section 7.21(4) BC Act).

For this activity, none of the matters required to be included in a SIS have been varied.

NEW LISTINGS

If key threatening processes are added to Schedule 4 of the BC Act between the issue of these requirements and the granting of concurrence, these must be addressed in the SIS and considered by the consent or determining authority and concurrence authority (the Environment Agency Head).

If threatened species or ecological communities are added to Schedule 1 of the BC Act between the issue of these requirements and the granting of concurrence, these additional matters will need to be addressed in the SIS and considered by the consent or determining authority and concurrence authority (the Environment Agency Head).

A SIS is not required to address a new listing of a vulnerable species or a vulnerable ecological community after the principal author signs the SIS. This exemption ceases to apply if the activity has not commenced or been approved within 12 months after the SIS has been publicly notified by the consent or determining authority (clause 7.4, BC Regulation). In this case, the newly listed vulnerable species or ecological community will need to be addressed in the SIS.

MATTERS TO BE ADDRESSED

The SIS must meet all the matters specified in sections 7.20 and 7.21 of the BC Act and clause 7.6 of the BC Regulation. The requirements outlined in the BC Act and the BC Regulation have been repeated below (italics) along with the specific EAH's Requirements for the activity.

The SIS must be formatted to follow the sections and subsections provided in the EAH's Requirements.

Failure to comply with the EAH's Requirements is a potential breach of the legislation, and the Department may be unable to grant concurrence to a request by the determining authority to carry out the activity.

1 FORM OF THE SPECIES IMPACT STATEMENT

A species impact statement for the purposes of this Part must be in writing signed by the principal author of the statement and by the applicant for development consent or the proponent of the activity proposed to be carried out (as the case requires). BC Act section 7.20 (1)

The proponent must sign the following declaration:

> "I…[insert name], of ..[address], being the proponent of the activity [insert name of activity, Lot & DP numbers, street, suburb and LGA names] have read and understood this species impact statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the activity".

The principal author must sign the following declaration:

> "I [insert name] of [address], being the principal author, have prepared the SIS in accordance with the EAH's Requirements issued on [insert date]."

2. CONTEXTUAL INFORMATION

2.1 Description of activity and study area

> *A species impact statement must include a full description of the proposed development or activity and the information as to matters relating to the impact on threatened species or ecological communities as is required by the regulations. (BC Act Section 7.20(2))*

2.1.1 Describe the activity

The SIS must include a comprehensive description of the nature, extent and timing of all components of the activity. A full description of the activity includes a description of all associated actions, including, but not restricted to, installation and maintenance of any proposed structures / dwellings and associated infrastructure, location of any associated facilities (including roads, amenities and other services), location of proposed roadway and associated infrastructure, fire protection zones, access and egress routes, changes in surface water flows, impacts of noise disturbance and pollution, and any increases in people and road traffic. Actions that occur both on and off the subject land resulting from the activity must be assessed, including actions conducted during any construction phase and any proposed action post-construction (e.g. proposed actions within a management plan).

2.1.2 Define the study area

The SIS must define the location, size and dimensions of the study area.

The study area should include the subject land and any adjacent land containing suitable habitat for threatened species that will be directly or indirectly affected by the activity.

Direct impacts are those that directly affect individuals or their habitat, including for example:

- poisoning or removal of the organism itself,
- removal of habitat, and
- clearing of native vegetation / habitat.

Indirect impacts occur when the activity affects threatened species or ecological communities or their habitats in a manner other than direct loss. Examples of indirect impacts include (but are not limited to):

- sediment, pollutant or nutrient runoff into adjacent vegetation
- habitat fragmentation or isolation
- implementation of asset protection zones (though these may also represent direct impact)
- loss of genetic diversity of threatened species, populations or communities
- altered pollination syndromes that may adversely affect seed set
- soil erosion
- altered hydrology regimes (including downstream impacts)
- changes to the saline / freshwater balance in marine environments
- exposure to heat or predators, or loss of shade

- inhibition of nitrogen fixation
- weed invasion and feral animal incursion
- introduction and spread of pathogens,
- noise
- dust
- light pollution
- fire (such as changes to intensity and frequency)
- fertilizer drift
- increased human activity (including litter) within or directly adjacent to sensitive habitat areas.

2.2 Relevant plans and maps

The SIS must include a map of the study area based on digital aerial photography (such as ADS40 imagery) or the best available imagery at an appropriate scale to clearly show:

- The boundary of the study area
- Land tenure and zoning, including protected areas, and any proposed changes
- Relevant Local Government planning instruments, including Local Environmental Plans and Development Control Plans
- IBRA bioregions and IBRA subregions
- Rivers, streams, estuaries classified by stream order and including riparian buffers
- Wetlands including important wetlands and riparian buffers
- Habitat connectivity that may serve as movement corridors
- Karst, caves, crevices, cliffs, rocks and other geological features of significance [delete if not relevant]
- Areas of outstanding biodiversity value
- Vegetation cover identifying the extent of woody and non-woody native vegetation and cleared areas
- Any access limitations

The SIS must include a map of the subject land based on digital aerial photography or the best available imagery at an appropriate scale to clearly show:

- The boundary of the subject land
- Map scale
- Topography
- Land tenure
- Vegetation cover identifying the extent of woody and non-woody native vegetation and cleared areas
- Locally significant areas for threatened species and areas of high human activity
- Any access limitations

Digital files of maps must be supplied with the SIS.

2.3 Vegetation

The SIS must identify and map the distribution of PCTs, or the most likely PCTs, and all Threatened Ecological Communities (TECs) in the study area. The identification must be in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. The identification of TECs must be consistent with the Threatened Species Scientific Committee Final Determination for the TEC.

Information that can support the identification of PCTs and TECs can be found on the:

a) BioNet Vegetation Classification database, which describes how to identify PCTs and TECs as per the NSW PCT classification, and details each PCT and its geographic distribution
b) Threatened biodiversity profile search webpage, which describes TECs.

Any existing information on native vegetation that is relevant to the study area should be reviewed and referenced to justify PCT and TEC identifications. This includes:

a) survey data or individual species records that are held in the Flora Survey (BioNet), or
b) existing maps of native vegetation in the area such as those held by the Department, or a local government authority, or
c) information in ecological reports, soil surveys or previous native vegetation surveys that is relevant to the study area.

3 INITIAL ASSESSMENT

A general description of the threatened species known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action, BC Regulation clause 7.6(2)(a)

3.1 Identifying candidate threatened species

The SIS must identify candidate threatened species that have or may have suitable habitat in the study area.

The following threatened species must be considered as candidate threatened species, as they have either been recorded in the general area, are within the species' known geographic limits or their broad habitat preferences may be present in the study area:

Scientific Name	Common Name	Legal Status
Myuchelys georgesi	Bellinger River Snapping Turtle	Critically Endangered
Mixophyes iteratus	Giant Barred Frog	Endangered
Myotis macropus	Southern Myotis	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Ptilinopus magnificus	Wompoo Fruit-dove	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable
Pandion cristatus	Eastern Osprey	Vulnerable

This list is not exhaustive. One of the roles of the SIS is to determine which species may be utilising a site given the limitations of existing databases.

A list of additional candidate species should be compiled by considering:

a) the distribution of species in the IBRA subregion within which the subject land and study area are mostly located
b) any geographic limitations of a species identified at a) that exclude it from the subject land and/or study area
c) associations between the species identified at a) and the PCTs occurring within the subject land
d) the native vegetation cover required to provide viable habitat for the species
e) the patch size required to provide viable habitat for the species

The identification of candidate species must be informed by databases including the *Threatened Biodiversity Data Collection* (TBDC) and other data available through the *Bionet Atlas* (www.bionet.nsw.gov.au/), *Atlas of Living Australia* (www.ala.org.au/), *Australian Museum* (http://ozcam.org.au/), *Birdlife Australia* (http://birdsaustralia.ala.org.au/BDRS/home.htm), and the *Royal Botanic Gardens* (http://plantnet.rbgsyd.nsw.gov.au/).

Previous surveys and assessments that are relevant to the locality may be used to assist in identifying candidate species.

3.2 Identify subject threatened species

An assessment of which threatened species known or likely to be present in the area are likely to be affected by the action (BC Regulation clause7.6(2)(b)).

3.2.1 Habitat assessment to confirm suitable habitat

A comprehensive habitat assessment should be conducted across the study area, identifying key habitat features for both flora and fauna. The SIS must evaluate the habitat of the study area for each candidate threatened species. It is important to record all areas of native and introduced vegetation, as even weeds can potentially provide habitat for threatened fauna. As part of the habitat assessment, you should look for:

- hollow-bearing trees, including dead stags
- bush rock and rocky outcrops
- natural burrows
- large trees with basal cavities
- logs
- wetlands, streams, rivers, dams and other water bodies
- nests and roosts
- permanent soaks and seepages
- areas that can act as corridors for plant or animal species.

The SIS must include an analysis of the suitability of the habitat for each candidate species based on the information in the TBDC and including:

- habitat constraints
- microhabitats or other habitat features
- breeding features
- any buffer area around habitat or breeding features
- any considerations around the size or shape of the habitat area

The list of candidate species should be refined based on the outcomes of the habitat assessment to exclude species that are not likely to be present in the study area, to create the list of subject species.

3.2.2 Targeted survey

A targeted species survey for all subject species must be undertaken.

The survey must:

a) only occur during the time specified for that species in the TBDC, unless there is clear justification to vary the timing and the reasoning is documented in the SIS
b) comply with the Department's threatened species survey guides published by the Secretary of the Department or anyone authorised by the Secretary

c) use best-practice methods that can be replicated for repeat surveys, if the Department has not published any relevant guides, after consulting the TBDC and the Department's relevant accountable officer for the entity.

The SIS must describe the survey timing, methods, design and effort used for each species survey. The SIS must record weather conditions (e.g. minimum ambient air temperature, maximum ambient air temperature, amount of precipitation that occurs each 24 hour period, details about wind speed and direction and the amount of cloud cover) and the phase of the moon for each day of survey (including dates).

Surveys must be undertaken by appropriately experienced and qualified persons.

A biodiversity expert recognised under the Biodiversity Offsets Scheme, a recognised expert from institutions such as the Australian Museum (Sydney), the National Herbarium of NSW at the Royal Botanic Gardens (Sydney) or an expert who is otherwise approved by the Department's Environment and Heritage Group (EHG) must be used to determine or confirm the identification of species that are unknown or which have been only provisionally identified.

If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent must discuss the proposed methodology with EHG's Biodiversity and Conservation Division.

The outcome of the survey must be a mapped area of habitat in which the species is present or is likely to use for each subject species.

For each species recorded by survey, the mapped areas must include:

- For fauna species, the entire area of the PCTs associated with that species in the TBDC that occur on the study area
- For flora species assessed by count as per the TBDC, a buffer of 30m around individuals or groups of individuals on the study area
- For flora species assessed by area as set out in the TBDC, all recorded individuals and the entire area of suitable habitat for them on the study area, such as the PCT in which they occur, and/or microhabitats in which they occur.

The SIS must include a map of the study area based on digital aerial photography or the best available imagery at an appropriate scale to show key habitat features for each subject species.

3.2.3 Final review of the list of subject threatened species

The results of the survey may be used to further refine the list of subject threatened species to reflect those threatened species that are known or likely to be present in the study area and which may be affected by the activity in the study area.

4 ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES

4.1 Assessment of species likely to be affected

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to, installation and maintenance of utilities, access and egress routes, and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of bushfire asset protection zones. If, as part of the activity, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any threatened species and/or populations must be addressed as part of the impacts of the overall activity. Proponents should also consider recommendations in '*Planning for Bushfire Protection*' (NSW Rural Fire Service 2019) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

4.2 Discussion of conservation status

For each species likely to be affected — details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it and its habitat requirements (BC Regulation clause 7.6(2)(c))

An assessment of whether those species are adequately represented in conservation reserves (or other similar protected areas) in the region, (BC Regulation clause 7.6(2)(e))

An assessment of whether any of those species is at the limit of its known distribution, (BC Regulation 7.6(2)(f))

Assessment must include reference to the key threatening processes (Schedule 4 to the BC Act). Assessment should also include reference to any approved or draft recovery plans which may be relevant to the activity; including those prepared by other State Governments or the Australian Government.

4.3 Discussion of local and regional abundance and distribution

An estimate of the local and regional abundance of those species (BC Regulation clause 7.6(2)(d))

4.3.1 Discussion of other known local populations

A discussion of other known populations in the locality must be provided, along with an assessment of their regional significance. The long-term security of other habitats must be examined as part of this discussion. The relative significance of the study area for threatened species in the locality must be discussed.

4.3.2 Discussion of habitat utilisation

An estimate of the numbers of individuals utilising the study area and how these individuals use the study area (e.g. residents, transients, adults, juveniles, nesting, foraging). This should include discussion of the significance of these individuals to the viability of the threatened species in the locality.

4.4 Assessment of habitat

A full description of the type, location, size and condition of the habitat of those species and details of the distribution and condition of similar habitats in the region (BC Regulation Clause 7.6(2)(g))

4.4.1 Description of habitat values

Specific habitat features shall be described, such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock

outcrops, presence of feed tree / shrub / groundcover species areas of native grasses, crevices, caves, drainage lines, soaks etc, and density of understorey vegetation / groundcover.

The condition of the habitat within the study area shall be discussed, including the prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads, and assessment of the potential for native seed bank resilience in disturbed areas.

Details of the fire history of the subject site (e.g. frequency, time since last fire, intensity) and the source of fire history (e.g. observation, local records) shall be provided.

4.4.2 Impacts on threatened species and/or populations in the national park estate

This section only needs to be addressed when threatened species and/or populations in the national park estate (e.g. National Parks, Nature Reserves) are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any threatened species and/or populations which may likely be directly or indirectly impacted upon that reside with the national park estate, including but not limited to fragmentation or loss of connective linkages, edge effects (e.g. increased boundary to area ratio), increased predation potential, weed invasion, loss or impacts on pollination vectors, changes to hydrology, nutrient increases, pollution, anthropogenic impacts (e.g. increased visitation, refuse) etc.

4.5 Discussion of the likely effect of the activity at local and regional scales

A full assessment of the likely effect of the action on those species, including, if possible, the quantitative effect of local populations in the cumulative effect in the region (BC Regulation Clause 7.6(2)(h))

4.5.1 Significance within a local context

If the activity involves the clearing of vegetation and/or removal / damage to habitat, the SIS must clearly articulate the size of this impact, and where applicable delineate this based on PCT or habitat features. Indirect impacts may lead to direct loss and must be adequately quantified and assessed in the SIS where this is the case. Both impacts within the study area and subject land must be considered and addressed.

The significance of impacts in the study area for conservation of affected threatened species or endangered populations in the *locality* must be discussed. An assessment of the significance of such impacts must compare and take into account the differences in the type, condition, tenure and long-term security, of other areas of known habitats in the *locality* with those in the study area.

4.5.2 Discussion of connectivity

The potential of the activity to increase fragmentation of the habitat or decrease the ability for movement of individuals and/or gene flow between habitats or populations of a threatened species must be appraised. The SIS must include an analysis of the connectivity value of the study area to the subject species.

4.5.3 Consideration of threatening processes

Assessment of effects must not be limited only to threats that are recognised as key threatening processes but must include other threatening processes that are generally accepted by the scientific community as affecting the species and are likely to be caused or exacerbated by the activity. This threat assessment should also include consideration of the threats and information in the Threatened Biodiversity Profiles available at https://www.environment.nsw.gov.au/threatenedSpeciesApp/.

4.6 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (BC Regulation Clause 7.6(2)(i)).

Where an Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the EIS or REF.

This section must include details of alternative locations considered or alternative footprints within study area and the condition and use of these areas. The SIS must include an explanation of why these are not considered feasible alternatives.

5 ASSESSMENT OF LIKELY IMPACTS ON THREATENED ECOLOGICAL COMMUNITIES

Part 5 of these requirements need only be addressed when threatened ecological communities are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to, installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of bushfire asset protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any endangered or critically endangered ecological communities must be addressed as part of the impacts of the overall activity.

5.1 Assessment of ecological communities (both endangered and critically endangered) likely to be affected

A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action (BC Regulation clause 7.6(3)(a)).

This must include reference to the ecological community as described by the NSW Scientific Committee, including maps of the extent and condition of the community with reference to those parts of the community that may only be represented by soil stored seed with no above ground components of the community present.

Endangered and critically endangered ecological communities that may occur on or near the study area include, but are not limited to:

Threatened Ecological Community	Legal Status
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	Endangered
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	Endangered

5.2 Discussion of conservation status

For each ecological community present — details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it and its habitat requirements (BC Regulation clause 7.6(3)(b))

An assessment of whether those ecological communities are adequately represented in conservation reserves (or other similarly protected areas) in the region (BC Act Clause 7.6(3)(c)).

An assessment of whether any of those ecological communities is at the limit of its known distribution (BC Act Clause 7.6(3)(d)) .

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered and/or critically endangered ecological community and are likely to be caused or exacerbated by the activity. The assessment should also include reference to any approved or draft recovery plans which may be relevant to the action.

5.2.1 Significance within a local context

An assessment of the community on the subject land in relation to other sites in the study area and in the locality. The tenure and long-term security of the community in the locality shall be examined as part of this discussion.

The relative significance of the study area for the endangered and/or critically endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the features including, the size of the remnant, the quality of the habitat and the level of disturbance in the study area compared to other sites in the locality.

5.2.2 Discussion of corridor values

The potential of the activity to increase fragmentation of the community and increase edge effects. If corridors that allow connectivity between local occurrences of endangered and/or critically endangered ecological communities are present within the study area, the impact of the proposal on these areas shall also be discussed.

5.2.3 Discussion of regional significance

The significance of the locality for the community from a regional perspective shall be noted and discussed.

5.2.4 Impacts on Ecological Communities in the national park estate

This section only needs to be addressed when endangered and/or critically endangered ecological communities in the national park estate are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any endangered and/or critically endangered ecological communities which may likely be directly or indirectly impacted upon that reside with the national park estate.

5.3 Assessment of habitat

A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region (BC Regulation clause 7.6(3)(e))

A full assessment of the likely effect of the action on the ecological community, including, if possible, the quantitative effect of local populations in the cumulative effect in the region (BC Regulation clause 7.6(3)(f))

5.3.1 Description of disturbance history

If the study area shows signs of disturbance, details should be provided of its disturbance history and an assessment should be made of the ability of the ecological community to recover to a pre-disturbance condition.

5.3.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification which may result from the proposed activity including the cumulative loss of habitat from the study area (including all proposed development applications and those areas in the locality already with development consent or identified for development) and the impacts of this on the viability of the endangered and/or critically endangered ecological community in the locality.

This shall include an assessment of the proportion of the ecological community to be affected by the activity, in relation to the total extent of the ecological community, and the impact of this on the viability of the ecological community in the locality.

5.4 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (BC Regulation Clause 7.6(3)(g)).

Where an Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the EIS or REF.

In the discussion of feasible alternatives to the proposed development with regards to biophysical, economic and social considerations, and the principles of ecologically sustainable development, the SIS must also include details on the alternative locations considered or alternative footprints within study area and the condition and use of these areas. The SIS must include an explanation of why these are not considered feasible alternatives.

6 AMELIORATIVE MEASURES

6.1 Description of ameliorative measures

A full description and justification of the measures proposed to mitigate any adverse effect of the action on the species, including a compilation (in a single section of the statement) of those measures, (BC Regulation Clause 7.6(2)(j))

A full description and justification of the measures proposed to mitigate any adverse effect of the action on the ecological community, including a compilation (in a single section of the statement) of those measures, (BC Regulation Clause 7.6(3)(h))

6.1.1 Biodiversity impact amelioration strategy

The SIS must include a strategy to outline all measures to minimise, mitigate, manage or offset the impacts of the activity on threatened species and ecological communities, or their habitats. This could include but not be limited to revegetation, vegetation management, habitat restoration/rehabilitation, habitat enhancement, monitoring and biodiversity offsets. The strategy should include the timing and frequency of actions and nominate the roles responsible for completing actions.

6.1.2 Long-term management strategies

Consideration shall be given to developing long-term management strategies to protect areas within the study area which are of particular importance for the threatened species or , ecological communities likely to be affected. This may include proposals to restore, improve or provide long term protection for habitat on site where possible. Any such proposal is to be accompanied by a plan of management identifying the specific areas to be restored, improved or protected, the threatened species / ecological community values of those areas, and detailing the management actions to be implemented to maintain and protect those values, including corrective actions to be taken in the event that monitoring indicates that management does not achieve specified objectives.

7 STATEMENT OF LONG-TERM VIABILITY

The SIS must include a concluding statement on whether the activity is likely to reduce the long-term viability for each of the subject threatened species or ecological communities at the local and bioregional scales. Conclusions must be justified and supported by the information and data presented in the SIS. Uncertainties should be acknowledged and discussed.

8 ADDITIONAL INFORMATION

8.1 Qualifications and experience

A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement (BC Act 7.20(3)).

8.2 Other approvals required for the development or activity

A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species (BC Regulation clause 7.6(2)(k))

A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the ecological community (BC Regulation clause 7.6(3)(i))

In addition to the list of other approvals the SIS must include the name of the determining authority or authorities under Part 5 of the EP&A Act and when these approvals are proposed to be obtained.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

An activity will require the approval of the Australian Government Minister for the Environment (in addition to any State or Local Government approval or determination) if that activity will have, or is likely to have, a significant impact on a matter of national environmental significance. Threatened species and communities listed in the EPBC Act are considered to be a matter of national environmental significance.

Many of the species and ecological communities listed in the BC Act are also listed in the EPBC Act. Further information regarding the operation of the EPBC Act (including Commonwealth-listed threatened species and communities) may be obtained from the Commonwealth Department of Agriculture, Water and Energy (DAWE) website www.environment.gov.au/ or by contacting the DAWE on (02) 6274 1111.

8.3 Licensing matters relating to the survey

Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are contained in Division 3 of Part 2 of the BC Act or in the *Animal Research Act 1985* in relation to animal research authorities:

Typically, you will require a biodiversity conservation licence under Division 3 of Part 2 of the BC Act to undertake activities that would otherwise constitute an offence (such as picking plants, harming animals or damaging a declared area of outstanding biodiversity value).

Information pertaining licences can be obtained from the following websites:

- www.environment.nsw.gov.au/licences-and-permits/wildlife-licences/licences-to-control-or-harm/licences-to-harm-threatened-species
- www.service.nsw.gov.au/transaction/apply-native-flora-and-fauna-research-licence

Please be aware of the requirements relating to animal care and ethics when conducting wildlife surveys. The handling and capture of animals is regulated by the NSW *Animal Research Act 1985* and the *Animal Research Regulation 1995*, which are administered by Department of Primary Industries. The Act requires that persons undertaking animal research must hold an Animal Research Authority. See www.animalethics.org.au/home for further information.

Appendix B

Assumptions and Limitations

This report has been prepared by GHD for Bellingen Shire Council and may only be used and relied on by Bellingen Shire Council for the purpose agreed between GHD and Bellingen Shire Council as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Bellingen Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Appendix C

Joyces Bridge Design and Construction Methodology

JOYCES BRIDGE REPLACEMENT

Project Description

Coastal Works are replacing Joyces Bridge over the Bellinger River on Darkwood Road, Darkwood under contract works for Bellingen Shire Council. The existing 48m four span, timber bridge will be removed and replaced adjacent with a new 49.5m four span, all concrete bridge on an improved alignment downstream. The site is located approx. 18km west of Bellingen, is highly flood prone and is in key habitat for the Bellinger River Snapping Turtle.

Existing Timber Bridge

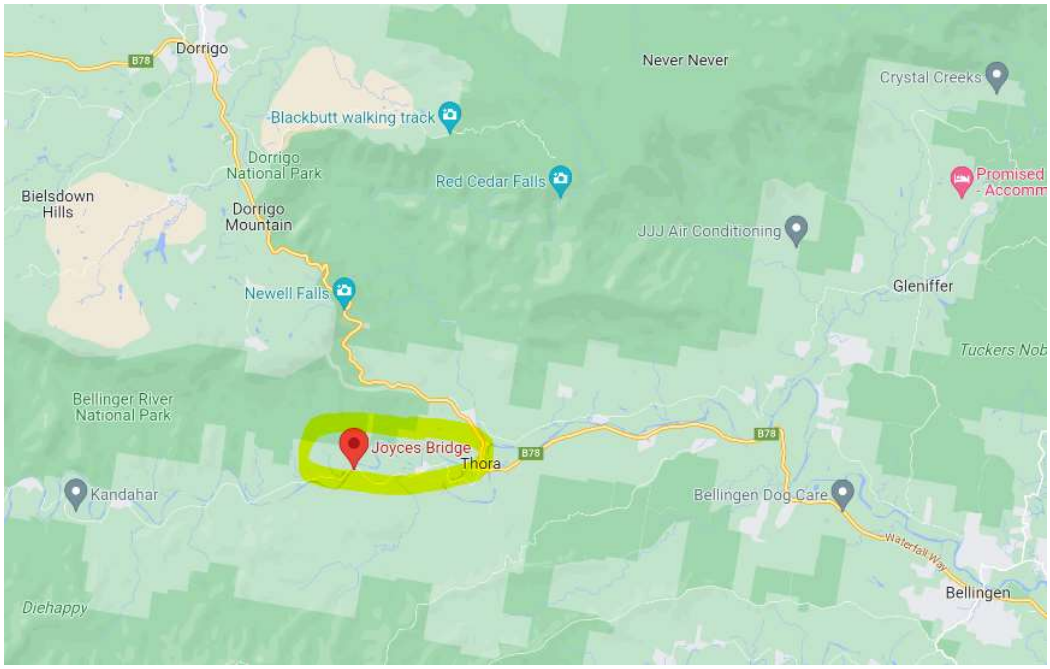
Form of Construction

Foundations – bored, cast in-situ concrete piles (600mm diameter) for all substructures

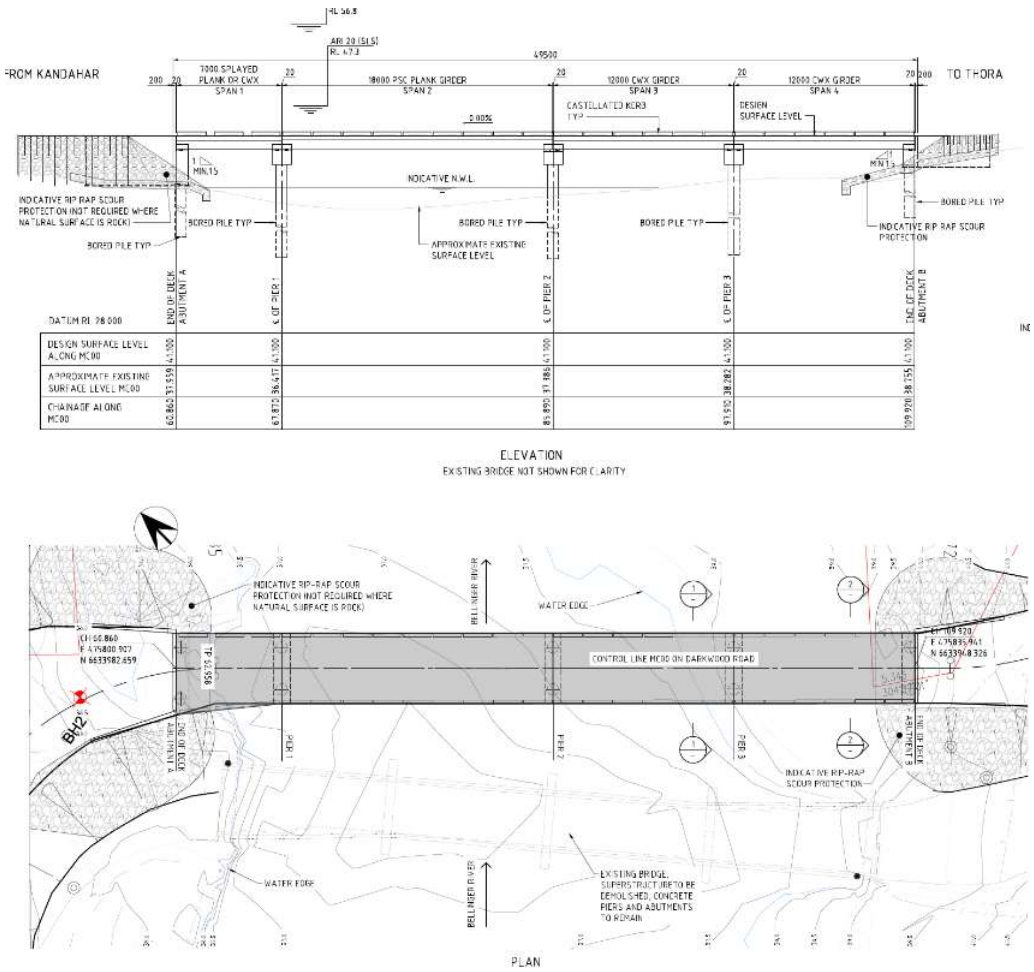
Substructure – cast in-situ reinforced concrete abutments and precast concrete headstocks, rock scour protection on bank and around abutments

Superstructure - precast concrete CoastalWorks 12m bridge beams for 2 spans, one longer span using 18m PSC pre-stressed bridge planks, one shorter 7m PSC plank span at the western end, cast in-situ deck pours for the two planks spans, bolt on concrete kerbs

Road approaches – 35m of road works one side and 60m the other side to tie into existing road, two coat bitumen seal, 6m wide plus fill formations, cast in-situ concrete approach slabs, open swale drains



Location Map



New Bridge Design

Construction Methodology & Sequence

1) Establishment:
    a. Set up compound, laydown and stockpile areas in private property at the next bend east of the bridge off Darkwood Road above the high flood level,
    b. Survey setout of boundaries, piling and vegetation no go zones,
    c. Installation of erosion and sediment controls for piling and river access ramps including booms in the water,
    d. Delivery of all piling and cast in situ work materials/formwork,
    e. Delivery of pre-filled rock bags,
    f. Establish bunded concrete washout and spoil areas at laydown area.

2) Access to riverbed from high banks:
    a. Clear and grub vegetation and topsoil from on land piling positions, stockpile away from river for later rehabilitation works or remove from site,
    b. On Thora (East) side, the access ramp is to be from the road edge immediately downstream of the abutment down to existing stable cobbly riverbed to Pier 3 and to the water's edge towards Pier 2.
    c. On the West side, the access ramp for piling is to be from the road edge down through Abutment A to the water's edge.
    d. Access ramps to be constructed with:
        i. Geofrabric underlay – extra length on the upstream side that can be used to wrap over the ramp and pinned down with rock bags during high flow events to prevent wash out,
        ii. 150mm thick, clean imported ballast (40-60mm) and/or gabion (50-200mm)

3) Prepare piling areas prior to piling contractor mobilisation:
    a. Abutments:
        i. Box down to underside of abutment plus 75mm for blinding layer, remove spoil to stockpile areas,
        ii. Level off adjacent area for positioning of piling rig,
        iii. Bench excavation for stability if needed and install edge delineation.
    b. At Pier 3 (out of waterway) – inside sediment fencing, excavator to dig down 1m to clear larger cobbles and use sieve bucket to sieve fines back into the excavation and cobbles onto adjacent cobble banks. Cobbles of this size (>200mm) particularly near the surface make 600 bored piling extremely difficult.
    c. At Pier 1 and 2:
        i. Access to both of these to be one at a time to limit the amount of afflux of the general water level and blockage of the wateryway,
        ii. Place rock bags with an excavator progressing out from the water's edge above the water level so an excavator can walk over them (on rubber mats to avoid tearing the bags)
        iii. Place a rock bag ring around the pile positions up to 300mm above water level to deflect the water flow/velocity around the area and provide a containment ring.
        iv. Lay geofabric on the inside of the rock bags with enough length to drape down to the bottom
        v. Fill inside the geofabric and bags with clean, imported, small aggregate (10mm-40mm) up to also 300mm above water level.

Aggregate will largely be self levelling and suitable for personnel access (not excavator tracks) and suitable for helping the pile liners to stand up before the high level rock strata

vi. Pull floating hydrocarbon boom tight to the bags

4) Bored piling works:
    a. Plant & equipment – 30t excavator with a 2t vibratory head attachment and pendulum drill head with Kelly bar for the auger.
    b. Abutments – excavator positioned on existing ground behind abutments,
    c. Pier 3 – excavator positioned on existing cobbly riverbed and access track.
    d. Pier 1 & 2 – excavator positioned on rock bags only not the aggregate infill area which will not be stable enough for excavator crawling only small plant, equipment and personnel.
    e. Vibratory head used to install permanent mild steel liners in position first
    f. Pile clean-out material placed either directly in a skip bin or on a geofabrics lined area adjacent the piling area so it can be removed from the riverbed area to the established stockpile area (or off site) daily. 2m screens of geofabric or ply to be erected along the line of rock bags at Pier 1 & 2 to deflect any loose material entering the water as the auger is pulled out.
    g. After piles are cleared, extend pile liners at the 3 pier sets by welding on extra sections up to the underside of headstock levels
    h. Place cages and pour concrete with concrete boom pump on the respective side of the river. Sucker truck to remove water from the wet pile holes during concrete placement.
    i. Concrete overpour out of top of piles (typically 0.2m3 per pile) to be contained within tarps area locally to the pile and then removed once dried the next day. At the abutments, overpour used as a blinding slab.

5) Remove in water piling access – remove piling rock bag areas in reverse order with excavator moving progressively out of the water. Excavator to scoop out imported aggregate from within the geofabric being carful not to tear. Last sections of aggregate removed by bunching, lashing and lifting sections of geofabric directly out of the waterway. Remove rock bags and stockpile until next stage.

6) Cast in-situ concrete sub-structure - abutments:
    a. Reinforcement placed and tied in place by hand on blinding slabs.
    b. Ply formwork shutters pre-made and placed with excavator using the established access ramps and tracks.
    c. Elevated walkway up to the top of concrete which will all cantilever off the formwork and not require additional footprint on the banks.
    d. Concrete boom pump to be positioned outside of the riverbed on the existing road approaches to pour. Concrete washout to either be off site or in established area up at the compound for later removal from site. Flowable high slump concrete mix used to minimise any risk of line blockages/breaks.
    e. Strip all formwork after concrete curing period,
    f. Complete mortar pads by hand mixed mortar to finish all substructures.

7) Landing precast headstocks:
    a. Place rock bags progressively out and tight around the in-river piles at Pier 1 and 2 for personnel access only to the top of piles (not for machinery),

b. Reinstate sufficient access track (as above) for crane and semi truck access down next to Pier 3 over the cobbly river bank
c. Lift headstocks to Pier 2 and 3 from eastern crane position, outriggers on rock bags for support.
d. Lift headstock at Pier 1 from the existing road approach at the western end
e. Use 0.5m3 kibble to lift exact amounts of concrete into each of the connecting void pours between the piles and headstocks, concrete trucks to remain on road approaches

8) Place scour rock around abutment fronts – place geofabric underlay first and use only clean imported quarry rock. No access for trucks inside high banks. Excavator to place scour rock from established access ramps and then from behind abutments out of the riverbed area.

9) Land all precast beams and planks and tie cast in-situ deck –
   a. Use same cranage position and access track for larger PSC planks and CoastalWorks as for the Pier 2 and 3 headstocks
   b. Smaller Franna crane to land smaller 7m PSC planks in the western span from on existing road approach
   c. beams sealed soffit formwork to be used between planks and beams to prevent concrete leakage into the waterway using FC sheeting, silicone and backing rod. Temporary access platforms to be installed along the outside edges for the 18m and 7m plank span for access and edge formwork.

10) General fill and drainage zone behind abutments – place and compact area immediately behind abutments up to underside of approach slabs. Maintain access to existing bridge for road traffic. All trucks, rollers and excavators out of the creek and sediment fencing along the whole bank lines to contain from any wet weather during this period.

11) Pour beam and deck pours – CoastalWorks 12m beam spans poured first, 18m and 7m plank span second with the approach slabs. Boom pumps to be again used from the respective sides without putting the line over the waterway. Curing of the deck pour to be done with clean water, soaker hoses and hessian.

12) Install bolt on kerb units onto plank span

13) Fully remove cranage access tracks and rock bags from around headstock piles – excavator to progressively remove rock bags, imported ramp materials and geofrabirc underlay working away from the water on each side back to the high banks. All imported rock to be re-used for road backfill. Rock bags removed from site.

14) Remove temporary works from plank span – use Franna crane and or HIAB truck on the new deck to lift out and load directly to laydown area.

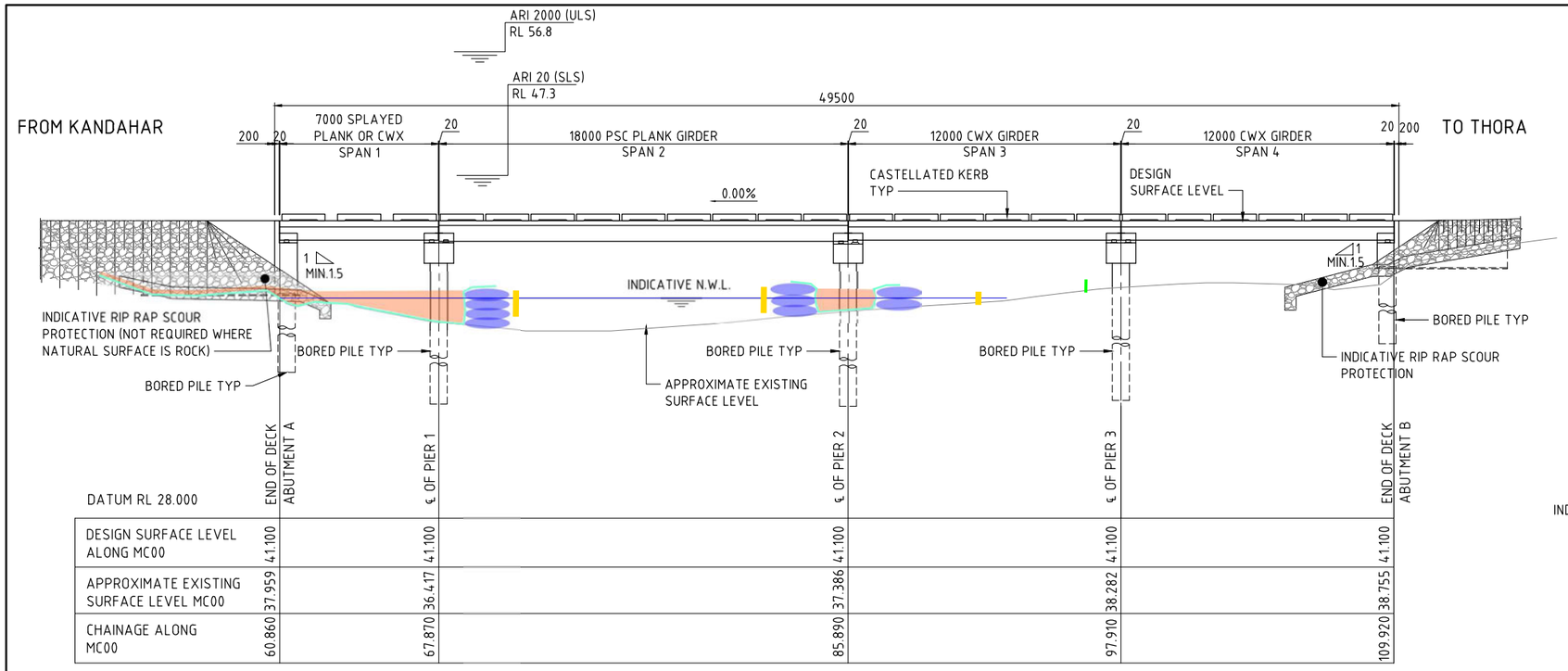
15) Complete approach roadworks – all imported, clean quarry materials (select fill, DGS, DGB) and 14/7 spray seal to finish. Swap traffic over to new bridge once completed.

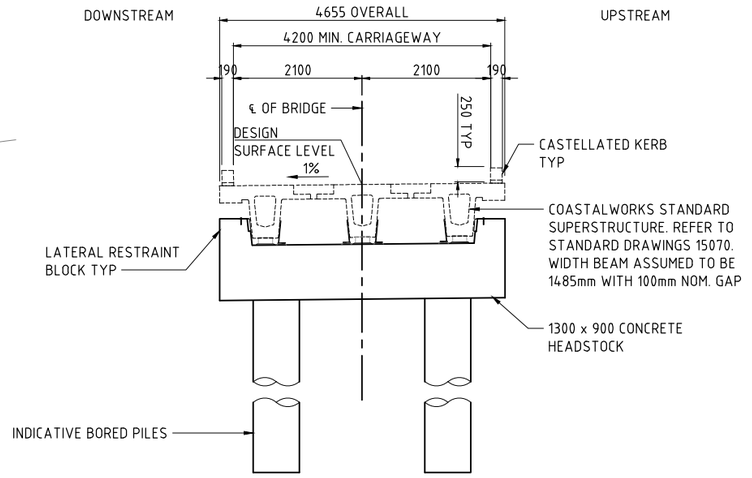
16) Demolish original bridge:
   a. Plant and equipment – 14t or 24t excavator with 360 degree rotating grab attachment, oxy torch for cutting bolts and chainsaw for cutting timbers.

b. Remove deck spans one by one starting out in the middle and working back to each abutment, removing ply and timber decking first followed by girders for each span. No access off deck required for this.
c. Once deck fully removed, remove protruding abutments to tie in better with the new scour rock and bank profile. Use rock breaker on excavator to break up and then remove in largest possible pieces by excavator and by hand.
d. For non-accessible headstocks in the water flow area, access via floating platform and remove timber components from above water with chainsaw and oxy cutting bolts down to top of concrete. Concrete headstocks to remain.
e. All bridge timbers to be loaded directly onto trucks for load out directly to waste disposal facility on a daily basis, no mass stockpiling on site

17) Complete rock scour protection – on upstream side of abutments and banks to tie in with where the existing bridge that was demolished and edge of road formation.

18) Demobilise construction activities – rehabilitate site with plantings and seeding disturbed areas, install temporary final erosion and sediment controls to remain in place for 3 months or until established.





SECTION 1

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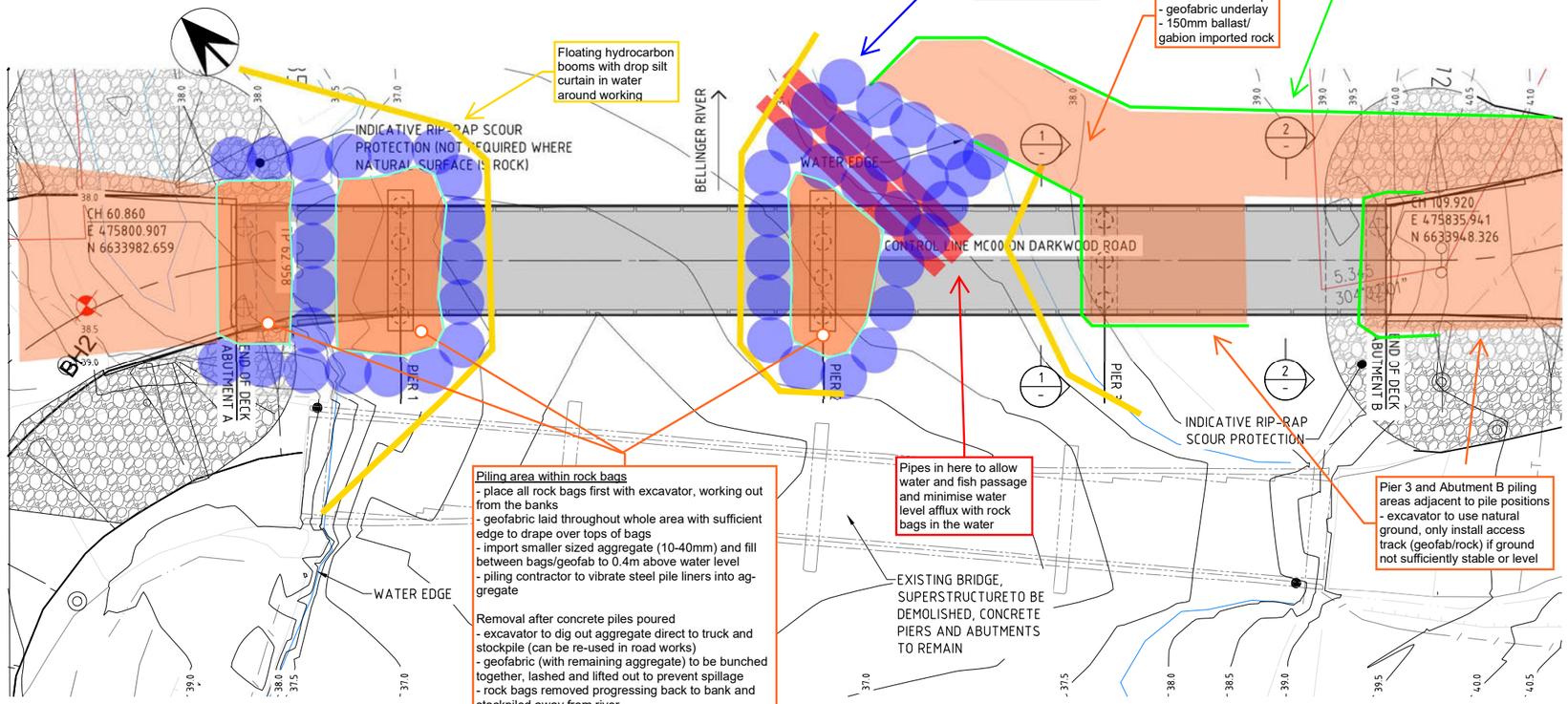
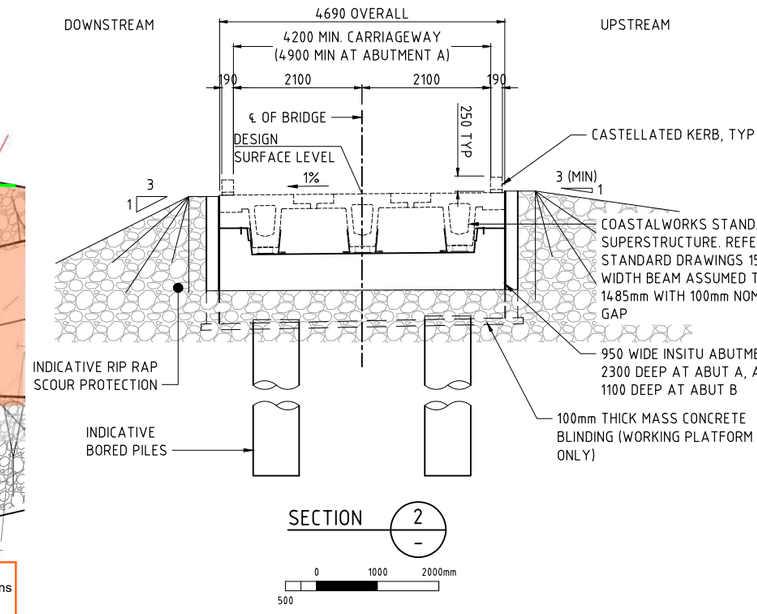
ELEVATION

EXISTING BRIDGE NOT SHOWN FOR CLARITY



PLAN



SECTION 2

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GENERAL NOTE:
ONLY ONE ROCK BAG ACCESS AREA TO BE IN THE WATER AT ANY ONE TIME. FOR EXAMPLE:
- INSTALL ROCK BAG PLATFORM TO PIER 1 AND ABUTMENT A
- COMPLETE PIER 1 & ABUTMENT A PILING WORKS COMPLETELY (CONCRETE POURED)
- REMOVE THIS AREA AND RE-INSTALL FOR PIER 2
- COMPLETE PILING WORKS AT PIER 2
- REMOVE BAGS AND STOCKPILE

UM.

NOT FOR CONSTRUCTION

ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH
03	01/06/2023	MINOR AMMENDMENTS	JR	DM	CR
02	17/05/2023	MINOR AMMENDMENTS	JR	DM	CR
01	19/04/2023	CONCEPT DESIGN	JR	DM	CR

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BRIDGE KNOWLEDGE PTY LTD

BELLINGEN SHIRE COUNCIL
BELLINGEN SHIRE COUNCIL

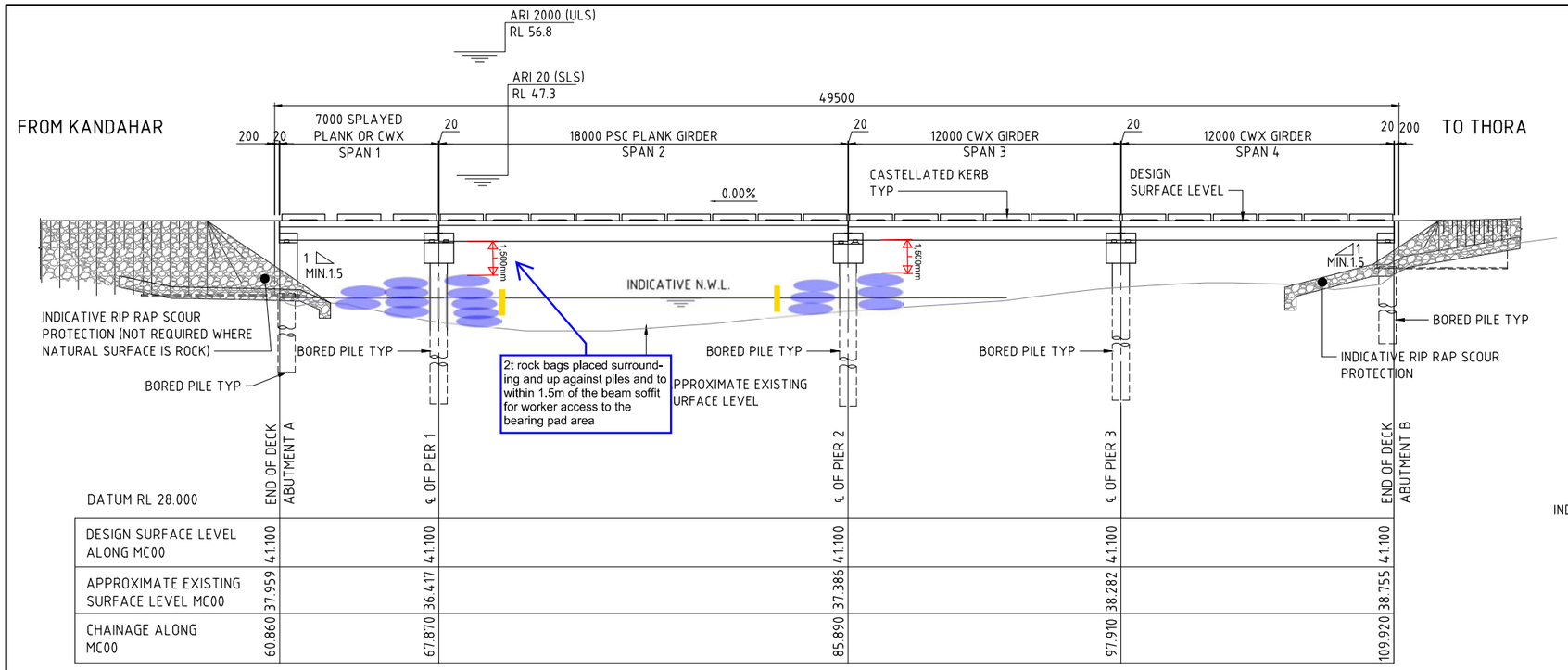
TITLE	PREPARED
DESIGN	YT
DESIGN CHECK	DM
DRAWING	JR
DRAWING CHECK	YT
APPROVED	DM

DARKWOOD ROAD — BELLINGEN SHIRE COUNCIL

TIMBER BRIDGE REPLACEMENT PROJECT
JOYCES BRIDGE

PILING ACCESS PLAN

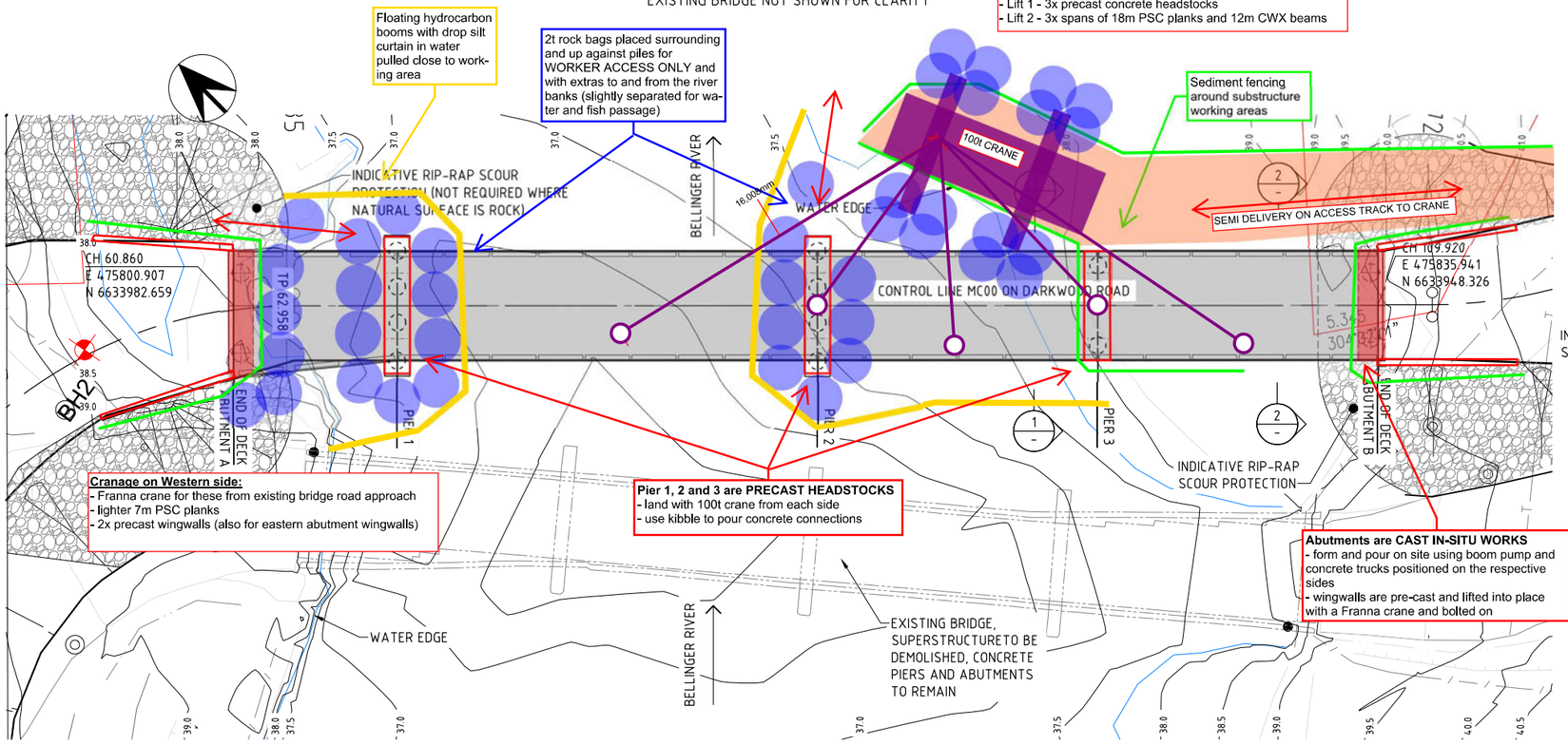
DRAWING SET No	BKP372-BSC
BRIDGE No	DRG-005
ISSUE STATUS	CONCEPT DESIGN
ISSUE	03
No SHEETS	5
SHEET No	05



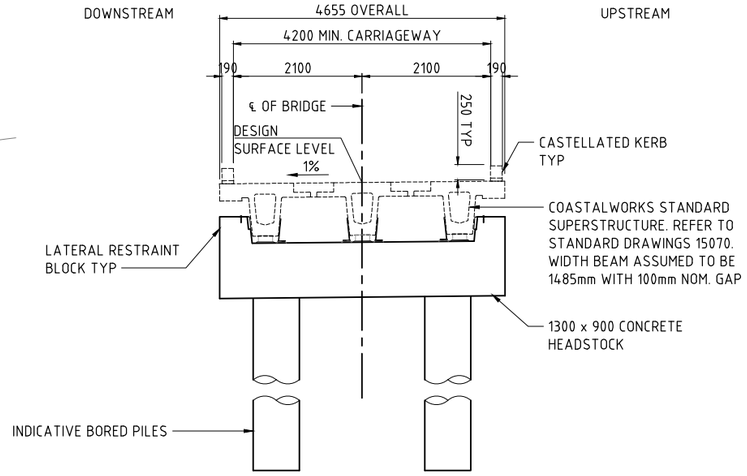
ELEVATION

EXISTING BRIDGE NOT SHOWN FOR CLARITY

Crane position:
- re-establish access track as per piling stage
- outrigger positions supported with rock bags
- Lift 1 - 3x precast concrete headstocks
- Lift 2 - 3x spans of 18m PSC planks and 12m CWX beams



PLAN



SECTION 1

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SECTION 2

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GENERAL NOTE:
BOTH ROCK BAG AREA TO BE RE-INSTALLED AT THE SAME TIME FOR THE RE-ESTABLISHMENT TO JOYCES AFTER COMPLETING HOBARTS BRIDGE.
BAGS PLACED TIGHT TO PIER 2 & 3 TO MINIMISE FOOTPRINT IN THE WATER.
BAGS TO REMAIN IN PLACE FOR PERSONNEL ACCESS UNTIL THE SUPERSTRUCTURE WORKS ARE COMPLETED FOR CONTINUING ACCESS NEEDS FOR WORKERS TO THE BEARING PAD AREA.
ACCESS TRACK ITO THE CREEK TO BE REMOVED ONCE CRANAGE WORKS ARE COMPLETED

NOT FOR CONSTRUCTION

03	01/06/2023	MINOR AMMENDMENTS	JR	DM	CR
02	17/05/2023	MINOR AMMENDMENTS	JR	DM	CR
01	19/04/2023	CONCEPT DESIGN	JR	DM	CR
ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH

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BELLINGEN SHIRE COUNCIL

TITLE	PREPARED
DESIGN	YT
DESIGN CHECK	DM
DRAWING	JR
DRAWING CHECK	YT
APPROVED	DM

DARKWOOD ROAD — BELLINGEN SHIRE COUNCIL

TIMBER BRIDGE REPLACEMENT PROJECT
JOYCES BRIDGE

CRANAGE ACCESS PLAN

DRAWING SET No	BKP372-BSC
BRIDGE No	DRG-005
ISSUE STATUS	CONCEPT DESIGN
ISSUE	03
No SHEETS	5
SHEET No	05

DARKWOOD ROAD 3 BRIDGES – EXAMPLE CONSTRUCTION METHODOLOGY PHOTOES

Excavator with 2t vibratory unit used to pitch steel pile liners

Excavator mounted pendulum pile boring rig with extendable Kelly bar and access ramps –

Excavator mounted rock anchor drilling setup (7-12t sized machine) with splatter screens used next to waterway

On-site grout mixing station for rock anchors up on banks away from anchors


Same smaller excavator (7t) rock anchor rig

Containment system used for pouring concrete bored piles to prevent concrete overpour entering the waterway


Kibble being used for on-site pours at headstocks near water to control concrete

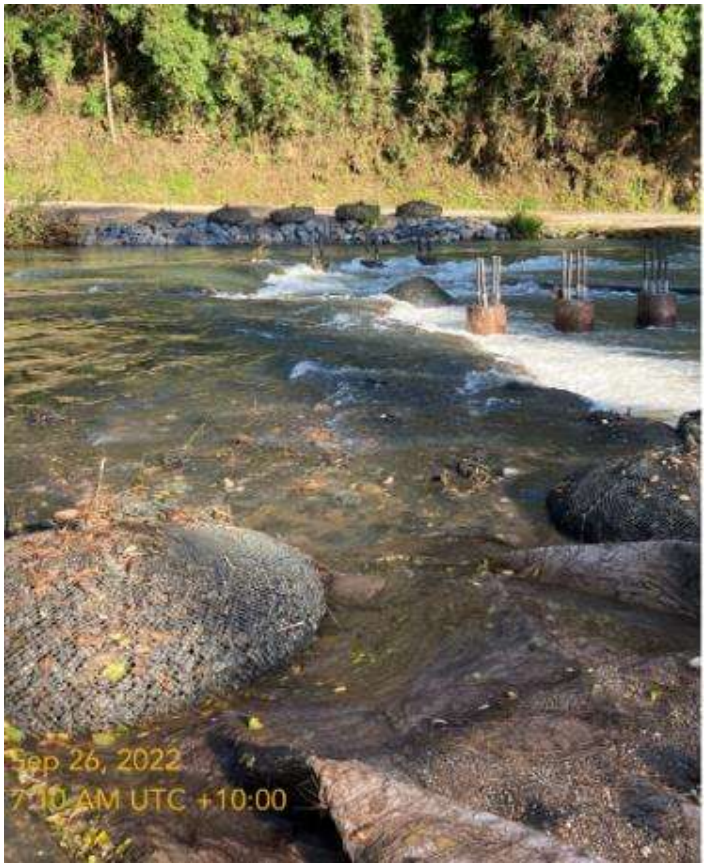
Cast in-situ headstock with elevated temporary works walkway around

Rock bags used as an access track and crane platform for landing precast components

Concrete deck pour with elevated walkway attached to bridge planks

Riverbank access ramp and working area and rock scour protection with excavator

Rock bags used to pin down geofabric with boom adjacent in water

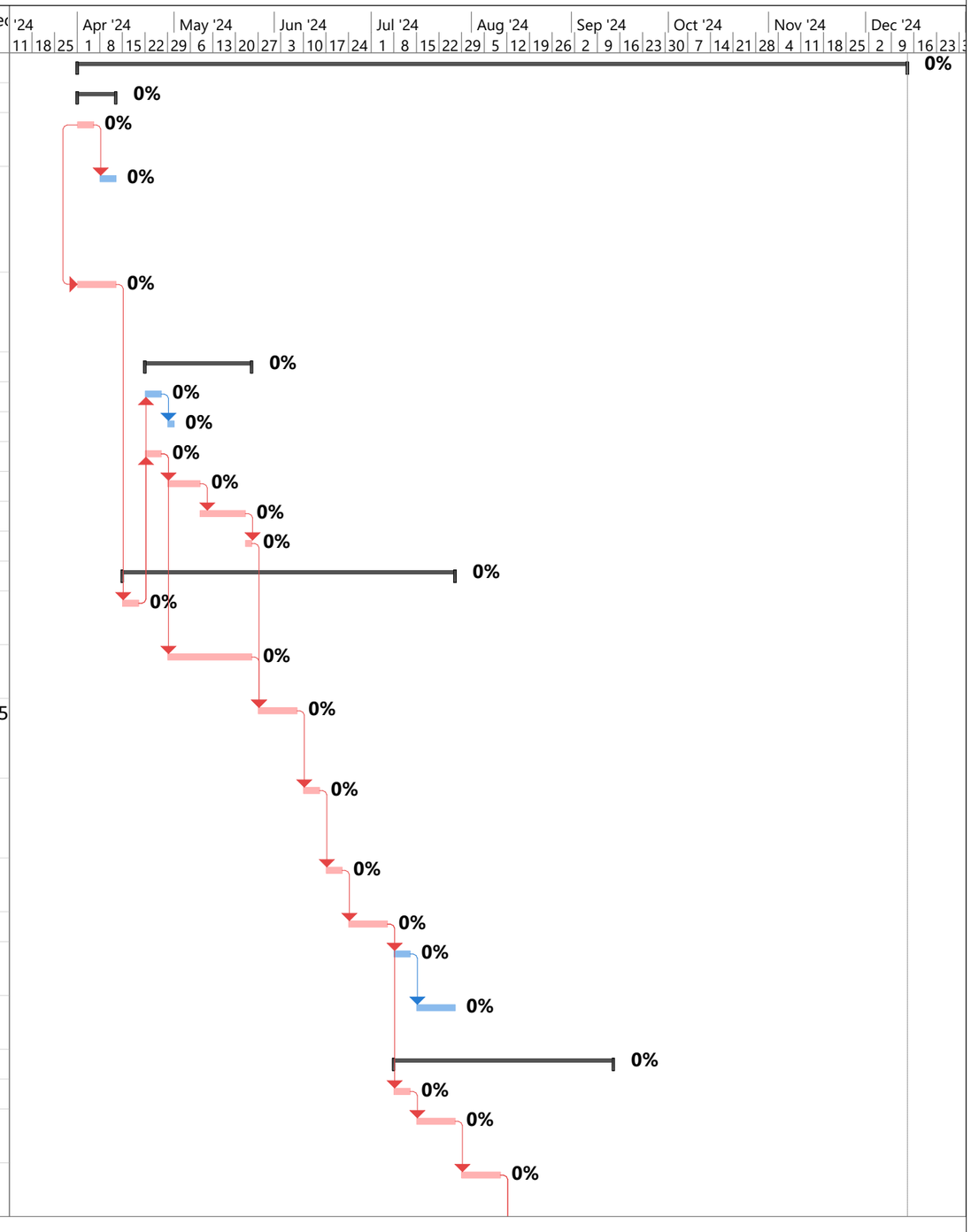


Rock bag access track being overtopped and remaining in place without any material loss during high water flow conditions

Landing precast concrete panels onto steel girder span

2024 Darkwood Bridges Program 5.7.23 - preferred

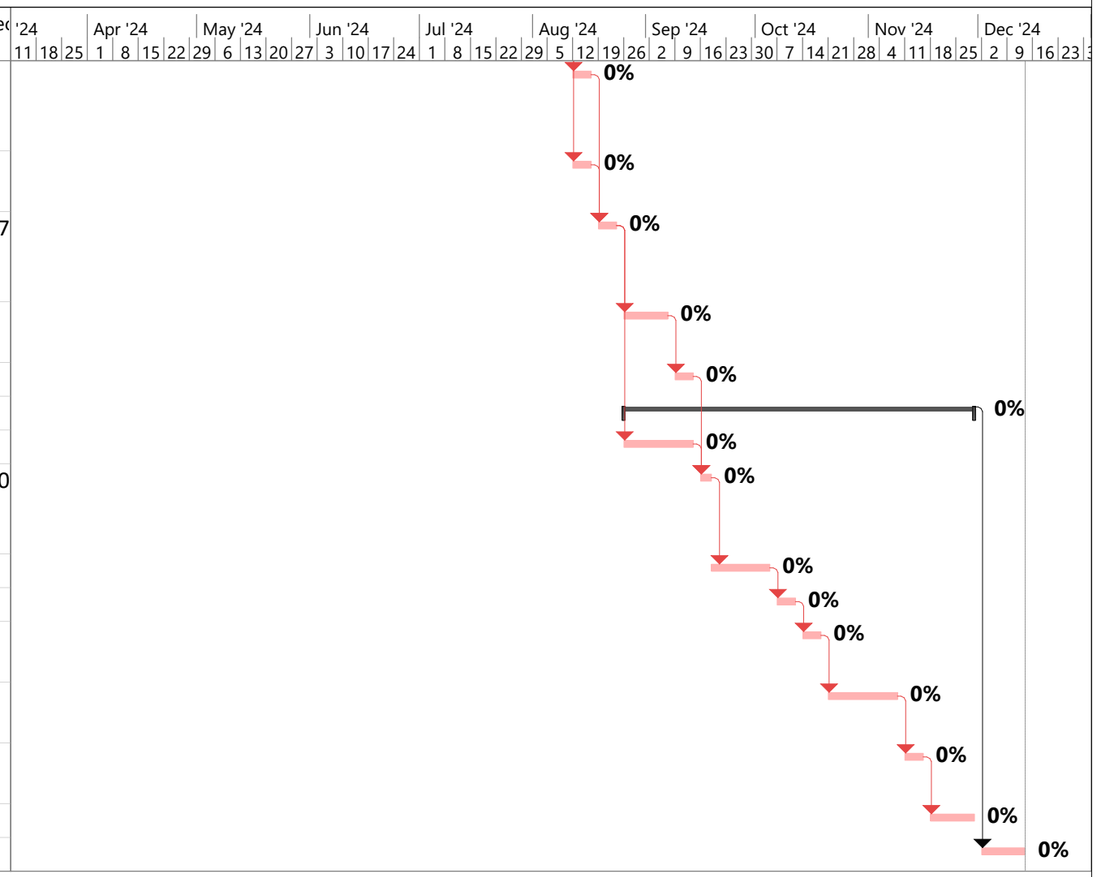
ID	Engineer	Task Name	Duration	Start	Finish	Predec
1	**2024**	**Coastal Works - Darkwood Bridges Program 2024**	**185 days**	**Mon 1/04/24**	**Fri 13/12/24**	
2		**Site Establishment all 3 sites**	**10 days**	**Mon 1/04/24**	**Fri 12/04/24**	
3	Crew 1	Main laydown & compound setup at Hobarts + major material deliveries	5 days	Mon 1/04/24	Fri 5/04/24	
4	Crew 1	ALL 3 SITES - vegetation clearing, piling material deliveries, establish excavator access tracks for river banks, ERSD controls at first pile positions and laydown and spoil areas	5 days	Mon 8/04/24	Fri 12/04/24	3
5	Crew 2	ALL 3 SITES - establish rock bag areas - Hobarts headstock, Joyces west abutment, Justins headstock and floating booms installed	10 days	Mon 1/04/24	Fri 12/04/24	3SS
6		**Piling all 3 sites**	**25 days**	**Mon 22/04/24**	**Fri 24/05/24**	
7	Crew 1	HOBARTS - mob, rock anchors (32) drilled, grouted	5 days	Mon 22/04/24	Fri 26/04/24	14
8	Crew 1	JUSTINS - rock anchors (10) and grouted incl. move	2 days	Mon 29/04/24	Tue 30/04/24	7
9	Crew 2	HOBARTS - mob, bored piles (5), pile reo & concrete pours	5 days	Mon 22/04/24	Fri 26/04/24	14
10	Crew 1	JUSTINS - bored piles (9) and poured, incl mob/demob	8 days	Mon 29/04/24	Wed 8/05/24	9
11	Crew 1	JOYCES - bored piles (16) & remove/stockpile rock bags	10 days	Thu 9/05/24	Wed 22/05/24	10
12	Crew 1	Contingency - days between to keep up, wet weather	2 days	Thu 23/05/24	Fri 24/05/24	11
13		**Hobarts Bridge (BSC)**	**75 days**	**Mon 15/04/24**	**Fri 26/07/24**	
14	Crew 2	Prepare all pile locations - box outs, blindings, ERSD controls, rock anchor bunds	5 days	Mon 15/04/24	Fri 19/04/24	5
15	Crew 2	Cast in-situ headstocks and abutments (during remaining piling works)	20 days	Mon 29/04/24	Fri 24/05/24	9
16	Both Crews	Cast in-situ headstocks and abutments completed both crews incl. scour rock in front of abutments and mortar pads	10 days	Mon 27/05/24	Fri 7/06/24	12,15
17	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove access tracks into creek, crane pads and landing prep	5 days	Mon 10/06/24	Fri 14/06/24	16
18	Both Crews	Land beams (2 days) & CoastalWorks beams stitch pours (3 days)	5 days	Mon 17/06/24	Fri 21/06/24	17
19	Both Crews	Plank span deck pour & approach slabs	10 days	Mon 24/06/24	Fri 5/07/24	18
20	Crew 2	Road works on approaches, swap traffic over, install kerbs and brackets	5 days	Mon 8/07/24	Fri 12/07/24	19
21	Crew 2	Demolition, final rock scour, full restoration, pack up & contingency	10 days	Mon 15/07/24	Fri 26/07/24	20
22		**Justins Bridge**	**50 days**	**Mon 8/07/24**	**Fri 13/09/24**	
23	Crew 1	Relocate compound from Hobarts, ERSD controls etc.	5 days	Mon 8/07/24	Fri 12/07/24	19
24	Crew 1	Cast in-situ headstocks and abutments (3) incl. elevated temporary support for headstock at start	10 days	Mon 15/07/24	Fri 26/07/24	23
25	Both Crews	Cast in-situ headstocks and abutments incl. scour rock in front of abutments	10 days	Mon 29/07/24	Fri 9/08/24	24



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

2024 Darkwood Bridges Program 5.7.23 - preferred

ID	Engineer	Task Name	Duration	Start	Finish	Predec
26	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove rock bags area, crane pads and landing prep	5 days	Mon 12/08/24	Fri 16/08/24	25
27	Both Crews	Steel girders deliverd and put together with franna on west side	5 days	Mon 12/08/24	Fri 16/08/24	25
28	Both Crews	Land beams and deck panels (2 days) & CoastalWorks beams stitch pour & complete steel girder deck bolting and grouting	5 days	Mon 19/08/24	Fri 23/08/24	26,27
29	Crew 1	Road works on approaches, install kerbs and brackets, swap traffic over	10 days	Mon 26/08/24	Fri 6/09/24	28
30	Crew 1	Demolition, final rock scour, full restoration, pack up	5 days	Mon 9/09/24	Fri 13/09/24	29
31		**Joyces Bridge**	**70 days**	**Mon 26/08/24**	**Fri 29/11/24**	
32	Crew 2	Precast 3x Joyces headstocks (CoastalWorks Precast Yard)	15 days	Mon 26/08/24	Fri 13/09/24	28
33	Both Crews	Relocate compound from Justins, re-install rock bag access for personnel access to headstocks only & crane pads	3 days	Mon 16/09/24	Wed 18/09/24	32,30
34	Both Crews	Cast in-situ abutments and bearing pads	12 days	Thu 19/09/24	Fri 4/10/24	33
35	Both Crews	Scour rock protection, approaches general fill	5 days	Mon 7/10/24	Fri 11/10/24	34
36	Both Crews	Land beams (2 days) & Coatalworks beams stitch pours (3 days)	5 days	Mon 14/10/24	Fri 18/10/24	35
37	Both Crews	Plank spans (2) deck pours & approach slabs & install kerb units	15 days	Mon 21/10/24	Fri 8/11/24	36
38	Both Crews	Road works on approaches, swap traffic over, install kerbs	5 days	Mon 11/11/24	Fri 15/11/24	37
39	Both Crews	Demolition, final rock scour, full restoration and pack up	10 days	Mon 18/11/24	Fri 29/11/24	38
40		**Contingency / wet weather**	**10 days**	**Mon 2/12/24**	**Fri 13/12/24**	**31**



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

DARKWOOD 2024 PROGRAM NOTES

Coastal Works intend to undertake the 3 Darkwood Road bridges – Hobarts, Joyces, Justins – as a single program of works commencing in April 2024 to December 2024. Preferred program utilises a typical rock anchor installation small excavator rig with air drilling. Below outlines some of the key dates for the construction sequence:

Site Establishment – April 2024
- Main compound and laydown set up at Hobarts.
- Laydown and piling material deliveries at all 3 bridges.
- Vegetation clearing complete at all 3 bridges
- Establish access points down banks and first piling position at all 3 sites with rock bag setups – 1x headstock at Hobarts, western headstock at Joyces, headstock at Justins.
- Establish all piling positions at Hobarts
- Install erosion and sed controls at all 3 bridges for laydown and piling positions

Piling All 3 bridges – April to June 2024
- Start at Hobarts with the two piling setups concurrently, one 7t excavator rock anchor setup and one 24t excavator for bored piles – aim for completion all in 1 week
- Both setups to move onto Justins Bridge – rock anchor completed in 3 days and setup demobilised from site, bored piles continue – 1.5 weeks
- Bored piling setup moves onto Joyces bridge last, first at previously established western side access which is then removed and established on the east side for completion – 2 weeks
- Coastal Works crews with an excavator to follow the piling crews to manage laydowns, modify the access requirements, remove piling spoil and maintain and adjust environmental controls.
- Coastal Works crew complete the bored pile pours progressively along with the contractor
- Justins site rock bags to remain at headstock to remain, Joyces river access completely removed.

Hobarts Main Bridge Construction – May – August 2024
- Cast in-situ substructure works (6 weeks) to commence in May with one CoastalWorks crew once all piling is completed and piling is continuing at the other sites.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in June.
- Superstructure to be landed, poured, and completed in July with both crews.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in late July and into August.

Justins Main Bridge Construction – July – September 2024
- Relocate main compound setup from Hobarts to Justins in late July once the Hobarts superstructure is completed with second CoastalWorks crew.
- Cast in-situ substructure works (4 weeks) to commence in August with one CoastalWorks crew and completed by both crews once Hobarts is completed.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in late August.
- Superstructure to be landed, poured, and completed in early September.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in September.

Joyces Main Bridge Construction – July – September 2024
- While Justins being finished, 3x precast headstocks made with second crew at Precast Yard.
- Relocate main compound setup from Justins to Joyces in October and reinstate rock bag access to the headstocks for personnel only and crane pads positions for landing precast components.
- Cast in-situ abutments (2 weeks) to be completed in October with both crews.
- Scour rock at abutments placed and abutment backfill completed in late October.
- Superstructure to be landed, poured, and completed by mid-November with both crews.
- Remove rock bags and bank access and complete the roadworks, remaining scour rock protection, demolition, and restoration in late November and December.

Appendix D

Hobarts Bridge Design and Construction Methodology

HOBARTS BRIDGE REPLACEMENT

Project Description

Coastal Works are replacing Hobarts Bridge over the Bellinger River on Darkwood Road, Darkwood under contract works for Bellingen Shire Council. The existing 48m five span, timber bridge will be removed and replaced adjacent with a new 54m four span, all concrete bridge on an improved alignment downstream. The site is located approx. 20km west of Bellingen, is highly flood prone and is in key habitat for the Bellinger River Snapping Turtle.

Existing Timber Bridge

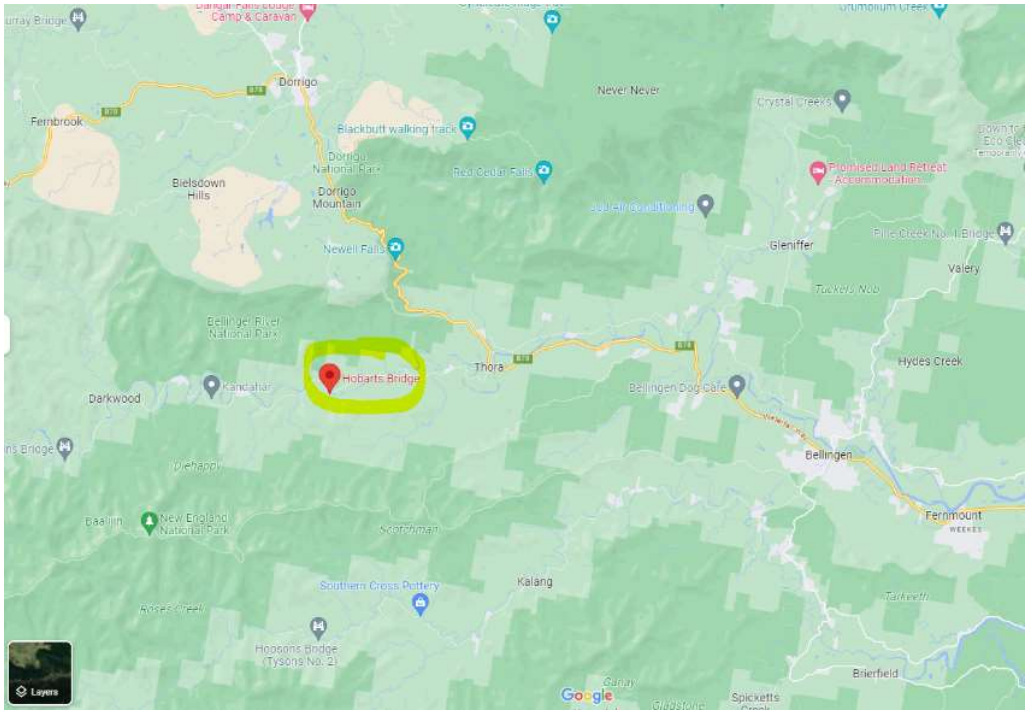
Form of Construction

Foundations – bored, cast in-situ concrete piles (600mm diameter) at one abutment and one headstock, rock anchors at the other abutments and two headstocks into high level rock

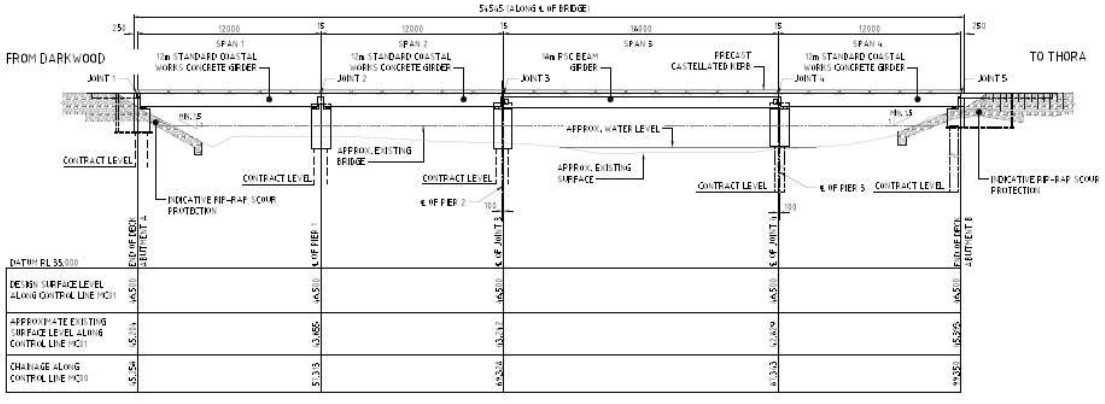
Substructure – cast in-situ reinforced concrete abutments and headstocks throughout, shorter at the two foundations with the bored piles and taller blade walls at the other rock anchor foundations poured directly onto the exposed high level rock shelf, rock scour protection on bank and around abutments

Superstructure - precast concrete CoastalWorks 12m bridge beams for 3 spans and one longer span using 18m PSC pre-stressed bridge planks and a cast in-situ deck pour, cast in-situ concrete approach slabs, bolt on concrete kerbs

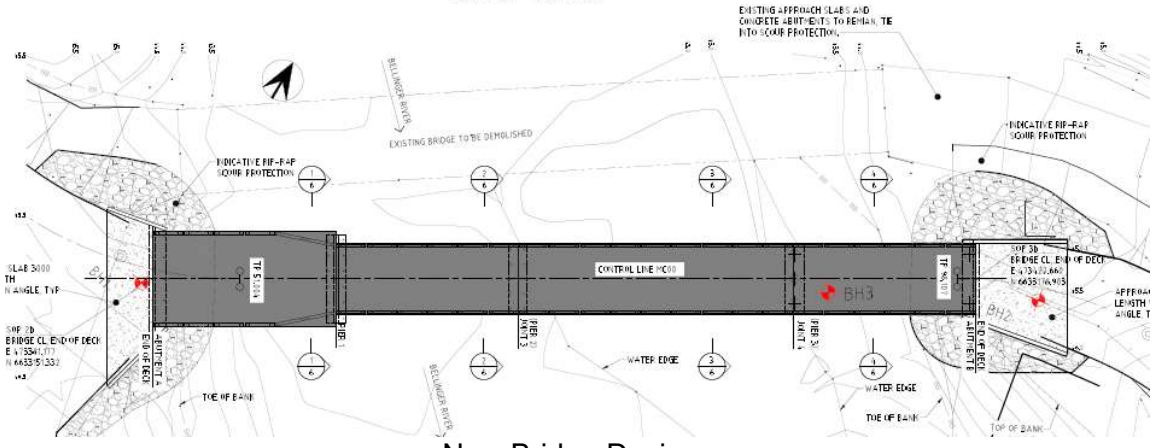
Road approaches – 40m of road works one side and 50m the other side to tie into existing road, two coat bitumen seal, 6m wide plus fill formations, open swale drains



Location Map



ELEVATION - ALONG MC00



New Bridge Design

Construction Methodology & Sequence

1) Establishment:
    a. Set up compound, laydown and stockpile areas in the Darkwood Road shoulder on the eastern approach off the road and above the high flood level,
    b. Survey setout of boundaries, piling and vegetation no go zones,
    c. Installation of erosion and sediment controls for piling and river access ramps including booms in the water,
    d. Delivery of all piling and cast in situ work materials/formwork,
    e. Delivery of pre-filled rock bags,
    f. Establish bunded concrete washout and spoil areas at laydown area.

2) Access to riverbed from high banks:
    a. Clear and grub vegetation and topsoil from ramp areas, stockpile away from river for later rehabilitation works or remove from site,
    b. On Thora (East) side, the access ramp is to be immediately downstream of the abutment down to existing stable alluvial gravel shelf. If the alluvial shelf does not churn up with the excavator tracks, then it will be accessed as is and flattened off at completion. If this is not the case, the access ramp construction will extend onto this area also for stability,
    c. On the school side (West), the access ramp is to be between new and existing abutments (shortest bank height) down onto existing exposed rock shelf. Rock shelf is suitable for tracked machine and foot access without a need to import access track materials. A minor amount of loose deposited gravels on top of the rock shelf may be shifted for leveling of plant and equipment.
    d. Access ramps to be constructed with:
        i. Geofrabric underlay – extra length on the upstream side that can be used to wrap over the ramp and pinned down with rock bags during high flow events to prevent wash out,
        ii. 150mm thick, clean imported ballast (40-60mm) and/or gabion (50-200mm)

3) Prepare piling areas prior to piling contractor mobilization:
    a. Abutments (one bored, one rock anchors)
        i. Box down to underside of abutment plus 75mm for blinding layer, remove spoil to stockpile areas,
        ii. Level off adjacent area for positioning of piling rig,
        iii. Bench excavation for stability if needed and install edge delineation.
    b. At Pier 3 (bored piles, east side of water) – blinding slab to be used to aid in keeping piles in correct position and providing a slab for the cast in-situ blade wall style headstock works:
        i. Place approximately 10 rock bags wrapped in geofabric along the edge of the low flow creek line to pin down the edge of the alluvial riverbed material and provide containment for the working area,
        ii. Pull floating hydrocarbon boom tight to the water side of the rock bags and install sediment fencing around the inside of the bag rim,
        iii. Over a 5m x 1.5m area over the footprint of the bored piles, excavator to dig down 1m to remove any larger cobbles,
        iv. Stand up 3 short steel pile liners in the wet excavation,

v. Pour a 0.5-1.0m deep reinforced concrete blinding slab 5m x 1.5m around the pile liners to approximately 200mm above low flow water level.

c. At Pier 1 and 2 (rock anchors) – reverse blinding layer to be used around the outside of the blade wall plan area to contain the footprint for piling works and later cast in-situ works from the waterway:
   i. Clear loose debris and river gravel from the blade wall footprint by hand and excavator,
   ii. Pier 2 is in a dry position on the rock shelf – form blinding with timber formwork and pour reinforced blinding ring,
   iii. Pier 3 is 75% dry with one corner in shallow approx. 0.3m deep water. For this corner first place sandbags to above water level, then line with multiple layers of building plastic on the inside and then timber formwork on top of this in the water. Use a sucker truck to remove water from inside this corner as it is displaced by the concrete pour,
   iv. Drier concrete mix to be used to minimise risk of seepage into the adjacent water and lifters cast in so that the blinding can be easily and fully removed after completion of the blade wall.

4) <u>Bored piling works:</u>
   a. Plant & equipment –30t excavator with a 2t vibratory head attachment and pendulum drill head with Kelly bar for the auger.
   b. Abutment B – excavator positioned on existing ground behind abutment,
   c. Pier 3 – excavator positioned on existing river gravel shelf between Abutment B and pier.
   d. Vibratory head used to install permanent mild steel liners in position first from ground level. Abutment B may not require these, Pier 3 to have liners vibrated down inside the established blinding.
   e. Pile clean-out material placed either directly in a skip bin or on a geofabrics lined area adjacent the piling area so it can be removed from the riverbed area to the established stockpile area (or off site) daily. 2m screens of geofabric or ply to be erected along the line of rock bags at Pier 3 to deflect any loose material entering the water as the auger is pulled out.
   f. After piles are cleared, place cages and pour concrete with concrete boom pump up at existing road level behind the abutment. Sucker truck to remove water from the wet pile holes during concrete placement.
   g. Concrete overpour out of top of piles (typically 0.2m3 per pile) to be contained at Pier 3 with tarps. Overpour at Abutment B used as a blinding slab.

5) <u>Rock anchor works:</u>
   a. Plant & equipment – 7t-10t excavator with a specialist air drilling attachment with Down Hole Hammer (DHH) and on-site grout mixing station. DHH option keeps noise and vibration down the hole rather than an above ground hammer which is much noisier above.
   b. Install 2m high spray screens, using geofabric or ply, on 3 sides of the rock anchor areas to deflect any natural rock spray from entering the water.
   c. Excavator drill rig to be positioned on the rock shelf well clear of the water between Pier 1 and 2 and on the existing road level for Abutment A,
   d. Grout mixing station to be on the western existing road near Abutment A out of the riverbed and banks. Bund the area from overspill and grout hoses to

the rock anchor working area to be plastic wrapped or run in a larger diameter conduit to capture any potential break.

e. Concrete revers blinding to be 200mm higher than rock level to act as containment for flushing of the rock anchor holes (water and rock sediment) and for containing grout overpour. These can be removed by sucker truck at end of works to tidy area ready for cast in-situ works.

6) Cast in-situ concrete sub-structure:
   a. Reinforcement placed and tied in place by hand inside reverse blindings at piers and on traditional blinding at abutments all above low flow water level.
   b. Ply formwork shutters pre-made and placed with excavator using the established access ramps and tracks.
   c. Two blade walls will require elevated walkway up to the top of concrete which will all cantilever off the formwork and not require additional footprint on the riverbed other than a ladder.
   d. Concrete boom pump to be positioned outside of the riverbed on the existing road approaches to pour all substructure works. Pump and concrete trucks to be brought to the respective sides of the river for pours so the boom line is not over the waterway at any time. Concrete washout to either be off site or in established area up at the compound for later removal from site. Flowable high slump concrete mix used to minimise any risk of line blockages/breaks.
   e. Strip all formwork and remove reverse blinding after concrete curing period,
   f. Install cantilevered walkway access platforms off new concrete for access to bearing pad level for piers,
   g. Complete mortar pads by hand mixed mortar to finish all substructures.

7) Fully remove piling access tracks – excavator to progressively remove rock bags, imported ramp materials and geofrabirc underlay working away from the water on each side back to the high banks. All imported rock to be re-used for road backfill.

8) Place scour rock around abutments – place geofabric underlay first and use only clean imported quarry rock. No access for trucks inside high banks. Excavator to place scour rock from established access ramps and then from behind abutments out of the riverbed area.

9) General fill and drainage zone behind abutments – place and compact area immediately behind abutments up to underside of approach slabs. Maintain access to existing bridge for road traffic. All trucks, rollers and excavators out of the creek and sediment fencing along the whole bank lines to contain from any wet weather during this period.

10) Establish crane outrigger positions – use rock bags placed either side either side of the existing timber bridge as outrigger positions, one set on the western end and one on the eastern end using an excavator from the existing bridge deck. Cranes to be positioned on the first 10m of the existing bridge for landing precast components under full road closure.

11) Land all precast beams and planks and tie cast in-situ deck and approach slabs – sealed soffit formwork to be used between planks and beams to prevent concrete leakage into the waterway using FC sheeting, silicone and backing rod. Temporary

access platforms to be installed along the outside edges for the 18m plank span for access and edge formwork.

12) Pour beam and deck pours – CoastalWorks 12m beam spans poured first, 18m plank span second with the approach slabs. Boom pumps to be again used from the respective sides without putting the line over the waterway. Curing of the deck pour to be done with clean water, soaker hoses and hessian.

13) Install bolt on kerb units onto plank span

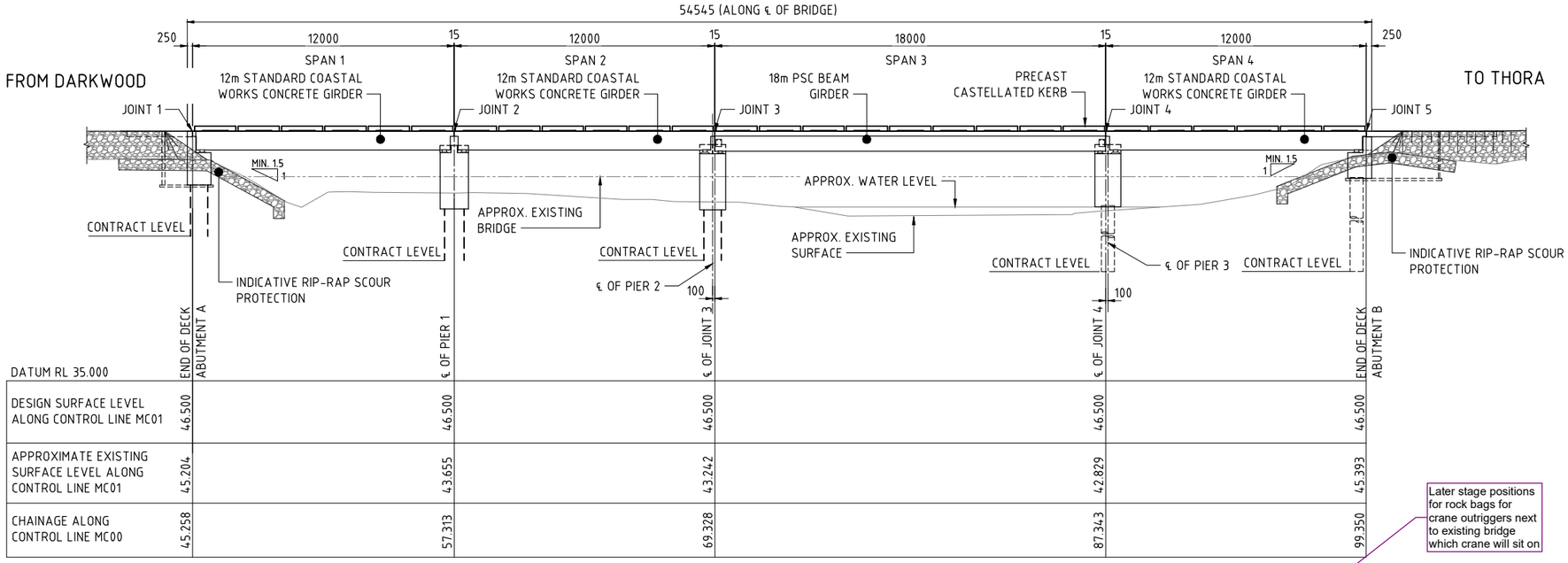
14) Remove temporary works from headstocks and plank span – use Franna crane and or HIAB truck on the new deck to lift out and load directly to laydown area.

15) Complete approach roadworks – all imported, clean quarry materials (select fill, DGS, DGB) and 14/7 spray seal to finish. Swap traffic over to new bridge once completed.

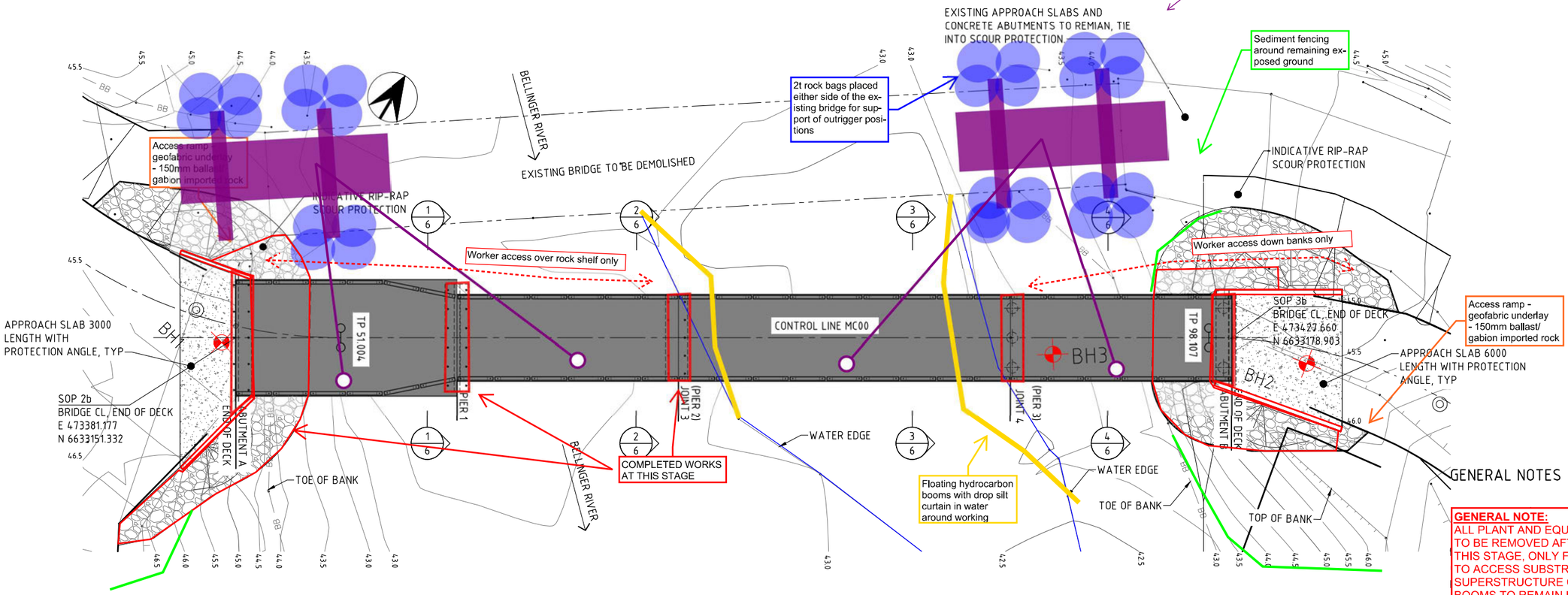
16) Demolish original bridge:
    a. Plant and equipment – 14t or 24t excavator with 360 degree rotating grab attachment, oxy torch for cutting bolts and chainsaw for cutting timbers.
    b. Remove deck spans one by one starting out in the middle and working back to each abutment, removing ply and timber decking first followed by girders for each span. No access off deck required for this.
    c. Once deck fully removed, remove headstocks on the western side that are accessible outside of the low flow water area only. Use rock breaker on excavator to break up and then remove in largest possible pieces by excavator and by hand.
    d. For non-accessible headstocks in the water flow area, access via floating platform and remove timber components from above water with chainsaw and oxy cutting bolts down to top of concrete. Concrete headstocks to remain.
    e. Existing concrete abutments to remain in place along bank edges to maintain stable banks into the future as scour protection.
    f. All bridge timbers to be loaded directly onto trucks for load out directly to waste disposal facility on a daily basis, no mass stockpiling on site

17) Complete rock scour protection – on upstream side of abutments and banks to tie in with where the existing bridge that was demolished and edge of road formation.

18) Demobilise construction activities – rehabilitate site with plantings and seeding disturbed areas, install temporary final erosion and sediment controls to remain in place for 3 months or until established.



ELEVATION - ALONG MC00



PLAN

GENERAL NOTES

GENERAL NOTE:
ALL PLANT AND EQUIPMENT ACCESS TO THE RIVER TO BE REMOVED AFTER CAST IN-SITU WORKS BY THIS STAGE, ONLY FOOT TRAFFIC FOR WORKERS TO ACCESS SUBSTRUCTURE DURING SUPERSTRUCTURE COMPLETION.
BOOMS TO REMAIN IN PLACE UNTIL SUPERSTRUCTURE COMPLETE

ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH
02	15/06/2023	100% DETAIL DESIGN	JR	DM	CR
01	05/05/2023	80% DETAIL DESIGN	JR	DM	CR

DESIGNER: bk. bridge knowledge. ENGINEERING CONSULTING SERVICES — BRIDGE KNOWLEDGE LTY PTD
CONTRACTOR: COASTAL WORKS — COASTAL WORKS
CLIENT: BELLINGEN SHIRE COUNCIL — BELLINGEN SHIRE COUNCIL

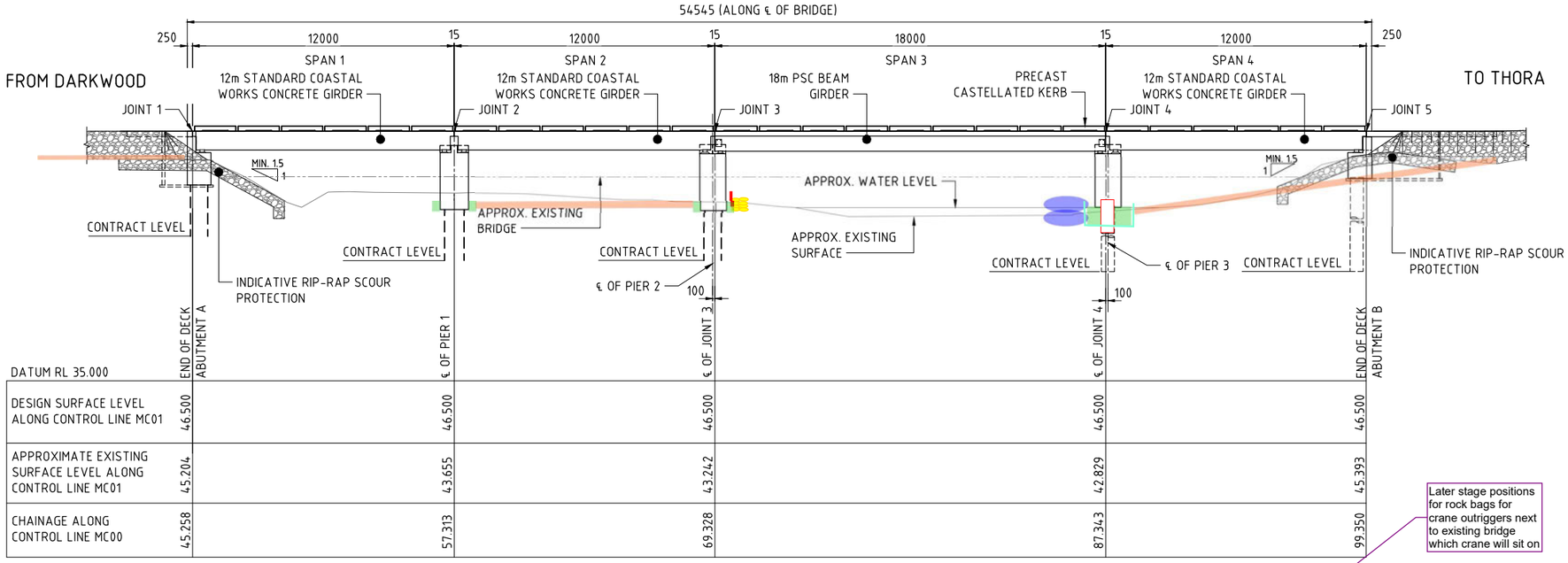
TITLE	PREPARED
DESIGN	YT
DESIGN CHECK	DM
DRAWING	JR
DRAWING CHECK	DM
APPROVED	CR

DARKWOOD ROAD — BELLINGEN SHIRE COUNCIL

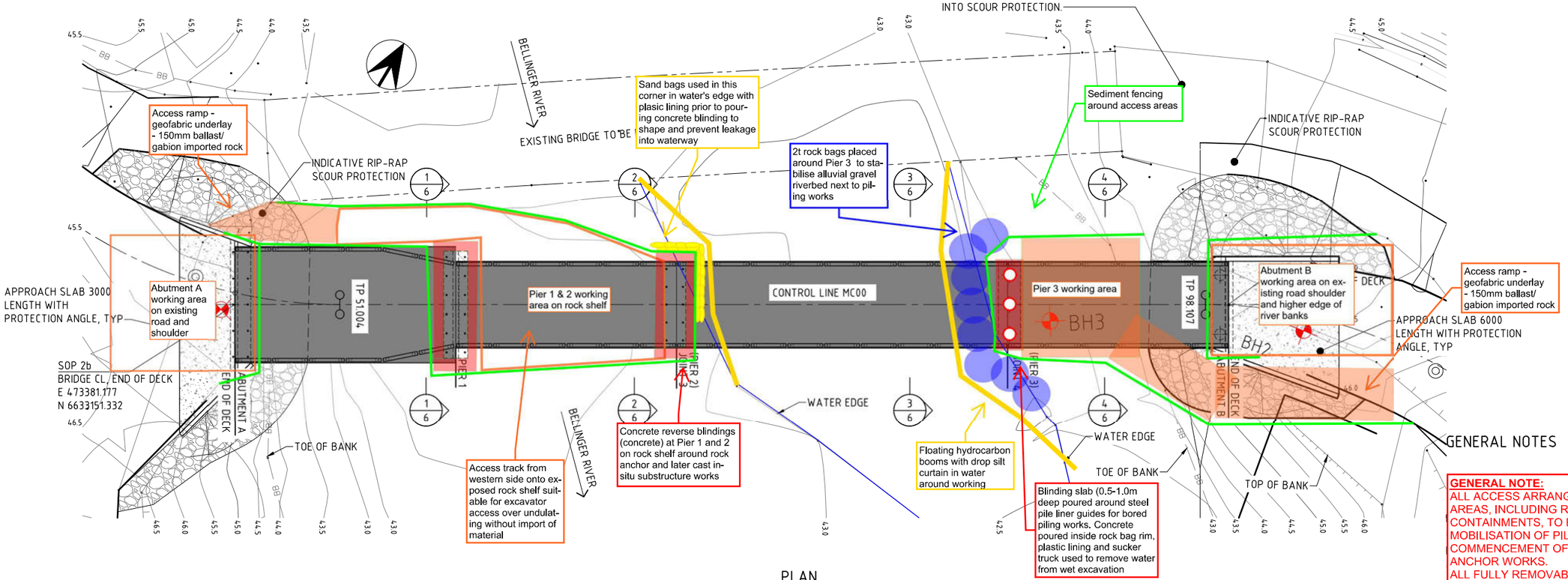
HOBARTS BRIDGE REPLACEMENT OVER BELLINGER RIVER

CRANAGE ACCESS PLAN

DRAWING SET No	BKP397-BSC
BRIDGE No	DRG-005
ISSUE STATUS	DETAIL DESIGN
ISSUE 02	No SHEETS 34	SHEET No 05



ELEVATION - ALONG MC00



PLAN

GENERAL NOTES

GENERAL NOTE:
ALL ACCESS ARRANGEMENTS FOR ALL PILING AREAS, INCLUDING REVERS BLINDING CONTAINMENTS, TO BE IN PLCE PRIOR TO MOBILISATION OF PILING CONTRACTOR AND COMMENCEMENT OF ANY PILING OR ROCK ANCHOR WORKS.
ALL FULLY REMOVABLE - REVERSE BLINDINGS AT PIER 1 & 2 TO BE COMPLETELY REMOVED AFTE COMPLETION OF THE SUBSTRUCTURE.
BLINDING AT PIER 3 TO BE PERMANENT UNDERNEATH THE COMPLETED SUBSTRUCTURE.

ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH
02	15/06/2023	100% DETAIL DESIGN	JR	DM	CR
01	05/05/2023	80% DETAIL DESIGN	JR	DM	CR

DESIGNER: bk. bridge knowledge. ENGINEERING CONSULTING SERVICES — BRIDGE KNOWLEDGE LTY PTD
CONTRACTOR: COASTAL WORKS — COASTAL WORKS
CLIENT: BELLINGEN SHIRE COUNCIL — BELLINGEN SHIRE COUNCIL

TITLE	PREPARED
DESIGN	YT
DESIGN CHECK	DM
DRAWING	JR
DRAWING CHECK	DM
APPROVED	CR

DARKWOOD ROAD — BELLINGEN SHIRE COUNCIL

HOBARTS BRIDGE
REPLACEMENT OVER BELLINGER RIVER

PILING ACCESS PLAN

DRAWING SET No	BKP397-BSC
BRIDGE No	DRG-005
ISSUE STATUS	DETAIL DESIGN
ISSUE	02
No SHEETS	34
SHEET No	05

DARKWOOD ROAD 3 BRIDGES – EXAMPLE CONSTRUCTION METHODOLOGY PHOTOES

Excavator with 2t vibratory unit used to pitch steel pile liners

Excavator mounted pendulum pile boring rig with extendable Kelly bar and access ramps –

Excavator mounted rock anchor drilling setup (7-12t sized machine) with splatter screens used next to waterway

On-site grout mixing station for rock anchors up on banks away from anchors


Same smaller excavator (7t) rock anchor rig

Containment system used for pouring concrete bored piles to prevent concrete overpour entering the waterway


Kibble being used for on-site pours at headstocks near water to control concrete

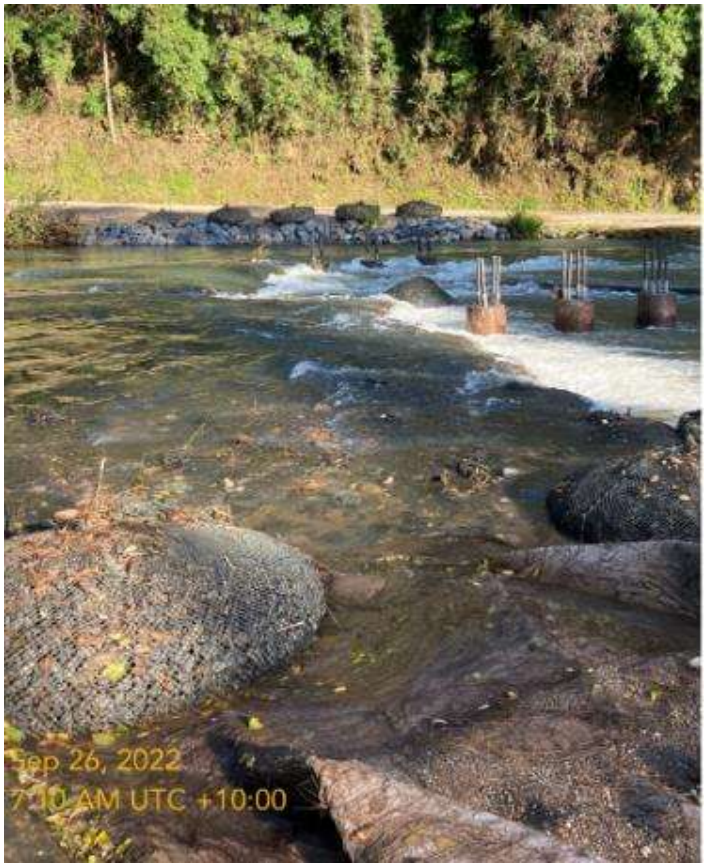
Cast in-situ headstock with elevated temporary works walkway around

Rock bags used as an access track and crane platform for landing precast components

Concrete deck pour with elevated walkway attached to bridge planks

Riverbank access ramp and working area and rock scour protection with excavator

Rock bags used to pin down geofabric with boom adjacent in water

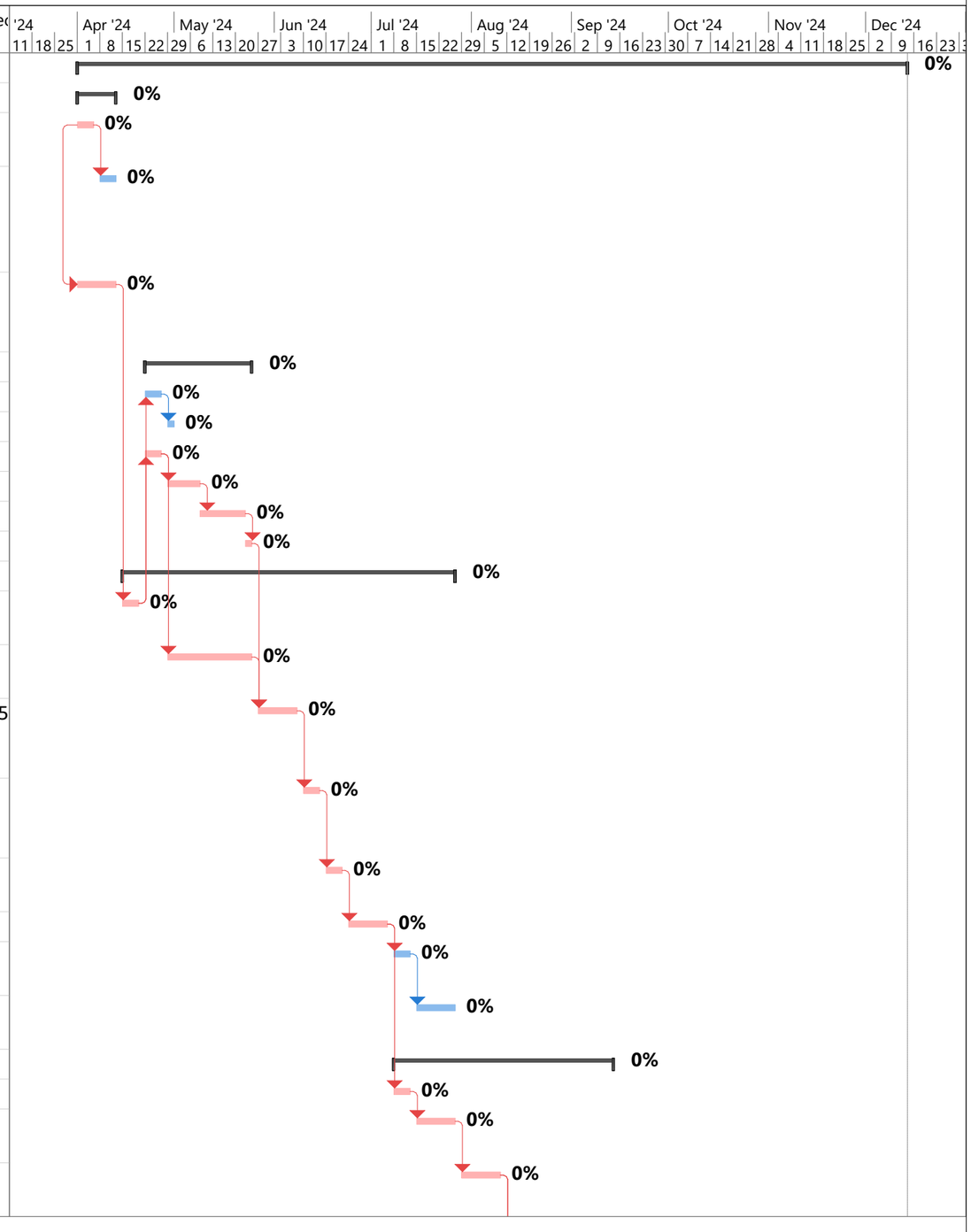


Rock bag access track being overtopped and remaining in place without any material loss during high water flow conditions

Landing precast concrete panels onto steel girder span

2024 Darkwood Bridges Program 5.7.23 - preferred

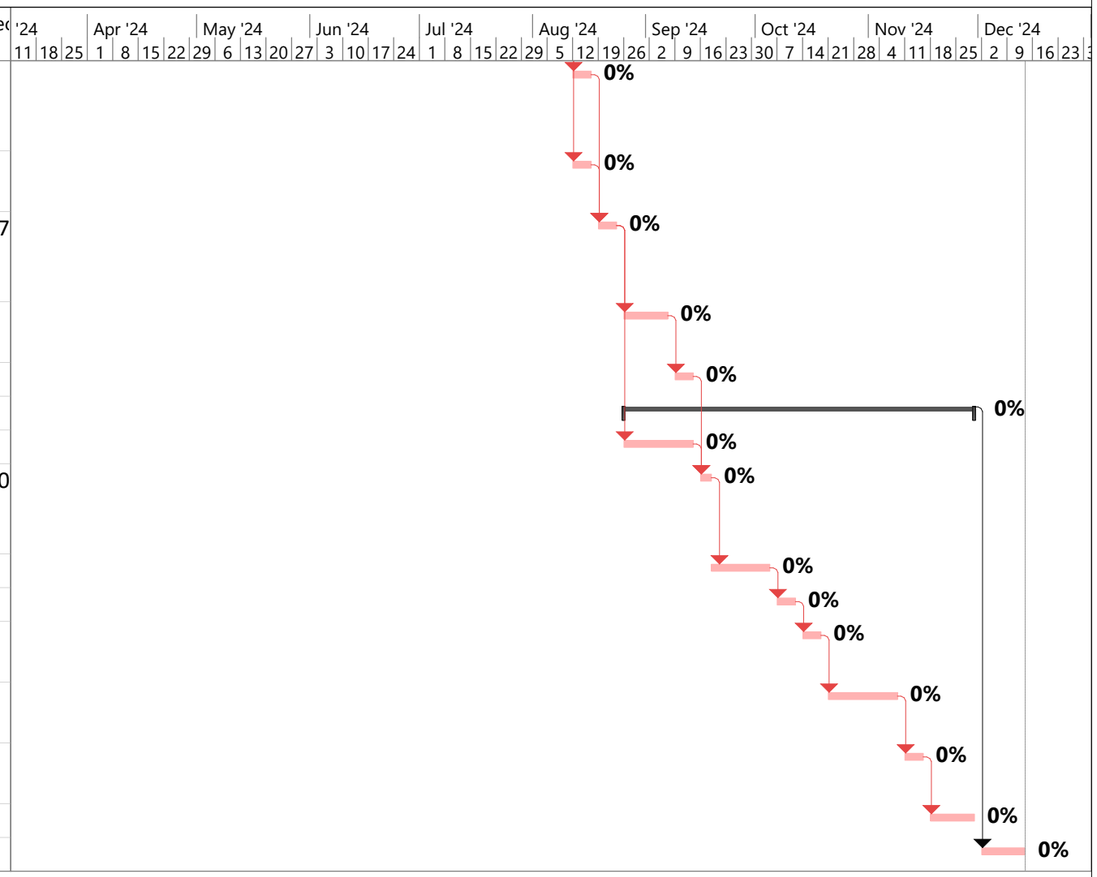
ID	Engineer	Task Name	Duration	Start	Finish	Predec
1	**2024**	**Coastal Works - Darkwood Bridges Program 2024**	**185 days**	**Mon 1/04/24**	**Fri 13/12/24**	
2		**Site Establishment all 3 sites**	**10 days**	**Mon 1/04/24**	**Fri 12/04/24**	
3	Crew 1	Main laydown & compound setup at Hobarts + major material deliveries	5 days	Mon 1/04/24	Fri 5/04/24	
4	Crew 1	ALL 3 SITES - vegetation clearing, piling material deliveries, establish excavator access tracks for river banks, ERSD controls at first pile positions and laydown and spoil areas	5 days	Mon 8/04/24	Fri 12/04/24	3
5	Crew 2	ALL 3 SITES - establish rock bag areas - Hobarts headstock, Joyces west abutment, Justins headstock and floating booms installed	10 days	Mon 1/04/24	Fri 12/04/24	3SS
6		**Piling all 3 sites**	**25 days**	**Mon 22/04/24**	**Fri 24/05/24**	
7	Crew 1	HOBARTS - mob, rock anchors (32) drilled, grouted	5 days	Mon 22/04/24	Fri 26/04/24	14
8	Crew 1	JUSTINS - rock anchors (10) and grouted incl. move	2 days	Mon 29/04/24	Tue 30/04/24	7
9	Crew 2	HOBARTS - mob, bored piles (5), pile reo & concrete pours	5 days	Mon 22/04/24	Fri 26/04/24	14
10	Crew 1	JUSTINS - bored piles (9) and poured, incl mob/demob	8 days	Mon 29/04/24	Wed 8/05/24	9
11	Crew 1	JOYCES - bored piles (16) & remove/stockpile rock bags	10 days	Thu 9/05/24	Wed 22/05/24	10
12	Crew 1	Contingency - days between to keep up, wet weather	2 days	Thu 23/05/24	Fri 24/05/24	11
13		**Hobarts Bridge (BSC)**	**75 days**	**Mon 15/04/24**	**Fri 26/07/24**	
14	Crew 2	Prepare all pile locations - box outs, blindings, ERSD controls, rock anchor bunds	5 days	Mon 15/04/24	Fri 19/04/24	5
15	Crew 2	Cast in-situ headstocks and abutments (during remaining piling works)	20 days	Mon 29/04/24	Fri 24/05/24	9
16	Both Crews	Cast in-situ headstocks and abutments completed both crews incl. scour rock in front of abutments and mortar pads	10 days	Mon 27/05/24	Fri 7/06/24	12,15
17	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove access tracks into creek, crane pads and landing prep	5 days	Mon 10/06/24	Fri 14/06/24	16
18	Both Crews	Land beams (2 days) & CoastalWorks beams stitch pours (3 days)	5 days	Mon 17/06/24	Fri 21/06/24	17
19	Both Crews	Plank span deck pour & approach slabs	10 days	Mon 24/06/24	Fri 5/07/24	18
20	Crew 2	Road works on approaches, swap traffic over, install kerbs and brackets	5 days	Mon 8/07/24	Fri 12/07/24	19
21	Crew 2	Demolition, final rock scour, full restoration, pack up & contingency	10 days	Mon 15/07/24	Fri 26/07/24	20
22		**Justins Bridge**	**50 days**	**Mon 8/07/24**	**Fri 13/09/24**	
23	Crew 1	Relocate compound from Hobarts, ERSD controls etc.	5 days	Mon 8/07/24	Fri 12/07/24	19
24	Crew 1	Cast in-situ headstocks and abutments (3) incl. elevated temporary support for headstock at start	10 days	Mon 15/07/24	Fri 26/07/24	23
25	Both Crews	Cast in-situ headstocks and abutments incl. scour rock in front of abutments	10 days	Mon 29/07/24	Fri 9/08/24	24



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

2024 Darkwood Bridges Program 5.7.23 - preferred

ID	Engineer	Task Name	Duration	Start	Finish	Predec
26	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove rock bags area, crane pads and landing prep	5 days	Mon 12/08/24	Fri 16/08/24	25
27	Both Crews	Steel girders deliverd and put together with franna on west side	5 days	Mon 12/08/24	Fri 16/08/24	25
28	Both Crews	Land beams and deck panels (2 days) & CoastalWorks beams stitch pour & complete steel girder deck bolting and grouting	5 days	Mon 19/08/24	Fri 23/08/24	26,27
29	Crew 1	Road works on approaches, install kerbs and brackets, swap traffic over	10 days	Mon 26/08/24	Fri 6/09/24	28
30	Crew 1	Demolition, final rock scour, full restoration, pack up	5 days	Mon 9/09/24	Fri 13/09/24	29
31		**Joyces Bridge**	**70 days**	**Mon 26/08/24**	**Fri 29/11/24**	
32	Crew 2	Precast 3x Joyces headstocks (CoastalWorks Precast Yard)	15 days	Mon 26/08/24	Fri 13/09/24	28
33	Both Crews	Relocate compound from Justins, re-install rock bag access for personnel access to headstocks only & crane pads	3 days	Mon 16/09/24	Wed 18/09/24	32,30
34	Both Crews	Cast in-situ abutments and bearing pads	12 days	Thu 19/09/24	Fri 4/10/24	33
35	Both Crews	Scour rock protection, approaches general fill	5 days	Mon 7/10/24	Fri 11/10/24	34
36	Both Crews	Land beams (2 days) & Coatalworks beams stitch pours (3 days)	5 days	Mon 14/10/24	Fri 18/10/24	35
37	Both Crews	Plank spans (2) deck pours & approach slabs & install kerb units	15 days	Mon 21/10/24	Fri 8/11/24	36
38	Both Crews	Road works on approaches, swap traffic over, install kerbs	5 days	Mon 11/11/24	Fri 15/11/24	37
39	Both Crews	Demolition, final rock scour, full restoration and pack up	10 days	Mon 18/11/24	Fri 29/11/24	38
40		**Contingency / wet weather**	**10 days**	**Mon 2/12/24**	**Fri 13/12/24**	**31**



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

DARKWOOD 2024 PROGRAM NOTES

Coastal Works intend to undertake the 3 Darkwood Road bridges – Hobarts, Joyces, Justins – as a single program of works commencing in April 2024 to December 2024. Preferred program utilises a typical rock anchor installation small excavator rig with air drilling. Below outlines some of the key dates for the construction sequence:

Site Establishment – April 2024
- Main compound and laydown set up at Hobarts.
- Laydown and piling material deliveries at all 3 bridges.
- Vegetation clearing complete at all 3 bridges
- Establish access points down banks and first piling position at all 3 sites with rock bag setups – 1x headstock at Hobarts, western headstock at Joyces, headstock at Justins.
- Establish all piling positions at Hobarts
- Install erosion and sed controls at all 3 bridges for laydown and piling positions

Piling All 3 bridges – April to June 2024
- Start at Hobarts with the two piling setups concurrently, one 7t excavator rock anchor setup and one 24t excavator for bored piles – aim for completion all in 1 week
- Both setups to move onto Justins Bridge – rock anchor completed in 3 days and setup demobilised from site, bored piles continue – 1.5 weeks
- Bored piling setup moves onto Joyces bridge last, first at previously established western side access which is then removed and established on the east side for completion – 2 weeks
- Coastal Works crews with an excavator to follow the piling crews to manage laydowns, modify the access requirements, remove piling spoil and maintain and adjust environmental controls.
- Coastal Works crew complete the bored pile pours progressively along with the contractor
- Justins site rock bags to remain at headstock to remain, Joyces river access completely removed.

Hobarts Main Bridge Construction – May – August 2024
- Cast in-situ substructure works (6 weeks) to commence in May with one CoastalWorks crew once all piling is completed and piling is continuing at the other sites.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in June.
- Superstructure to be landed, poured, and completed in July with both crews.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in late July and into August.

Justins Main Bridge Construction – July – September 2024
- Relocate main compound setup from Hobarts to Justins in late July once the Hobarts superstructure is completed with second CoastalWorks crew.
- Cast in-situ substructure works (4 weeks) to commence in August with one CoastalWorks crew and completed by both crews once Hobarts is completed.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in late August.
- Superstructure to be landed, poured, and completed in early September.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in September.

Joyces Main Bridge Construction – July – September 2024
- While Justins being finished, 3x precast headstocks made with second crew at Precast Yard.
- Relocate main compound setup from Justins to Joyces in October and reinstate rock bag access to the headstocks for personnel only and crane pads positions for landing precast components.
- Cast in-situ abutments (2 weeks) to be completed in October with both crews.
- Scour rock at abutments placed and abutment backfill completed in late October.
- Superstructure to be landed, poured, and completed by mid-November with both crews.
- Remove rock bags and bank access and complete the roadworks, remaining scour rock protection, demolition, and restoration in late November and December.

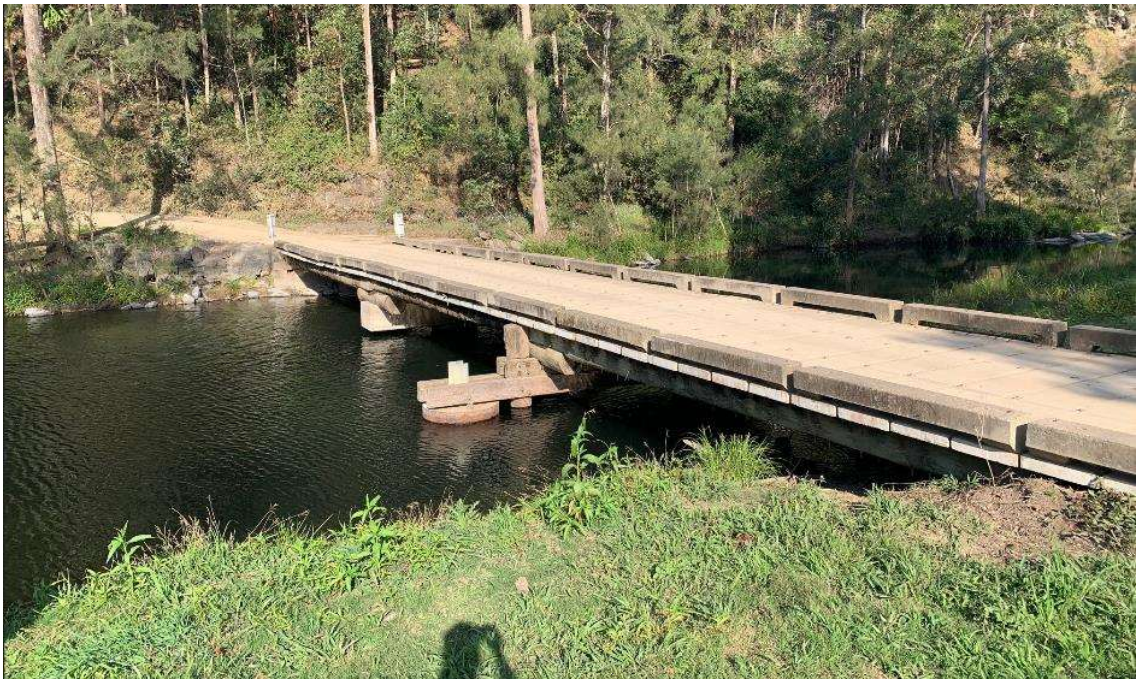
Appendix E

Justins Bridge Design and Construction Methodology

JUSTINS BRIDGE REPLACEMENT

Project Description

Coastal Works are replacing Justins Bridge over the Bellinger River on Darkwood Road, Darkwood under contract works for Bellingen Shire Council. The existing 32m four span, timber bridge will be removed and replaced adjacent with a new 32m two span, concrete and steel bridge on a raised alignment downstream. The site is located approx. 35km west of Bellingen, is highly flood prone and is in key habitat for the Bellinger River Snapping Turtle.



Existing Timber Bridge

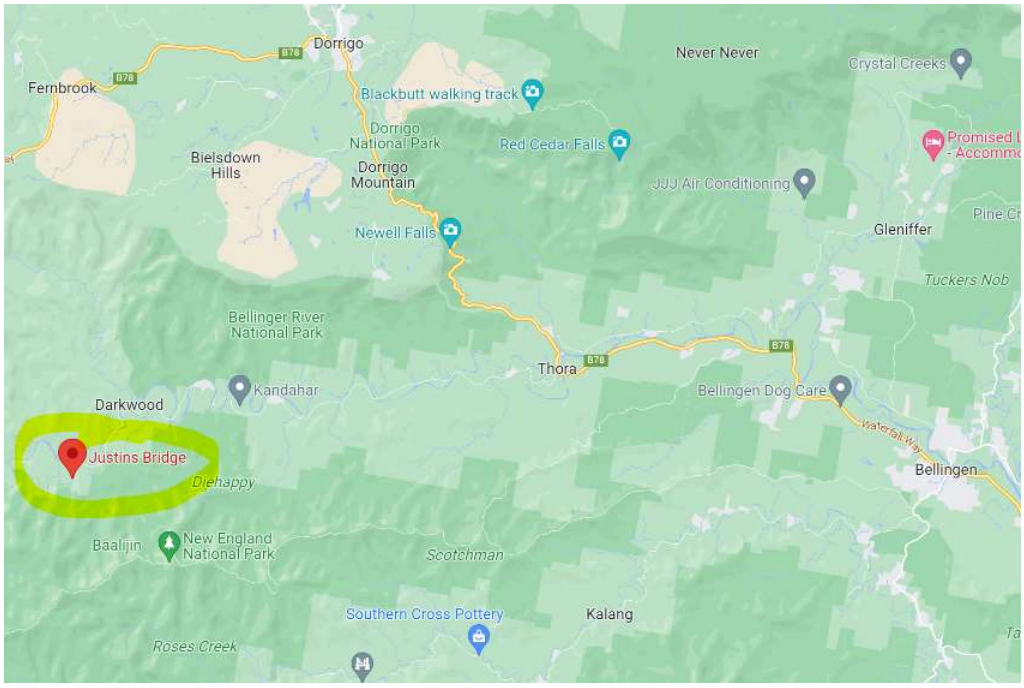
Form of Construction

Foundations – bored, cast in-situ concrete piles (600mm diameter) at one abutment and one headstock, rock anchors at the other abutment into high level rock

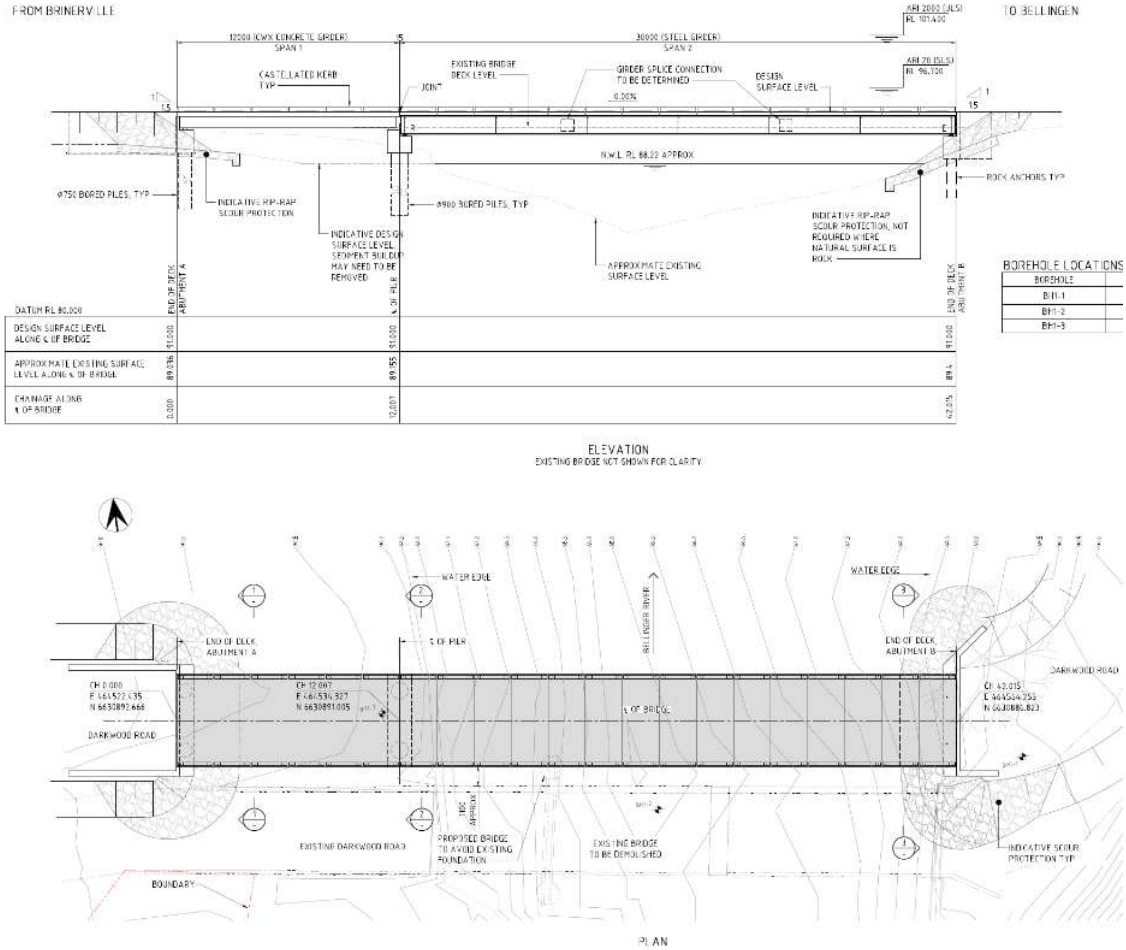
Substructure – cast in-situ reinforced concrete abutments and headstocks poured direct onto existing ground levels on top of piles including direct onto foundation rock at the rock anchor abutment, rock scour protection on banks and around abutments

Superstructure – one span is precast concrete CoastalWorks 12m bridge beams, one span is 30m long over the low flow area over the creek using spliced steel girders with CoastalWorks precast concrete deck panels, bolt on concrete kerbs

Road approaches – 20-30m of road works each side to tie into existing road, two coat bitumen seal, 6m wide plus fill formation formations, open swale drains



Location Map



New Bridge Design

Construction Methodology & Sequence

1) Establishment:
    a. Set up compound, laydown and stockpile areas in the Darkwood Road shoulder and private property paddock on the eastern approach off the road and above the high flood level,
    b. Survey setout of boundaries, piling and vegetation no go zones.
    c. Installation of erosion and sediment controls for piling areas including booms in the water.
    d. Delivery of all piling materials.
    e. Delivery of pre-filled rock bags.
    f. Establish bunded concrete washout and spoil areas at laydown area.

2) Access to and establishment of piling areas:
    a. Clear and grub surface vegetation and topsoil from the three piling locations, stockpile away from river for later rehabilitation works or remove from site.
    b. At Abutment B (east side, rock anchors), excavators can sit in existing road shoulder behind the abutment. Box out with 14t excavator to expose rock.
    c. At Abutment A (west side), no access establishment required, box out with 14t excavator down to pile cutoff level.
    d. At Headstock, no access ramp required, existing riverbanks will be stable enough for tracked machinery access and are to be re-profiled at the end of works. Keep access paths next to abutment and in between headstock and Abutment A. Place rock bags along river side of the piling set to stabilise banks and provide additional containment, pull floating boom tight to water line at rock bags. Minor box out to piles (<0.5m) and provide sediment fencing along inside of rock bags.
    e. Should any areas for excavator positioning become unstable or present unanticipated risk for becoming churned up, establish access platform with geofabric underlay and 150mm clean imported ballast and/or gabion rock with extra length of geofabric on the upstream side that can be used to wrap over and pinned down with rock bags during high flow events to prevent wash out.

3) Rock anchor works:
    a. Plant & equipment – 7t-10t excavator with a specialist air drilling attachment with Down Hole Hammer (DHH) and on-site grout mixing station. DHH option keeps noise and vibration down the hole rather than an above ground hammer which is much noisier above.
    b. Install 2m high spray screens, using geofabric or ply, on 3 sides of the rock anchor area to deflect any natural rock spray from entering the water.
    c. Grout mixing station to be on the eastern existing road immediately next to Abutment B works with minimal grout tube run. Bund the area from overspill and grout hoses to the rock anchor working area to be plastic wrapped.
    d. Box out will be sufficient to contain flushing of the rock anchor holes (water and rock sediment) and for containing grout overpour. These can be removed by sucker truck at end of works to tidy area ready for cast in-situ works.

4) Bored piling works:
    a. Plant & equipment – 30t excavator with a 2t vibratory head attachment and pendulum drill head with Kelly bar for the auger.

b. Vibratory head used to install permanent mild steel liners in position first at all 9 pile positions for western structures.
c. Use pendulum auger to bore out inside each with required rock sockets.
d. Pile clean-out material placed either directly in a skip bin or on a geofabrics lined area adjacent the piling area so it can be removed from the riverbed area to the established stockpile area (or off site) daily.
e. After piles are cleared, place cages and pour concrete with concrete boom pump up at existing road level on the western approach for both headstock and western abutment. Sucker truck to remove water from the wet pile holes during concrete placement.
f. Concrete overpour out of top of piles (typically 0.2m3 per pile) to be contained within the box out areas and become a blinding slab for cast in-situ works.

5) Cast in-situ concrete sub-structure:
   a. Reinforcement placed and tied in place by hand on blinding slabs.
   b. Ply formwork shutters pre-made and placed with excavator using the same access points used during piling. Personnel access to all from ground level.
   c. Elevated walkway required for taller abutments up to the top of concrete which will all cantilever off the formwork and not require additional footprint.
   d. Concrete boom pump to be positioned outside of the riverbed on the existing road approaches to pour all substructure works. Pump and concrete trucks to be brought to the respective sides of the river for pours so the boom line is not over the waterway at any time. Concrete washout to either be off site or in established area up at the compound for later removal from site. Flowable high slump concrete mix used to minimise any risk of line blockages/breaks.
   e. Complete mortar pads by hand mixed mortar to finish all substructures and strip all formwork and elevated access platforms.

6) Fully remove piling temporary working areas and establish western crane position – excavator to progressively remove rock bags, any imported ramp materials (if needed) and geofrabirc underlay working away from the western water's edge. All imported rock to be re-used for road backfill. Reposition rock bags for a crane pad on the downstream side of Abutment A.

7) Cut and re-profile higher bank materials under the shorter western span – excavator to box out materials down to 200mm above the water ripple line from the existing western water line to the western abutment. Place direct into tipper trucks to remove from site.

8) Place scour rock around abutments – place geofabric underlay first and use only clean imported quarry rock. No access for trucks inside high banks, tip adjacent and behind abutments in manageable quantities for placement by 14t excavator.

9) Land all precast concrete beams, steel girders and precast deck panels – semis to deliver beams to western side, all beams and girders lifted in by crane on western side as well as half the steel girder span deck panels. Remaining deck panels placed by Franna crane progressively to Abutment B. Bolting down of panels all to be done from deck level, no scaffold required.

10) Pour 12m beam stitch pour – sealed formwork to be used between CoastalWorks planks to prevent concrete leakage into the waterway using FC sheeting, silicone and backing rod. Boom pump to used from western side again without putting the line over the waterway.

11) Complete approach roadworks – all imported, clean quarry materials (select fill, DGS, DGB) and 14/7 spray seal to finish. Swap traffic over to new bridge once completed.

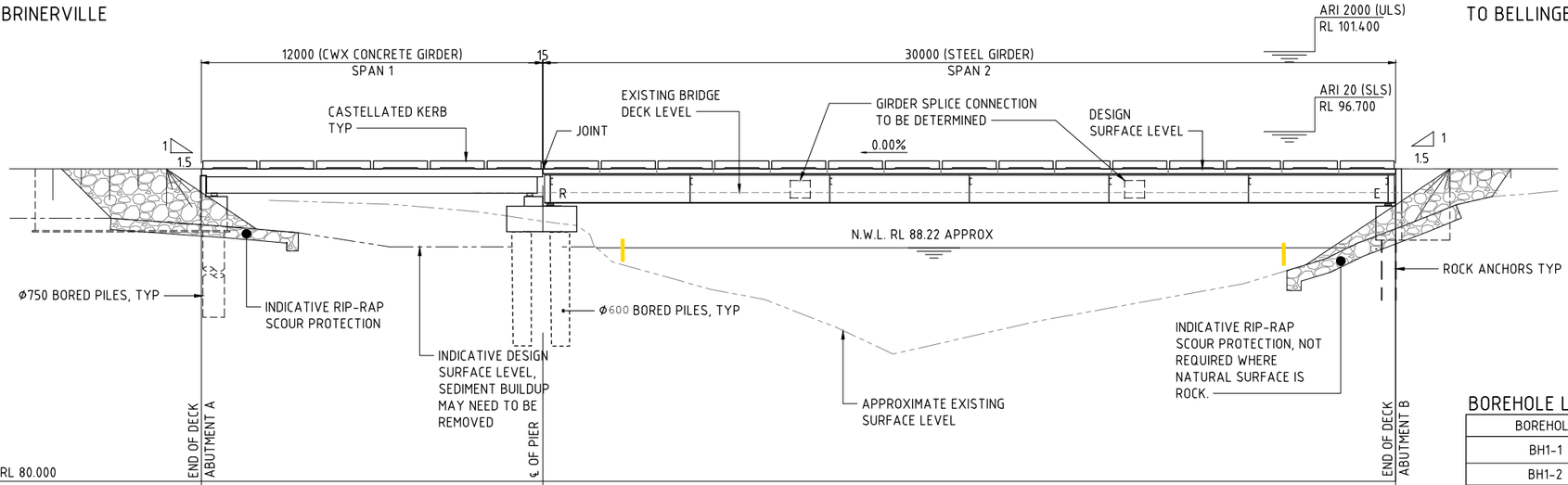
12) Demolish original bridge:
    a. Plant and equipment – 14t or 24t excavator with 360 degree rotating grab attachment, oxy torch for cutting bolts and chainsaw for cutting timbers, Franna crane for lifting concrete deck panels.
    b. Remove deck spans one by one starting out in the middle and working back to each abutment, removing concrete deck panels direct onto transport and timber girders for each span. No access off deck or in high banks required.
    c. For in-stream headstocks, install floating scaffold platforms out from each bank. Remove timber components of headstocks using chainsaw and protruding steel components with an oxy torch from platforms, removing all cut off items from the waterway. Concrete headstocks and piles to remain.
    d. Divers to be used with underwater chainsaws to remove timber piles. Floating barrels first attached to the timber before cutting and roped to the banks for full removal.
    e. For abutments and existing western headstock outside the water area, use rock breaker on excavator to break up concrete footings and then remove in largest possible pieces by excavator and by hand down to ground level.
    f. All bridge timbers to be loaded directly onto trucks for load out directly to waste disposal facility on a daily basis, no mass stockpiling on site

13) Complete rock scour protection – on upstream side of abutments and banks to tie in with where the existing bridge that was demolished and edge of road formation.

14) Demobilise construction activities – rehabilitate site with plantings and seeding disturbed areas, install temporary final erosion and sediment controls to remain in place for 3 months or until established.

FROM BRINERVILLE

TO BELLINGEN



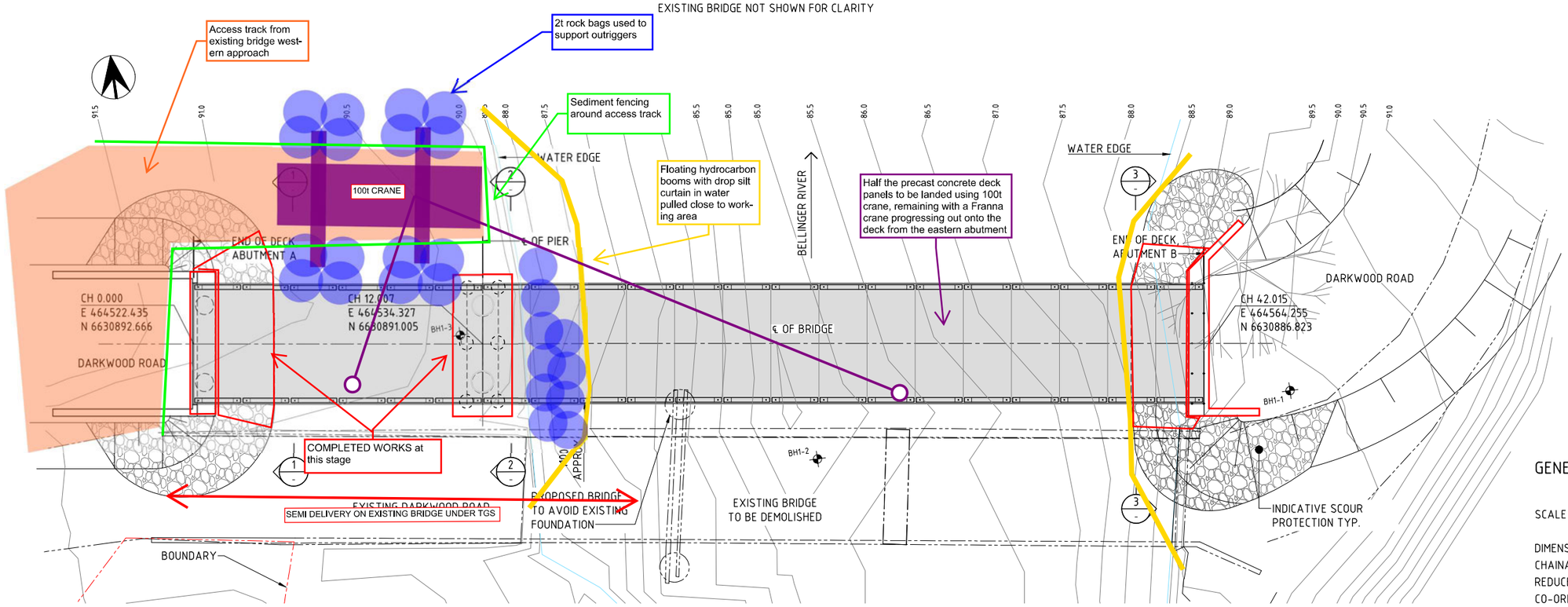
DATUM RL 80.000	END OF DECK ABUTMENT A	℄ OF PIER	END OF DECK ABUTMENT B
DESIGN SURFACE LEVEL ALONG ℄ OF BRIDGE	91.000	91.000	91.000
APPROXIMATE EXISTING SURFACE LEVEL ALONG ℄ OF BRIDGE	89.036	89.155	89.4
CHAINAGE ALONG ℄ OF BRIDGE	0.000	12.007	42.015

BOREHOLE LOCATIONS

BOREHOLE	EASTING	NORTHING	RL
BH1-1	464567	6630884	89.8
BH1-2	464547	6630884	84.8
BH1-3	464533	6630891	89.3

ELEVATION

EXISTING BRIDGE NOT SHOWN FOR CLARITY



PLAN

GENERAL NOTES

SCALE 1 0 1 2 3 4 5m OR AS SHOWN.

DIMENSION IN MILLIMETERS.
CHAINAGES AND REDUCED LEVELS ARE IN METERS.
REDUCED LEVELS ARE TO THE AUSTRALIAN HEIGHT DATUM.
CO-ORDINATES ARE TO MGA ZONE 56.
DENOTES BOREHOLE LOCATION (APPROXIMATE).

NOT FOR CONSTRUCTION

ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH
02	29/05/2023	CONCEPT DESIGN	JR	DM	CR
01	25/05/2023	CONCEPT DESIGN	JR	DM	CR

THIS DRAWING IS CONFIDENTIAL AND SHALL ONLY BE USED FOR THE PURPOSE OF THE NOMINATED PROJECT

	PREPARED	CHECKED
DESIGN	D. MERRIKIN	C. RILEY
DRAWING	J. REN	D. MERRIKIN

PREPARED BY
bk. bridge knowledge. ENGINEERING CONSULTING SERVICES
DANIEL MERRIKIN
STRUCTURAL ENGINEER

BELLINGEN SHIRE COUNCIL
BELLINGEN SHIRE COUNCIL

DARKWOOD ROAD ADELE HOUSE

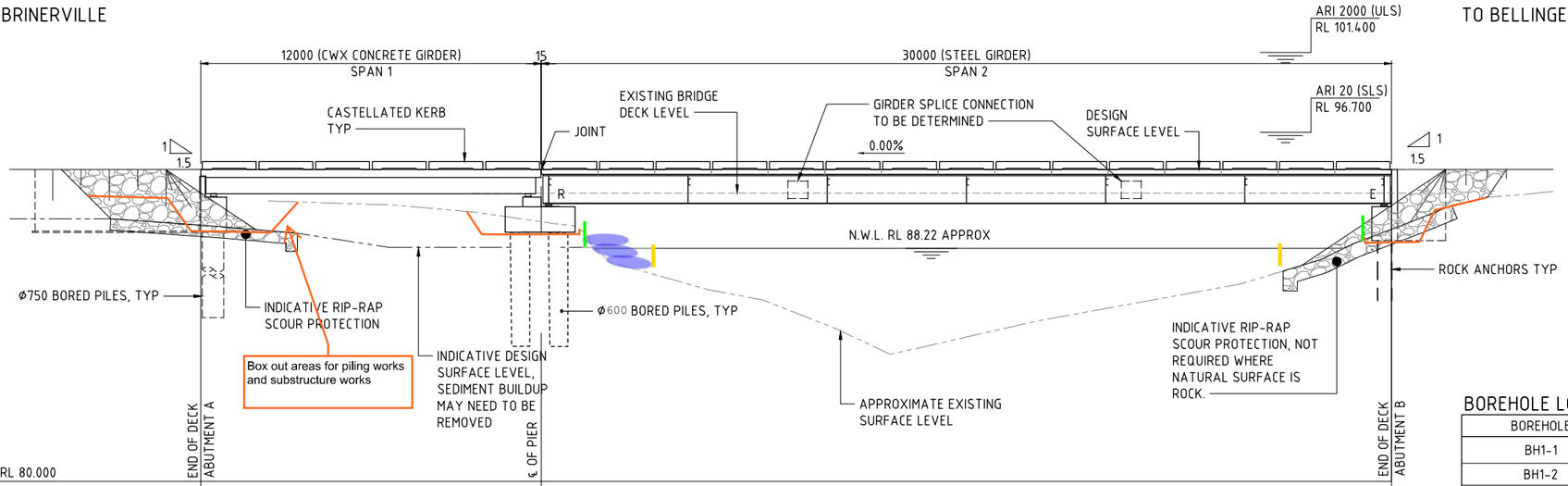
CONCEPT REDESIGN
FIXING COUNTRY BRIDGE PROGRAM
JUSTINS BRIDGE

CRANAGE ACCESS PLAN

DRAWING SET No	BKP414-BR104
DRAWING No	BR104-DRG-02
ISSUE STATUS	CONCEPT DESIGN
ISSUE 2	No SHEETS 3	SHEET No 02

FROM BRINERVILLE

TO BELLINGEN



DATUM RL 80.000	END OF DECK ABUTMENT A	℄ OF PIER	END OF DECK ABUTMENT B
DESIGN SURFACE LEVEL ALONG ℄ OF BRIDGE	91.000	91.000	91.000
APPROXIMATE EXISTING SURFACE LEVEL ALONG ℄ OF BRIDGE	89.036	89.155	89.4
CHAINAGE ALONG ℄ OF BRIDGE	0.000	12.007	42.015

ELEVATION

EXISTING BRIDGE NOT SHOWN FOR CLARITY

BOREHOLE LOCATIONS

BOREHOLE	EASTING	NORTHING	RL
BH1-1	464567	6630884	89.8
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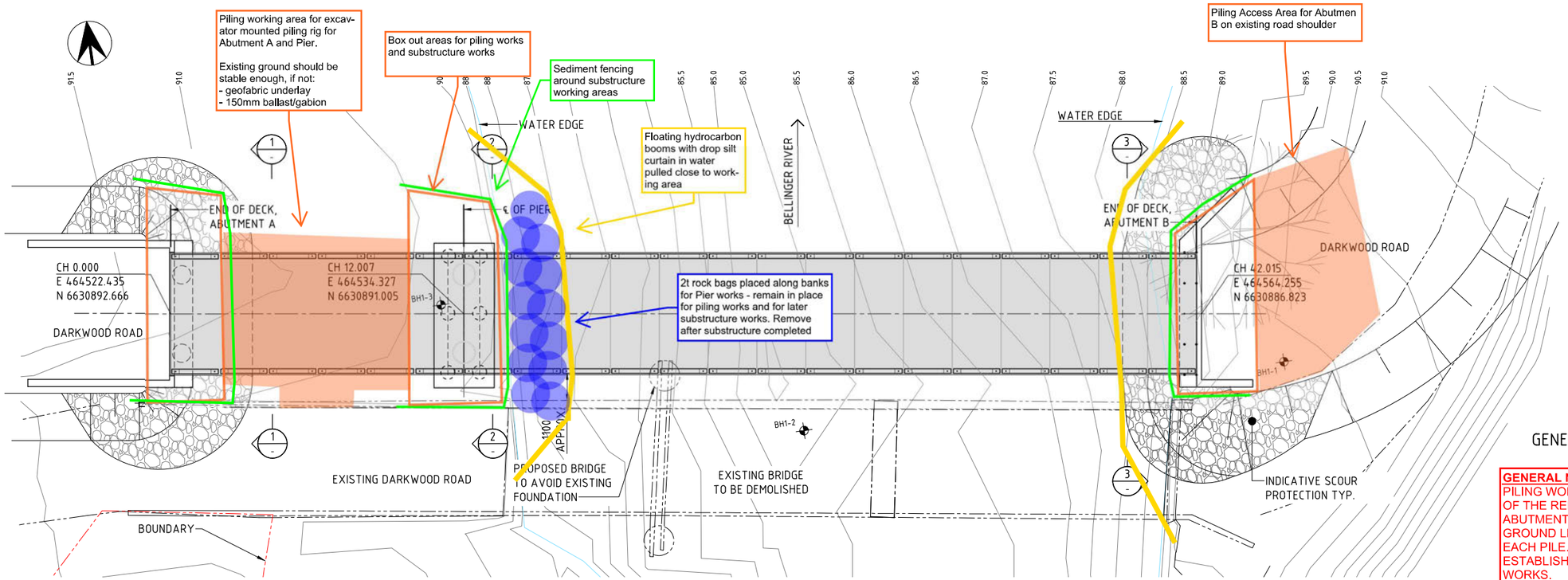

PLAN

GENERAL NOTES

GENERAL NOTE:
PILING WORKS TO OCCUR PRIOR TO PROGRESSION OF THE REMAINING STRUCTURE. BORED PILING AT ABUTMENT A AND PIER TO BE FROM EXISTING GROUND LEVEL A LIMIT TO SMALL BOX OUT LOCAL TO EACH PILE. CAP AND BACKFILL PILES UNTIL RE-ESTABLISHMENT AND PROGRESSION OF CAST IN-SITU WORKS.
ROCK BAGS TO REMAIN IN PLACE ALONG BANK EDGE FOR ONGOING STABILITY IN TIME PERIOD BETWEEN PILING AND CAST IN-SITU WORKS

ISSUE	DATE	AMENDMENT DESCRIPTION	PREP	CHECK	AUTH
02	29/05/2023	CONCEPT DESIGN	JR	DM	CR
01	25/05/2023	CONCEPT DESIGN	JR	DM	CR

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	PREPARED	CHECKED
DESIGN	D. MERRIKIN	C. RILEY
DRAWING	J. REN	D. MERRIKIN

PREPARED BY
bk. bridge knowledge. ENGINEERING CONSULTING SERVICES
DANIEL MERRIKIN
STRUCTURAL ENGINEER

BELLINGEN SHIRE COUNCIL
BELLINGEN SHIRE COUNCIL

DARKWOOD ROAD ADELE HOUSE

CONCEPT REDESIGN
FIXING COUNTRY BRIDGE PROGRAM
JUSTINS BRIDGE

PILING ACCESS PLAN

DRAWING SET No	BKP414-BR104
DRAWING No	BR104-DRG-02
ISSUE STATUS	CONCEPT DESIGN
ISSUE 2	No SHEETS 3	SHEET No 02

DARKWOOD ROAD 3 BRIDGES – EXAMPLE CONSTRUCTION METHODOLOGY PHOTOES

Excavator with 2t vibratory unit used to pitch steel pile liners

Excavator mounted pendulum pile boring rig with extendable Kelly bar and access ramps –

Excavator mounted rock anchor drilling setup (7-12t sized machine) with splatter screens used next to waterway

On-site grout mixing station for rock anchors up on banks away from anchors


Same smaller excavator (7t) rock anchor rig

Containment system used for pouring concrete bored piles to prevent concrete overpour entering the waterway


Kibble being used for on-site pours at headstocks near water to control concrete

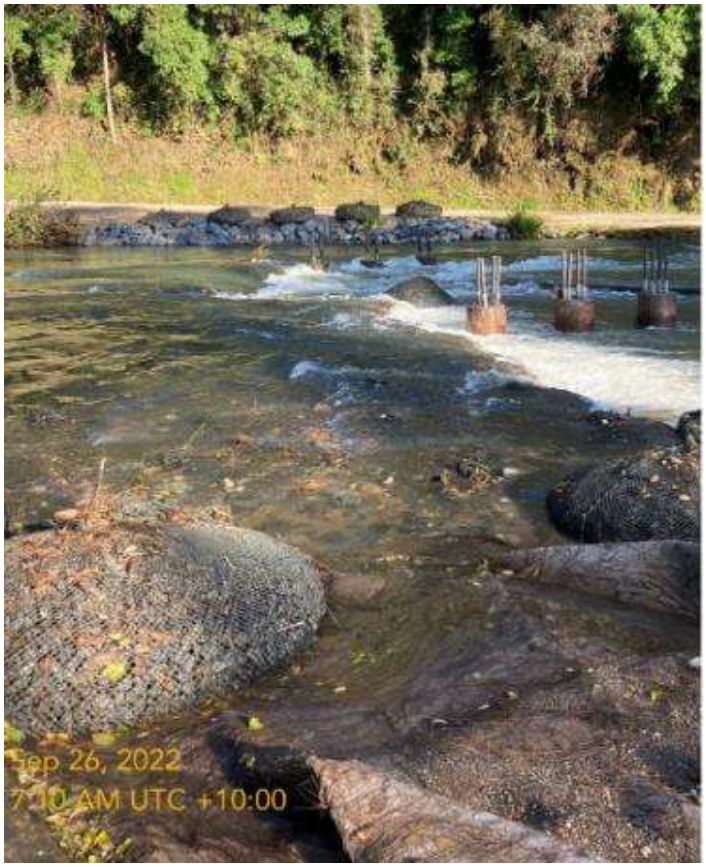
Cast in-situ headstock with elevated temporary works walkway around

Rock bags used as an access track and crane platform for landing precast components

Concrete deck pour with elevated walkway attached to bridge planks

Riverbank access ramp and working area and rock scour protection with excavator

Rock bags used to pin down geofabric with boom adjacent in water

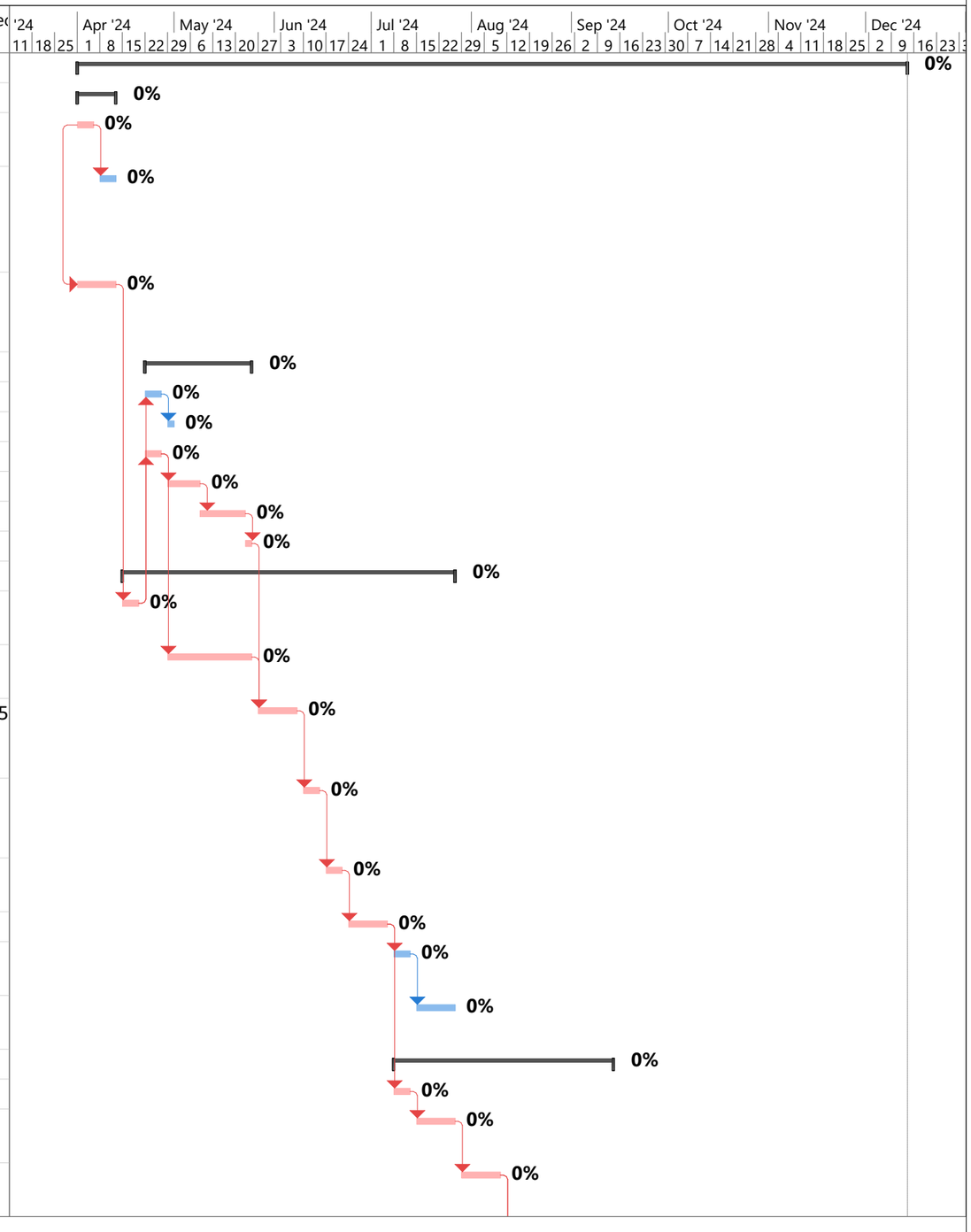


Rock bag access track being overtopped and remaining in place without any material loss during high water flow conditions

Landing precast concrete panels onto steel girder span

2024 Darkwood Bridges Program 5.7.23 - preferred

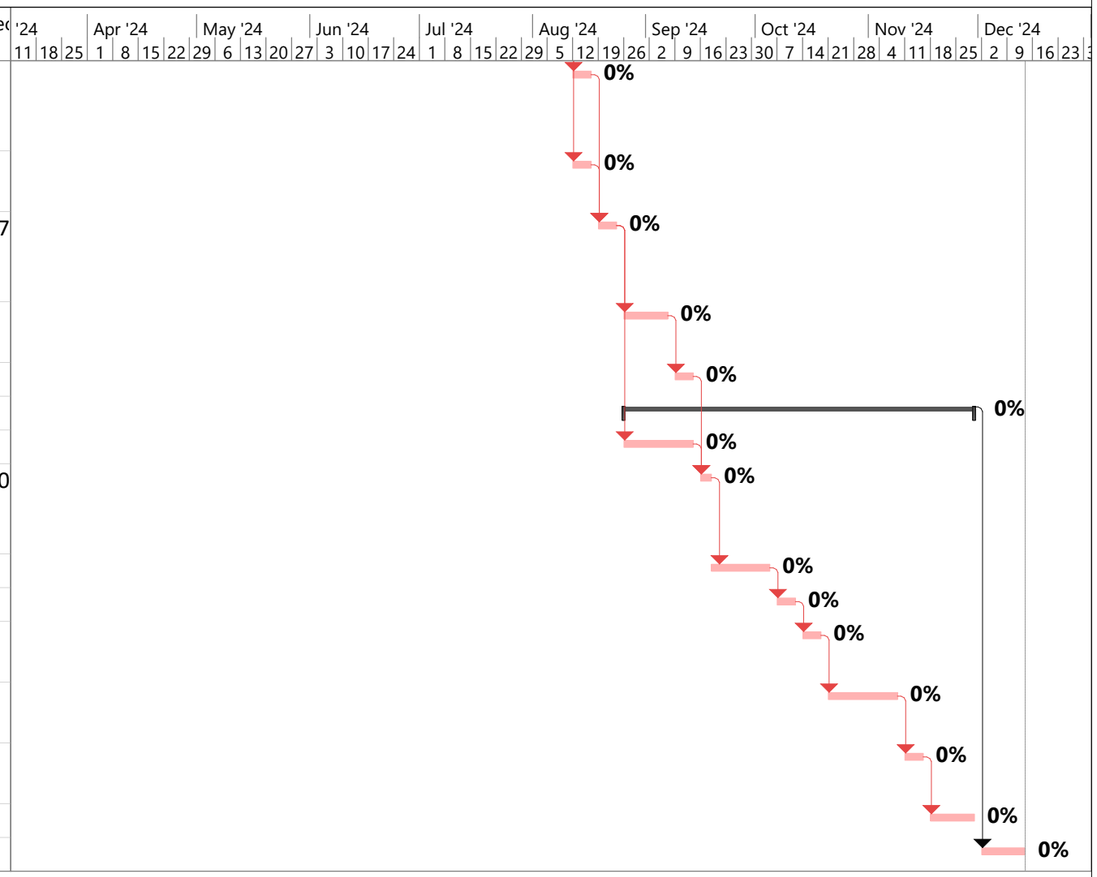
ID	Engineer	Task Name	Duration	Start	Finish	Predec
1	**2024**	**Coastal Works - Darkwood Bridges Program 2024**	**185 days**	**Mon 1/04/24**	**Fri 13/12/24**	
2		**Site Establishment all 3 sites**	**10 days**	**Mon 1/04/24**	**Fri 12/04/24**	
3	Crew 1	Main laydown & compound setup at Hobarts + major material deliveries	5 days	Mon 1/04/24	Fri 5/04/24	
4	Crew 1	ALL 3 SITES - vegetation clearing, piling material deliveries, establish excavator access tracks for river banks, ERSD controls at first pile positions and laydown and spoil areas	5 days	Mon 8/04/24	Fri 12/04/24	3
5	Crew 2	ALL 3 SITES - establish rock bag areas - Hobarts headstock, Joyces west abutment, Justins headstock and floating booms installed	10 days	Mon 1/04/24	Fri 12/04/24	3SS
6		**Piling all 3 sites**	**25 days**	**Mon 22/04/24**	**Fri 24/05/24**	
7	Crew 1	HOBARTS - mob, rock anchors (32) drilled, grouted	5 days	Mon 22/04/24	Fri 26/04/24	14
8	Crew 1	JUSTINS - rock anchors (10) and grouted incl. move	2 days	Mon 29/04/24	Tue 30/04/24	7
9	Crew 2	HOBARTS - mob, bored piles (5), pile reo & concrete pours	5 days	Mon 22/04/24	Fri 26/04/24	14
10	Crew 1	JUSTINS - bored piles (9) and poured, incl mob/demob	8 days	Mon 29/04/24	Wed 8/05/24	9
11	Crew 1	JOYCES - bored piles (16) & remove/stockpile rock bags	10 days	Thu 9/05/24	Wed 22/05/24	10
12	Crew 1	Contingency - days between to keep up, wet weather	2 days	Thu 23/05/24	Fri 24/05/24	11
13		**Hobarts Bridge (BSC)**	**75 days**	**Mon 15/04/24**	**Fri 26/07/24**	
14	Crew 2	Prepare all pile locations - box outs, blindings, ERSD controls, rock anchor bunds	5 days	Mon 15/04/24	Fri 19/04/24	5
15	Crew 2	Cast in-situ headstocks and abutments (during remaining piling works)	20 days	Mon 29/04/24	Fri 24/05/24	9
16	Both Crews	Cast in-situ headstocks and abutments completed both crews incl. scour rock in front of abutments and mortar pads	10 days	Mon 27/05/24	Fri 7/06/24	12,15
17	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove access tracks into creek, crane pads and landing prep	5 days	Mon 10/06/24	Fri 14/06/24	16
18	Both Crews	Land beams (2 days) & CoastalWorks beams stitch pours (3 days)	5 days	Mon 17/06/24	Fri 21/06/24	17
19	Both Crews	Plank span deck pour & approach slabs	10 days	Mon 24/06/24	Fri 5/07/24	18
20	Crew 2	Road works on approaches, swap traffic over, install kerbs and brackets	5 days	Mon 8/07/24	Fri 12/07/24	19
21	Crew 2	Demolition, final rock scour, full restoration, pack up & contingency	10 days	Mon 15/07/24	Fri 26/07/24	20
22		**Justins Bridge**	**50 days**	**Mon 8/07/24**	**Fri 13/09/24**	
23	Crew 1	Relocate compound from Hobarts, ERSD controls etc.	5 days	Mon 8/07/24	Fri 12/07/24	19
24	Crew 1	Cast in-situ headstocks and abutments (3) incl. elevated temporary support for headstock at start	10 days	Mon 15/07/24	Fri 26/07/24	23
25	Both Crews	Cast in-situ headstocks and abutments incl. scour rock in front of abutments	10 days	Mon 29/07/24	Fri 9/08/24	24



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

2024 Darkwood Bridges Program 5.7.23 - preferred

ID	Engineer	Task Name	Duration	Start	Finish	Predec
26	Both Crews	Attach wingwalls, approaches general fill, strip structures, mortar pads, remove rock bags area, crane pads and landing prep	5 days	Mon 12/08/24	Fri 16/08/24	25
27	Both Crews	Steel girders deliverd and put together with franna on west side	5 days	Mon 12/08/24	Fri 16/08/24	25
28	Both Crews	Land beams and deck panels (2 days) & CoastalWorks beams stitch pour & complete steel girder deck bolting and grouting	5 days	Mon 19/08/24	Fri 23/08/24	26,27
29	Crew 1	Road works on approaches, install kerbs and brackets, swap traffic over	10 days	Mon 26/08/24	Fri 6/09/24	28
30	Crew 1	Demolition, final rock scour, full restoration, pack up	5 days	Mon 9/09/24	Fri 13/09/24	29
31		**Joyces Bridge**	**70 days**	**Mon 26/08/24**	**Fri 29/11/24**	
32	Crew 2	Precast 3x Joyces headstocks (CoastalWorks Precast Yard)	15 days	Mon 26/08/24	Fri 13/09/24	28
33	Both Crews	Relocate compound from Justins, re-install rock bag access for personnel access to headstocks only & crane pads	3 days	Mon 16/09/24	Wed 18/09/24	32,30
34	Both Crews	Cast in-situ abutments and bearing pads	12 days	Thu 19/09/24	Fri 4/10/24	33
35	Both Crews	Scour rock protection, approaches general fill	5 days	Mon 7/10/24	Fri 11/10/24	34
36	Both Crews	Land beams (2 days) & Coatalworks beams stitch pours (3 days)	5 days	Mon 14/10/24	Fri 18/10/24	35
37	Both Crews	Plank spans (2) deck pours & approach slabs & install kerb units	15 days	Mon 21/10/24	Fri 8/11/24	36
38	Both Crews	Road works on approaches, swap traffic over, install kerbs	5 days	Mon 11/11/24	Fri 15/11/24	37
39	Both Crews	Demolition, final rock scour, full restoration and pack up	10 days	Mon 18/11/24	Fri 29/11/24	38
40		**Contingency / wet weather**	**10 days**	**Mon 2/12/24**	**Fri 13/12/24**	**31**



Critical	Split	Finish-only	Baseline Milestone	Manual Summary	Inactive Task
Critical Split	Task Progress	Duration-only	Milestone	Project Summary	Inactive Milestone
Critical Progress	Manual Task	Baseline	Summary Progress	External Tasks	Inactive Summary
Task	Start-only	Baseline Split	Summary	External Milestone	Deadline

DARKWOOD 2024 PROGRAM NOTES

Coastal Works intend to undertake the 3 Darkwood Road bridges – Hobarts, Joyces, Justins – as a single program of works commencing in April 2024 to December 2024. Preferred program utilises a typical rock anchor installation small excavator rig with air drilling. Below outlines some of the key dates for the construction sequence:

Site Establishment – April 2024
- Main compound and laydown set up at Hobarts.
- Laydown and piling material deliveries at all 3 bridges.
- Vegetation clearing complete at all 3 bridges
- Establish access points down banks and first piling position at all 3 sites with rock bag setups – 1x headstock at Hobarts, western headstock at Joyces, headstock at Justins.
- Establish all piling positions at Hobarts
- Install erosion and sed controls at all 3 bridges for laydown and piling positions

Piling All 3 bridges – April to June 2024
- Start at Hobarts with the two piling setups concurrently, one 7t excavator rock anchor setup and one 24t excavator for bored piles – aim for completion all in 1 week
- Both setups to move onto Justins Bridge – rock anchor completed in 3 days and setup demobilised from site, bored piles continue – 1.5 weeks
- Bored piling setup moves onto Joyces bridge last, first at previously established western side access which is then removed and established on the east side for completion – 2 weeks
- Coastal Works crews with an excavator to follow the piling crews to manage laydowns, modify the access requirements, remove piling spoil and maintain and adjust environmental controls.
- Coastal Works crew complete the bored pile pours progressively along with the contractor
- Justins site rock bags to remain at headstock to remain, Joyces river access completely removed.

Hobarts Main Bridge Construction – May – August 2024
- Cast in-situ substructure works (6 weeks) to commence in May with one CoastalWorks crew once all piling is completed and piling is continuing at the other sites.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in June.
- Superstructure to be landed, poured, and completed in July with both crews.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in late July and into August.

Justins Main Bridge Construction – July – September 2024
- Relocate main compound setup from Hobarts to Justins in late July once the Hobarts superstructure is completed with second CoastalWorks crew.
- Cast in-situ substructure works (4 weeks) to commence in August with one CoastalWorks crew and completed by both crews once Hobarts is completed.
- Scour rock at abutments placed, rock bags removed, access tracks to the riverbank removed, crane positions established, and abutment backfill completed in late August.
- Superstructure to be landed, poured, and completed in early September.
- One CoastalWorks crew to complete the roadworks, remaining scour rock protection, demolition, and restoration in September.

Joyces Main Bridge Construction – July – September 2024
- While Justins being finished, 3x precast headstocks made with second crew at Precast Yard.
- Relocate main compound setup from Justins to Joyces in October and reinstate rock bag access to the headstocks for personnel only and crane pads positions for landing precast components.
- Cast in-situ abutments (2 weeks) to be completed in October with both crews.
- Scour rock at abutments placed and abutment backfill completed in late October.
- Superstructure to be landed, poured, and completed by mid-November with both crews.
- Remove rock bags and bank access and complete the roadworks, remaining scour rock protection, demolition, and restoration in late November and December.

Appendix F

Aquatic Ecological Assessment Report

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AQUATIC SCIENCE AND MANAGEMENT

Bellingen Shire Council – Hobarts, Joyces, Justins and Duffys Bridge Replacements

Aquatic Ecological Assessment

Report Prepared for:

GHD

August 2023

Prepared By:

Aquatic Science and Management

Document History

Version	Issued To	Format	Date
DRAFT_V1	Shaun Lawer	*.pdf, *.dox	1/08/2023

Contents

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1. Introduction

1.1 Introduction and Background

The Bellinger-Kalang River system is one of the largest drainage systems of the NSW east coast and the major river system in the Bellingen Shire Council (BSC) Local Government Area (LGA).

BSC have secured funding to replace key bridges over the Bellinger and Kalang Rivers that serve remote communities in the Thora and Kalang valleys. Hobarts, Justins, Joyces and Duffy's Bridges are to be replaced. The works are permissible without consent under the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) and thus require preparation of a Review of Environmental Factors (REF) by way of environmental assessment. GHD are preparing the REF.

The bridges are over the Bellinger and Kalang Rivers, both mapped as Key Fish Habitat under the *Fisheries Management Act 1994*. Bridge construction will require a *Section 200* permit from NSW DPI Fisheries for dredging and reclamation (unless authorised under the *Crown Land Management Act 2016* in which case Crown Lands will require a *Section 199* consultation). In order to provide NSW Fisheries with the required information for either a Section 199 consultation or Section 200 permit, Key Fish Habitat will require further assessment prior to completion of the REF.

The proposed works include:

- Removal and replacement of four bridges, Hobarts, Joyces and Justins Bridges over the Bellinger River and Duffys Bridge over the Kalang River.
- Construction of new bridge abutments
- Construction of new bridge pilings.
- Realignments of the existing approaches.
- Installation of scour rock
- Rehabilitation and revegetation of the riverbank in the area of works.

The proposed works will require a Review of Environmental Factors (REF) under Part 5 of the Environmental Planning and Assessment Act 1979, including relevant state and federal statutory environmental investigations. This aquatic ecological assessment of the proposed works is to contribute to the REF and meet the information requirements for DPI Fisheries assessment. It will consider:

- The likelihood of occurrence within the study area of threatened aquatic species and communities listed under the Federal *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the NSW *Biodiversity Conservation Act 2016* (BC Act) and the *Fisheries Management Act 1994* (FM Act).
- The potential impacts of the proposed works on threatened aquatic species known or considered likely to inhabit the study area as per the requirements of the EPBC Act, BC Act and the FM Act.

- Information and approvals requirements for the proposed works under the FM Act.
- The overall aquatic ecological impacts of the proposed works.
- Any additional approvals requirements for the proposed works, based upon potential aquatic ecological impacts.

1.2 Description of Proposed Works

The aquatic ecological assessment described in this report applies to the proposed works described in **Table 1.1** (see **Appendix A** for detailed works diagrams and methods). Detailed work methods are provided in the REF.

Table 1.1 Proposed works at each of the four bridge sites

Bridge	***Location (MGA Zone 56)***	***Methods***
Hobarts	E 473400 N 6633165	▪ Setup compound, laydown and stockpile areas outside of the flood zone and off the road on the eastern approach. ▪ Install erosion and sedimentation (ERSED) controls. ▪ Install access ramps on both sides of the river to exposed gravel/rock bars mostly within the proposed bridge and scour rock footprint. ▪ Install 3 concrete blade piers 1300 mm wide x 4655 – 6240 mm long, each anchored into the bed of the Bellinger River by 3 x 600 mm bored piles or N28 anchors. ▪ Construct new concrete abutments on the high banks using prefabricated wing walls and casting the 1200 mm high abutment in place, with 3 x 600 mm embedded piles bored into bedrock. ▪ Repeated placement of 2 tonne rock bags to stabilise crane positions, controls and temporary access ways. ▪ Remove access ramps. ▪ Install scour rock around abutments to the toe of the bank keyed in to high banks upstream and downstream. ▪ Backfill to abutments. ▪ Reshape approaches to downstream of existing bridge. ▪ Place concrete girders for the bridge deck by crane. ▪ Pour concrete decks. ▪ Demolish existing bridge, removing deck, girders, headstocks outside of low flow water area (or those constructed from timber), but leaving existing abutments and concrete piers to minimise disturbance to bed and banks. ▪ Finalise scour rock placement. ▪ Rehabilitate site, including plantings and temporary ERSED controls to remain for 3 months or until stable. ▪ The detailed construction methodology is provided in the REF.

Bridge	***Location (MGA Zone 56)***	***Methods***
Joyces	E 475820 N 6633965	▪ Setup compound, laydown and stockpile areas outside of the flood zone and off the road on the eastern approach. ▪ Install erosion and sedimentation (ERSED) controls, including sediment fencing and floating hydrocarbon booms with drop silt curtains around access pathways. ▪ Install access ramps on both sides of the river to exposed gravel/rock bars mostly within the proposed bridge and scour rock footprint. ▪ Repeated placement of 2 tonne rock bags to stabilise crane positions, controls and temporary access ways. ▪ Install flow/fish passage pipes under eastern access track. ▪ Install 6 x 600 mm bored piles with 3 concrete headstocks into the bed of the Bellinger River. ▪ Remove piling access works. ▪ Construct new concrete abutments on the high banks using prefabricated wing walls and casting the 950 mm wide abutments in place, each with 2 x 600 mm piles bored into bedrock. ▪ Install scour rock around abutments to the toe of the bank keyed in to high banks upstream and downstream. ▪ Install crane access within footprint of previous access works. ▪ Place concrete girders for the bridge deck by crane. ▪ Backfill to abutments. ▪ Pour concrete decks. ▪ Remove crane access works. ▪ Reshape approaches to downstream of existing bridge. ▪ Demolish existing bridge, remove all decking and girders, partially remove abutments to improve tie-in, leaving existing piers, concrete headstocks and majority of abutments to minimise disturbance to bed and banks. ▪ Finalise scour rock placement. ▪ Rehabilitate site, including plantings and temporary ERSED controls to remain for 3 months or until stable. ▪ The detailed construction methodology is provided in the REF.

Bridge	***Location (MGA Zone 56)***	***Methods***
Justins	E 464540 N 6630890	▪ Setup compound, laydown and stockpile areas outside of the flood zone and off the road on the eastern approach. ▪ Install erosion and sedimentation (ERSED) controls, including sediment fencing and floating hydrocarbon booms with drop silt curtains around access pathways. ▪ Install access ramp on western side of the river to exposed gravel/rock bar mostly within the proposed bridge and scour rock footprint. ▪ Access on eastern side from existing road shoulder. ▪ Repeated placement of 2 tonne rock bags to stabilise crane positions, controls and temporary access ways. ▪ Install 2 x 600 mm bored piles into the bed of the Bellinger River with a concrete headstock cast *in-situ*. ▪ Construct new concrete abutments on the high banks using prefabricated wing walls and casting the 1000 mm wide, 900 mm deep abutments in place, with 2 x 600 mm piles bored into bedrock or rock anchors. ▪ Remove piling access works and establish crane position on western bank. ▪ Install scour rock around abutments to the toe of the bank keyed in to high banks upstream and downstream. ▪ Install scour rock around abutments to the toe of the bank keyed in to high banks upstream and downstream. ▪ Place beams, girders and bridge deck by crane and franna crane. ▪ Stich pour. ▪ Reshape approaches to downstream of existing bridge. ▪ Demolish existing bridge, remove all decking and girders, removing timber headstocks and steel components, cutting off timber piles to bed level, leaving concrete piers and headstocks over the water and removing existing abutments. ▪ Finalise scour rock placement. ▪ Rehabilitate site, including plantings and temporary ERSED controls to remain for 3 months or until stable. ▪ The detailed construction methodology is provided in the REF. Reshape approaches to downstream of existing bridge.

Bridge	***Location (MGA Zone 56)***	***Methods***
Duffys	E 486165 N 6629365	▪ Install 6 x 900 mm bored piles into the bed of the Kalang River with two concrete headstocks cast *in-situ*. ▪ Construct new concrete abutments on the high banks using prefabricated wing walls and casting the 1200 mm wide, 1600 - 2000 mm deep abutments in place, with 5 x 750 mm piles bored into bedrock or rock anchors. ▪ Install scour rock around abutments to the toe of the bank keyed in to high banks upstream and downstream. ▪ Place concrete girders for the bridge deck. ▪ Reshape approaches to downstream of existing bridge. ▪ Demolish existing bridge, removing the deck, cutting the existing timber piers to ground level, but leaving the abutments to minimise disturbance to bed and banks. ▪ Detailed construction methodology yet to be prepared but likely to involve similar methods to those described above.

Bridge plans are presented in **Appendix A**.

At the time of writing, detailed construction methodology had been developed for proposed bridge replacements at Hobarts, Joyces and Justins Bridges. It is an assumption of this report that methods for construction of the proposed bridge replacement at Duffys Bridge will be equivalent. The proposed construction methodologies include many strategies to restrict potential harm to the aquatic environment.

The major features of the proposed works with a potential to disturb the aquatic environment are:

- Boring piles and installing rock anchor systems.
- Access and operation of heavy machinery. Heavy machinery will include excavators, trucks, concrete trucks, 100 tonne cranes and franna cranes.
- Excavator and crane access to exposed rock on the bed of the rivers.
- Pollution of water from concrete overpour/spill, disturbance to riverbed materials and drilling works.
- Removal of riparian vegetation.
- Installation of access ramps to the river bed.
- Hydrocarbon spill from machinery.
- Adjustments to existing flow patterns resulting from the placement of new piers.

Most of the work will be undertaken on site using excavators, cranes, trucks and light vehicles. Vehicle access to the sites would be via Darkwood Rd and Kalang Rd.

The combined proposed works at Hobarts, Joyces and Justins bridges are planned to occur between April and December 2024 including site establishment, construction and demolition of the existing bridges. A further 3 months has been allowed for site stabilization following rehabilitation works.

1.3 Location

The proposed works are located on the Bellinger and Kalang Rivers near Bellingen, approximately 420 km north-north-east of Sydney. A map of the study area is presented in **Figure 1.1**. A detailed description of the locations is presented in **Section 2**.

1.4 Proponent

With the exception of the haulage routes and sites for stockpile, laydown and compounds, the proposed works are largely located on Crown Land. Bellingen Shire Council (BSC) are the proponent.

1.5 Alternatives Considered

A variety of alternatives to the proposed works were considered. They include:

- Do nothing. This option has been discarded due to the risk to safety and access of leaving the existing bridges in place.
- Other bridge designs, construction methods and materials have been considered during concept development. The current proposal represents the best mixture of feasibility, cost and minimised environmental impact.

1.6 Strategic Need for the Proposal

The proposed activity is a key element to maintaining safe access to remote communities in the Bellingen Shire LGA.

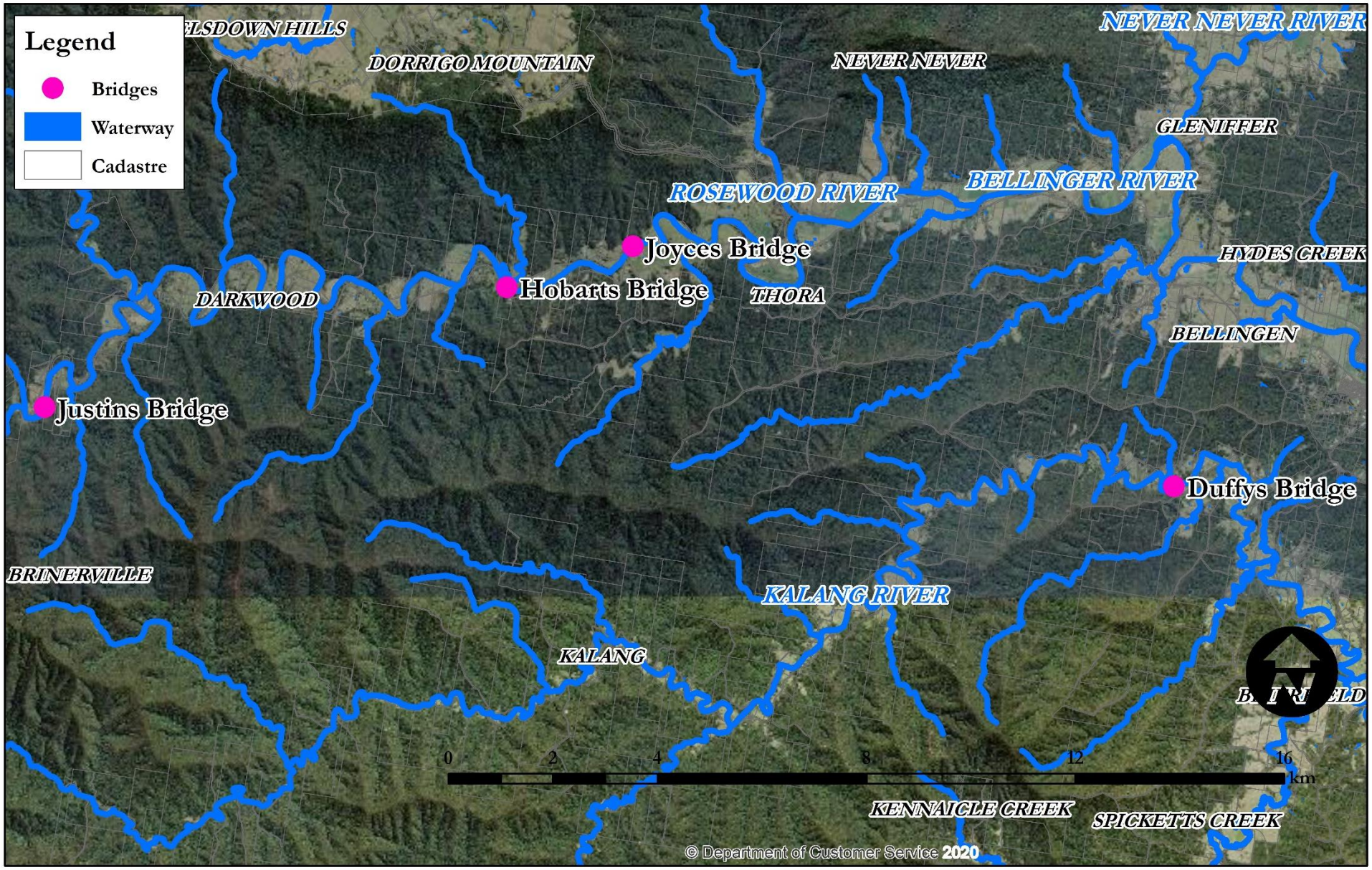

Figure 1.1 Key features of the study area and bridge locations

2. Site Description and Environmental Assessment

2.1 Site Location and Study Area

The locations for the proposed bridges are across the Bellinger and Kalang Rivers near Bellingen NSW. The location is approximately 420 km north-north-east of Sydney. The proposed works are mostly in and on the bed and banks of the Bellinger and Kalang Rivers. Haulage routes are on the existing road networks. Stockpiles and site compounds would be located outside of the flood zone.

The study area for this assessment includes the bridge sites, upstream and downstream aquatic habitat within 100m of the bridges. Stockpile sites and compound locations, which are located outside of the aquatic habitat and away from the banks of the rivers, are not considered.

2.2 Climate and Rainfall

The study area experiences a subtropical climate typical of the Mid-North and North coast of NSW. Rainfall tends to be greatest during the late summer and early autumn months. The closest Bureau of Meteorology (BOM) station with long-term data is in Dorrigo. Basic climate information for the Dorrigo BOM station is displayed in **Figure 2.2**.

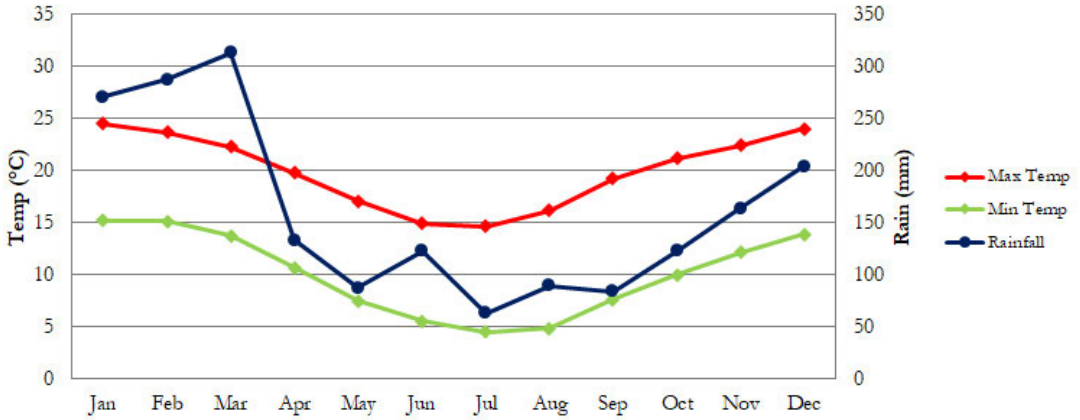

Figure 2.2 Average climate information for Dorrigo (1997 – 2023, BOM 2023).

2.3 Landuses and Zoning

The surrounding landuses are primarily agricultural.

The zoning instrument in the study area is the *Bellingen Local Environment Plan 2010* (BLEP). The zonings that apply to the study area are; E4 – Environmental Living and E3 – Environmental Management. The majority of the land affected by the proposed works, including the earthworks, is zoned E4 – Environmental Living.

2.4 Site Inspections

Site inspections to inform this report were undertaken on the 30th June and 4th July 2023. The site inspections comprised of a foot-based meander around the bed and banks of the Bellinger and Kalang Rivers within 100 m upstream and downstream of the bridge sites to identify aquatic habitat features and assess bank condition.

During the site inspections all aquatic and riparian flora encountered were identified with the assistance of photography and field guides.

Photographs of all important habitat types were collected. The locations of photo sites and all photographs are presented in **Appendix H**. Aquatic habitat types were described and notes about their distribution collected in order to facilitate predictive occurrence of threatened species, populations and communities identified during online searches.

2.5 Aquatic Habitat

In terms of aquatic habitat, the study area includes the Bellinger and Kalang Rivers and a small number of mapped tributaries.

The Bellinger - Kalang River system is a major east coast drainage with a shared opening to the Pacific Ocean at Urunga. It has a catchment area of approximately 1110 km^2 and the Bellinger is approximately 69 km long while the Kalang is approximately 77 km long. In the study area the Bellinger and Kalang Rivers are either confined bedrock rivers with a discontinuous floodplain or meandering gravel bed freshwater systems through the lower reaches of the coastal ranges. The reaches within the study area are all pool and riffle sequences. The Bellinger and Kalang Rivers in the study area are Key Fish Habitat. Maps of key fish habitat around the individual bridges are presented in **Figures 2.3 to 2.6**. For the purpose of environmental assessment under the *Fisheries Management Act 1994*, all sites are Class 1 - Major Key Fish Habitat, containing Type 1 - highly sensitive Key Fish Habitat. Specific habitat features in the study area are gravel bars, beds of aquatic plants, unvegetated unconsolidated sediments, bedrock outcrops, snag features, deep pools and riffles.

There are several mapped tributaries within or near the study areas around each bridge (**Figures 2.3 to 2.6**). Of these, only Blakes Gully, located approximately 150 m downstream of the Duffys Bridge site, is mapped as Key Fish Habitat. The others are all ephemeral first or second order streams. For the purposes of environmental assessment, Blakes Gully is Class 3 - Minimal Key Fish Habitat with Type 2 – moderately sensitive

key fish habitat. The proposed works are unlikely to have any impact on mapped tributaries.

Figure 2.3 Key fish habitat around Duffys Bridge

Figure 2.4 Key fish habitat around Hobarts Bridge

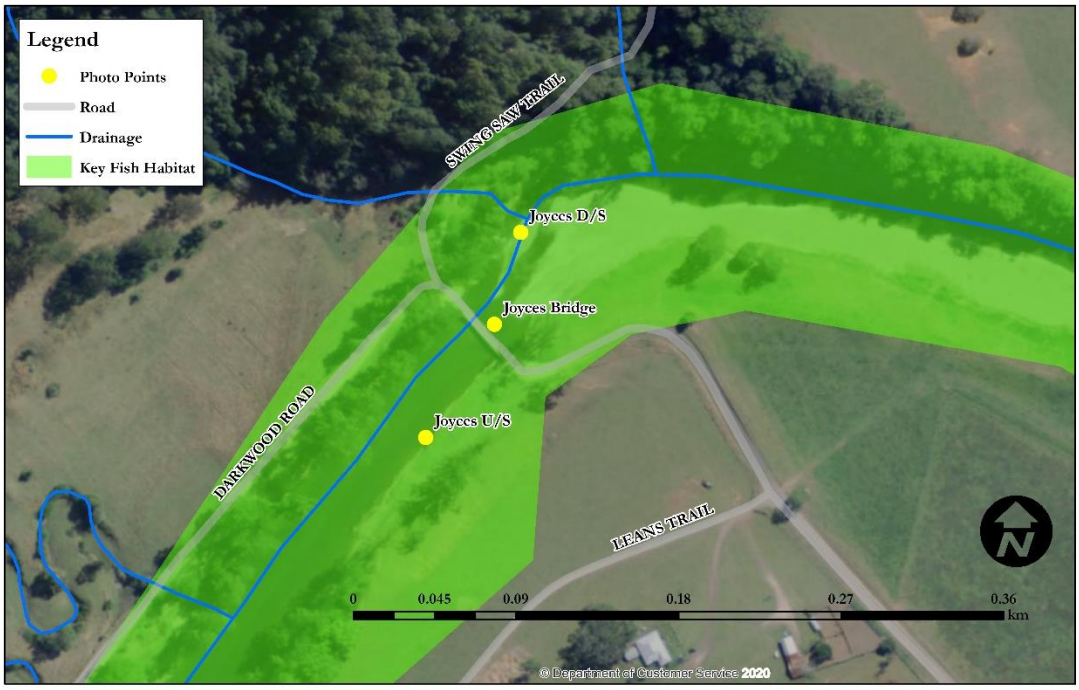

Figure 2.5 Key fish habitat around Joyces Bridge

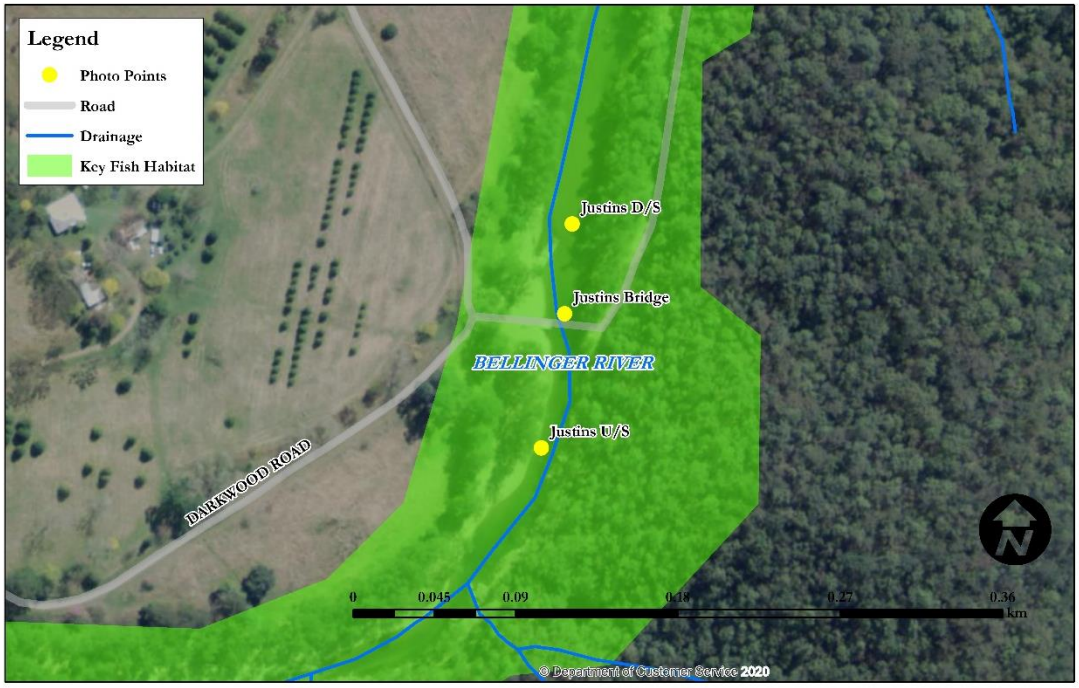

Figure 2.6 Key fish habitat around Justins Bridge

A description of habitat features around each existing and new bridge site is presented in **Table 2.1** along with a description of the major features within 100 m upstream and downstream. The photos in **Appendix H** form part of the aquatic habitat description

Table 2.1 Aquatic habitat features around each of the bridges

Bridge	***Upstream Habitat***	***Bridge Habitat***	***Downstream Habitat***
Duffys	The benthic material was mostly rock with some coarse and fine gravel. Upstream of the photo point there is a long pool to approximately 1 m deep that enters a short riffle prior to the existing bridge. There is a large gravel bar on the river left which is densely vegetated with a mixture of native and non-native species. Structural elements include large snags and a mixed bed of aquatic plants.	The benthic material was mostly rock with some coarse and fine gravel and a low proportional cover of alluvial fines. The bridge crosses the low-flow river channel and a flood chute and gravel bar. The flood chute is densely vegetated with majority weeds on the upstream side. There is a riffle feature heading downstream of the bridge and a small shallow pool underneath it. Structural features include the bridge pylons, many large snags, a small, sparse bed of *Vallisneria nana* that is upstream of the existing bridge and scattered small beds of *Isolepis fluitans* under the left (western) bank under the proposed bridge.	The benthic material was mostly rock with some coarse and fine gravel. There is a large gravel bar on the river right, a riffle feature leading from the bridge and a long pool downstream to 1.5 m deep. Structural features include lots of large woody debris downstream of the bridge including a log jam in the downstream pool, a small amount of trailing vegetation on the left bank and scattered small beds of *Isolepis fluitans* in the riffle feature.
Hobarts	The benthic material was mostly coarse and fine gravel with a low proportional cover of rock and sand. Upstream of the bridge is a long shallow pool that enters a riffle immediately upstream of the existing bridge. Structural features are limited but include a small number of snags, scattered trailing vegetation, a small bed of *V. nana* and a small bed of emergent vegetation, both on the toe of the right bank.	The benthic material was mostly bedrock with a low cover of rock. There is short pool to approximately 2 m deep directly under the existing bridge with riffle features immediately upstream and downstream. Much of the existing bridge crosses a large gravel bar and bedrock outcrops. The new bridge is located over the entry to a riffle feature and gravel bar. Structural features around the bridges include bridge piers, bedrock caves and a few scattered large snags. No aquatic plants around the old or new bridges.	The benthic material was mostly rock with a low cover of bedrock. There is a long steep riffle downstream of the bridge that enters a bedrock constrained pool to approximately 2 m deep. There is also a backwater, separated from the main channel by a large, well vegetated gravel bar, at the confluence of two ephemeral streams that enter on the river right. Structural features in the riffle and pool include bedrock overhangs. The backwater has a high proportional cover of mixed aquatic plant beds.
Joyces	Upstream of the bridge is a very long pool feature to approximately 1 m deep. The benthic material is an even mixture of rock and large gravel. Structural features include a small number of snags, scattered large beds of mixed submerged aquatic plants and some small stands of emergent aquatic plants (*Schoenoplectus mucronatus*).	The benthic material was mostly rock, with a small area of bedrock and gravel. A long pool extends from upstream all the way under the existing and new bridge sites, where it has a maximum depth of approximately 2 m. There is some scour rock around the existing bridge abutments. Structural habitat features included a small number of large snags, the	The benthic material was mostly bedrock with a low cover of rock. There is a long steep riffle downstream of the bridge with a large gravel bar on the river right. Structural features include a small bed of submerged aquatic plants and some scattered large snags, all on the river left.

		existing concrete bridge piers, debris fields, bedrock caves and large, scattered beds of mixed aquatic plants. Aquatic plants are mostly concentrated upstream of the existing bridge, though there are some scattered clumps of *Vallisneria nana* downstream of the existing bridge with a total area of approximately 2 m^2.	
Justins	Upstream of the existing bridge the river is comprised of a long pool, greater than 100 m long and to a maximum depth of approximately 2 m during low flow conditions. The benthic material is primarily rock and bedrock with a small proportion of gravel and alluvial sand. Structural habitat is limited to a gravel bar, bedrock features, occasional clumps of *P. parviflora*, and trailing riparian vegetation.	The pool located upstream continues under the existing bridge with a maximum depth of approximately 3 m. Benthic material on the river right is dominated by bedrock and rock features but on the river left is dominated by a cover of alluvial sand and gravel. Structural habitat include bedrock features, existing bridge piers, a deep pool and a small number of large snags and other small debris.	The Bellinger River is comprised of a series of long shallow pools with a short intervening riffle feature downstream of the existing Justins Bridge. The benthic material is mostly rock with small proportional coverages or gravel and alluvial sand. Structural habitat includes a gravel bar/island, the riffle feature and large, scattered beds of mixed aquatic plants mostly comprising *V. nana* and *Potamogeton perfoliatus*.

Potential Impacts of the Proposed Activity

There will be some direct impacts, and potential indirect impacts upon aquatic habitat in the Bellinger and Kalang Rivers associated with the proposed works. These are presented for each location in **Table 2.2**:

There will be no direct impacts on any of the mapped tributaries within the study area associated with the proposed works.

Table 2.2 Potential impact to aquatic habitat at each of the bridge sites

Bridge	***Benthic Habitat***	***Structural Habitat***	***Vegetative Habitat***
Duffys	Piles will be installed in rock with some coarse and fine gravel. Temporary access will be required over an exposed gravel bar. Impacts to an unknown area of unvegetated, unconsolidated rock, gravel and sediment.	At least 16 existing timber bridge piers will be removed to bed level. One or two large snags may require removal to facilitate access and piling works.	Direct impacts to aquatic vegetation will be limited to the potential removal of four individual clumps of *Potamophila parviflora* (total area < 1 m^2) growing out of disused timber pylons and a scattered bed of *Isolepis fluitans* smaller than 0.5 m^2 that is under proposed scour rock. There are potential impacts to vegetative habitats downstream associated with sediment pollution or other water pollution.
Hobarts	Piles will be installed in rock and bedrock with some coarse and fine gravel. Scour rock will be placed over exposed rock and bedrock. Temporary access will be required over a gravel bar and exposed bedrock. Rock bags will be placed over some submerged and some exposed rock. Combined total impacts to approximately 215 m^2 of consolidated and unconsolidated rock, gravel and sediment.	Existing bridge piers will be mostly retained. Snag removal is unlikely to be required.	Direct impacts to aquatic vegetation are unlikely. There are potential impacts to vegetative habitats downstream associated with sediment pollution or other water pollution.
Joyces	Piles will be installed in rock and bedrock. Scour rock to be placed over exposed rock and bedrock and a small area of submerged rock. Temporary excavator access will be required over an exposed gravel bar and submerged rock and unconsolidated sediment. Rock bags will be placed temporarily over submerged rock and bedrock. Combined total impacts to approximately 320 m^2 of consolidated and unconsolidated rock, gravel and sediment.	Existing bridge piers will be mostly retained. Snag removal is unlikely to be required.	Direct impacts to aquatic vegetation will be limited to disturbance of several small clumps of *Vallisneria nana* downstream of the existing bridge with a total area of approximately 1-2 m^2. Shading is unlikely to impact any further vegetation. There are potential impacts to vegetative habitats downstream associated with sediment pollution or other water pollution.

Bridge	***Benthic Habitat***	***Structural Habitat***	***Vegetative Habitat***
Justins	Piles will be installed in areas of exposed rock, and sand with some coarse and fine gravel. Scour rock will be installed over a small area of submerged bedrock and some exposed rock and gravel. Rock bags will be placed temporarily over submerged and exposed rock, sand and gravel. Temporary crane access to exposed rock and gravel required. Combined total impacts to approximately 75 m^2 of consolidated and unconsolidated bedrock, rock, gravel and sediment.	Timber bridge piers will be removed to bed level. One or two large snags may require removal to facilitate access and piling works.	Direct impacts to aquatic vegetation are unlikely. There are potential impacts to vegetative habitats downstream associated with sediment pollution or other water pollution.

2.6 Water Quality

Site Assessment

Water quality is a key aspect of overall aquatic environmental health. Poor water quality can negatively impact aquatic fauna, flora and habitats. Water quality in the Bellinger and Kalang Rivers is relatively well described. In addition, physicochemical water quality measurements were collected during the site inspections.

Water quality studies of the Bellinger and Kalang Rivers undertaken in 2009-2010 and 2015-16 included studies of water quality. Samples were collected monthly for 12-month periods and the sample sites included sites BR1 between Justins and Hobarts Bridges, BR2 approximately 4 km downstream of Joyces Bridge and KR2 approximately 2 km downstream of Duffys Bridge (Ryder *et al* 2011, Mika *et al* 2016). Of these sites, only BR2 was sampled in 2015-16. In general,

- The sites are freshwater with near neutral average pH.
- Turbidity was below state guideline concentrations during all surveys and total suspended solids concentrations were consistently low.
- Dissolved oxygen concentrations were consistently healthy.
- Chlorophyll-a concentrations (a surrogate for algal biomass) were below state guideline concentrations during all surveys in 2019-10 and most surveys in 2015-16.
- Available nitrogen concentrations were consistently high relative to guideline concentrations but available phosphorus concentrations were generally lower than guideline concentrations, particularly in the Kalang.
- BR1 had extremely high values for total nitrogen and total phosphorus at times.

Water quality results collected during the site inspections for this assessment are presented in **Table 2.3**. They demonstrate excellent water quality for a wide variety of native freshwater flora and fauna.

Table 2.3 Water quality results collected during the site inspections

Site	*Date*	*Time*	*Temp (°C)*	*pH*	*EC (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*DO (% sat)*
Duffys D/S	30/06	12:50:08	11.17	7.17	0.087	6.4	8.56	80.5
Duffys U/S	30/06	13:09:59	11.13	7.26	0.091	5.2	8.6	80.9
Justins D/S	4/07	12:09:48	11.49	7.11	0.07	5	10.03	95.1
Justins U/S	4/07	12:28:51	11.72	7.23	0.07	5.6	7.75	73.9
Hobarts D/S	4/07	13:50:14	12.57	7.04	0.067	5.6	8.62	83.7
Hobarts U/S	4/07	13:29:59	12.66	7.08	0.063	5.7	7.93	77.2
Joyces D/S	4/07	14:27:17	12.42	7.12	0.067	6.4	9.75	94.4
Joyces U/S	4/07	14:42:58	12.7	7.16	0.068	7.1	7.98	77.8

Potential Impacts of the Proposed Activity

There are some general potential short-term negative impacts of the proposed activity on water quality in the study area.

There is potential for short-term impacts on water quality in the study area associated with drilling, bank excavations, concrete pours, scour rock placement, disturbance to ground covers and spills from machinery. Historical water quality monitoring from around the study area indicates that the Bellinger and Kalang Rivers could be highly sensitive to pollution.

Drilling and bank excavations present a risk of short-term sediment pollution and increased turbidity downstream.

Operation of the machinery around the site carries a risk of hydrocarbon pollution from spills of fuel, oil or hydraulic fluids. Impacts of this nature could extend far downstream in the rivers and have significant consequences.

The construction methodology developed for Hobtarts, Justins and Joyces Bridges includes many strategies to mitigate risks to water quality:

- Repeated use of pre-filled rock bags
- Installation of sediment fencing around all disturbed soils and riverbanks.
- Stockpiles and laydown areas to be located outside of high flood zones.
- Minimal access to exposed riverbed only, mostly within the footprint of the proposed works.
- Material specifications that exclude fines.
- Floating hydrocarbon booms with drop silt curtains around all piling works and temporary access tracks.
- No concrete pours boom lines positioned over water.
- Use of sucker trucks to remove site water.
- Use of spray screens around rock anchor drilling locations.
- Refuelling locations to be at least 50 m from waterways and in bunded areas.
- Concrete truck washout to be remote from sites or in bunded areas outside of high flood zones.
- Daily removal of excavated materials, rock hole flushout materials to stockpiles.

In addition to the above, it is recommended that

- All materials specifications are to exclude fines.
- Spill kits must be kept on site at all times.

2.7 Fauna

There were no aquatic fauna observed during the site inspection.

The fauna of the Bellinger and Kalang Rivers in the study area are very well described elsewhere. Gilligan (2010) surveyed freshwater fish communities throughout the Bellinger-Kalang River basin, including sites in the lowlands (as per Justins, Hobarts and Joyces Bridges) and coastal plains area (as per Duffys Bridge). The study assigned values for 'expectedness' and 'nativeness' of species captured at each site. They found freshwater fish communities overall to be in moderate condition during the time of sampling. Overall fish community condition was good in the coastal zone and moderate in the lowlands. The nativeness of the freshwater fish communities was good, with only one species of alien fish found at only one site (a heavily degraded site in the coastal plains). The expectedness was poor across the study area, with six expected species not observed. The species observed are presented in **Table 2.4**.

Table 2.4 Freshwater fish in the Bellinger Kalang River system (Gilligan 2010)

Common Name	***Species Name***	***Notes***
Australian Bass	*Macquaria novemaculeata*	Freshwater fish that breeds in estuaries. Recruitment impacted by restrictions in riparian habitat and beds of aquatic vegetation. Likely to pass upstream and downstream of the study area.
Australian Smelt	*Retropinna semoni*	A schooling fish found among structural habitats in fresh and brackish waters. Likely to pass upstream and downstream of the study area.
Bellinger Climbing Galaxias	*Galaxias sp.*	A freshwater fish likely to be found upstream of the study area
Bullrout	*Notesthes robusta*	Normally a freshwater species but enter estuaries during rain events. Likely to pass upstream and downstream of the study area.
Cox's Gudgeon	*Gobiomorphus coxii*	Freshwater fish that favours structured habitats. Juveniles commonly encountered in estuaries. Likely to pass upstream and downstream of the study area.
Ornate Rainbowfish	*Rhadinocentrus ornatus*	A freshwater species. Likely to pass upstream and downstream of the study area.
Dwarf Flat-headed Gudgeon	*Phylipnodon acrostomus*	Mostly found in lower freshwater and upper estuarine reaches. Unlikely to be found in the study area.
Empire Gudgeon	*Hypseleotris compressa*	Freshwater fish that favours structured habitats. Juveniles commonly encountered in estuaries. Likely to pass upstream and downstream of the study area.
Firetail Gudgeon	*Hypseleotris galii*	A common freshwater species.

Common Name	***Species Name***	***Notes***
Flat-headed Gudgeon	*Phylipnodon grandiceps*	Mostly found in lower freshwater and upper estuarine reaches. Likely to pass upstream and downstream of the study area.
Bellinger Freshwater Catfish	*Tandanus sp.*	A freshwater species.
Freshwater Herring	*Potamolosa richmondia*	A freshwater fish that appears to spawn in estuarine reaches. Likely to pass upstream and downstream of the study area.
Freshwater Mullet	*Myxus petardi*	Schooling freshwater fish that spawns in estuaries or marine environments. Likely to pass upstream and downstream of the study area.
Sea Mullet	*Mugil cephalus*	Schooling estuarine and freshwater fish that undertakes a migration in marine environments to spawn. Likely to pass upstream and downstream of the study area.
Long-finned Eel	*Anguilla reinhardtii*	Freshwater fish that undertakes a migration in marine environments to spawn. Likely to pass upstream and downstream of the study area.
Short-finned Eel	*Anguilla australis*	Freshwater fish that undertakes a migration in marine environments to spawn. Likely to pass upstream and downstream of the study area.
Southern Blue-eye	*Pseudomugil signifer*	Ranges from estuarine to freshwater habitats. Likely to pass upstream and downstream of the study area.
Striped Gudgeon	*Gobiomorphus australis*	Freshwater fish that favours structured habitats. Juveniles commonly encountered in estuaries. Likely to pass upstream and downstream of the study area.
Yellowfin Bream	*Acanthopagrus australis*	Occurs mainly in estuaries and marine habitats but sometimes found in freshwater environments. Unlikely to use the study area.
Gambusia	*Gambusia holbrooki*	Introduced freshwater fish also found in upper estuarine reaches

NSW DPI fisheries fish community condition maps indicate that the waters of the Bellinger and Kalang Rivers in the study area are in 'Good' condition (**Figure 2.8,** Riches *et al.* 2016).

Threatened species populations and communities of aquatic fauna listed under the FM Act, BC Act and the EPBC Act were subjected to a potential occurrence assessment of threatened fauna species listed under the EPBC Act or BC Act is provided in **Appendix B**. Species subject to the assessment were determined using DPIE Bionet database search of the study area, mapped freshwater fish distributions presented on the DPI Fisheries Spatial Data viewer and an EPBC Act Protected Matters Search of the study area (refer to **Appendix E**). The potential occurrence assessment did not include frogs or the Bellinger River Snapping Turtle (*Myuchelys georgesii*) as it is understood these are already considered as part of the REF. Only one species of animal was assessed, the

Southern Purple-spotted Gudgeon (*Mogurnda adspersa*) (**Figure 2.9**). It was thought to possibly occur in the study area. A seven-part test (as per the FM Act) to assess the likelihood of a significant impact upon threatened species was applied. The results of the seven-part test is presented in **Appendix D**. The test concluded that there is not likely to be any significant impact arising from the proposed activity on Southern Purple-spotted Gudgeon.

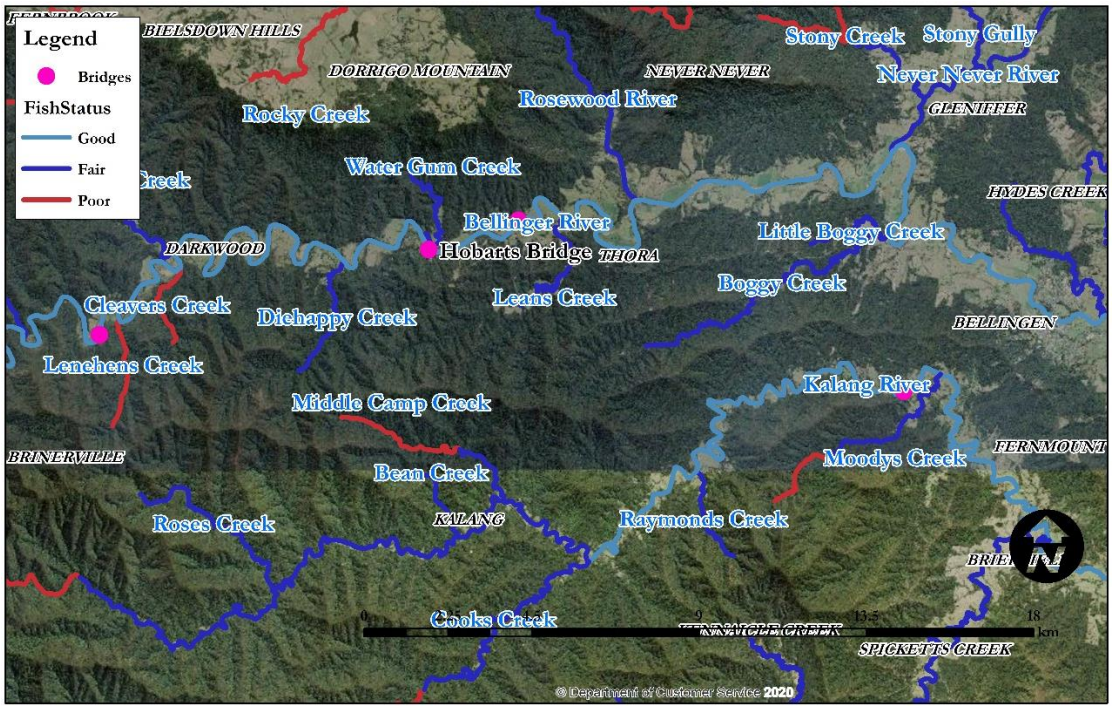

Figure 2.7 Freshwater fish community status in the study area

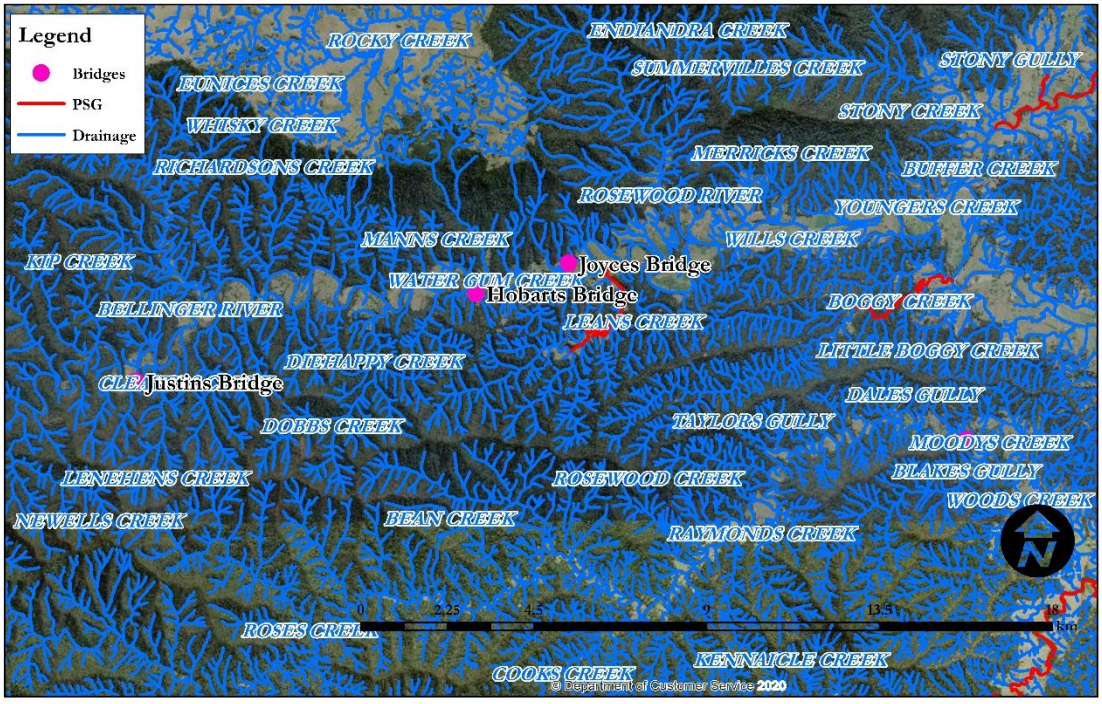

Figure 2.8 Southern Purple-spotted Gudgeon habitat in the study area

Other threatened species listed under the FM Act, including the Black Cod (*Epinephelus daemelii*), White Shark (*Carcharodon carcharias*), Great Hammerhead Shark (*Sphyrna mokarran*) and Scalloped Hammerhead Shark (*Sphyrna lewini*), have distributions that overlap the entrance to the Bellinger-Kalang River system but do not enter freshwater areas conforming to the description of the study area. The short-term or long-term influence of the proposed works is unlikely to extend into the habitat of any of these species.

Potential Impacts of the Proposed Activity

The proposed earthworks would result in direct impacts to benthic invertebrate fauna and, potentially, some short-term disturbances to more mobile aquatic fauna. The potential impacts of the proposed works upon aquatic fauna are difficult to predict but potentially include:

- Direct impacts to aquatic flora (an important habitat feature for aquatic fauna) through drilling, scour rock placement and shading. A total combined area of approximately 3.5 m^2 of aquatic flora is likely to be impacted (See **Section 2.8**).
- The proposed works would have direct impacts upon the less mobile benthic invertebrate fauna on benthic habitats underneath the areas of scour rock placement, rock bag placement and drilling.
- The proposed works would potentially have a short-term impact upon water quality (see **Section 2.6**) that might, in turn negatively impact aquatic fauna.

2.8 Aquatic Flora

Beds of aquatic flora were observed at each of the bridge sites within the study area. The species observed are presented in **Table 2.5**.

Table 2.5 Aquatic flora identified during the site inspections

Common Name	*Species Name*	*Duffys*	*Hobarts*	*Joyces*	*Justins*
Floating Clubrush	*Isolepis fluitans*	Y		Y	Y
Hydrilla	*Hydrilla verticilliata*		Y	Y	
A Millfoil	*Myriophyllum sp.*	Y			
Water Couch	*Paspalum distichum*				
Smartweed	*Persicaria decipiens*	Y			Y
A Smartweed	*Persicaria attenuata*		Y		
Spotted Knotweed	*Persicaria strigosa*	Y	Y		Y
Small Knotweed	*Polygonum plebium*				
Curled Pondweed	*Potamogeton crispus*		Y	Y	
Clasped Pondweed	*Potamogeton perfoliatus*				Y
Pondweed	*Potamogeton octandrus*		Y		
River Sweetgrass	*Potamophila parviflora*		Y	Y	Y

Marsh Clubrush	*Schoenoplectus mucronatus*		Y	Y	Y
River Clubrush	*Schoenoplectus validus*		Y		Y
Cumbungi	*Typha sp.*		Y		
Ribbonweed	*Valisneria nana*	Y	Y	Y	Y

There were no individual threatened species of flora observed during the site inspection.

A potential occurrence assessment of threatened aquatic flora species listed under the EPBC Act or BC Act is provided in **Appendix B**. Species subject to the assessment were determined using OEH Atlas of NSW Wildlife database search of the study area (refer to **Appendix E**). Some threatened aquatic flora species identified by the EPBC Act Protected Matters Search Tool identified as "*species or their habitats*" potentially occurring within the study area (refer to **Appendix D**) were also subject to the potential occurrence assessment. Terrestrial plants included in the results of online searches were not considered. A total of 2 species of aquatic plant were included in the potential occurrence assessment. Of these, both were found to possibly occur in the study area. A five-part test to assess the likelihood of a significant impact upon each of the threatened species was applied to both species. The results of the five-part tests are presented in **Appendix C**. The conclusions were that there is not likely to be any significant impact arising from the proposed activity on any of the threatened species potentially occurring in the study area.

The Bionet search identified one Threatened Ecological Community (TEC) associated with the aquatic environment within the search area – Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. A potential occurrence assessment found it is unlikely to occur in the study area.

Potential Impacts of the Proposed Activity

The proposed works would result in direct and indirect impacts to aquatic flora that include:

- Direct impacts to aquatic flora through drilling, scour rock placement and shading. A total area of approximately 3.5 m^2 is likely to be impacted.
- The proposed works would potentially have a short-term impact upon water quality (see **Section 2.6**) that might, in turn, negatively impact aquatic flora downstream.

2.9 Banks and Riparian Vegetation

The condition of the banks and riparian vegetation at the time of the site inspection was highly variable within and between sites. A brief description of the banks and riparian zones around the proposed and existing bridge sites is presented in **Table 2.6**.

Table 2.6 Riparian and bank condition at each of the bridge sites

Bridge	*Riparian Vegetation*	*River Bank*
Duffys	▪ Left bank has moderate vegetation continuity, good vegetation structure and mostly non-native vegetation. Width of riparian vegetation 3 – 10 m. ▪ Right bank has high vegetation continuity in the area of the proposed bridge, mostly native species and has a medium vegetation structure. Width of riparian vegetation is > 20 m, including the vegetated gravel bar.	▪ Left bank steep to 2.5 m high, comprised of alluvial materials and no signs of active erosion. ▪ Right bank is gradual to 2 m high, comprised of gravels and has no signs of active erosion.
Hobarts	▪ Left bank has poor vegetation continuity in the area of the proposed bridge, a mixture of native and non-native species and has a medium vegetation structure. Width of riparian vegetation is 2 - 4 m. ▪ Right bank has poor vegetation continuity, poor vegetation structure and is a mixture of native and non-native vegetation. Width of riparian vegetation 2 m.	▪ Left bank moderately steep to 4 m high, comprised of gravel and alluvial materials and with no signs of active erosion. ▪ Right bank is gradual to 3 m high, comprised of rock, gravels and bedrock and has no signs of active erosion.
Joyces	▪ Left bank has poor vegetation continuity in the area of the proposed bridge, has a poor vegetation structure and is comprised of mixed native and non-native species. Width of riparian vegetation is < 2 m. ▪ Right bank has negligible vegetation continuity, poor vegetation structure and is comprised of mostly native vegetation. Width of riparian vegetation < 2 m.	▪ Left bank is gradually sloped to 3 m high, comprised of bedrock and some alluvial materials and with no signs of active erosion. ▪ Right bank is gradual to 2.5 m high, comprised of rock, gravels and alluvial materials. Some signs of historical erosion.
Justins	▪ Left bank has negligible vegetation continuity in the area of the proposed bridge, has a very poor vegetation structure and is comprised of mostly non-native species. Width of riparian vegetation is < 2 m. ▪ Right bank has poor vegetation continuity, poor vegetation structure and is comprised of mostly native vegetation. Width of riparian vegetation < 2 m.	▪ Left bank is steeply sloped to 2.5 m high, comprised of gravel and alluvial materials and with no signs of active erosion. ▪ Right bank is gradual to 3 m high, comprised of rock and bedrock with no signs of active erosion.

Potential Impacts of the Proposed Activity

At all sites riparian vegetation will be cleared and roots will be grubbed to allow construction of abutments and placement of scour rock. Specific bank lengths and

Table 2.7 Riparian and bank condition at each of the bridge sites

Bridge	*Riparian Vegetation*	*River Bank*
Duffys	Some native trees and mixed native and non-native shrubs and ground covers to be removed on the left and right banks for 12 m of riverbank	15 m of riverbank to be disturbed on left side of the river from high bank to toe. 19 m of high bank on right side of

	and gravel bar on either bank. Vegetation on the right bank gravel bar will need to be cleared for access track.	the river in addition to disturbances to the gravel bar that forms the low bank.
Hobarts	Some native trees and mixed native and non-native shrubs and ground covers to be removed on the left and right banks for 12 m of riverbank on the left bank and 15 m on the right bank and gravel bar. Vegetation on the right bank gravel bar will need to be cleared for access tracks.	12 m of riverbank to be disturbed on left side of the river from high bank to toe. 15 m of high bank on right side of the river in addition to disturbances to the gravel bar that forms the low bank.
Joyces	Mixed native and non-native ground covers to be removed on the left and right banks for approximately 16 m of riverbank and gravel bar on either bank. Some vegetation on the right bank gravel bar will need to be cleared for an access track.	16 m of riverbank to be disturbed on the left side of the river from high bank to toe. 16 m of high bank on right side of the river in addition to disturbances to the gravel bar that forms the low bank.
Justins	One native tree on right bank and mixed native and non-native shrubs and ground covers to be removed on the left and right banks for approximately 8 m of riverbank on either side.	Approximately 8 m of riverbank to be disturbed on both sides of the river from high bank to toe.

3. Summary of Impacts and Suggested Controls

A variety of positive and negative impacts have been identified. They are summarised in **Table 3.1** along with the recommendations of this report.

Table 3.1 Summary of impacts and recommendations

Type of Impact	*Impacts*	*Recommendations*
Aquatic Habitat	Temporary and permanent impacts to a combined total of at least 610 m² of consolidated and unconsolidated unvegetated benthic materials from drilling, piling, abutments, access tracks and rock bag placements.	No further controls suggested to those included in construction plans. Apply for a Section 200 permit from NSW DPI Fisheries for reclamation.
	Direct impacts to 3.5 m2 of aquatic vegetation.	No further controls suggested. Impacts have been minimised by placement of piers.
	Removal of several individual snags to facilitate piling.	Reposition any snags that are removed to a suitable location within the permanent aquatic environment.
	Removal of existing bridge piers	No further controls suggested. Impacts have been minimised by leaving piers in place where feasible.
Water Quality	There is potential for short-term minor impacts on water quality in the study area associated with associated with drilling, bank excavations, concrete pours, scour rock placement and disturbance to ground covers. These relate specifically to increased suspended sediment concentrations and associated increases to nutrient concentrations and turbidity.	- Strategies already described in the construction methodology will be adequate to mitigate most risks to water quality. - Prepare an ERSED plan for the earthworks and revegetation phase. - All materials specifications to exclude fines.

Type of Impact	*Impacts*	*Recommendations*
Water Quality	Operation of the machinery around the site carries a risk of hydrocarbon pollution from spills of fuel, oil or hydraulic fluids. Impacts of this nature could extend downstream in the Bellinger and Kalang Rivers and have significant consequences.	- Strategies already described in the construction methodology will be adequate to mitigate most risks to water quality. - Maintain suitable spill kits on site during works. - Refuel machinery remote from waterways. - All stored fuel (and other chemicals) to be kept in a bunded area remote from waterways. - Daily heavy plant checks on all hydraulic hoses, fuel lines and bearings.
Aquatic Fauna	The proposed works would have direct impacts upon the benthic invertebrate fauna on submerged river beds impacted by some drilling and rock bag placements.	No suitable controls.
	The proposed works would potentially have a short-term impact upon water quality that might, in turn, negatively impact aquatic fauna.	- Strategies already described in the construction methodology will be adequate to mitigate most risks to water quality. - Prepare an ERSED plan for the earthworks and revegetation phase. - All materials specifications to exclude fines. - Maintain suitable spill kits on site during works. - Refuel machinery remote from waterways. - All stored fuel (and other chemicals) to be kept in a bunded area remote from waterways. - Daily heavy plant checks on all hydraulic hoses, fuel lines and bearings.

Type of Impact	*Impacts*	*Recommendations*
Aquatic Flora	Direct impacts to aquatic flora through drilling, scour rock placement and shading. A total area of approximately 3.5 m^2 is likely to be impacted.	No further controls, impact already minimised in design phase.
River Banks and Riparian Vegetation	Removal of riparian vegetation	- Riparian vegetation removal has been minimised in the design phase. - Revegetation to refer to Raine and Gardiner (1997) for species selection and placement.
	Disturbances to river banks associated with access, abutment construction and scour rock placement.	- No further controls. - Area of disturbance minimised to construction footprint in design phase and rehabilitation of disturbed banks considered.

4. Legal and Planning Framework

4.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is used to plan and assess development proposals in NSW. Certain development does not need consent under *Part 4* of the EP&A Act, including developments where the proponent is a public authority, such as *State Environmental Planning Policy (Infrastructure) 2007*.

Such developments may still require assessment under *Part 5* of the EP&A Act if they are likely to have a significant impact on the environment.

4.2 State Environmental Planning Policy (Infrastructure) 2007

The *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across the state. *Section 108* of the ISEPP defines soil conservation works as development necessary 'to avoid, manage or mitigate the effects of erosion'.

Under *Section 109* of the ISEPP development for the purpose of soil conservation works may be carried out by or on behalf of a public authority without consent on any land. This includes environmental management works.

4.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) lists among its objectives:

- To conserve fish stocks and key fish habitats; and
- To conserve threatened species and ecological communities of fish and marine vegetation.

The FM Act includes all major rivers within the definition of Key Fish Habitats. The Hastings River meets the description of and is mapped as Key Fish Habitat.

Under the FM Act (Part 7, Division 3), NSW Fisheries are responsible for assessing proposals for dredging and reclamation in NSW waterways. *Section 200* of the FM Act authorises local government authorities to carry out dredging and reclamation works in Key Fish Habitat with the authorisation of the Minister (Currently the Minister for Primary Industries). The proposed activity will require a *Section 200* permit from DPI Fisheries because it involves reclamation.

Finally, the FM Act provides for the protection of threatened species of fish, ecological communities and critical habitat listed as vulnerable, endangered or critically endangered. Under the FM Act it is an offence to harm any listed species, population or community. For any proposed activity it is the responsibility of the proponent to meet the

information requirements that will allow the minister to determine whether a significant impact will arise from the activity.

Underpinning the responsibilities and powers granted to NSW Fisheries are the *Policy and guidelines for fish habitat conservation and management* (NSW Fisheries 2013). Specifically:

- Section 3.3 outlines the general information requirements of NSW Fisheries for the assessment of proposed activities on fish and fish habitats.
- Section 6.3 outlines the specific information requirements of NSW Fisheries for the assessment of proposed reclamation activities on fish and fish habitats.

4.4 Water Management Act 2000

Under the *Water Management Act 2000* controlled activity approvals are required for certain types of developments that are carried out near waterways, including the removal of material or vegetation from land and the deposition of material on land. However, *Clause 40* of the *Water Management Regulation 2018* contains details of exemptions for public authorities to the requirement to hold a controlled activity approval. Consequently, BSC do not require a controlled activity approval under the *Water Management Act 2000* for the proposed activity.

4.5 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) and the *Biodiversity Conservation Regulation 2017* set out the legal framework for the protection of flora, fauna and ecological communities in NSW. Relevant sections of the BC Act are those that allow for

- Licensing of acts that may damage protected species and ecological communities (Part 2, Division 3).
- Listing of threatened flora, fauna and ecological communities (Part 4).
- Listing of key threatening processes.
- Biodiversity assessment and approvals under the planning act (Part 7), including 5-part tests of significance. An assessment of significance of the potential impacts of the proposal on threatened species, populations, ecological communities and their habitats is required under *Section 7.3* of the BC Act.

Schedules of threatened species, populations and ecological communities were checked in the preparation of this ecological assessment. They include listings for two plant species that are thought to possibly occur within the study area. No threatened species, populations or ecological communities are likely to be significantly negatively impacted by the proposal (refer to **Appendix C**).

Among the key threatening processes listed under the BC Act is 'Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands (as described in the final determination of the Scientific Committee to list the threatening process)'. The

proposed activity is unlikely to result in the alteration of the current flow regime of the Bellinger or Kalang Rivers in the short or long term. The proposed works are not, and will not contribute to, the operation of any key threatening processes.

4.6 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key federal legislation for the assessment of environmental impacts of a proposed activity. Under the 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". These are considered in **Appendix E** of this REF.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is not likely to be a significant impact of the proposed works upon any matter of national environmental significance. Accordingly, the proposed works do not need to be referred to the Federal Department of the Environment and Energy under the EPBC Act.

4.7 Bellingen Local Environmental Plan 2010

Bellingen Shire Council is the local government authority for the study area. The proposed works occur on land zoned E4 – Environmental Living under the *Bellingen Local Environmental Plan 2010* (BLEP). Under the BLEP, construction of roads is permissible with consent in areas zoned E4. However, development consent is not required because the proposed activity would be assessed under provisions of the ISEPP.

4.8 Approvals Required

No development approval is required.

A *Section 200* permit or *Section 199* consultation from DPI Fisheries would be required under the FM Act for reclamation.

No controlled activity approval would be required.

No consultation arising from impacts to threated aquatic flora, aquatic fauna or aquatic communities would be required with the NSW Minister for the Environment for the proposed works.

No Biodiversity Conservation Licence would be required for impacts upon aquatic threatened species or aquatic species associated with TECs.

No referral with the Federal Government Department of the Environment for potential impacts to aquatic matters would be required.

5. Conclusions

The likely short-term and long-term environmental effects upon the aquatic environment resulting from the proposed activities are potentially significant. However, the construction methodologies developed for the proposed activities to date contain a several strategies to mitigate environmental risk. In this report there are a small number of suggested further strategies.

Correct implementation of environmental controls should adequately mitigate the short-term risks to the aquatic environment associated with the proposed works.

There are a small number of relatively minor unavoidable long-term impacts to the aquatic environment that will arise from the proposed works. For the most part, these are impacts to unvegetated, unconsolidated rock and bedrock associated with piling. At two of the sites the proposed works would result in impacts to small areas of aquatic plants. In total, the aerial extent of this is to a maximum of approximately 3 m^2.

No significant negative impact on any threatened species, population or ecological community would be likely to arise from the proposed activities.

A *Section 200* licence from NSW DPI Fisheries would be required prior to commencement of the proposed activities.

6. Project Team

The Following individuals contributed to the preparation of this report

Mathew Birch
Environmental Scientist
Aquatic Science and Management

7. References

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8. Appendices

Appendix A
Proposed Works

Appendix B

Threatened Species Potential Occurrence Assessment

Table B.1 Threatened aquatic species potential occurrence assessment

Scientific Name	*Common Name*	*Status*		*Habitat Requirement*	*Suitability of Site Habitat*	*Potential Occurrence*
		BC Act	*EPBC Act*			
Mogurnda adspersa	Purple-spotted Gudgeon	E	V	Usually found in slow moving or still waters of rivers creeks and billabongs, often amongst weeds rocks and snags.	Suitable	**Possible**
Persicaria elatior	Tall Knotweed	V	V	Normally grows in damp places, especially beside streams and lakes.	Suitable	**Possible**
Zannichellia palustris	Horned Pondweed	E		Grows in fresh or slightly saline stationary or slowly flowing water	Suitable	**Possible**
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea along the NSW coast.	Unsuitable	Unlikely

Appendix C
BC Act 5 Part Tests

Table C.1 Five Part Tests for Tall Knotweed and Horned Pondweed

Factor	**Tall Knotweed (*Persicaria elatior*)**	**Horned Pondweed (*Zannichellia palustris*)**
(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. [BC Act section 7(1)(a)]	Tall Knotweed flowers in the summer and autumn. The proposed activity would not have any impact upon the life cycle of Tall Knotweed. No disturbance to Tall Knotweed is likely to occur as a result of the proposed activity.	Horned Pondweed flowers during the warmer months and dies back completely in the summer months. The proposed activity would not have any impact upon the life cycle of Horned Pondweed. No disturbance to Horned Pondweed is likely to occur as a result of the proposed activity
(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction [BC Act section 7(1)(b)]	N/A	N/A

Factor	**Tall Knotweed (*Persicaria elatior*)**	**Horned Pondweed (*Zannichellia palustris*)**
(c) in relation to the habitat of a threatened species or ecological community: i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality [BC Act section 7(1)(c)]	The proposed bridge works will not result in any change to available Tall Knotweed habitat in the study area. No isolation or fragmentation of Tall Knotweed habitat would result from the proposed works.	The proposed bridge works will not result in any change to available Horned Pondweed habitat in the study area. No isolation or fragmentation of Horned Pondweed habitat would result from the proposed works.
(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly) [BC Act section 7(1)(d)]	There are no declared areas of outstanding biodiversity value within the study area.	
(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process [BC Act section 7(1)(e)]	The proposed works are not, not part of and not likely to increase the impact of any of the 39 key threatening processes listed under the BC Act, although there is 1 relevant Key Threatening Processes listed; Alteration to the natural flow regimes of rivers and streams. While there may be minor changes to the direction of flow around new bridge piers but there would be no significant changes to flow volumes, flow velocities or river levels associated with the proposed works and the proposed works are not considered part of this key threatening process or likely to increase the impact of this key threatening process.	
Conclusion	No significant negative impact on Tall Knotweed.	No significant impact on Horned Pondweed

Appendix D

FM Act Seven Part Test

Assessment of significance ('7-part test') under Part 7 of the NSW Fisheries Management Act 1994 for the Purple Spotted Gudgeon

Background

A review of relevant databases and documents indicate that potential habitat may exist for the Purple Spotted Gudgeon (*Mogurnda adspersa*) in the study area.

Assessment of Significance criterion (Seven Part Test)	**Southern Purple-spotted Gudgeon (*Mogurnda adspersa*)**
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	No. The proposed works are not likely to interfere with the breeding, growth or movement of Southern Purple-spotted Gudgeon. The proposed works will be timed and undertaken in a way that would have a very minor, if any, impact upon the aquatic environment. The proposed works will not result in any significant change to fish passage during or after works.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	N/A
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A

Assessment of Significance criterion (Seven Part Test)	**Southern Purple-spotted Gudgeon (*Mogurnda adspersa*)**
d) In relation to the habitat of a threatened species, population or ecological community: i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	Southern Purple-spotted Gudgeon utilise freshwater habitats that are found near the study area (Pusey *et al.* 2004). However, the proposed works are unlikely to have a significant impact on habitat upstream or downstream of the bridge sites. i) The aquatic habitats that will be removed or modified are mostly riffle habitats or deep pools in a high flow environment. There is also a potential impact to approximately 3 m^2 of aquatic plant beds, w very small proportion of the overall vegetative aquatic habitat in the greater study area. However, following the proposed works, which will be undertaken in a dry period, the habitat will remain functionally the same ii) The proposed works will not result in the fragmentation or isolation of habitat for Southern Purple-spotted Gudgeon. The proposed works will result in no change to fish passage between areas of potential habitat for Southern Purple-spotted Gudgeon. iii) The habitat that will be modified by the proposed works is not of specific importance to the Southern Purple-spotted Gudgeon. There are no recorded observations of Southern Purple-spotted Gudgeon in the Bellinger River and the bridge sites have not been mapped as potential habitat for Southern Purple-spotted Gudgeon.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)	There is no critical habitat listed for Southern Purple-spotted Gudgeon.
f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan	The proposed works are not consistent with any of the 29 recovery plan objectives (under 8 categories) recommended for the Southern Purple-spotted Gudgeon (Port Stephens Fisheries Institute 2012).
g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP	There are currently 8 key threatening processes listed under the *Fisheries Management Act 1994*. These include Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams. The proposed activity involves the installation of an instream structure. However, the proposed activity will not impact fish and is unlikely to impact the volume or velocity of flows in the Bellinger and Kalang Rivers.

Conclusion

The proposal would not have a significant impact upon Southern Purple-spotted Gudgeons. This conclusion is based upon:

- No works occurring in mapped Southern Purple-spotted Gudgeon habitat.
- The relatively restricted area of disturbance associated with the proposed activity.
- No change to fish passage during or following the proposed works.

Appendix E

Protected Matter Search Tool Results

Appendix F
Bionet Search Tool Results

Appendix G

Consideration of EPBC Protected Matters

Matters of National Environmental Significance

Background

Under the *Environment Protection and Biodiversity Conservation Act 1999* the following matters of national environmental significance and impacts on Commonwealth Land are to be considered to assist in determining whether the proposal should be referred to the Australian Government Department of Agriculture, Water and the Environment.

Matter Assessed	***Notes***
a) Any impact on a World Heritage Property?	None.
b) Any impact on a place of National Heritage?	None
c) Any impact on a Wetland of International Importance?	None
d) Any impact on a listed aquatic threatened species or aquatic ecological communities?	No negative impact.
e) Any impact on an aquatic migratory species protected under international agreements?	None of the species identified in the search would be negatively impacted by the proposed activity.
f) Any impact on Commonwealth Marine Areas?	None
g) Any impact on the Great Barrier Reef Marine Park?	None.
h) Any nuclear actions?	None.
i) Any impact on a water resource (in relation to coal seam gas development and large coal mining development)?	None.

Conclusion

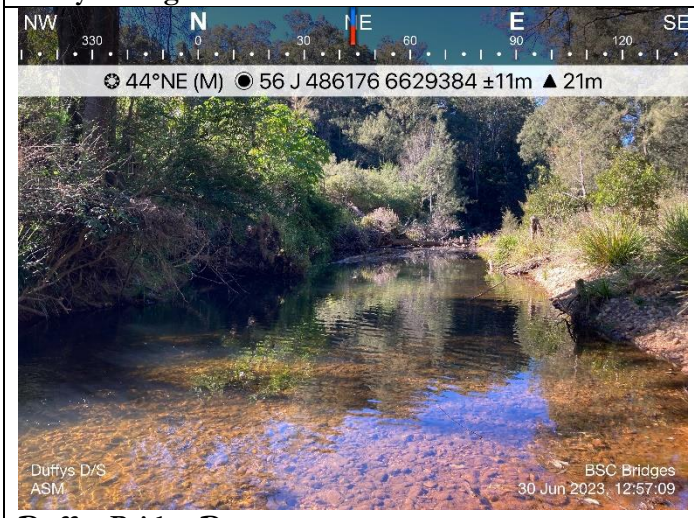
No referral required.

Appendix H

Plates

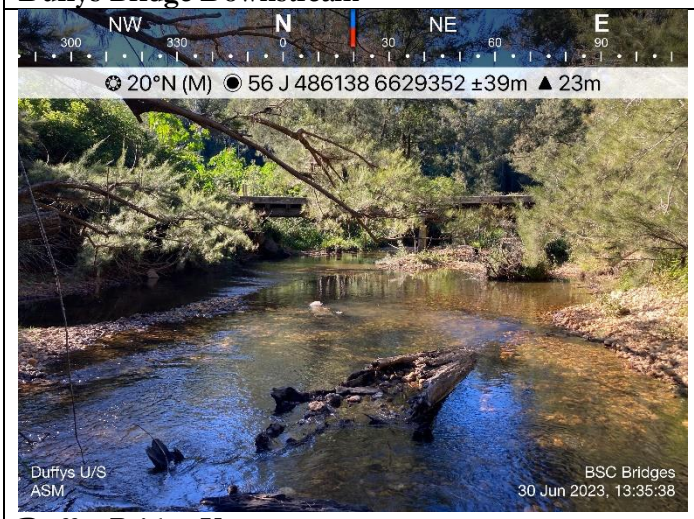
Duffys Bridge Downstream

Duffys Bridge Downstream



Duffys Bridge Downstream

Duffys Bridge Downstream



Duffys Bridge Upstream

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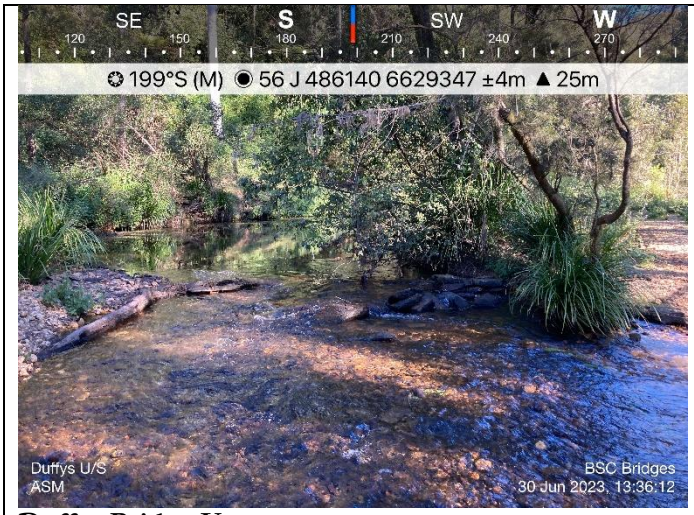

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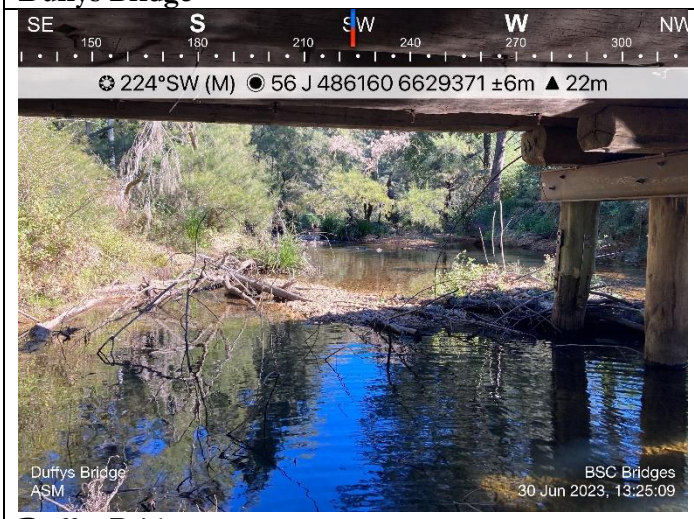
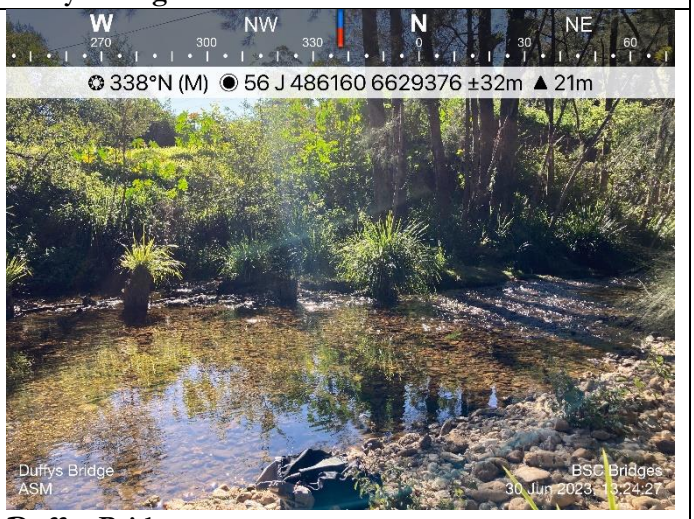


Duffys Bridge



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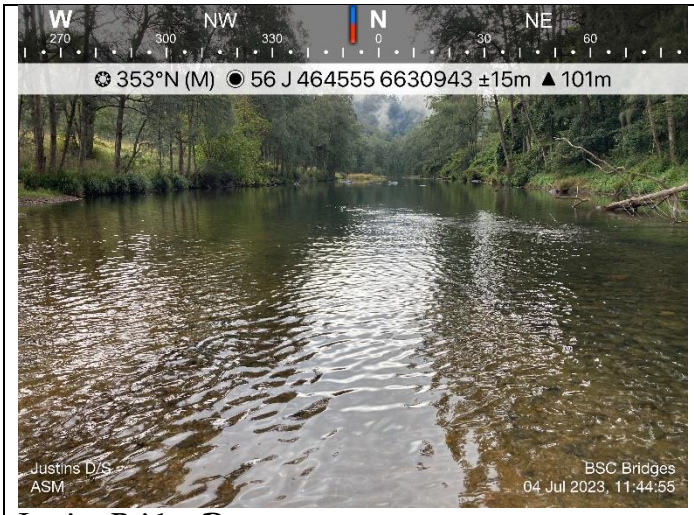

Justins Bridge Downstream

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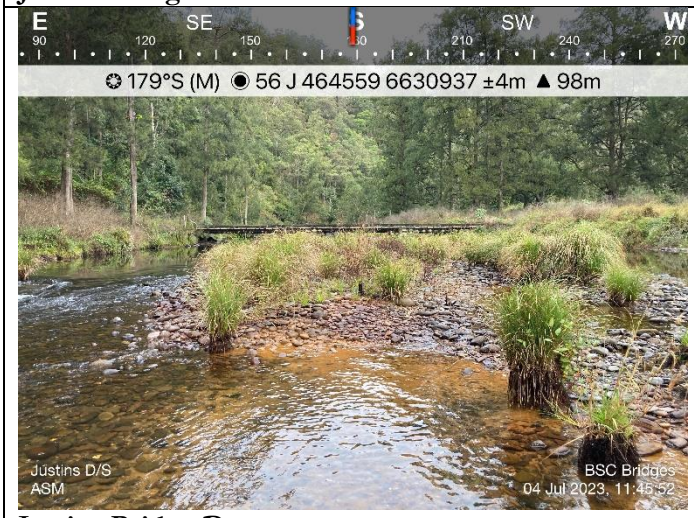

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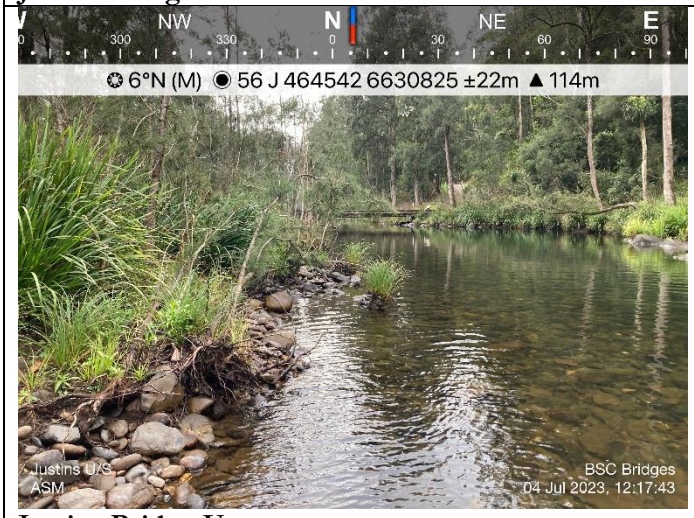

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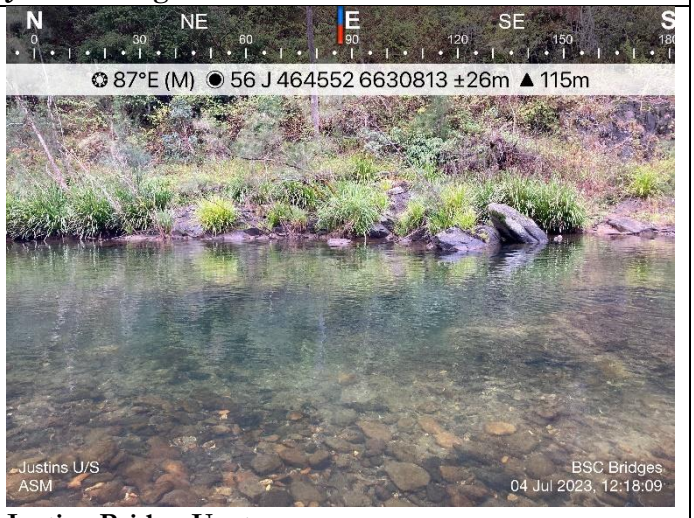

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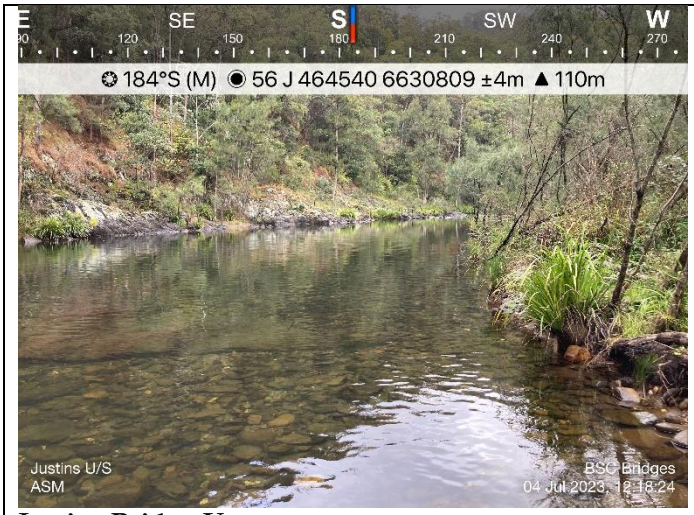

Justins Bridge Upstream

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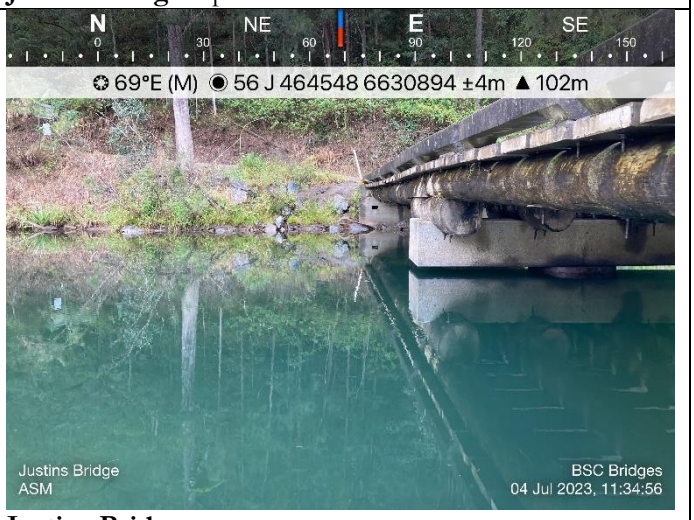

Justins Bridge

Justins Bridge

Justins Bridge

Hobarts Bridge Downstream

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Hobarts Bridge Downstream

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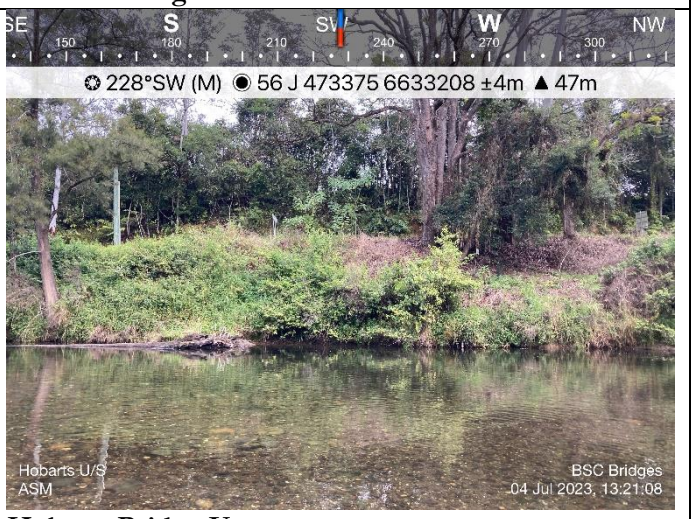
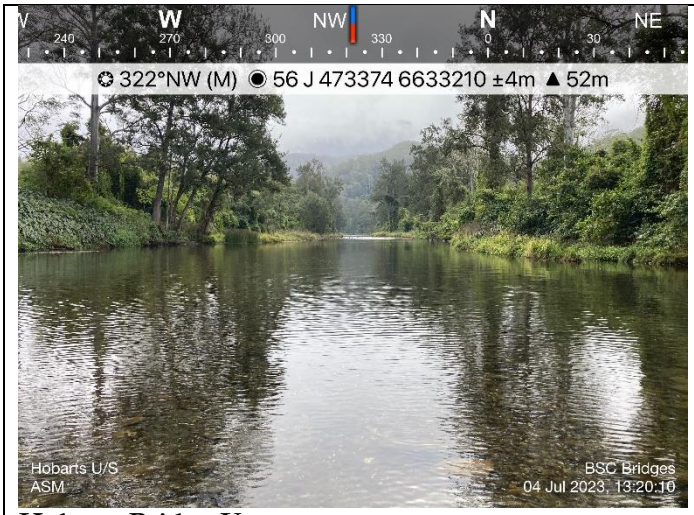
Hobarts Bridge Upstream



Hobarts Bridge Upstream



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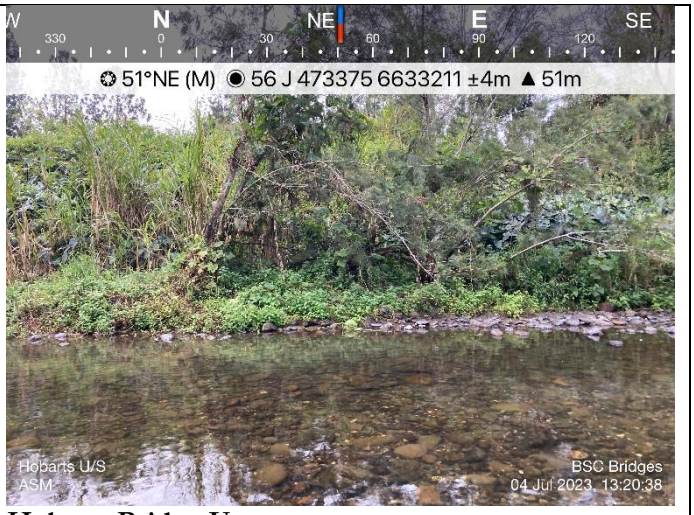

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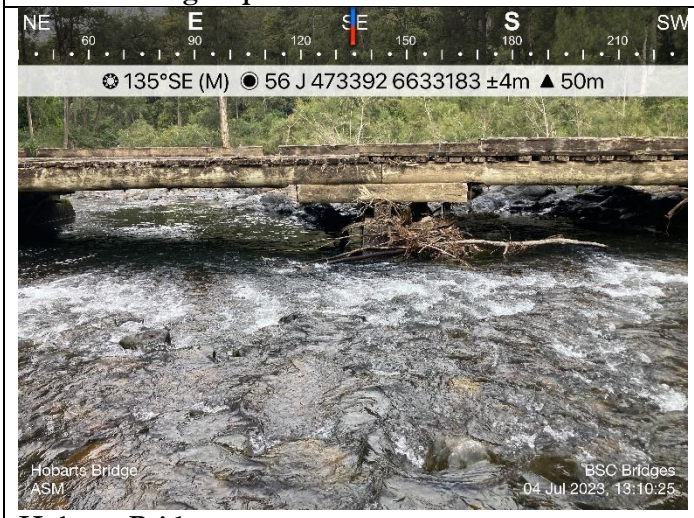

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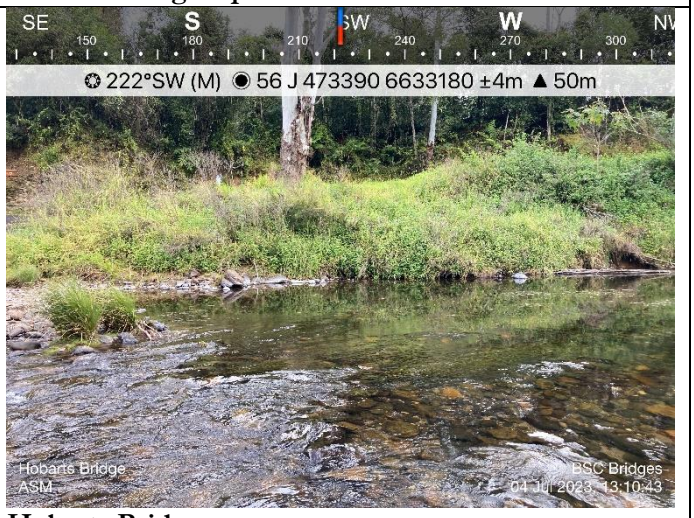

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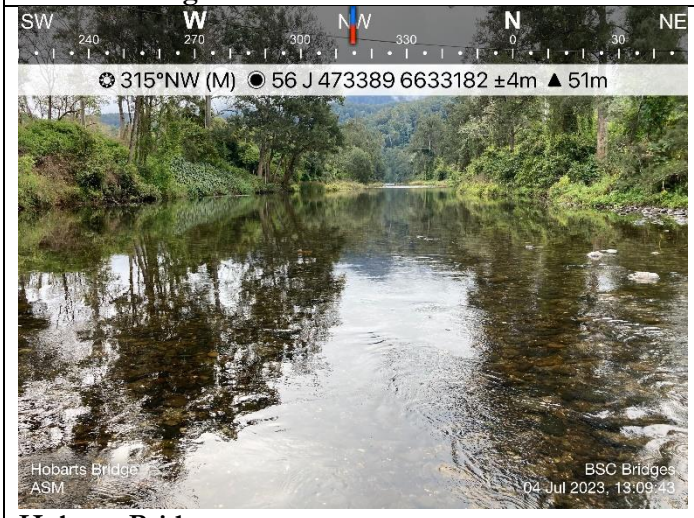
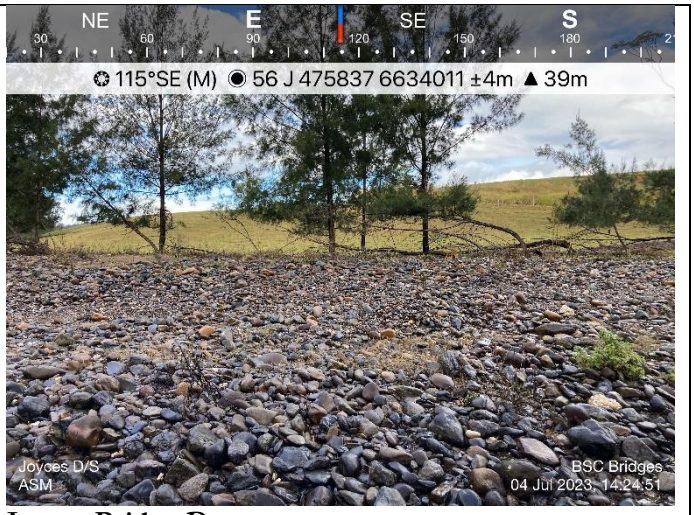


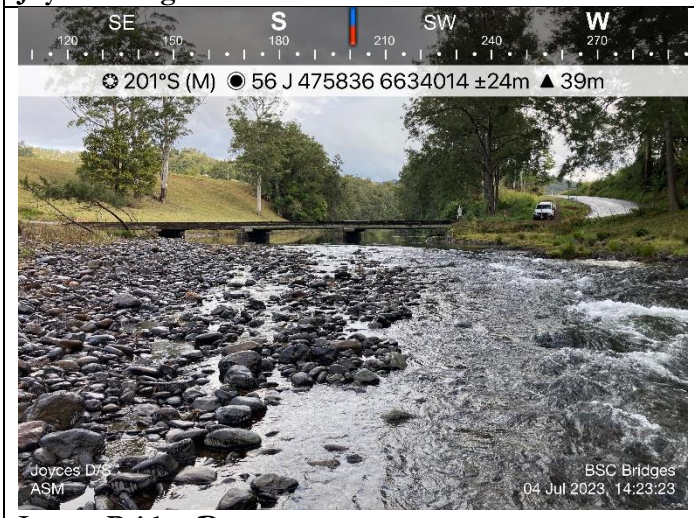
Hobarts Bridge

Hobarts Bridge

Joyces Bridge Downstream



Joyces Bridge Downstream



Joyces Bridge Downstream

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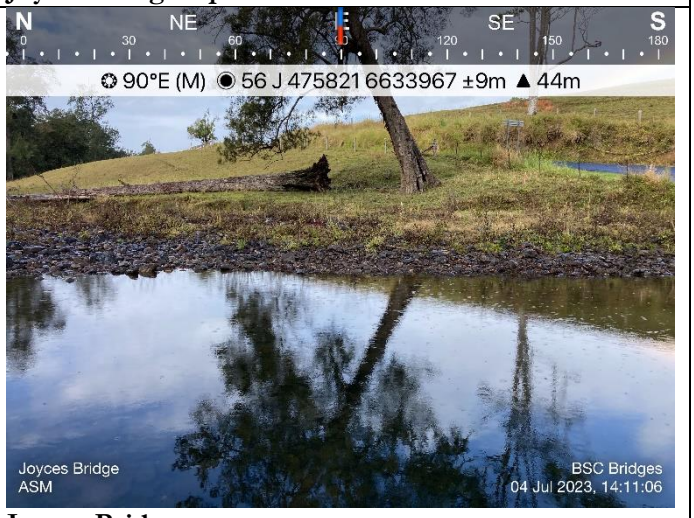
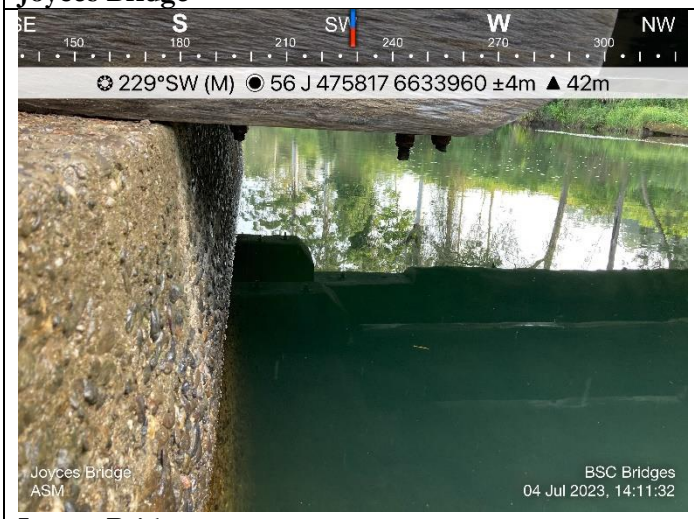
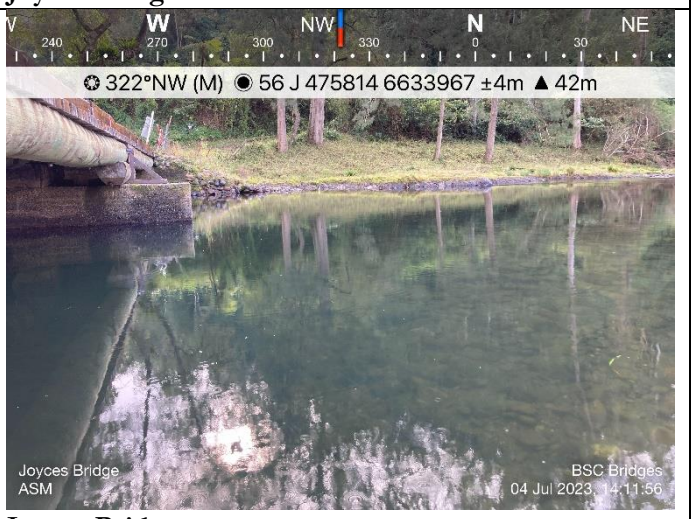


Joyces Bridge



Joyces Bridge



Joyces Bridge

Appendix G

Microbat Analysis Report

Technical Memorandum

December 15, 2023

To	Mal Weerakoon	**Tel**	[Enter text]
Copy to	[Enter text]	**Email**	[Enter text]
From	[Enter text]	**Ref. No.**	12611463
Subject	Bat call analysis – Bellinger River – Four Bridge Sites		

Dear Mal,

The following technical memo presents the methods and results for analysis of bat calls for the Bellingen Bridge upgrade project (project number - 12611463).

Anabat detector recorders were placed for four nights near or under the following four existing bridges all located within the Bellingen Local Government Area (LGA):

- Duffy's Bridge located on Kalang Road, Kalang NSW, crossing the Kalang River
- Joyces Bridge located on Darkwood Road, crossing the Bellinger River
- Hobarts Bridge located on Darkwood Road, crossing the Bellinger River
- Justins Bridge located on Darkwood Road, crossing the Bellinger River

Table 1 *Anabat detector placement and photos*

Location	Dates and details of placement	Photos of bridge and underside of bridge targeting potential roost habitat
Duffys Bridge	27-28th November 2023: Southern end underside of bridge 29-30th November 2023: Northern end underside of bridge	 *Plate 1 Underside of Duffys Bridge*

Location	Dates and details of placement	Photos of bridge and underside of bridge targeting potential roost habitat
		 *Plate 2 Potential microbat roosting habitat under Duffys Bridge*
Joyces Bridge	27-28th November 2023: On casuarina on north side of Bellinger River ~50m downstream from bridge (as access to underside of bridge was difficult) 29-30th November 2023: Northern end underside of bridge	 *Plate 3 Underside of Joyces Bridge*  *Plate 4 Potential microbat roosting habitat under Joyces Bridge*

Location	Dates and details of placement	Photos of bridge and underside of bridge targeting potential roost habitat
Hobarts Bridge	27th November 2023: Western end underside of bridge 28th November 2023: South side of Bellinger River ~75m from bridge (moved from underside of bridge due to forecast rain) 29-30th November 2023: Eastern end underside of bridge	 *Plate 5 Underside of Hobarts Bridge*  *Plate 6 Potential microbat roosting habitat under Hobarts Bridge*
Justins Bridge	27-28th November 2023: Eastern end underside of bridge 29-30th November 2023: Western end underside of bridge	 *Plate 7 Underside of Justins Bridge*

1. Analysis method

Bat calls were recorded during field surveys using Anabat Express Zero Crossing detectors (Titley Scientific).

The zero crossing analysis file (zca file) recorded using the detector was converted to zc sequence files using Anabat Insight (version 2.0.6-3) for analysis and in order to add metadata (e.g. species label etc). During the conversion process a filter was applied to identify bat sequences and remove noise files. Noise files were moved to a separate folder for later checking.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for potential species (Pennay et al 2011; Churchill 2008; Van Dyck et al. 2013) and records from BioNet (December 2023) and BatMap (December 2023). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000 for similar process) as summarised in Table 1. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls. Species nomenclature follows Armstrong et al 2022.

Table 2 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species for e.g. *Chalinolobus gouldii /Ozimops sp.*

2. Analysis results

A large number of zc sequence files were recorded from 2 of the 4 locations (n = 13,000 +). Very few files and no bat calls were recorded for the Duffys Bridge or Hobarts Bridge sites. A review of the log files revealed that both detectors suffered from technical issues (e.g. faulty power supply or possible faulty microphone). Both Justins Bridge and Joyces Bridge sites each recorded 4 consecutive nights of data.

The analysis of data focused on the emergence period – the period from sunset onwards for 2 hours to understand the timing and activity of bat species that may be roosting within the bridge structure. Data for the remainder of the night was scanned using species specific filters and random manually checking of data.

Emergence summary

Table 3 provides a summary of emergence period calls recorded at each bridge site for each date. In summary:

Justins Bridge

– The detector was placed on the underside of the bridge for two nights each at two locations (opposite ends)
– A small number of calls (< 15) each night were recorded for the evening emergence period for 2 of the 4 survey nights (27-28/11/23) including calls from the species group *Myotis macropus/Nyctophilus sp.*and two probable *Falsitrellus tasmaniensis* calls. No calls were recorded for this same period for the 29-30/11/23.
– A small number of calls (< 10) each night were also recorded for the early morning re-entry period near sunrise for 3 of the 4 survey nights (28, 29, 30/11/23).
– This data suggests some bat species may be roosting within the bridge, most likely at a location, nearby the site of the detector for the detector dates 27-28/11/23 or between the two detector sites.

Joyces Bridge

– The detector was placed near the bridge on a tree for two consecutive nights then on the underside of the bridge for two consecutive nights

– A small number of calls (< 3) each night were recorded for the evening emergence period for 2 non-consecutive nights of the 4 survey nights (27 and 30/11/23) including calls from the species group *Myotis macropus/Nyctophilus* sp.and *M.o.oceanensis/Vespadelus* sp.
– No calls were recorded or the early morning re-entry period near sunrise for any survey night
– The few calls recorded indicate emergence from a nearby roost however the source of the calls cannot be confidently placed within bridge structure.

Table 3 Summary of first calls recorded for each site for each date

Date	Sunset / Civil twilight (CT)	First calls	Species / Group	Notes
Joyces Bridge				
27/11/23	19:33 / 19:59	19:47 20:04 20:13 20:16	Bat call undescribed *S. rueppellii/S. orion/F. tasmaniensis* *M.o.oceanensis/Vespadelus sp* *M.macropus/Nyctophilus sp.*	1 call prior to CT and few (< 5) calls within 15 mins of CT No post CT near sunrise calls (05:12 am – 05:39 am) were recorded
28/11/23	19:33 / 20:00	20:21	*M.macropus/Nyctophilus sp.* .	No calls before or within 15 mins of CT No post CT near sunrise calls were recorded
29/11/23	19:34 / 20:01	20:19	*M.macropus/Nyctophilus sp.* .	No calls before or within 15 mins of CT No post CT near sunrise calls were recorded
30/11/23	19:35 / 20:02	20:13 20:16	*C. gouldii/S. rueppellii/S. orion* Bat call undescribed	2 calls within 15 min of CT No post CT near sunrise calls were recorded
Justins Bridge				
27/11/23	19:33 / 19:59	19:54 19:55 19:58 20:01 20:03 20:05 20:06 20:07 20:12 20:13 20:14	*C. gouldii* and bat call undescribed *C. gouldii* and bat call undescribed *C. gouldii* and bat call undescribed *M. macropus/ Nyctophilus sp.* *Falsistrellus tasmaniensis (PR)* and bat call undescribed bat call undescribed *C. gouldii/ Ozimops sp* *M. macropus/ Nyctophilus sp.* *M. macropus/ Nyctophilus sp.* *C. gouldii/ Ozimops sp* *V. darlingtoni/V. reguls*	Several calls prior to CT and many calls within 15 mins of CT including SG M. macropus/Nyctophilus sp. and PR F. tasmaniensis No post CT near sunrise calls (05:12 am – 05:39 am) were recorded

Date	Sunset / Civil twilight (CT)	First calls	Species / Group	Notes
28/11/23	19:33 / 20:00	19:57 19:59 20:00 20:03 20:04 20:10 20:11 20:14 20:15	*M. macropus/ Nyctophilus sp.* *M. o. oceansis/ Vespadelus sp.* *C. gouldii/ Ozimops sp* *S. orion/F. tasmaniensis* bat call undescribed *M. macropus/ Nyctophilus sp.* bat call undescribed *C. gouldii/ Ozimops sp* *M. macropus/ Nyctophilus sp.*	Several calls prior to CT and many calls within 15 mins of CT including SG *M. macropus/Nyctophilus* sp. Few post CT near sunrise calls were recorded and identified as undescribed bat calls
29/11/23	19:34 / 20:01	20:48	*C. gouldii* and bat call undescribed	No calls before or within 15 mins of CT Few post CT near sunrise calls were recorded for *M. macropus/ Nyctophilus sp.* and *C. gouldii/ Ozimops sp.*
30/11/23	19:35 / 20:02	20:59	*M. macropus/ Nyctophilus sp.*	No calls before or within 15 mins of CT Few post CT near sunrise calls were recorded for *M. macropus/ Nyctophilus sp.* and *Micronomus norfolkensis*

Table notes – sunset/civil twilight source - https://www.timeanddate.com/ (location Thora NSW)

Species summary

Of the 13,903 files recorded approximately 82% contained bat files of some description. Remaining files contained anthropogenic and/or insect noise. Table 3 presents a summary of the species recorded for each site for the survey period as a result of the bat call analysis. Seven species were positively (Definite) identified of the 21 or so species that are known to occur from the locality of the study area. As many as five other species may also have been recorded, but poor data quality and/or interspecific call similarities precluded reliable identification of additional species. Furthermore not all files were labelled as a species or species group, therefore additional species may also be occur within the data. Three of the seven species positively identified are listed under the *Biodiversity Conservation Act 2016* listed:

– *Myotis macropus* – vulnerable BCA Act
  - Recorded from approximately 50 (definite and probable combined) files consisting of 15 or more consecutive pulses. Most call sequences recorded average initial slope of greater than 400 octaves per second (OPS) and average pulse interval of less than 75 milliseconds (ms). Some sequences also contained pulse shapes displaying central kink in slope.
  - In addition 268 files were attributed to the species group Nyctophilus sp./Myotis Macropus. The call characteristics of both species are very similar and can be easily confused particularly when call quality is less than optimal. Given the location of the bat detectors (e.g. next to or over water) and few definitive Nyctophilus calls (n = 7) recorded during the survey, it is most likely that a portion of calls attributed to the species group Nyctophilus sp./Myotis Macropus are Myotis macropus.
– *Micronomus norfolkensis* – vulnerable BCA Act

- Recorded from approximately 145 (definite and probable combined) files consisting of calls with 5 or more consecutive pulses and a characteristic frequency of 31 – 35 kHz. Most call sequences consisted of alternating pulses with most pulses presenting a short initial and down-sweeping tail.

– *Miniopterus australis* – vulnerable BCA Act

- Recorded from approximately 28 (definite) files consisting of calls with 3 or more consecutive pulses and a characteristic frequency of 57 – 63 kHz. Most call sequences consisted of curved alternating pulses with down-sweeping tail. This species has a higher characteristic frequency than any other species within this region.

Example spectrogram calls for the three threatened bat species definitely identified from call analysis are provided in Attachment 1.

Table 4 Summary of bat call analysis results for each site and night

Species or Species Group	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-27	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-28	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-29	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-30	Justins Bridge_Dracula/SN434272 2023-11-27	Justins Bridge_Dracula/SN434272 2023-11-28	Justins Bridge_Dracula/SN434272 2023-11-29	Justins Bridge_Dracula/SN434272 2023-11-30
Austronomus australis	D	D	D	D				
Chalinolobus gouldii			PR		D	D	D	D
Chalinolobus morio				D				
Falsistrellus tasmaniensis	D				PR			
Micronomus norfolkensis	PR	D	D	D		D	PR	PR
Miniopterus australis	D	D	D					
Myotis macropus PR	D	D	D		D			
Nyctophilus spp	D	D		D				
Ozimops ridei		PR		PR				
C. gouldii/S. rueppellii/S. orion		SG		SG	SG	SG		
C.gouldii/O. ridei/ M. norfolkensis		SG	SG	SG	SG	SG	SG	SG
M.macropus/ Nyctophilus sp.	SG	SG	SG	SG	SG	SG	SG	SG
M.o.oceanensis/Vespadelus sp	SG	SG	SG	SG	SG	SG	SG	
S. orion/F. tasmaniensis	SG	SG	SG			SG		
S. rueppellii/S. orion/F. tasmaniensis	SG		SG	SG	SG			

Species or Species Group	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-27	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-28	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-29	Joyces Bridge_ Wagga Wagga/ SN409366 2023-11-30	Justins Bridge_Dracula/SN434272 2023-11-27	Justins Bridge_Dracula/SN434272 2023-11-28	Justins Bridge_Dracula/SN434272 2023-11-29	Justins Bridge_Dracula/SN434272 2023-11-30
V. pumilus/M. australis	SG				SG	SG		
V.darlingtoni/ V.regulus			SG		SG			
Vespadelus sp./C. morio.				SG				
Other bat calls	Y	Y	Y	Y	Y	Y	Y	Y
Number of files	245	324	3047	2665	2908	2900	500	1352
Number of species per night	5	5	4	4	2	2	1	1
Survey effort (hrs:mins)	11	11	11	11	11	11	11	11

Table Notes:
Total number of species recorded for each night/site is based on definite (D) identification only. Total number of D species for each night includes one *Nyctophilus* species where recorded. See Table 1 for confidence rating e.g. D or Pr
Other bat calls – incomplete single pulses, single scattered pulses, call sequences consisting of incomplete, fragmented pulses lacking key diagnostic features
ce, e, v - species listed under the *NSW Biodiversity Conservation Act 2016*.
CE, E, VU – species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
Survey effort: estimate of time between sunset and sunrise for a successful night of Anabat detection.

Regards

Craig Grabham
Senior Ecologist

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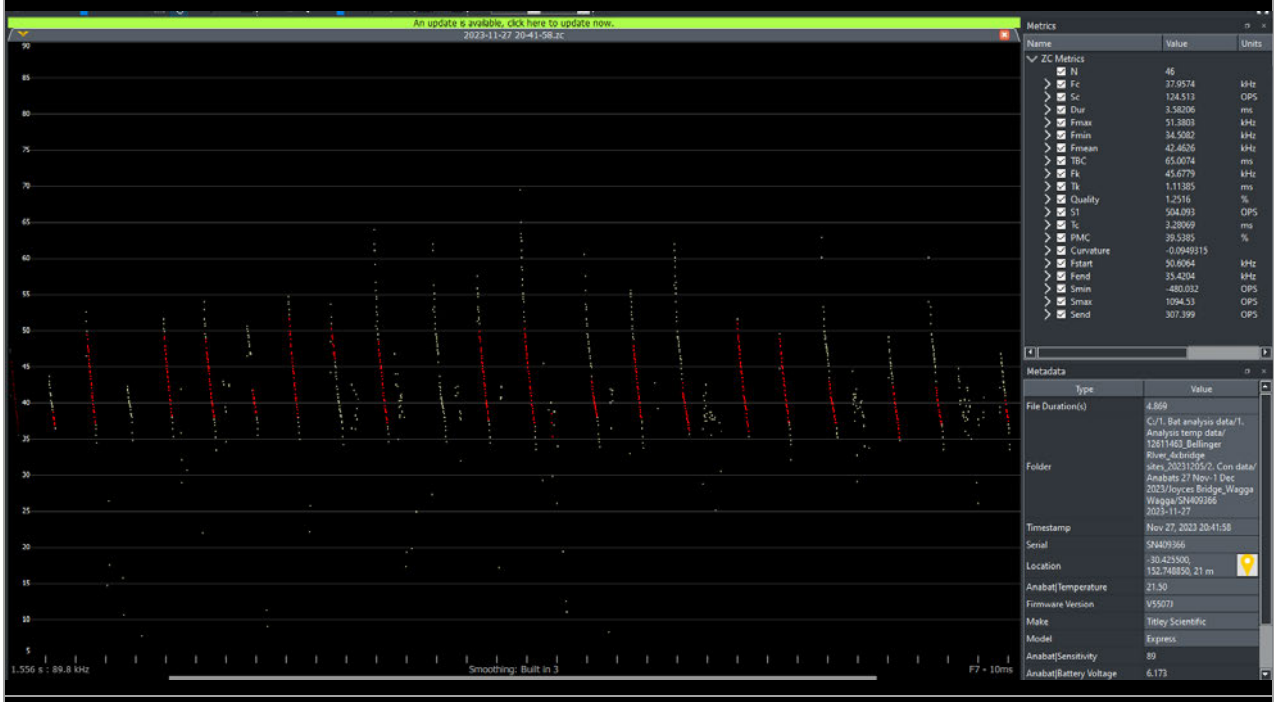
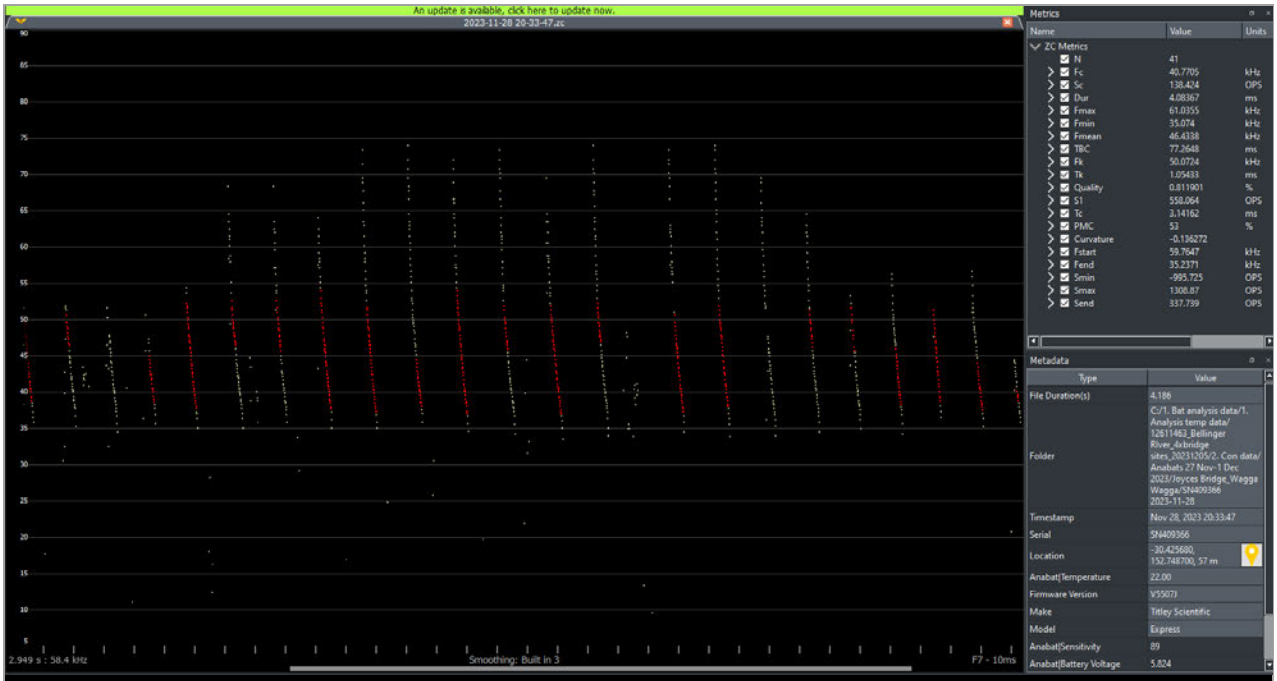
Attachment 1 – Example spectrogram calls from site for Definite threatened species. Calls presented in F7, compressed mode

Myotis macropus

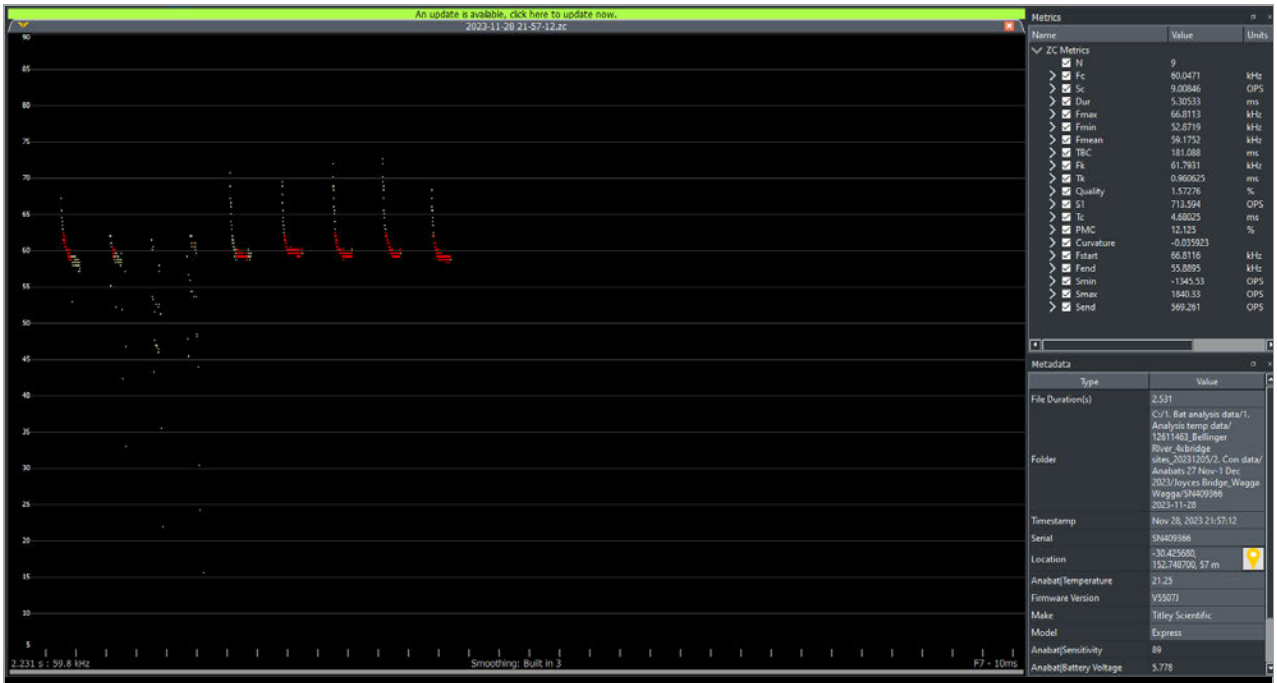


Myotis macropus

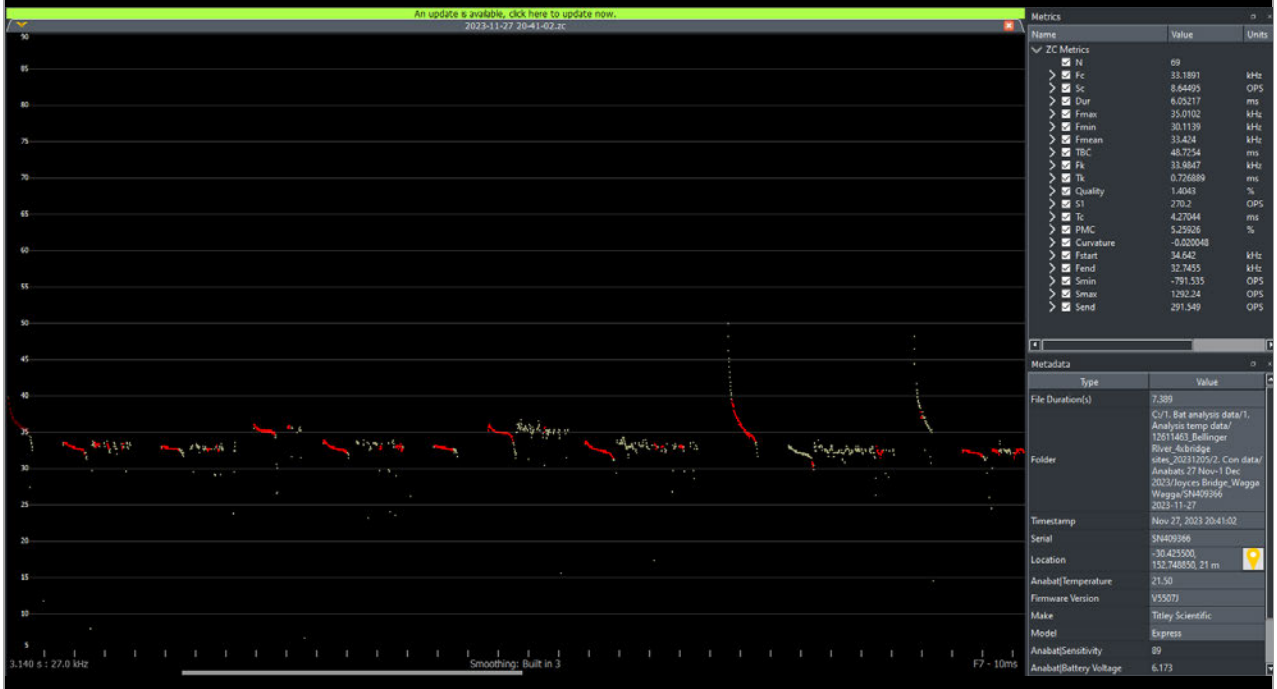


Miniopterus australis

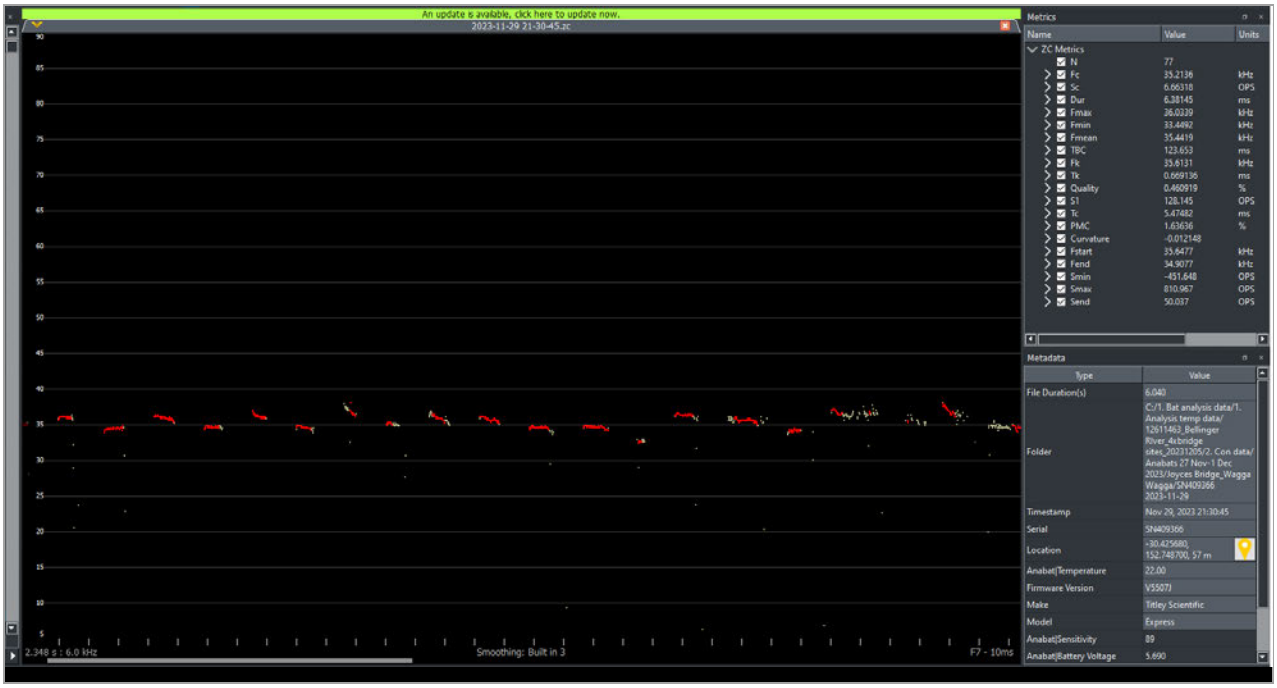
Miniopterus australis



Micronomus norfolkensis



Micronomus norfolkensis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Model
Express
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Anabat|Battery Voltage
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Appendix H

Fauna Species List

Observation type: O: Observed, A: Aural observation :W: Heard
NSW Status: P: Protected, E= Endangered, V=Vulnerable, CE=Critically Endangered

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Joyces Bridge								
Litoria phyllochroa	Leaf-green Tree Frog	P		A	3	Joyces Bridge	NOC 1	27/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	1	Joyces Bridge	NOC 1	27/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	10	Joyces Bridge	NOC 2	28/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		A	10	Joyces Bridge	NOC 2	28/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		A	5	Joyces Bridge	NOC 2	28/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	1	Joyces Bridge	NOC 2	28/11/2023
(Microchiroptera suborder) (Microchiroptera suborder)	Unidentified microbat			O	1	Joyces Bridge	NOC 2	28/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	19	Joyces Bridge	NOC 3	29/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	3	Joyces Bridge	NOC 3	29/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	3	Joyces Bridge	NOC 3	29/11/2023
Mus musculus	House Mouse			O	1	Joyces Bridge	NOC 3	29/11/2023
Intellagama lesueurii	Eastern Water Dragon	P		O	2	Joyces Bridge	NOC 3	29/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Aegotheles cristatus	Australian Owlet-nightjar	P		A	1	Joyces Bridge	NOC 3	29/11/2023
Vanellus miles	Masked Lapwing	P		A	2	Joyces Bridge	NOC 3	29/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	19	Joyces Bridge	NOC 3	29/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	3	Joyces Bridge	NOC 3	29/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	3	Joyces Bridge	NOC 3	29/11/2023
Mus musculus	House Mouse			O	1	Joyces Bridge	NOC 3	29/11/2023
Intellagama lesueurii	Eastern Water Dragon	P		O	2	Joyces Bridge	NOC 3	29/11/2023
Aegotheles cristatus	Australian Owlet-nightjar	P		A	1	Joyces Bridge	NOC 3	29/11/2023
Vanellus miles	Masked Lapwing	P		A	2	Joyces Bridge	NOC 3	29/11/2023
Intellagama lesueurii	Eastern Water Dragon	P		O	5	Joyces Bridge	NOC 4	30/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	4	Joyces Bridge	NOC 4	30/11/2023
Tropidechis carinatus	Rough-scaled Snake	P		O	4	Joyces Bridge	NOC 4	30/11/2023
Anguilla australis	Shortfin Eel			O	1	Joyces Bridge	NOC 4	30/11/2023
Litoria dentata	Bleating Tree Frog	P		O	1	Joyces Bridge	NOC 4	30/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Litoria phyllochroa	Leaf-green Tree Frog	P		O	1	Joyces Bridge	NOC 4	30/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	1	Joyces Bridge	NOC 4	30/11/2023
Limnodynastes peronii	Brown-striped Frog	P		O	1	Joyces Bridge	NOC 4	30/11/2023
Cracticus tibicen	Australian Magpie	P		A	1	Joyces Bridge	BIRD2	28/11/2023
Vanellus miles	Masked Lapwing	P		A	2	Joyces Bridge	BIRD2	28/11/2023
Corvus coronoides	Australian Raven	P		OA	3	Joyces Bridge	BIRD2	28/11/2023
Psophodes olivaceus	Eastern Whipbird	P		A	2	Joyces Bridge	BIRD2	28/11/2023
Eudynamys orientalis	Eastern Koel	P		A	1	Joyces Bridge	BIRD2	28/11/2023
Rhipidura albiscapa	Grey Fantail	P		OA	20	Joyces Bridge	BIRD2	28/11/2023
Oriolus sagittatus	Olive-backed Oriole	P		A	4	Joyces Bridge	BIRD2	28/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		OA	6	Joyces Bridge	BIRD2	28/11/2023
Eopsaltria australis	Eastern Yellow Robin	P		A	1	Joyces Bridge	BIRD2	28/11/2023
Ailuroedus crassirostris	Green Catbird	P		O	3	Joyces Bridge	BIRD2	28/11/2023
Gallinula tenebrosa	Dusky Moorhen	P		O	8	Joyces Bridge	BIRD2	28/11/2023
Alisterus scapularis	Australian King-parrot	P		O	1	Joyces Bridge	BIRD2	28/11/2023
Phalacrocorax sulcirostris	Little Black Cormorant	P		O	1	Joyces Bridge	BIRD2	28/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Anhinga novaehollandiae	Australasian Darter	P		O	1	Joyces Bridge	BIRD2	28/11/2023
Macropygia amboinensis	Brown Cuckoo-dove	P		O	3	Joyces Bridge	BIRD2	28/11/2023
Ardea ibis	Cattle Egret	P		O	1	Joyces Bridge	BIRD2	28/11/2023
Monarcha melanopsis	Black-faced Monarch	P		O	1	Joyces Bridge	BIRD2	28/11/2023
Acanthiza pusilla	Brown Thornbill	P		O	2	Joyces Bridge	BIRD2	28/11/2023
Nesoptilotis leucotis	White-eared Honeyeater	P		O	1	Joyces Bridge	BIRD2	28/11/2023
Pachycephala pectoralis	Golden Whistler	P		O	2	Joyces Bridge	BIRD2	28/11/2023
Neochmia temporalis	Red-browed Finch	P		OA	5	Joyces Bridge	BIRD2	28/11/2023
Litoria dentata	Bleating Tree Frog	P		A	2	Joyces Bridge	BIRD2	28/11/2023
Hobarts Bridge								
Adelotus brevis	Tusked Frog	P		A	3	Hobarts Bridge	NOC 1	27/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		A	30	Hobarts Bridge	NOC 1	27/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	10	Hobarts Bridge	NOC 1	27/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	1	Hobarts Bridge	NOC 1	27/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		O	1	Hobarts Bridge	NOC 2	28/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	1	Hobarts Bridge	NOC 2	28/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	10	Hobarts Bridge	NOC 2	28/11/2023
Adelotus brevis	Tusked Frog	P		A	1	Hobarts Bridge	NOC 2	28/11/2023
Limnodynastes peronii	Brown-striped Frog	P		O	3	Hobarts Bridge	NOC 2	28/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	11	Hobarts Bridge	NOC 3	29/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	2	Hobarts Bridge	NOC 3	29/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		O	5	Hobarts Bridge	NOC 3	29/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	5	Hobarts Bridge	NOC 3	29/11/2023
Adelotus brevis	Tusked Frog	P		A	1	Hobarts Bridge	NOC 3	29/11/2023
Austronomus australis	White-striped Freetail-bat	P		A	3	Hobarts Bridge	NOC 3	29/11/2023
Anguilla australis	Shortfin Eel			O	4	Hobarts Bridge	NOC 3	29/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	8	Hobarts Bridge	NOC 4	30/11/2023
Anguilla australis	Shortfin Eel			O	2	Hobarts Bridge	NOC 4	30/11/2023
Intellagama lesueurii	Eastern Water Dragon	P		O	2	Hobarts Bridge	NOC 4	30/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Litoria phyllochroa	Leaf-green Tree Frog	P		A	2	Hobarts Bridge	NOC 4	30/11/2023
Perameles nasuta	Long-nosed Bandicoot	P		A	1	Hobarts Bridge	NOC 4	30/11/2023
Limnodynastes peronii	Brown-striped Frog	P		A	1	Hobarts Bridge	NOC 4	30/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		A	4	Hobarts Bridge	NOC 4	30/11/2023
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V	OA	500	Hobarts Bridge	BIRD4	29/11/2023
Pteropus alecto	Black Flying-fox	P		OA	200	Hobarts Bridge	BIRD4	29/11/2023
Malurus cyaneus	Superb Fairy-wren	P		OA	2	Hobarts Bridge	BIRD4	29/11/2023
Ailuroedus crassirostris	Green Catbird	P		O	1	Hobarts Bridge	BIRD4	29/11/2023
Alisterus scapularis	Australian King-parrot	P		OA	1	Hobarts Bridge	BIRD4	29/11/2023
Macropygia amboinensis	Brown Cuckoo-dove	P		O	1	Hobarts Bridge	BIRD4	29/11/2023
Acanthiza pusilla	Brown Thornbill	P		O	1	Hobarts Bridge	BIRD4	29/11/2023
Colluricincla harmonica	Grey Shrike-thrush	P		O	1	Hobarts Bridge	BIRD4	29/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		OA	2	Hobarts Bridge	BIRD4	29/11/2023
Pachycephala rufiventris	Rufous Whistler	P		O	1	Hobarts Bridge	BIRD4	29/11/2023
Cracticus tibicen	Australian Magpie	P		O	1	Hobarts Bridge	BIRD4	29/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Psophodes olivaceus	Eastern Whipbird	P		A	2	Hobarts Bridge	BIRD4	29/11/2023
Pseudophryne bibronii	Bibron's Toadlet	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Melithreptus brevirostris	Brown-headed Honeyeater	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Trichoglossus haematodus	Rainbow Lorikeet	P		A	3	Hobarts Bridge	BIRD4	29/11/2023
Rhipidura leucophrys	Willie Wagtail	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Corvus coronoides	Australian Raven	P		OA	4	Hobarts Bridge	BIRD4	29/11/2023
Lopholaimus antarcticus	Topknot Pigeon	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Pachycephala pectoralis	Golden Whistler	P		A	2	Hobarts Bridge	BIRD4	29/11/2023
Oriolus sagittatus	Olive-backed Oriole	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Ptilinopus superbus	Superb Fruit-dove	V,P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Eopsaltria australis	Eastern Yellow Robin	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Dacelo novaeguineae	Laughing Kookaburra	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Eudynamys orientalis	Eastern Koel	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Adelotus brevis	Tusked Frog	P		A	1	Hobarts Bridge	BIRD4	29/11/2023
Justins Bridge								
Litoria latopalmata	Broad-palmed Frog	P		O	1	Justins Bridge	NOC 1	27/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	10	Justins Bridge	NOC 1	27/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		OA	1	Justins Bridge	NOC 2	28/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	1	Justins Bridge	NOC 2	28/11/2023
Hoplocephalus Stephens'sii	Stephens's' Banded Snake	V,P		O	1	Opportunistic.~1.8km NE of Justins Bridge on Darkwood Road	NOC 2	28/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	1	Justins Bridge	NOC 3	29/11/2023
Litoria latopalmata	Broad-palmed Frog	P		O	1	Justins Bridge	NOC 3	29/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	1	Justins Bridge	NOC 3	29/11/2023
Austronomus australis	White-striped Freetail-bat	P		A	2	Justins Bridge	NOC 3	29/11/2023
	Unidentified Turtle			O	1	Justins Bridge	NOC 4	30/11/2023
Anguilla australis	Shortfin Eel			O	2	Justins Bridge	NOC 4	30/11/2023
Intellagama lesueurii	Eastern Water Dragon	P		O	1	Justins Bridge	NOC 4	30/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	3	Justins Bridge	NOC 4	30/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		A	1	Justins Bridge	NOC 4	30/11/2023
Podargus strigoides	Tawny Frogmouth	P		A	1	Justins Bridge	NOC 4	30/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
(Microchiroptera suborder) (Microchiroptera suborder)	Unidentified microbat			O	1	Justins Bridge	NOC 4	30/11/2023
Phalacrocorax varius	Pied Cormorant	P		O	1	Justins Bridge	BIRD3	29/11/2023
Eolophus roseicapillus	Galah	P		OA	3	Justins Bridge	BIRD3	29/11/2023
Fulica atra	Eurasian Coot	P		O	1	Justins Bridge	BIRD3	29/11/2023
Malurus cyaneus	Superb Fairy-wren	P		OA	3	Justins Bridge	BIRD3	29/11/2023
Rhipidura albiscapa	Grey Fantail	P		OA	1	Justins Bridge	BIRD3	29/11/2023
Gallinula tenebrosa	Dusky Moorhen	P		O	1	Justins Bridge	BIRD3	29/11/2023
Dacelo novaeguineae	Laughing Kookaburra	P		A	3	Justins Bridge	BIRD3	29/11/2023
Egretta novaehollandiae	White-faced Heron	P		O	1	Justins Bridge	BIRD3	29/11/2023
Chenonetta jubata	Australian Wood Duck	P		A	2	Justins Bridge	BIRD3	29/11/2023
Macropygia amboinensis	Brown Cuckoo-dove	P		A	2	Justins Bridge	BIRD3	29/11/2023
Oriolus sagittatus	Olive-backed Oriole	P		A	1	Justins Bridge	BIRD3	29/11/2023
Eopsaltria australis	Eastern Yellow Robin	P		A	1	Justins Bridge	BIRD3	29/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		A	1	Justins Bridge	BIRD3	29/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Cacatua galerita	Sulphur-crested Cockatoo	P		OA	3	Justins Bridge	BIRD3	29/11/2023
Pachycephala pectoralis	Golden Whistler	P		A	2	Justins Bridge	BIRD3	29/11/2023
Strepera graculina	Pied Currawong	P		A	1	Justins Bridge	BIRD3	29/11/2023
Cracticus tibicen	Australian Magpie	P		A	2	Justins Bridge	BIRD3	29/11/2023
Psophodes olivaceus	Eastern Whipbird	P		A	1	Justins Bridge	BIRD3	29/11/2023
Leucosarcia melanoleuca	Wonga Pigeon	P		A	2	Justins Bridge	BIRD3	29/11/2023
Eopsaltria australis	Eastern Yellow Robin	P		A	1	Justins Bridge	BIRD3	29/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		A	1	Justins Bridge	BIRD3	29/11/2023
Cacatua galerita	Sulphur-crested Cockatoo	P		OA	3	Justins Bridge	BIRD3	29/11/2023
Pachycephala pectoralis	Golden Whistler	P		A	2	Justins Bridge	BIRD3	29/11/2023
Strepera graculina	Pied Currawong	P		A	1	Justins Bridge	BIRD3	29/11/2023
Cracticus tibicen	Australian Magpie	P		A	2	Justins Bridge	BIRD3	29/11/2023
Psophodes olivaceus	Eastern Whipbird	P		A	1	Justins Bridge	BIRD3	29/11/2023
Leucosarcia melanoleuca	Wonga Pigeon	P		A	2	Justins Bridge	BIRD3	29/11/2023
Duffys Bridge								
Rattus fuscipes	Bush Rat	P		O	1	Duffys Bridge	NOC 1	27/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Litoria dentata	Bleating Tree Frog	P		A	2	Duffys Bridge	NOC 1	27/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		A	5	Duffys Bridge	NOC 1	27/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	10	Duffys Bridge	NOC 1	27/11/2023
(Microchiroptera suborder) (Microchiroptera suborder)	Unidentified microbat			O	1	Duffys Bridge	NOC 1	27/11/2023
Limnodynastes peronii	Brown-striped Frog	P		A	2	Duffys Bridge	NOC 2	28/11/2023
Litoria fallax	Eastern Dwarf Tree Frog	P		A	1	Duffys Bridge	NOC 2	28/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		O	2	Duffys Bridge	NOC 2	28/11/2023
Limnodynastes dumerilii	Eastern Banjo Frog			A	1	Duffys Bridge	NOC 2	28/11/2023
Perameles nasuta	Long-nosed Bandicoot	P		O	1	Duffys Bridge	NOC 2	28/11/2023
Podargus strigoides	Tawny Frogmouth	P		O	1	Duffys Bridge	NOC 3	29/11/2023
Anguilla australis	Shortfin Eel	0		O	3	Duffys Bridge	NOC 3	29/11/2023
Vanellus miles	Masked Lapwing	P		A	1	Duffys Bridge	NOC 3	29/11/2023
Adelotus brevis	Tusked Frog	P		A	3	Duffys Bridge	NOC 3	29/11/2023
Uperoleia laevigata	Smooth Toadlet	P		A	1	Duffys Bridge	NOC 3	29/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	3	Duffys Bridge	NOC 3	29/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Austronomus australis	White-striped Freetail-bat	P		A	1	Duffys Bridge	NOC 3	29/11/2023
Pavo cristatus	Indian Peafowl			A	4	Duffys Bridge	NOC 3	29/11/2023
Ranoidea wilcoxii	Eastern Stony Creek Frog	P		A	4	Duffys Bridge	NOC 4	30/11/2023
(Microchiroptera suborder) (Microchiroptera suborder)	Unidentified microbat			O	2	Duffys Bridge	NOC 4	30/11/2023
Adelotus brevis	Tusked Frog	P		OA	3	Duffys Bridge	NOC 4	30/11/2023
Litoria peronii	Peron's Tree Frog	P		A	1	Duffys Bridge	NOC 4	30/11/2023
Pavo cristatus	Indian Peafowl			A	1	Duffys Bridge	NOC 4	30/11/2023
Litoria phyllochroa	Leaf-green Tree Frog	P		A	1	Duffys Bridge	NOC 4	30/11/2023
Macropod sp.	Unidentified macropod	P		A	1	Duffys Bridge	NOC 4	30/11/2023
Rhipidura leucophrys	Willie Wagtail	P		A	3	Duffys Bridge	NOC 4	30/11/2023
Pachycephala pectoralis	Golden Whistler	P		A	5	Duffys Bridge	BIRD1	27/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		OA	5	Duffys Bridge	BIRD1	27/11/2023
Corvus coronoides	Australian Raven	P		A	2	Duffys Bridge	BIRD1	27/11/2023
Melithreptus brevirostris	Brown-headed Honeyeater	P		A	5	Duffys Bridge	BIRD1	27/11/2023
Dacelo novaeguineae	Laughing Kookaburra	P		A	1	Duffys Bridge	BIRD1	27/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Cormobates leucophaea	White-throated Treecreeper	P		A	2	Duffys Bridge	BIRD1	27/11/2023
Ailuroedus crassirostris	Green Catbird	P		A	4	Duffys Bridge	BIRD1	27/11/2023
Rhipidura leucophrys	Willie Wagtail	P		A	5	Duffys Bridge	BIRD1	27/11/2023
Pavo cristatus	Indian Peafowl			A	1	Duffys Bridge	BIRD1	27/11/2023
Psophodes olivaceus	Eastern Whipbird	P		A	3	Duffys Bridge	BIRD1	27/11/2023
Eudynamys orientalis	Eastern Koel	P		A	4	Duffys Bridge	BIRD1	27/11/2023
Meliphaga lewinii	Lewin's Honeyeater	P		OA	12	Duffys Bridge	BIRD5	30/11/2023
Colluricincla harmonica	Grey Shrike-thrush	P		O	1	Duffys Bridge	BIRD5	30/11/2023
Eopsaltria australis	Eastern Yellow Robin	P		OA	3	Duffys Bridge	BIRD5	30/11/2023
Melithreptus lunatus	White-naped Honeyeater	P		O	1	Duffys Bridge	BIRD5	30/11/2023
Neochmia temporalis	Red-browed Finch	P		OA	5	Duffys Bridge	BIRD5	30/11/2023
Melithreptus brevirostris	Brown-headed Honeyeater	P		O	1	Duffys Bridge	BIRD5	30/11/2023
Corvus coronoides	Australian Raven	P		OA	1	Duffys Bridge	BIRD5	30/11/2023
Pavo cristatus	Indian Peafowl			A	2	Duffys Bridge	BIRD5	30/11/2023
Ailuroedus crassirostris	Green Catbird	P		OA	4	Duffys Bridge	BIRD5	30/11/2023

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Eolophus roseicapillus	Galah	P		O	4	Duffys Bridge	BIRD5	30/11/2023
Sphecotheres vieilloti	Australasian Figbird	P		O	1	Duffys Bridge	BIRD5	30/11/2023
Alisterus scapularis	Australian King-parrot	P		O	1	Duffys Bridge	BIRD5	30/11/2023
Cracticus tibicen	Australian Magpie	P		O	2	Duffys Bridge	BIRD5	30/11/2023
Rhipidura leucophrys	Willie Wagtail	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Oriolus sagittatus	Olive-backed Oriole	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Malurus cyaneus	Superb Fairy-wren	P		A	4	Duffys Bridge	BIRD5	30/11/2023
Cormobates leucophaea	White-throated Treecreeper	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Macropygia amboinensis	Brown Cuckoo-dove	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Philemon corniculatus	Noisy Friarbird	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Dacelo novaeguineae	Laughing Kookaburra	P		A	3	Duffys Bridge	BIRD5	30/11/2023
Vanellus miles	Masked Lapwing	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Grallina cyanoleuca	Magpie-lark	P		A	1	Duffys Bridge	BIRD5	30/11/2023
Opportunistic sightings								
Wallabia bicolor	Swamp Wallaby	P		O	3			
Thylogale sp.	Unidentified Pademelon	P		O	1			

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Hoplocephalus Stephens'sii	Stephens's' Banded Snake	V,P		O	1			
Centropus phasianinus	Pheasant Coucal	P		O	2			
Acanthiza chrysorrhoa	Yellow-rumped thornbill	P		O	3			
Alectura lathami	Australian Brush-turkey	P		O	4			
Intellagama lesueurii	Eastern Water Dragon	P		O	15			
Coturnix ypsilophora	Brown Quail	P		O	2			
Cacatua galerita	Sulphur-crested Cockatoo	P		O	2			
Tropidechis carinatus	Rough-scaled Snake	P		O	1			
Threskiornis spinicollis	Straw-necked Ibis	P		O	8			
Platycercus elegans	Crimson Rosella	P		O	2			
Cracticus nigrogularis	Pied Butcherbird	P		O	6			
Perameles nasuta	Long-nosed Bandicoot	P		O	1			
Tachybaptus novaehollandiae	Australasian Grebe	P		O	2			
Manorina melanocephala	Noisy Miner	P		O	10			

Scientific Name	Common Name	NSW Status	EPBC Status	Observation Type	Number	Location	Survey ID	Date
Trachystoma petardi	Pinkeye Mullet, Fresh Water Mullet			O	18			
Mus musculus	House Mouse			O	20+			
Hydromys chrysogaster	Water-rat	P		O	2+			
Varanus varius	Lace monitor	P		O	1			
Isoodon macrourus	Northern Brown Bandicoot	P		O	2			
Intellagama lesueurii	Eastern Water Dragon	P		O	15			

Appendix I

Flora Species List

Key:

Status: n=native, e=exotic

Biosecurity obligation: a = asset protection

Scientific name	Common name	Status
Hobarts Bridge		
Casuarina cunninghamiana	River oak	n
Ageratina riparia	Mistflower	e
Persicaria strigosum	Spotted knotweed	n
Setaria sphacelata	Pigeon grass	e
Persicaria decipiens	Slender knotweed	n
Ageratum houstonianum	Blue billygoat weed	e
Cuphea carthagenensis	Colombian waxweed	e
Carex appressa	Grassy sedge	n
Lomandra hystrix	Stream mat-rush	n
Cyperus spp	Sedges	n
Joyces Bridge		
Casuarina cunninghamiana	River oak	n
Lomandra hystrix	Stream mat-rush	n
Ageratum houstonianum	Blue billygoat weed	e
Cynodon dactylon	Common couch	n
Trifolium repens	White clover	e
Setaria sphacelata	Pigeon grass	e
Juncus spp	Rush	n
Carex appressa	Grassy sedge	n
Sporobolus fertilis	Giant parramatta grass	e, a
Cyperus spp	Sedge	n
Ageratina riparia	Mistflower	e
Tradescantia fluminensis	Trad	e
Duffys Bridge		
Casuarina cunninghamiana	River oak	n

Scientific name	Common name	Status
Cinnamomum camphora	Camphor laurel	e, a
Ligustrum sinense	Small-leaved privet	e, a
Ricinus communis	Castor oil plant	e
Ficus coronata	Sandpaper fig	n
Leptospermum brachyandrum	Tea tree	n
Lomandra hystrix	Stream mat-rush	n
Ageratum houstonianum	Blue billygoat weed	e
Calochlaena dubia	Rainbow fern	n
Setaria palmifolia	Palm grass	e
Setaria sphacelata	Pigeon grass	e
Thunbergia alata	Black-eyed susan	e
Paspalum mandiocanum	Broadleaved paspalum	e
Justins Bridge		
Casuarina cunninghamiana	River oak	n
Ageratina riparia	Mistflower	e
Persicaria strigosum	Spotted knotweed	n
Setaria sphacelata	Pigeon grass	e
Cyperus spp	Sedge	n
Ageratum houstonianum	Blue billygoat weed	e
Cuphea carthagenensis	Colombian waxweed	e
Carex appressa	Grassy sedge	n
Lomandra hystrix	Stream mat-rush	n

Appendix J

Likelihood of Occurrence Table

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Flora								
Native Guava *Rhodomyrtus psidioides d*	CE	CE	PMST, BioNet	Occurs from Broken Bay, approximately 90 km north of Sydney, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation and also occur up to approximately 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest, and wet sclerophyll forest often near creeks and drainage lines. Extremely susceptible to infection by Myrtle Rust.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified within the Project footprint during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified within the Project footprint during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified within the Project footprint during the field survey.	**May occur** This species was not recorded during targeted surveys by subconsultant however, . historical records occur within 5 km of the Project and the species may occur.
Scrub Turpentine *Rhodamnia rubescens*	CE	CE	PMST, BioNet	Occurs in coastal districts north from Batemans Bay in New South Wales to areas inland of Bundaberg in Queensland. Populations typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000 -1,600 mm. Found in littoral, warm temperate and subtropical rainforest, and wet sclerophyll forest usually on volcanic and sedimentary soils. Highly to extremely susceptible to infection by Myrtle Rust.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Slender Marsdenia *Marsdenia longiloba*	E	V	PMST, BioNet	Scattered sites on the north coast of NSW north from Barrington Tops to QLD. Grows in subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and in areas with rocky outcrops. Associated species include *Eucalyptus crebra, E. microcorys, E. acmenoides, E. saligna, E. propinqua, Corymbia intermedia and Lophostemon confertus.*	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified within the Project footprint during the field survey	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified within the Project footprint during the field survey	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.
Milky Silkpod *Parsonsia dorrigoensis*	E	V	PMST, BioNet	Scattered populations on the north coast between Kendall and Woolgoolga. Grows on brown clay soils in subtropical and warm temperate rainforest, on rainforest margins and in moist eucalypt forest up to 800m asl. Has a preference for more open areas and forest edges.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Scented Acronychia *Acronychia littoralis*	E	E	PMST	Scented Acronychia is found between Fraser Island in Queensland and Port Macquarie on the north coast of NSW, within 2 km of the coast on sandy soil. Scented Acronychia occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.
White-Flowered Wax Plant *Cynanchum elegans*	E	E	PMST, BioNet	This species is a climbing plant with a variable form. This species is found from Gloucester district to the Wollongong area and inland to Mt Dangar. It is often found in ecotones between dry subtropical rainforest and sclerophyll forest/woodland communities from Brunswick Heads to the Illawarra region (DEWHA, 2008)	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.
Vincetoxicum woollsii (listed as *Tylophora woollsii EPBC*)	E	E	PMST, BioNet	This species is a slender, woody climber growing up to 3 m long. It is found in the New South Wales north coast and New England Tablelands, north to southern Queensland. It grows in moist eucalypt forest, moist sites in dry eucalypt forests and rainforest margins (OEH, 2020).	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Nightcap Plectranthus, Silver Plectranthus *Coleus nitidus* (listed as *Plectranthus nitidus EPBC*)	E	E	PMST	This species is a multi-stemmed herb forming small clumps 30 – 0150 cm tall. It forms small clumps in gullies and on boulders in rainforest or open forest on the margins of rainforest (DEWHA, 2008). Its distribution is restricted to southeast Queensland northeast New South Wales, occurring from Nightcap Range north to the McPherson Range.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.
Clear Milkvine *Leichhardtia longiloba* (listed as *Marsdenia longiloba EPBC*)	V	E	PMST, BioNet	Scattered sites on the north coast of NSW north from Barrington Tops to QLD. Grows in subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and in areas with rocky outcrops. Associated species include *Eucalyptus crebra, E. microcorys, E. acmenoides, E. saligna, E. propinqua, Corymbia intermedia* and *Lophostemon confertus.*	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**Unlikely to occur** The species has not been recorded within 5 km of the Project and suitable habitat was not identified during the field survey.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Red Boppel Nut *Hicksbeachia pinnatifolia*	V	V	PMST, BioNet	Occurs in the coastal areas of north-east NSW from the Nambucca Valley north to south-east Queensland. Occurs in subtropical rainforest, moist eucalypt forest and Brush Box forest. The species usually habitats flat to gently inclined valley flats to steeply inclined slopes and hillcrests. Soils are generally slightly acidic loams derived from basalt (Weston, 1995).	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.
Hairy Jointgrass *Arthraxon hispidus*	V	V	PMST, BioNet	Scattered locations through SE QLD and northern coast and tablelands of NSW to Kempsey and inland to Glen Innes. Found in or on the edges of rainforest and wet eucalypt forest, often near creeks or swamps. Also recorded in woodland, or around freshwater springs on coastal foreshore dunes, gullies, and creek banks and on creek beds in open forests.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Tall Velvet Sea-berry *Haloragis exalata subsp. velutina*	V	V	PMST	Occurs on the north coast of NSW, and is abundant in inaccessible areas of the Macleay River. Grows in damp places near watercourses, in woodland on steep rocky slopes of gorges.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Ravine Orchid *Sarcochilus fitzgeraldii*	V	V	PMST	Occurs north-east NSW, north of the Macleay River, to Maleny in south-east Queensland. Grows mainly on rocks, amongst organic matter, in cool, moist, shady ravines, gorges and on cliff faces in dense subtropical rainforest at altitudes between 500 and 700 m. Occasional clumps are found on the bases of fibrous-barked trees.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**May occur** Suitable habitat for the species occurs within the Project footprint, however there are historical records within 5 km of the Project and the species may occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Rainforest cassia *Senna acclinis*	-	E	BioNet	Coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows in or on the edges of subtropical and dry rainforest.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Newry Golden Wattle *Acacia chrysotricha*	-	E	BioNet	Restricted to an area south of Bellingen on the NSW north coast. An understorey species on rainforest edges and in wet or dry eucalypt forest in steep narrow gullies on quartzite soils.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Neoastelia spectabilis	-	V	BioNet	This soft-stemmed lily-like plant is only found in New South Wales, specifically in the New England National Park which occurs on the eastern edge of the New England Tablelands. It is associated in Antarctic Beech rainforest, often growing in rocky crevices near waterfalls and seepage lines on rocky slopes. It occurs in altitudes between 900 - 1150 m.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Red-flowered King of the Fairies *Oberonia titania*	-	V	BioNet	Occurs on the NSW north coast, north from Kendall. Found in littoral and subtropical rainforest and paperbark swamps, but can also occur in eucalypt-forested gorges and in mangroves.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Rusty Plum, Plum Boxwood *Niemeyera whitei*	-	V	BioNet	Occurs in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland. Distributional stronghold on the mid north coast around Coffs Harbour. Found in gullies, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest. Occurs on poorer soils in areas below 600 metres above sea level.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**May occur** This species was not recorded during targeted surveys by subconsultant however, historical records occur within 5 km of the Project and the species may occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Silver Sword Lily *Neoastelia spectabilis*	V	V	PMST, BioNet	This soft-stemmed lily-like plant is only found in New South Wales, specifically in the New England National Park which occurs on the eastern edge of the New England Tablelands. It is associated in Antarctic Beech rainforest, often growing in rocky crevices near waterfalls and seepage lines on rocky slopes. It occurs in altitudes between 900 - 1150 m.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Bertya sp. Clouds Creek (M.Fatemi 4)	-	E	PMST, BioNet	A 3 m tall hairy stemmed shrub that only occurs in NSW west of the Great Dividing Range. The species occurs in low shrubland or heath, surrounded by eucalypts. It mainly grows on rocky, steep slopes within shallow soil. Flowers after August and are still in seed-set between January to February.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Leafless Tongue-orchid *Cryptostylis hunteriana*	V		PMST, BioNet	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Large Tongue Orchid and the Bonnet Orchid. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak *Macadamia integrifolia*	V	V	PMST, BioNet	Found in remnant rainforest in northern NSW and south-east Queensland, preferring partially open areas such as rainforest edges. While specimens have been collected from the North Coast of NSW, this species is not known to occur naturally in NSW.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Knotweed, Tall Knotweed *Persicaria elatior*	V	V	PMST, BioNet	Recorded in south-eastern NSW from Ulladulla to the Victorian border. Known from Raymond Terrace and the Grafton area in northern NSW. Normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Lesser Swamp-orchid *Phaius australis*	E	E	PMST, BioNet	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Grows in swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Smooth-bark Rose Apple, Red Lilly Pilly *Syzygium hodgkinsoniae*	V	V	PMST, BioNet	Syzygium hodgkinsoniae has a distribution from Richmon River (NSW) to Maleny and Kin Kin (QLD), with disjunct populations in Kuranda and Gordonvale (QLD). S. hodgkinsoniae occurs in riverine subtropical or gallery rainforests on deep rich alluvial and basalt soils at altitudes up to 300 m (Barry & Thomas, 1994; Floyd, 1989; Hyland, 1983; NSW DECCW, 2005; Sheringham & Westaway, 1995; Stanley & Ross, 1986).	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Austral Toadflax, Toadflax *Thesium australe*	V	V	PMST, BioNet	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Asperula asthenes Trailing Woodruff	V	V	PMST, BioNet	Occurs in scattered locations from Bulahdelah to Kempsey. Some records from Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Callistemon pungens	V	V	PMST, BioNet	In NSW, occurs on the northern tablelands from Inverell to the eastern escarpment in New England NP. Habitats range from riparian areas dominated by Casuarina cunninghamiana subsp. cunninghamiana to woodland and rocky shrubland and if often observed growing along rocky watercourses with sandy granite or basalt creek beds. Flowers over spring and summer.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	PMST, BioNet	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Large Tongue Orchid and the Bonnet Orchid. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Euphrasia arguta	CE	CE	PMST, BioNet	Recently rediscovered near Nundle on the north-western slopes and tablelands, once known from scattered locations between Sydney, Bathurst and Walcha. Known populations occur in eucalypt forest with a mixed grass/shrub understorey, while previous records are described as occurring in open forest, grassy country and river meadows. Dense stands observed in cleared firebreak areas, suggesting it may respond well to disturbance.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Gingidia rupicola Mountain Angelica, Broad-leafed Carrot	E	E	PMST, BioNet	Endemic to NSW and known from only two locations within New England National Park. Occurs in Snow Gum (Eucalyptus pauciflora) Woodland and at the edge of Antarctic Beech (Nothofagus moorei) forest. Grows in humic soil in pockets in ledges or cracks in basalt or trachyte rocks, mostly on cliff faces at altitudes of 1400–1750 m above sea level.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Birds								
Anthochaera phrygia Regent Honeyeater	CE	CE	PMST, BioNet	Mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. Very patchy distribution in NSW, mainly confined to the two main breeding areas and surrounding fragmented woodlands. Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests.	**Unlikely to occur** No suitable habitat for the species occurs within the Project footprint, and the species was not identified during the field survey. No historical records occur within 5 km.	**Unlikely to occur** No suitable habitat for the species occurs within the Project footprint, and the species was not identified during the field survey. No historical records occur within 5 km.	**Unlikely to occur** No suitable habitat for the species occurs within the Project footprint, and the species was not identified during the field survey. No historical records occur within 5 km.	**Unlikely to occur** No suitable habitat for the species occurs within the Project footprint, and the species was not identified during the field survey. No historical records occur within 5 km.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Lathamus discolor Swift parrot	CE	E	PMST	The swift parrot breeds in Tasmania during the summer, before migrating north to mainland Australia for the winter (DCCEEW, 2023). The species inhabits dry sclerophyll forests and woodlands, particularly areas supporting winter-flowering species (DCCEEW, 2023). Mostly recorded in box-ironbark woodlands (Menkhorst et al., 2019). Routinely returns to winter foraging habitat.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**May occur** Suitable habitat for the species occurs within broader locality of the Project footprint. The species was not identified during the field survey. Historical records occur within 5 km of the Project and the species may occur.
Atrichornis rufescens Rufous Scrub-bird	E	V	PMST, BioNet	Found above 600 m sea level in north-eastern NSW, including subtropical, warm temperate and cool temperate rainforests, and nearby moist and wet eucalypt forests. Requires dense ground cover, a moist microclimate at ground level and abundant leaf litter, which is usually restricted to ecotones, forested watercourses and wetlands, and areas regenerating from fires, storms or along roadsides.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Rostratula australis Australian Painted Snipe	E	E	PMST	The Australian painted snipe has a broad distribution across, though is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, NSW, and Victoria (DCCEEW, 2023). The species generally inhabits shallow, terrestrial freshwater wetlands, including temporary and permanent lakes, swamps, claypans and waterlogged grasslands (DCCEEW, 2023, Menkhorst et al., 2019). Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum (DCCEEW, 2023) A rare species seldom seen.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Botaurus poiciloptilus Australasian Bittern	E	E	PMST	Occurs within eastern and south-eastern Australia. Considered uncommon throughout much of its range (Pizzey and Knight, 1999). Occurs in and about water in reedbeds, sedges and rushes (Menkhorst et al., 2019). Occasionally seen in tussock paddocks, saltmarshes, and brackish wetlands.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Erythrotriorchis radiatus Red Goshawk	V	CE	PMST, BioNet	The red goshawk is widely distributed throughout northern and eastern Australia, particularly in a wide coastal strip along eastern Queensland, through to Cape York and the Northern Territory / Kimberly. The species occurs in a range of habitats, often at ecotones, including coastal and sub-coastal tall open forests, tropical savannahs crossed by wooded or forested watercourses, woodlands, edges of rainforests and gallery forests along watercourses, and wetlands that include Melaleuca and Casuarina species (Menkhorst et al., 2019). The species typically nests in tall trees within 1 km of permanent water and favours habitats that support a high abundance of bird species (Pizzey and Knight, 1999).	**May occur** Suitable habitat for the species occurs within the broader Project Area of the Project footprint, however there are no historical records within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within the broader Project Area of the Project footprint, however there are no historical records within 5 km of the Project. The species is highly mobile and may occur temporarily	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Climacteris picumnus victoriae Brown treecreeper (eastern subspecies)	V	V	PMST, BioNet	Brown treecreepers (south-eastern) are endemic to south-eastern Australia from the Grampians in western Victoria, through central New South Wales to the Bunya Mountains in Queensland (DCCEEW, 2023). The subspecies mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. They also occur in mallee, forests, and woodlands subject to periodic inundation (DCCEEW, 2023).	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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					Joyces Bridge	**Hobarts Bridge**	**Justins Bridge**	**Duffys Bridge**
Hirundapus caudacutus White-throated needletail	V, Mig	-	PMST	Almost exclusively aerial, it does prefer wooded, inland areas and heathland. In coastal areas they have been seen flying over mudflats and beaches. Widespread throughout eastern and south-eastern Australia. It has been recorded long all coastal regions of QLD and NSW (Menkhorst et al., 2019). Breeds in eastern Siberia, north-eastern China and Japan between August to October and arrives in Australia during September and October. Upon arrival they move south along both sides of the Great Dividing Range in QLD and NSW. They head north again, passing through QLD in February and March (DCCEEW, 2023).	**May occur** The species has been historically recorded within 5 km of the Project. The species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions. Unlikely to be a permanent occupant.	**May occur** The species has been historically recorded within 5 km of the Project. The species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions. Unlikely to be a permanent occupant.	**May occur** The species has been historically recorded within 5 km of the Project. The species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions. Unlikely to be a permanent occupant.	**May occur** The species has been historically recorded within 5 km of the Project. The species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions. Unlikely to be a permanent occupant.
Calyptorhynchus lathami lathami Glossy black-cockatoo	V	V	PMST, BioNet	Uncommon although widespread throughout suitable forest and woodland habitats. Occurs 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. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species).	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Glossopsitta pusilla Little lorikeet	V	-	PMST	Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	**May occur** The species has not been historically recorded within 5 km of the Project however the species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project however the species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project however the species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project however the species is largely nomadic. Species may occur temporarily in response to seasonal and climatic conditions.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Haliaeetus leucogaster White-bellied sea-eagle	Marine	V	PMST, BioNet	Widespread along the NSW coast, and along all major inland rivers and waterways. Habitats characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries, and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs, and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Pandion cristatus Eastern osprey	Mig	V	PMST, BioNet	The eastern osprey is distributed around the Australian coastline, excluding only Victoria and Tasmania (EOH, 2023). Preferred habitats for the species include coastlines, estuaries, bays and inlets, river systems and lake complexes, and the species are known to venture inland, particularly in northern Queensland (Pizzey and Knight, 1999; OEH, 2023). The species favours large, emergent trees, cliff faces and high vantage points as nesting habitat, usually in exposed locations and within 1 km of water (Thomson et al., 2019).	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile c. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.	**May occur** The species has not been historically recorded within 5 km of the Project, however, the species is largely nomadic and highly mobile. Species may occur temporarily in response to seasonal and climatic conditions.
Ptilinopus magnificus Wompoo fruit-Dove	-	V	BioNet	Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. Rare south of Coffs Harbour, it used to occur in the Illawarra, though there are no recent records. Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act						
					Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Ptilinopus regina Rose-crowned Fruit-Dove	-	V	BioNet	Occurs from Newcastle north to Cape York, with vagrants occasionally as far south as Victoria. Occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. Thought to be locally nomadic in response to fruit availability.	**May occur** Suitable habitat for the species occurs within broader Project Area of the Project footprint, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area of the Project footprint, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area of the Project footprint, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area of the Project footprint, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.
Ptilinopus superbus Superb Fruit-Dove	-	V	BioNet, confirmed present during survey	Occurs principally from north-eastern in Queensland to north-eastern NSW. Much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.	**Confirmed present** This species was heard calling in the vicinity of Hobarts Bridge. Suitable habitat occurs within the Project Area.	**May occur** Suitable habitat for the species occurs within broader Project Area, however the species was not identified during the field survey. No historical records occur within 5 km of the Project however, the species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within broader Project Area, however, the species was not identified during the field survey. Historical records occur within 5 km of the Project. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Ephippiorhynchus asiaticus Black-necked Stork	-	E	BioNet	Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland away from breeding areas). Species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the species. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	**May occur** Suitable habitat for the species occurs within the Project footprint, however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within the Project footprint, however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within the Project footprint, however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable habitat for the species occurs within the Project footprint, however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Ninox strenua Powerful Owl	-	V	BioNet	The powerful owl is endemic to eastern and south-eastern Australia, occurring east of the Great Dividing Range from southern Queensland to the Victorian highlands (Menkhorst et al., 2019). The species inhabits forested coastal ranges, open eucalypt forests and woodlands, often along sheltered gullies and watercourses with dense mid and understoreys. As an obligate hollow-nester, the species requires vegetation communities containing trees over 150 years old and an abundance of large hollows (Bain et al. 2014; Cooke, 2002). The species generally favours dense gullies for roosting and nesting sites (Cooke et al. 2002, Clemens et al., 2020).	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Tyto novaehollandiae Masked Owl	-	V	BioNet	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. Lives in dry eucalypt forests and woodlands from sea level to 1100 m and often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	**May occur** Suitable roosting habitat for this species was recorded during the field survey, however there are few records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey, however there are few records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey, however there are few records within 5 km. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey, however there are few records within 5 km. The species is highly mobile and may occur temporarily.
Tyto tenebricosa Sooty Owl	-	V	BioNet	Occupies the eastern most one-eighth of NSW, occurring on the coast, coastal escarpment, and eastern tablelands. Found in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roost by day in the hollow of a tall forest tree or in heavy vegetation and nest in very large tree hollows.	**May occur** Suitable roosting habitat for this species was recorded during the field survey. There are records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey. There are records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey. There are records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable roosting habitat for this species was recorded during the field survey. There are records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Daphoenositta chrysoptera Varied Sittella	-	V	BioNet	Sedentary species, inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Found in eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.	**Unlikely to occur** No suitable habitat for this species was recorded during the field survey. There are no historical records within 5 km of the Project footprint, as such the species is unlikely to occur.
Hieraaetus morphnoides Little Eagle	-	V	BioNet	Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Also found in Sheoak or Acacia woodlands and riparian woodlands of inland NSW. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Lophoictinia isura Square-tailed kite	-	V	BioNet	Ranges along coastal and subcoastal areas from south-western to northern Australia. Scattered records throughout NSW indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. Observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland in arid north-western NSW.	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey. There are few records 5 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded during the field survey. There are records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Tyto longimembris Eastern Grass Owl	-	V	BioNet	More likely to be resident in the north-east of NSW. Numbers can fluctuate greatly, increasing especially during rodent plagues. Found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. Always breeds on the ground. Nests are found in trodden grass, and often accessed by tunnels through vegetation.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** Suitable habitat is absent from the Project footprint. Whie there is one record of the species approximately 5 km northeast of the Project , without suitable habitat, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Calidris ferruginea Curlew Sandpiper	CE	E	PMST, BioNet	Distributed around most of the Australian coastline. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. Migrates to Australia for the non-breeding period, arriving between August and November, and departing between March and mid-April. Generally occupies littoral and estuarine habitats, and is mainly found in intertidal mudflats of sheltered coasts in NSW. Also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover	V	V	PMST, BioNet	Breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. The species is almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Grantiella picta Painted Honeyeater	V	V	PMST	Nomadic species occurring at low densities throughout its range. Most commonly found on the inland slopes of the Great Dividing Range in NSW, where almost all breeding occurs. More likely to be found in the north of its distribution in winter. Inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests. Specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Hirundapus caudacutus White-throated Needletail	V	V	PMST	Migrates to eastern Australia from October to April. Almost exclusively aerial and most often seen before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. Occurs over most types of habitat, but mostly recorded above wooded areas, including open forest and rainforest. May also fly between trees or in clearings, below the canopy. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern)	E	E	PMST	Found throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata. Prefers lightly wooded country, usually open eucalypt woodland, Acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Neophema chrysostoma Blue-winged Parrot	V	V	PMST	During the non-breeding period, from autumn to early spring, birds are recorded in western NSW, with some reaching south-eastern NSW, particularly on the southern migration. Inhabits a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. Tends to favour grasslands and grassy woodlands, often found near wetlands both near the coast and in semi-arid zones. Sometimes seen in altered environments such as airfields, golf-courses and paddocks. Pairs or small parties forage mainly near or on the ground for seeds of a wide range of native and introduced grasses, herbs and shrubs.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew	CE	E	PMST	Occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. Generally occupies coastal lakes, inlets, bays and estuarine habitats, and is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts in NSW. Rarely seen inland.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Stagonopleura guttata Diamond Firetail	V	V	PMST	Widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. Scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities, and often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Turnix melanogaster Black-breasted Button-quail	V	CE	PMST	Endemic to south-eastern Queensland and far north-eastern NSW, at scattered sites from the Byfield region south to the Border Ranges and mainly on and east of the Great Divide but extending inland to the inner western slopes, up to 300 km from the coast. The species is rare in NSW, it hasn't been detected in NSW since 2000 and ecological requirements are largely unknown. Preferred habitat includes drier low closed forests, including dry rainforests, vine forest and vine thickets, often in association with Hoop Pine, and Bottletree scrubs. The understorey may be dense or sparse, but a deep, moist leaf-litter layer, in which the birds forage, is an important component of habitat. Birds have been recorded using Lantana thickets at edges of rainforest or Lantana understorey of forest or rainforest, but it is not known if Lantana associations are suitable for sustaining breeding.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act						
					Joyces Bridge	**Hobarts Bridge**	**Justins Bridge**	**Duffys Bridge**
Mammals								
Phascolarctos cinereus Koala	E	E	PMST, BioNet	Found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests of NSW, with some smaller populations on the plains west of the Great Dividing Range. Inhabits eucalypt woodlands and forests, and feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but will select preferred browse species in any one area.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur while moving to areas of suitable habitat.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur while moving to areas of suitable habitat.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur while moving to areas of suitable habitat.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur while moving to areas of suitable habitat.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Petauroides volans Greater glider (southern and central)	E	E	PMST	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria. This species is largely restricted to tall, mature, eucalypt forests and woodlands (DCCEEW, 2023; Eyre et al., 2022). Species requires abundance of hollow-bearing trees which provide den sites and is generally restricted to extensive forest networks larger than 160 km2 (DCCEEW, 2023).	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur.	**May occur** The Project footprint doesn't support suitable foraging habitat for the species and the species was not confirmed present within the Project footprint; however the species has been historically recorded within 5 km. As such, the species may occur.	**Unlikely to occur** The species has not been historically recorded within 5 km and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Potorous tridactylus Long-nosed potoroo	V	V	PMST, BioNet	Generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns, or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint, however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area of the Project footprint. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Notamacropus parma Parma wallaby	V	V	PMST, BioNet	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area. There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area There are historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat for this species was recorded in the broader Project Area however there are no records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.
Pteropus poliocephalus Grey-headed flying-fox	V	V	PMST, BioNet, confirmed present during surveys	Generally found within 200 km of the eastern coast of Australia, from Rockhampton to Adelaide. May be found in unusual locations in times of natural resource shortage. Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	**May occur** Suitable foraging habitat occurs within broader Project Area. The species has been historically recorded within 5 km. Known to travel large distances to forage and may occur temporarily.	**Confirmed present** Grey-headed flying-fox camp was recorded within 120m of Project footprint. Black Flying-foxes also occur in this camp. This is a maternity camp for both species; dependant young observed, comprising at least 1000 individuals and restricted to a bamboo plantation.	**May occur** Suitable foraging habitat occurs within broader Project Area The species has been historically recorded within 5 km. Known to travel large distances to forage and may occur temporarily.	**May occur** Suitable foraging habitat occurs within broader Project Area. The species has been historically recorded within 5 km. Known to travel large distances to forage and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Dasyurus maculatus maculatus Spot-tailed quoll (SE mainland population)	E	V	PMST	The spotted-tailed quoll is found along both sides of the Great Dividing Range from the Victorian to the Queensland borders (DCCEEW, 2023). Prefers mature wet forest habitat, though known to inhabit a range of forest environments, from rainforest to open woodland (EOH, 2023). They require forests with suitable den sites such as rock crevices, caves, hollow logs, burrows, and tree hollows.	**May occur** This species was not observed during field surveys or remote camera survey efforts. There are no historical records within 5 km of the Project footprint however there is suitable denning habitat within the broader Project Area. The species has a large home range and may occur temporarily.	**May occur** This species was not observed during field surveys or remote camera survey efforts. There are no historical records within 5 km of the Project footprint however there is suitable denning habitat within the broader Project Area. The species has a large home range and may occur temporarily	**May occur** This species was not observed during field surveys or remote camera survey efforts. There are no historical records within 5 km of the Project footprint however there is suitable denning habitat within the broader Project Area. The species has a large home range and may occur temporarily	**May occur** This species was not observed during field surveys or remote camera survey efforts. There are no historical records within 5 km of the Project footprint however there is suitable denning habitat within the broader Project Area. The species has a large home range and may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Petaurus australis australis Yellow-bellied glider (south-eastern)	V	V	PMST	The yellow-bellied glider has a widespread but patchy distribution from south-eastern Queensland to the SA-Victoria border (DCCEEW, 2023). The species occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests (Rees et al. 2007). Yellow-bellied gliders favour large patches of mature old growth forest that provide suitable trees for foraging and shelter, with a preference for forests with a high proportion of winter-flowering and smooth-barked eucalypt. Hollow-bearing trees are a critical habitat feature for the yellow-bellied glider due to their usage as dens.	**May occur** Suitable habitat for the species occurs within the broader locality of the Project footprint, however the species was not identified during the field survey. There are no historical records occur within 5 km of the Project.	**May occur** Suitable habitat for the species occurs within the broader locality of the Project footprint, however the species was not identified during the field survey. There are no historical records occur within 5 km of the Project.	**May occur** Suitable habitat for the species occurs within the broader locality of the Project footprint, however the species was not identified during the field survey. There are no historical records occur within 5 km of the Project.	**May occur** Suitable habitat for the species occurs within the broader locality of the Project footprint, however the species was not identified during the field survey. There are no historical records occur within 5 km of the Project.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Chalinolobus dwyeri Large-eared pied bat	V	V	PMST	The large-eared pied bat occurs in eastern Australia, from Rockhampton to Canberra (DCCEEW, 2023). The species roosts in sandstone cliffs, rock outcrops and woodland valleys and requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging. In south-east Queensland, the species is known from rainforest and moist eucalypt forest habitats at high elevation (DCCEEW, 2023).	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km. The species may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km. The species may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km. The species may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km. The species may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Syconycteris australis Common Blossom Bat	-	V	BioNet	Found in coastal areas of eastern Australia from Hawks Nest in NSW to Cape York peninsula in Queensland. In areas, the distribution extends inland to coastal foothills. Often roosts in littoral rainforest and feed on nectar and pollen from flowers in adjacent heathland and paperbark swamps. Also recorded in a range of other vegetation communities, such as subtropical rainforest, wet sclerophyll forest and other coastal forests. Generally roost individually in dense foliage and vine thickets of the sub-canopy, staying in the same general area for a season.	**May occur** Suitable foraging habitat was recorded during the field survey and there is one historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.	**May occur** Suitable foraging habitat was recorded during the field survey however there are no historical records within 5 km of the Project Area. The species is highly mobile and may occur temporarily.
Phascogala tapoatafa Brush-tailed Phascogale	-	V	BioNet	Mainly found east of the Great Dividing Range in NSW, with occasional records west to the divide. Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Forages preferentially in rough barked trees of 25 cm DBH or greater.	**Unlikely to occur** No suitable habitat was identified during the field survey. There are no historical records within 5 km and the species is unlikely to occur.	**Unlikely to occur** No suitable habitat was identified during the field survey. There are no historical records within 5 km and the species is unlikely to occur.	**Unlikely to occur** No suitable habitat was identified during the field survey. There are no historical records within 5 km and the species is unlikely to occur.	**Unlikely to occur** No suitable habitat was identified during the field survey. There are no historical records within 5 km and the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Miniopterus australis Little Bent-Winged Bat	-	V	BioNet, confirmed present during surveys	Occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Prefers moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests, and banksia scrub. Generally found in well-timbered areas. Roosts in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day. Forages for small insects beneath the canopy of densely vegetated habitats.	**Confirmed present** Data analysed from the Anabat echolocators from this site indicate these species may be roosting near the Project footprint. The source of the calls cannot be confidentially placed within bridge structure. However they are confirmed as foraging around the bridge and can be assumed that they utilise the bridge.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, there are no historical records within 5 km of the Project Area and the species wasn't recorded during the field survey. The species is highly mobile and may occur temporarily.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, there are no historical records within 5 km of the Project Footprint and the species wasn't recorded during the field survey. The species is highly mobile and is likely to occur.	**Likely to occur** Suitable roosting habitat was recorded during the field survey; however the species wasn't recorded during the field survey. The species has been recorded within 5 km of the Project Footprint. The species is highly mobile and is likely to occur.
Falsistrellus tasmaniensis Eastern False Pipistrelle	-	V	Confirmed present during surveys	Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows but also found under loose bark on trees or in buildings.	**Confirmed present** Data analysed from the Anabat echolocators from this site indicate these species may be roosting near the Project footprint. The source of the calls cannot be confidentially placed within bridge structure.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint and is likely to occur	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint and is likely to occur.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint and is likely to occur

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Micronomus norfolkensis Eastern Coastal Free-Tailed Bat	-	V	Confirmed present during surveys	Found along the east coast from south Queensland to southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures.	**Confirmed present** Data analysed from the Anabat echolocators from this site indicate these species may be roosting near the Project footprint. The source of the calls cannot be confidentially placed within bridge structure.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint and is likely to occur.	**Confirmed present** Data analysed from the Anabat echolocators from this site indicate these species may be roosting near the Project footprint. The source of the calls cannot be confidentially placed within bridge structure.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint and is likely to occur
Miniopterus orianae oceanensis Large bent-winged bat	-	V	BioNet, confirmed present during surveys	Occurs along the east and north-west coasts of Australia. Uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings, and other man-made structures. Hunts in forested areas, catching moths and other flying insects above the tree tops.	**Confirmed present** Data analysed from the Anabat echolocators from this site indicate these species may be roosting near the Project footprint. The source of the calls cannot be confidentially placed within bridge structure.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint. The species is highly mobile is likely to occur.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile are likely to occur.	**Likely to occur** Suitable roosting habitat was recorded during the field survey, however the species wasn't recorded. The species has been recorded within 5 km of the Project footprint. The species is highly mobile and is likely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Myotis macropus Southern Myotis	-	V	BioNet, confirmed present during surveys	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water.	**Confirmed present** The Project footprint supports suitable roosting and foraging habitat. Data analysed from the Anabat echolocators from this site indicate these species may be roosting nearby. The source of the calls cannot be confidentially placed within bridge structure.	**Likely to occur** The Project footprint supports suitable roosting and foraging habitat, however, were not confirmed present during field surveys due to technical issues with the echolocation recorder. There are historical records within 5 km. The species is likely to occur.	**Confirmed present** The Project footprint supports suitable roosting and foraging habitat. Data analysed from the Anabat echolocators from this site indicate that some bat species may be roosting within the bridge.	**Likely to occur** The Project footprint supports suitable roosting and foraging habitat, however, were not confirmed present during field surveys due to technical issues with the echolocation recorder. There are historical records within 5 km. The species is likely to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Phoniscus papuensis Golden-Tipped Bat	-	V	BioNet	Distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roosts mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Saccolaimus flaviventris Yellow-Bellied Sheathtail-Bat	-	V	BioNet	Wide-ranging species found across northern and eastern Australia. Rare visitor of south-western NSW in late summer and autumn. Scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. It forages in most habitats across its very wide range, with and without trees.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable roosting habitat was recorded during the field survey, however, the species wasn't recorded. The species has been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.
Nyctophilus bifax Eastern Long-Eared Bat	-	V	BioNet	Appears to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. Typically inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest. Coastal rainforest and patches of coastal scrub are particularly favoured.	**Unlikely to occur** The species is not known to occur south of Maclean area, approximately 100 km north of the Project areas. The species is unlikely to occur due to its restricted distribution.	**Unlikely to occur** The species is not known to occur south of Maclean area, approximately 100 km north of the Project areas. The species is unlikely to occur due to its restricted distribution.	**Unlikely to occur** The species is not known to occur south of Maclean area, approximately 100 km north of the Project areas. The species is unlikely to occur due to its restricted distribution.	**Unlikely to occur** The species is not known to occur south of Maclean area, approximately 100 km north of the Project areas. The species is unlikely to occur due to its restricted distribution.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Vespadelus troughtoni Eastern Cave Bat	-	V	BioNet	Found on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; recorded roosting in disused mine workings. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Forage over a small area, but are capable of flying 500 m over clear paddocks.	**May occur** Data analysed from the Anabat echolocators did not confidential record this species. It is likely to have been from a different species group. The Project footprint supports foraging habitat. There are no known records within 5 km, however this species may occur.	**May occur** Suitable foraging habitat was identified during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** Suitable foraging habitat was identified during the field survey, however, the species wasn't recorded. The species has not been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.	**May occur** The Project footprint supports suitable foraging habitat, however, were not confirmed present during field surveys, potentially due to technical issues with the echolocation recorder. The Project footprint supports foraging habitat. There are no known records within 5 km, however this species may occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Pseudomys gracilicaudatus Eastern Chestnut Mouse	-	V	BioNet	Mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. Isolated records in the Jervis bay area. Found in heathland in low numbers and most common in dense, wet heath and swamps. Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. The species is highly mobile may occur temporarily.
Pseudomys novaehollandiae New Holland mouse	-	V	BioNet	Largely restricted to the coast of central and northern NSW, with one inland occurrence near Parkes. Known from Royal National Park (NP), the Kangaroo Valley, Kuringai Chase NP, and Port Stephens's to Evans Head near the Queensland border. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. Soil type may be an important indicator of suitability of habitat, with deeper top soils and softer substrates being preferred for digging burrows.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**Unlikely to occur** The species has not been historically recorded within 5 km of the Project footprint and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Petrogale penicillata Brush-tailed Rock-wallaby	V	V	PMST	Occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. It typically shelters or basks during the day in rock crevices, caves and overhangs and are most active at night when foraging. Browse on vegetation in and adjacent to rocky areas.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**Unlikely to occur** The species has not been historically recorded within 5 km of the Project footprint and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.
Pseudomys oralis Hastings River Mouse, Koontoo	E	E	PMST	Occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. It typically shelters or basks during the day in rock crevices, caves and overhangs and are most active at night when foraging. Browse on vegetation in and adjacent to rocky areas.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**Unlikely to occur** The species has not been historically recorded within 5 km of the Project footprint and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat is absent from the Project footprint. As such, the species is unlikely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Reptiles								
Myuchelys georgesi Bellinger River Snapping Turtle	CE	CE	PMST, BioNet	This freshwater turtle is endemic to the Bellinger Catchment on the north coast of New South Wales. It is typically prefers moderate to deep pools with a rocky substrate.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.
Hoplocephalus Stephens'sii Stephens's' Banded Snake	-	V	BioNet, confirmed present during surveys	Ranges along the coast from Southern Queensland to Gosford in NSW. Inhabits rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day.	**Likely to occur** Suitable habitat is present within the Project footprint. There are known historical records within 5 km. As such, the species is likely to occur.	**Likely to occur** This species was recorded approximately 1.8 km north east of the Project footprint. This species prefers wet sclerophyll forest and rainforest. There are known historical records within 5 km NE of the bridge.	**Likely to occur** Suitable habitat is present within the Project footprint. There are known historical records within 5 km. As such, the species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. There are known historical records within 5 km. As such, the species is likely to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Coeranoscincus reticulatus Three-toed Snake-tooth Skink	V	V	PMST	Occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. Very uncommon south of Grafton. Inhabits rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. Lives in loose soil, leaf litter and rotting logs, and feeds on earthworms and beetle grubs. Recorded in garden beds and urban yards under leaf litter on alluvial soils.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.	**May occur** Suitable habitat was not identified during the field survey, however, the species has been recorded within 5 km of the Project footprint. As such, the species has the potential to occur temporarily.
Frogs								
Mixophyes balbus Stuttering Frog	V	E	PMST, BioNet	This large frog is found along the east coast of Australia from Southern Queensland to north-east Victoria. Their preferred habitat is rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has not been recorded within 5 km of the Project footprint however has the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has been recorded within 5 km of the Project footprint and has the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has not been recorded within 5 km of the Project footprint however has the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has been recorded within 5 km of the Project footprint and has the potential to occur.

Species/ Community	Conservation status		Source	Distribution and habitat requirements	Likelihood of occurrence			
	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Mixophyes iteratus Giant Barred Frog	E	V	PMST, BioNet, recorded within 10 km of Project footprint for all Bridges during survey.	Distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Stronghold in northern NSW, particularly the Coffs Harbour-Dorrigo area. Typically found along freshwater streams with permanent or semi-permanent water, generally at lower elevation. Favours moist riparian habitats such as rainforest or wet sclerophyll forest for the deep leaf litter which provides shelter and foraging. Sometimes occur in other riparian habitats with drier forest or degraded riparian remnants, and occasionally around dams.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.	**Likely to occur** Suitable habitat is present within the Project footprint. The species is likely to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Philoria sphagnicolus Sphagnum Frog	V	V	PMST, BioNet	Occurs as a series of fragmented populations along the eastern escarpment of the Great Dividing Range in north-east NSW from Chaelundi State Forest south to Killabakh Nature Reserve near Comboyne. Habitat characterised by high moisture levels. Typically found in high rainfall areas at high elevation in Sphagnum Moss beds or seepages on steep slopes. Habitat often occurs in rainforest (including Antarctic Beech forest) and wet sclerophyll forest. Also occur at lower elevation (to about 250 m) in wet coastal foothills.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat was absent from the Project footprint. As such, the species is unlikely to occur.	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat was absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat was absent from the Project footprint. As such, the species is unlikely to occur**.**	**Unlikely to occur** The species has not been historically recorded within the Study area and suitable habitat was absent from the Project footprint. As such, the species is unlikely to occur.
Litoria brevipalmata Green-Thighed Frog	-	V	BioNet	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland. Occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. Prefers wetter forests in the south of its range, but extends into drier forests in northern NSW.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has been recorded within 5 km of the Project footprint so have the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has not been recorded within 5 km of the Project footprint however has the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has not been recorded within 5 km of the Project footprint however has the potential to occur.	**May occur** The Project footprint supports suitable habitat for this species however they were not recorded during the field survey. The species has not been recorded within 5 km of the Project footprint however has the potential to occur.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Litoria subglandulosa Glandular Frog	V	V	PMST	Known only from stream habitats on the eastern escarpment of the Great Dividing Range from the "The Flags" near Walcha in the south to Girraween National Park in the north, a distance of about 250 km. Glandular Frogs may be found along streams in rainforest, moist and dry eucalypt forest or in subalpine swamps.	**May occur** The broader Project Area may support suitable breeding habitat. The species has been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily. .	**May occur** The broader Project Area may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily	**May occur** The broader Project Area may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.	**May occur** The broader Project Area may support suitable breeding habitat. The species has been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily
Insects and Crustacean								
Phyllodes imperialis southern subspecies Southern Pink Underwing Moth	E	E	PMST, BioNet	Distributed from Nambour in south-eastern Queensland to Bellingen in northern NSW. Known to occur in a small number of localities from the QLD border to Wardell, with a disjunct population in the Bellingen area. Found in subtropical rainforest below about 600 m elevation. Potential breeding habitat for the species is restricted to areas where the caterpillar's food plant, a native rainforest vine, *Carronia multisepalea*, occurs in subtropical rainforest.	**May occur** The broader Project Area may support suitable breeding habitat. The species has been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.	**May occur** The broader Project Area may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.	**May occur** The broader Project Area may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.	**May occur** The broader Project Area may support suitable breeding habitat. The species has been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.

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	EPBC Act	BC Act			Joyces Bridge	Hobarts Bridge	Justins Bridge	Duffys Bridge
Phyllodes imperialis smithersi Pink Underwing Moth	-	E	BioNet	This moth is typically found below 600 m altitude in subtropical rainforest on fertile alluvium and rich volcanic soils. It occurs in association with the vine *Carronia multisepalea*, a vine which is needed for this species to breed.	**May occur** The broader Project Area of the Project footprint may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily	**May occur** The broader Project Area of the Project footprint may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily.	**May occur** The broader Project Area of the Project footprint may support suitable breeding habitat. The species has not been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily	**May occur** The broader Project Area of the Project footprint may support suitable breeding habitat. The species has been recorded within 5 km of the Project footprint. This species is highly mobile so may occur temporarily

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