

Terrestrial flora and fauna assessment

Executive summary

GHD Pty Ltd (GHD) was engaged by Roads and Maritime Services (Roads and Maritime) to undertake a terrestrial flora and fauna assessment for the removal of the existing bridge and construction of a new bridge (the proposal) at Tabulam in New South Wales. This flora and fauna assessment forms part of a review of environmental factors (REF) for the proposal.

The proposed development would clear up to 11.12 hectares of vegetation, including site compounds, site access, batch plant site and an area for the new bridge. The area of clearing is likely to be less than this. This area is dominated by exotic vegetation with scattered occurrences of native shrubs and trees. The proposal would not clear any important terrestrial foraging habitat, hollow-bearing trees or stags. The proposal would remove the existing bridge and result in the loss of known microbat roosting habitat, however the overflow structures, where the vast majority of roosting microbats were recorded, are being retained.

Hydrosphere has been engaged to undertake a separate aquatic impact assessment for the proposal and therefore this assessment only considers terrestrial flora and fauna impacts associated with the proposal.

A number of indirect impacts associated with the construction works could affect locally occurring flora and fauna in the retained vegetation in adjoining areas including degradation of surface waters, sediments, dust and runoff, weed invasion and edge effects, and pests and pathogens (such as *Phytophthora* (*Phytophthora cinnamomi*) and Myrtle Rust (*Uredo rangelii*)). The proposal has the potential to indirectly impact microbats at the site through construction noise and vibration. Potential impacts on flora and fauna during the operational phase would be similar to the existing environment.

This assessment concluded that the site provides habitat for seven threatened microbats and one bird listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act); and one aquatic species and three migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The consideration of the seven factors under section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) concludes that the proposal is not 'likely' to have 'a significant effect' on any threatened species or communities listed under the TSC Act and a species impact statement is therefore not required. Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposal is unlikely to impose a significant impact on EPBC Act listed species and therefore referral of this proposal to the Department of the Environment is not required.

Site specific environmental mitigation measures and safeguards to address the identified impacts have been detailed in the review of environmental factors (REF) for the proposal, and would be used to inform a construction environment management plan (CEMP). GeoLINK is currently developing a bat management plan for the proposal. The CEMP would be developed by the contractor to reflect the REF requirements in accordance with the specifications set out in the RMS QA Specifications G36 Environment Protection (Management System).

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was engaged by Roads and Maritime Services (Roads and Maritime) to undertake a flora and fauna assessment for the removal of the existing bridge and construction of a new bridge (the proposal) at Tabulam in New South Wales. This terrestrial flora and fauna assessment forms an appendix to the review of environmental factors (REF) for the proposal. Hydrosphere Consulting Pty Ltd has undertaken a separate aquatic impact assessment for the proposal and the results of this assessment are reported separately within the appendices of the REF.

1.2 Proposal description

Roads and Maritime propose to replace the existing Bruxner Highway Bridge over the Clarence River at Tabulam with a modern structure and remove the existing structure. Key proposal details are outlined in Table 1-1. The key features of the proposal are shown in Figure 1-1.

The existing Bruxner Highway bridge over the Clarence River at Tabulam, which is a state heritage listed structure, is primarily a timber structure and has an overall length of about 300 metres, comprising 13 timber approach spans and five composite timber/steel De Burgh truss central spans. The overall width between kerbs is 4.6 metres, accommodating single lane traffic only. The main spans are supported by concrete piers located in the river, whilst the approaches are supported by timber trestles.

Extensive maintenance works have been conducted over recent years to ensure the bridge remains safe for legally loaded vehicles. However, the bridge presents significant transport limitations both now and into the future and also requires a disproportionate share of Roads and Maritime bridge maintenance funding.

Table 1-1 Proposal details

Project	Tabulam New Bridge
Region	NSW Roads and Maritime Services, Northern Region
Road name/number	Bruxner Highway, HW16
Project location	Tabulam NSW
Project length	830 metres
Council area(s)	Kyogle Council, Tenterfield Shire Council

The new alignment would extend from near the most western overflow structure, west of the Clarence River, before crossing the river downstream and on a slight angle to the existing bridge, converging and re-joining the Bruxner Highway at the Clarence Street intersection. Key features of the proposal include:

- Construction of a new bridge crossing over the Clarence River.
- Alterations to the alignment of the road approaches to the east and west would be required in order to link with the new bridge.
- Augmentation of Overflow Bridge No. 1 and retention of Overflow Bridge No. 2 to manage floodwaters and protect threatened fauna using the bridges as habitat.
- Creation of a new intersection on the western approach to provide safer access to Clarence River Road.

- Reconstruction of the Bruxner Highway's intersections with Clarence Street and Tabulam Road to the east of the Clarence River.

The proposal would be completed in a staged manner with the new bridge being constructed in the first phase and upon diversion of traffic onto the new bridge, removal of the existing bridge. Existing road approaches would also be removed and rehabilitated.

Construction would require the establishment of a temporary site compound on the eastern alignment and a temporary concrete batching plant on land west of Tabulam Road immediately north of the Tabulam Rivulet.

1.3 Definitions

For the purpose of this report, the following definitions apply:

- The 'proposal site' refers to the area that would be directly impacted by the proposal. The proposal site is shown in Figure 1-1. Site compounds would be located in existing cleared areas as shown on Figure 1-1.
- 'Study area' - the area that was assessed during this investigation as shown on Figure 1-1. The study area is wider than the proposal site and was surveyed to account for the route options stage and possible changes to the proposal site which may occur following the field work.
- 'Locality' - the area within a 10 km radius of the study area.

1.4 Study area

The proposal is located in a regional setting with a mixture of rural and residential land uses. Tabulam is located east of the existing bridge (Figure 1-1). The Clarence River flows in a southerly direction under the existing timber bridge which spans the river. There are patches of remnant native vegetation associated with the Clarence River north and south of the proposal site, which is dominated by exotic pasture grasses and weeds.

The study area includes the existing Tabulam Bridge and two overflow structures west of the Clarence River, the proposed location of the new bridge, site compound and temporary concrete batch plant.

1.5 Study aims

The primary aim of this flora and fauna assessment is to determine whether any threatened biota listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act) or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are likely to be affected by the proposal, and the significance of impacts.

The specific objectives of the assessment are as follows:

- Provide information on the terrestrial flora and fauna in the vicinity of the proposal.
- Identify vegetation communities occurring in the vicinity of the proposal.
- Identify fauna habitat types present in the vicinity of the proposal.
- Identify the presence or likely occurrence of threatened species, populations and ecological communities and their habitats listed under the TSC Act.
- Identify the presence or likely occurrence of matters of national environmental significance listed under the EPBC Act.

- Assess the potential impacts of the proposal on the identified ecological values in the vicinity of the proposal.
- Outline recommendations to avoid and minimise impacts on identified ecological values in the vicinity of the proposal.

1.6 Legislative context for assessment

A brief description of legislation relating to flora and fauna is outlined below.

1.6.1 State legislation

Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) lists threatened species, populations or ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats. If any of these could be impacted by the proposal, an assessment of significance that addresses the requirements of Section 5A of the *Environment Planning and Assessment Act 1979* (EP&A Act) must be completed to determine the significance of the impact.

The proposal site was assessed for the potential presence of threatened species, populations and ecological communities listed under the TSC Act (refer to Section 3) and concludes that seven threatened fauna species have the potential to occur within the proposal site.

The assessment of likely impacts on threatened species together with recommended mitigation measures are addressed in Section 3 and Section 4 respectively.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. The NP&W Act also aims to foster public appreciation, understanding and enjoyment of nature and cultural heritage, and provides for the preservation and management of national parks, historic sites and certain other areas identified under the Act. The NP&W Act is administered by the NSW Office of Environment and Heritage (OEH).

No areas of National Park estate occur within or adjacent to the proposal site. An assessment of the proposal in relation to impacts on native flora and fauna (with an emphasis on threatened species and habitat) is undertaken in Section 4. This assessment concludes that there would be temporary negative impacts to native flora and fauna, in particular indirect noise and vibration impacts to microbats.

Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. Eight weed species listed as noxious under the NW Act by the NSW Department of Primary Industries – Biosecurity (NSW DPI), for the Tenterfield Shire Council local government area were identified in the survey area.

These species and their respective control categories are listed below:

- Annual Ragweed (*Ambrosia artemisiifolia*) - Class 5
- Bathurst/Noogoora Burr (*Xanthium* species) – Class 4
- Blackberry (*Rubus fruticosus* aggregate species) - Class 4
- Crofton Weed (*Ageratina adenophora*) – Class 4

- Green Cestrum (*Cestrum parqui*) – Class 3
- Johnson Grass (*Sorghum halepense*) – Class 4
- Lantana (*Lantana camara*) – Class 4 and Weed of National Significance
- Narrow-leaf Privet (*Ligustrum sinense*) – Class 4

Class 5 noxious weeds (restricted plants) require control as per requirements for notifiable weed. Class 4 weeds (locally controlled weeds) are widely spread and likely to spread further. Control is undertaken according to specific measures in a Local Control Authority (LCA). Class 3 weeds (regionally controlled weeds) are likely to spread and must be fully and continuously suppressed and destroyed. All noxious weeds within the site would be managed in accordance with the NW Act. Mitigation measures to control the spread of noxious weeds are discussed in Section 5-2.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

Hydrosphere are currently undertaking an aquatic impact assessment which will assess the impact of the proposal on aquatic species and habitat. Some key threatening processes listed on the FM Act relating to aquatic and riparian habitat have implications for terrestrial species and are discussed in Section 4.8.

1.6.2 State environmental planning policies

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy 44 Koala Habitat Protection (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'.

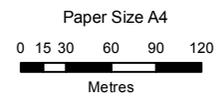
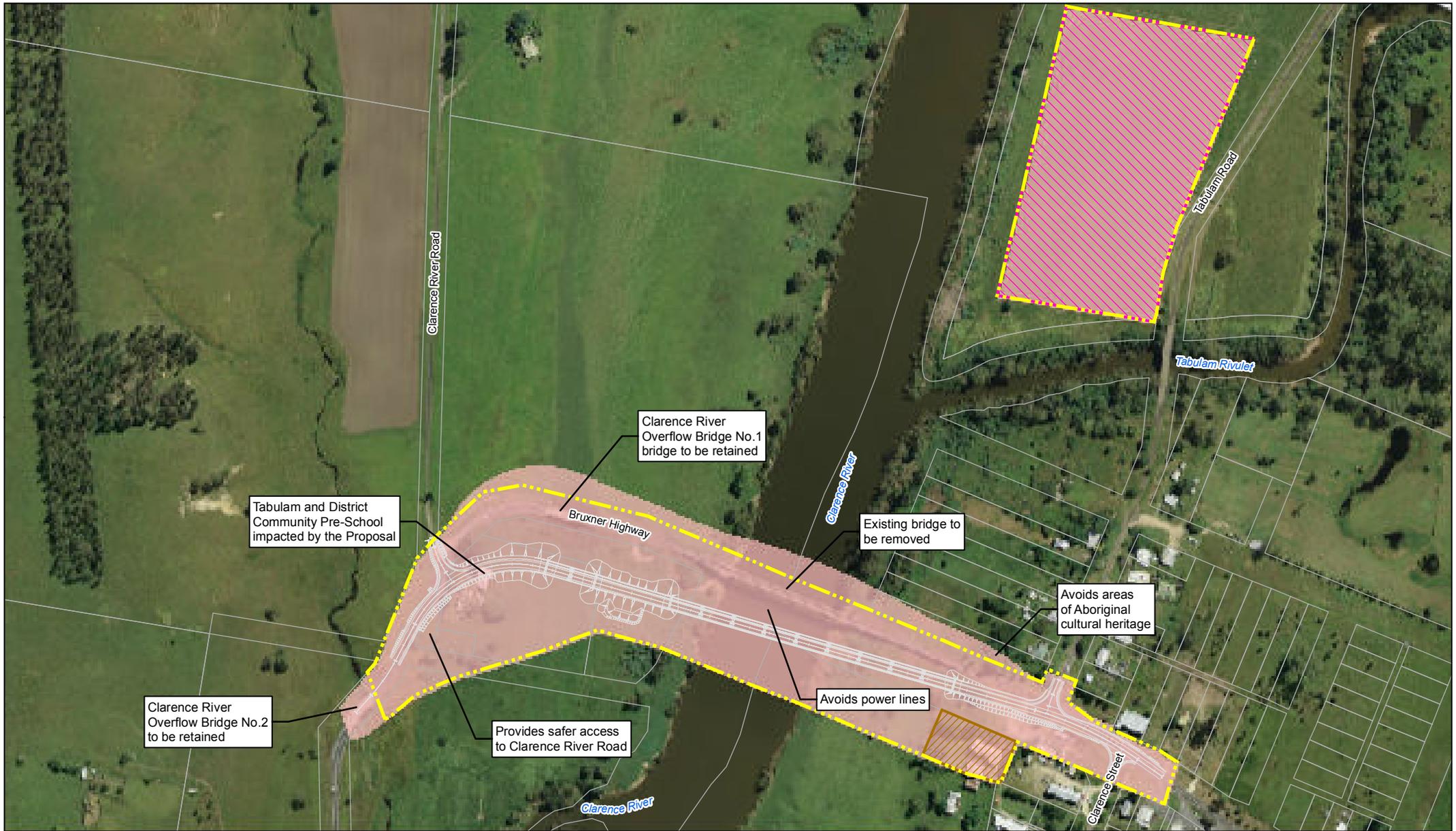
Clause 6 of SEPP 44 states that the SEPP applies only to land 'in relation to which a development application has been made'. Clause 94 of ISEPP precludes the proposed works from requiring consent therefore Part 2 of SEPP 44 does not apply to the proposal. It is Roads and Maritime's policy, however, to consider environmental issues relating to their works to the fullest extent possible, including impacts on Koalas.

1.6.3 Commonwealth legislation

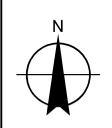
Environment Protection and Biodiversity Conservation Act 1999

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

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance (Section 6). Accordingly, the proposal has not been referred to the Commonwealth Department of the Environment.



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



LEGEND

- Proposal site
- Study area
- Cadastre

- Site compound
- Proposed concrete batch plant (Batch plant will utilise approximately 1ha. Actual location to be confirmed.)

Design

Roads and Maritime Services
 Tabulam New Bridge
 Flora and Fauna Assessment

Job Number | 22-16888
 Revision | 0
 Date | 07 Jan 2015

Proposal site and study area **Figure 1-1**

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Data source: LPI: DTDB, DCDB, 2012, RMS: Imagery, 2012. Created by: tmorton, fmackay, gmcdiarmaid

2. Methodology

2.1 Personnel

Personnel involved in the field surveys and reporting are identified in Table 2-1.

Table 2-1 Personnel details

Personnel name	Qualification	Experience	Role
Vanessa Owen	B Env Sc, B Sc (Hons)	13 years	Flora and fauna surveys, assessment and reporting
Carlie McClung	B Env Sc, Mast Env Mgt	14 years	Flora and fauna surveys, assessment and reporting
Arien Quin	BSc BA – Botany Major	7 years	Flora and fauna surveys, assessment and reporting
Trish Chadwick	B Sc	16 years	Flora and fauna surveys, assessment and reporting
Craig Grabham	B Sc B App Sc (Hons)	16 years	Anabat call recording analysis

2.2 Database searches and literature review

A desktop review was undertaken to help determine the conservation significance of the site and to identify threatened species, populations and ecological communities listed under the TSC Act and FM Act (i.e. threatened 'biota') and matters of national environmental significance listed under the EPBC Act that could potentially occur at the site.

The following documentation was reviewed prior to the field investigations:

- Commonwealth Department of the Environment (DotE) Protected Matters Search Tool for relevant matters of national environmental significance listed under the EPBC Act (June 2014, buffered at 10 km).
- NSW Office of Environment and Heritage (OEH) Wildlife Atlas database (OEH, 2014a) for threatened species listed under the TSC Act (within a 10 km radius of the site).
- OEH (2014b) online threatened biodiversity profiles for endangered ecological communities known to occur within the locality (Northern Rivers Catchment Management Area (CMA)).
- OEH Vegetation Types Database for information regarding vegetation types.
- DPI Noxious Weeds Database for information regarding noxious weeds.

2.3 Field surveys

Field surveys were conducted during the route options stage by two ecologists on 15- 17 January 2014 within the proposal site shown on Figure 1-1. Further terrestrial surveys were undertaken 30 June and 01 July 2014. Methods utilised during the assessment are described below. Survey effort is summarised in Table 2-4.

2.3.1 Flora survey and vegetation mapping

A combination of random meander and targeted searches for threatened species was used to survey the proposal site and to map vegetation communities. Detailed descriptions of survey techniques are outlined below.

Vegetation mapping

Native vegetation types were identified based on dominant flora species present within each structural layer (i.e. canopy, shrub and ground layers). Boundaries of vegetation types were recorded using a hand-held GPS unit. Exotic or highly modified native vegetation was defined based on structure and species composition. Boundaries of vegetation communities were marked with a hand-held GPS and mapped in geographical information system (GIS).

Vegetation types within the proposal site were then assessed against identification criteria for state and Commonwealth listed threatened ecological communities (critically endangered ecological communities, threatened ecological communities and endangered ecological communities). Vegetation and habitats were compared with descriptions provided in OEH (2014) and DotE (2014) profiles.

Flora surveys

A systematic traverse of the proposal site was undertaken to record dominant plant species within each of the vegetation types. The floristic and structural information recorded within each vegetation type was used to identify and describe the nominated vegetation types, identify threatened ecological communities and determine the conservation status of vegetation types under the TSC Act and EPBC Act.

All vascular plants (i.e. not mosses, lichens or fungi) identified during the survey were recorded on proforma field data sheets. Plant specimens that could not be identified rapidly in the field were collected and subsequently identified using the Flora of NSW (Harden 1992-2003). Plant specimens that were problematic to identify (either insufficient sample collected or no reproductive material available at the time of the survey) were identified to genus level.

Information regarding vegetation structure and disturbance history was also recorded throughout the proposal site.

Targeted threatened flora surveys

Targeted surveys were undertaken for threatened flora species identified during the desktop review which could potentially occur given known distributions, previous records in the locality and habitat requirements for each species. Random meander transects, according to the methods of Cropper (1993), were focused in areas of proposed impact in potentially suitable habitat and within immediately adjoining vegetation.

Nomenclature

Plant nomenclature is in accordance with *The Flora of New South Wales* Volumes 1 to 4 (Harden, 1992 - 2002) and taxonomic updates in PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (Version 2.0, <http://plantnet.rbgsyd.nsw.gov.au>).

2.3.2 Fauna survey

Fauna habitat assessment

An assessment of potential threatened fauna habitat was made across the proposal site. The locations of any important habitat features, such as microbat roosting habitat were captured with a handheld GPS unit and photographed where appropriate.

Searches for potential habitat for threatened fauna species included but were not limited to:

- Koala feed trees
- Hollow-bearing trees
- Potential roosts for microchiropteran bats
- Vegetated ponds, riparian vegetation and drainage lines for frogs and waterbirds

Fauna survey

The fauna survey comprised:

- Two days diurnal bird and reptile surveys
- Two nights spotlighting for threatened microbats, arboreal mammals and owls
- Deployment of a bat call recording device (Anabat) to record microchiropteran bats and targeted microbat survey as detailed below

Figure 2-1 shows the fauna survey locations.

Microchiropteran bat surveys

GHD undertook microbat surveys in January and June 2014, and GeoLINK undertook microbat surveys in April 2014 as outlined below.

GHD surveys

Two anabat detectors were deployed overnight by GHD under the existing bridge on the eastern and western banks and the Clarence River (January 2014), and at Overflow Number 2 (June 2014).

Craig Grabham (GHD) completed analysis of all bat calls. Bat calls were recorded during field surveys using Anabat detectors (Bernview Environmental, Padstow NSW). Data from each detector was downloaded via the CF card using CFCread (version 4.3s Corben 2011). Calls were identified using zero-crossing analysis and AnalookW software (version 3.8v, Chris Corben 2012) by visually comparing the time-frequency graph and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from published guidelines.

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 possible species (Pennay *et al.* 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2014b). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of four or more consecutive pulses of similar frequency. Calls with less than four defined pulses were excluded from the analysis. 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) as summarised in Table 2-2.

Species nomenclature follows Pennay *et al.* (2011), then van Dyck and Strahan (2008).

Table 2-2 Confidence rating applied to Anabat 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 e.g. <i>Nyctophilus spp.</i> The calls of <i>Nyctophilus</i> species using this method cannot be distinguished during the analysis process and are therefore lumped together.

GeoLINK surveys

GeoLINK have undertaken microbat surveys at Tabulam Bridge and Clarence River Overflow Structure 1 (April 2014). This survey involved above and below bridge surveys including Anabat, spotlighting, thermal imagery cameras, dusk and dawn direct inspection surveys (GeoLINK 2014).

Ground debris searches

Ground debris searches were undertaken during the survey while incidentally traversing the site. These included active searches for small fauna and opportunistic observation of fauna activity such as scats, tracks, burrows or other traces.

Opportunistic observations

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

2.3.3 Likelihood of occurrence of threatened species

Following collation of database records and species and community profiles a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the proposal site. The likelihood of threatened and migratory biota occurring in the proposal site was assessed based on presence of records from the locality, species distribution and habitat preferences, and quality of potential habitat present. The results of this assessment are provided in Appendix A.

Table 2-3 provides a key to the likelihood of occurrence in the proposal site of threatened biota known or likely to occur in the locality.

Table 2-3 Key to likelihood of occurrence for threatened species

Likelihood	Definition
Present	Recorded during current survey
High	Presence of potential high value habitat (e.g. breeding and foraging habitat; important movement corridors).
Moderate	Presence of potential medium value habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors).
Low	Presence of potential low value habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors).
Unlikely	No preferred habitat or corridors present.

2.4 Survey effort

A summary of the survey effort in relation to field technique is summarised in Table 2-4. Weather conditions at the time of field surveys are summarised in Table 2-5.

Table 2-4 Summary of survey effort

Field Technique	Person Hours	Dates	Time of Day
Flora survey - Random meander	8	15/01/2014, 16/01/2014, 30/06/2014, 01/07/2014	Afternoon
Fauna survey - Diurnal reptile survey and habitat assessment	4	15/01/2014 and 16/01/2014	Afternoon
Fauna survey -Dawn inspection of microbat roost sites and bird survey	1	15/01/2014 and 16/01/2014	Dawn
Fauna survey -Dusk inspection of microbat roost sites. Call playback and bird survey	2	15/01/2014 and 16/01/2014	Dusk
Fauna survey -Anabat and targeted microbat searches underneath bridge and overflows	8	15/01/2014, 16/01/2014, 30/06/2014, 01/07/2014	Set at dusk and left overnight
Fauna survey -Spotlight microbat, amphibian, owl and arboreal mammal survey	2	15/01/2014 and 16/01/2014	Evening

Table 2-5 Summary of Casino weather conditions (Bureau of Meteorology 2014)

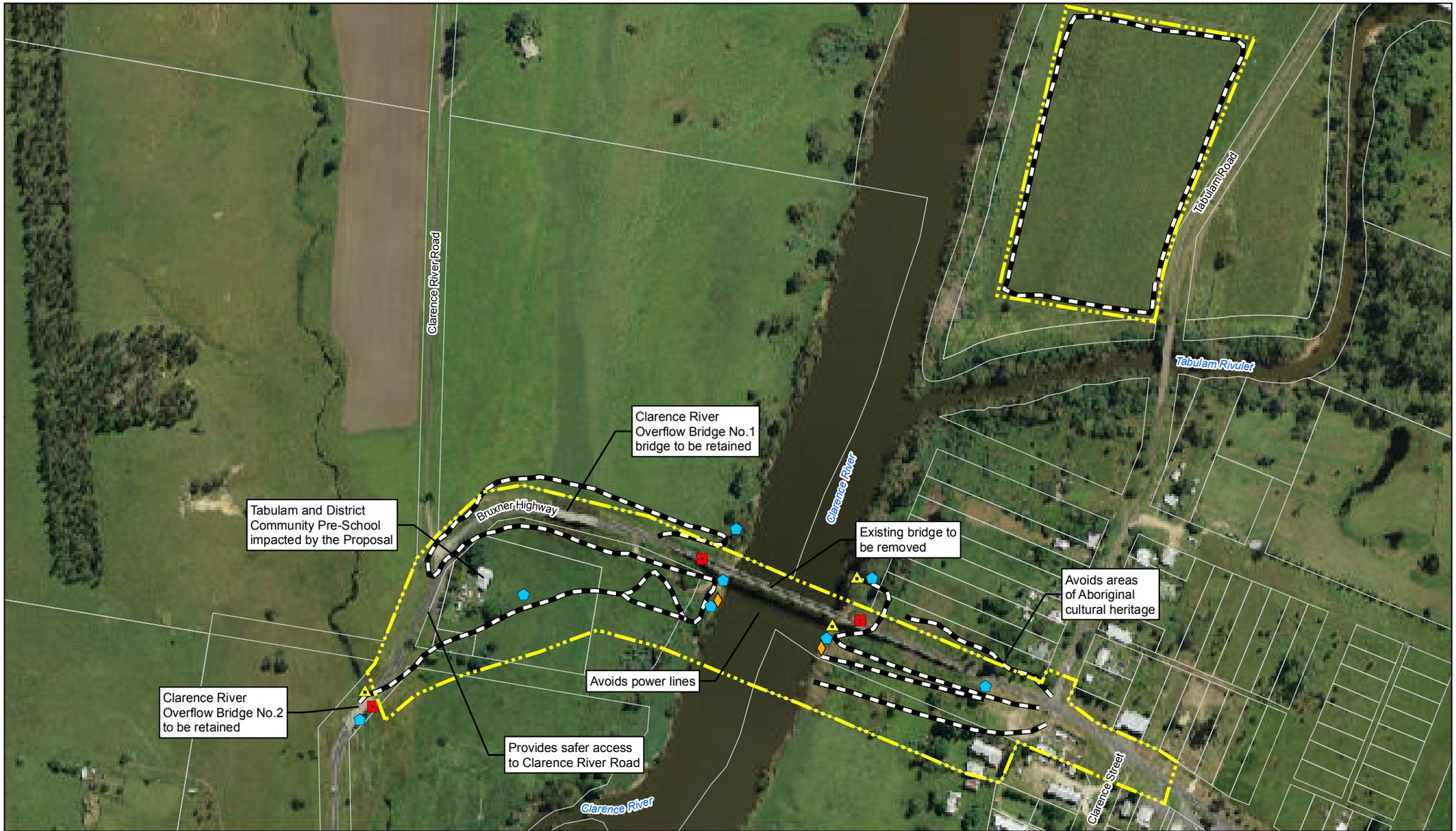
Parameters	15/01/2014	16/01/2014	30/6/2014	01/07/2014
Rainfall (mm)	12.4	0	0	0
Minimum temperature (°C)	16.6	16.2	4.2	0.4
Maximum temperature (°C)	30.6	31.5	16.5	19.1
Wind (km p/h)	41 ENE	39 E	19 WSW	24 S

2.5 Limitations

The current survey was not designed to detect all species present at the site, rather to provide an overall assessment of the ecological values on site. Given the duration and timing of the field survey it is likely that some species that occur at the site (permanently, seasonally or transiently) were not detected during the survey. These species are likely to include flora species that are difficult or impossible to locate or identify at this time of year due to a lack of reproductive material and/or their seasonal nature, and mobile fauna which may occasionally utilise the site on an opportunistic basis. To overcome this limitation assessments of significance have been undertaken for those species that have a moderate to high likelihood of occurrence (based on the presence of suitable habitat) but were not necessarily detected during the survey.

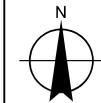
It was beyond the scope of the survey to carry out detailed surveys such as fauna trapping.

Site conditions (including the presence of threatened species of flora and/or fauna) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



Paper Size A4
 0 15 30 60 90 120
 Metres

Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



LEGEND

- Anabat
- ◆ Aquatic Habitat Assessment
- ▲ Dusk and Targeted Survey Location
- ◆ Fauna Survey Points (observation)

- Random Survey Meander
- Cadastral
- Proposal site

Roads and Maritime Services
 Tabulam New Bridge
 Flora and Fauna Assessment

Job Number | 22-16888
 Revision | 0
 Date | 07 Jan 2015

Flora and Fauna
 Survey Locations

Figure 2-1

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© 2015. Whilst every care has been taken to prepare this map, GHD (LPI and RMS) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: LPI: DTDB, DCDB, 2012, RMS: Imagery, 2012. Created by: tmorton, fmackay, gmcdiarmaid

3. Existing environment

3.1 Flora species

A total of 97 species of flora were recorded within the proposal site, comprising 24 native and 73 exotic species, mainly grasses and herbs.

No threatened plant species was recorded within the proposal site.

The full list of plant species recorded is presented in Appendix D. Species recorded are discussed below in relation to the vegetation communities occurring within the proposal site.

3.2 Noxious and environmental weeds

The *Noxious Weeds Act 1993* (NW Act) provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The proposal site contains numerous exotic flora species, eight of which are declared as noxious weeds in the Kyogle and Tenterfield Shire local government areas. A list of noxious weeds recorded within the proposal site is provided in Table 3-1. In addition to these noxious weeds there are a number of environmental weeds, particularly exotic grasses that occur throughout the proposal site.

Table 3-1 Declared noxious weeds of the Kyogle and Tenterfield Shire LGAs recorded during the field survey

Scientific Name	Common Name	Control Class
<i>Lantana camara</i>	Lantana	4
<i>Xanthium</i> species	Bathurst/Noogoora Burr	4
<i>Rubus fruticosus</i> aggregate species	Blackberry	4
<i>Ageratina adenophora</i>	Crofton Weed	4
<i>Sorghum halepense</i>	Johnson Grass	4
<i>Ligustrum sinense</i>	Narrow-leaf Privet	4
<i>Ambrosia artemesiifolia</i>	Annual Ragweed	5
<i>Cestrum parqui</i>	Green Cestrum	3

Class 5 noxious weeds (restricted plants) require control as per requirements for notifiable weed. Class 4 weeds (locally controlled weeds) are widely spread and likely to spread further. Control is undertaken according to specific measures in a Local Control Authority (LCA). Class 3 weeds (regionally controlled weeds) are likely to spread and must be fully and continuously suppressed and destroyed.

3.3 Vegetation types

Overall the proposal site is highly modified. Exotic vegetation covers about 11.12 hectares of the proposal site (including site compound area and batch plant site). This comprises predominantly a dense cover of exotic grasses and weeds, including *Paspalum* (*Paspalum dilatatum*), Rhodes Grass (*Chloris gayana*), Buffalo Grass (*Stenotaphrum secundatum*), Couch (*Cynodon dactylon*), Kikuyu (*Pennisetum clandestinum*), Pigeon Grass (*Setaria incrassata*) and Purpletop (*Verbena bonariensis*).

There are occasional, isolated trees and shrubs, predominantly exotic or garden species, including Jacaranda (*Jacaranda mimosifolia*), Crepe Myrtle (*Lagerstroemia* sp.), Cadagi Tree (*Corymbia torreliana*) and the native Weeping Bottlebrush (*Callistemon viminalis*) and Lightwood (*Acacia implexa*). Dense stands of the exotic Castor Oil Plant (*Ricinus communis*) occur on the eastern bank of the Clarence River.



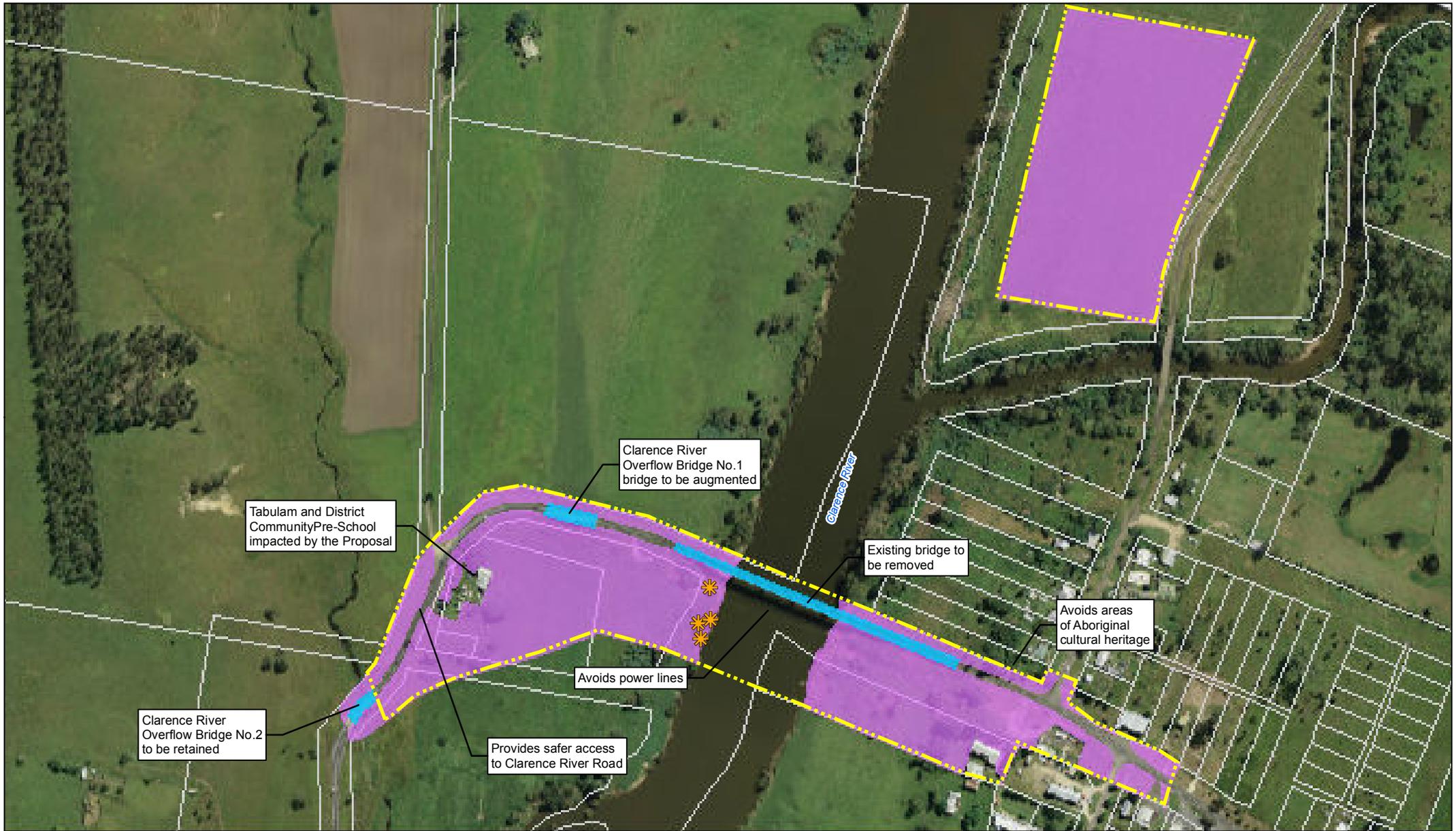
Plate 3-1 Exotic vegetation on the eastern bank of the Clarence River



Plate 3-2 Exotic vegetation on the western bank of the Clarence River

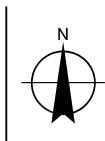


Plate 3-3 Exotic vegetation at the batch plant site



Paper Size A4
 0 15 30 60 90 120
 Metres

Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 56



LEGEND

Proposal site
 Cadastre

Exotic Vegetation
 Mircobat Roosting Habitat

Weeping Bottlebrush

Roads and Maritime Services
 Tabulam New Bridge
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Vegetation Mapping
 and Fauna Habitats

Figure 3-1

3.4 Fauna species

Seven mammals, one frog, four reptiles and 33 bird species were observed.

The full list of fauna species recorded is presented in Appendix F. Guilds and species observed included:

- Forest birds including the Pied Currawong (*Strepera graculina*) and Laughing Kookaburras (*Dacelo leachii*)
- Parrots common in urban and agricultural landscapes such as the Rainbow Lorikeet (*Trichoglossus haematodus*) and introduced bird species, including the Common Myna (*Acridotheres tristis*)

No owls, ground-dwelling or arboreal mammal species were recorded during field surveys. One common frog, the Eastern Dwarf Tree Frog (*Litoria fallax*) was recorded along the banks of the Clarence River.

The threatened Grey-headed Flying-fox (*Pteropus poliocephalus*) was observed flying downstream of the proposal site, however there is no foraging or roosting habitat available at the site.

Four common reptiles were recorded, including the Longneck Turtle (*Chelodina longicollis*) and Eastern Water Dragon (*Physignathus lesueurii*).

It is considered highly likely that Platypus (*Ornithorhynchus anatinus*) are present as water ripples consistent with Platypus activity were observed.

Six microchiropteran bat species were confidently identified via calls recorded from underneath the bridge and Overflow Structure 2, including one threatened species (the East-coast Free-tailed Bat *Mormopterus norfolkensis*) and five common species (Table 3-2). A number of other species were assigned as probable or species groups, including five further threatened species (the Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*, Greater Broad-nosed Bat *Scoteanax rueppellii*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Little Bentwing-bat *Miniopterus australis* and Large-footed Myotis (*Myotis macropus*) (Table 3-2). The same species assemblage was recorded under the overflow structure, with approximately 54 individuals spotlighted.

Table 3-2 Summary of GHD anabat call analysis (January and June 2014)

Species Name	Common Name	Confidence Rating	Total Calls	Roost Preference
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Definite	1	Tree hollows and buildings
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Probable	3	Tree hollows and buildings
<i>Chalinolobus gouldii</i> / <i>Mormopterus</i> sp.	Gould's Wattled Bat	Species group	1	Tree hollows and buildings
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Probable	1	Tree hollows, caves, disused fairy martin nests, bridges, culverts and buildings

Species Name	Common Name	Confidence Rating	Total Calls	Roost Preference
<i>Miniopterus schreibersii oceanensis</i> (Vulnerable TSC Act)/ <i>Vespadelus</i> species	Eastern Bentwing-bat/ Vespadelus sp.	Species group	8	Caves, mines, bridges, culverts and buildings
<i>Mormopterus norfolkensis</i>	East-coast Free-tailed Bat	Definite	6	Tree hollows and buildings/
<i>Mormopterus ridei/norfolkensis</i>	East-coast Free-tailed Bat	Species group	8	Tree hollows and buildings/tree hollows and buildings
<i>Mormopterus</i> sp.	-	Species group	1	
<i>Myotis macropus</i> (Vulnerable TSC Act)/ <i>Nyctophilus</i> sp.	Large-footed Myotis	Species group	38	Caves, disused fairy martin nests, bridges, culverts and buildings
<i>Rhinolophus megaphyllus</i>	Smaller Horseshoe Bat	Definite	1	Tree hollows, caves, nests, bridges, culverts and buildings
<i>Scoteanax rueppellii</i> (Vulnerable TSC Act)/ <i>Scotorepens orion/Falsistrellus tasmaniensis</i> (Vulnerable TSC Act)	Greater Broad-nosed Bat/Eastern Broad-nosed Bat/Eastern False Pipistrelle	Species group	11	Tree hollows and buildings/tree hollows/tree hollows
<i>Tadarida australis</i>	White-striped Freetail-bat	Definite	1	
<i>Vespadelus darlingtoni</i>	Large Forest Bat	Definite	1	Tree hollows
<i>Vespadelus darlingtoni</i>	Large Forest Bat	Probable	5	Tree hollows
<i>Vespadelus darlingtoni/regulus</i>	Large Forest Bat/ Southern Forest Bat	Species group	21	Tree hollows
<i>Vespadelus pumilus/Miniopterus australis</i> (Vulnerable TSC Act)	Eastern Forest Bat/ Little Bentwing-bat	Species group	1	Tree hollows/Caves, mines, bridges and buildings
<i>Vespadelus pumilus</i>	Eastern Forest Bat	Definite	1	Tree hollows
<i>Vespadelus regulus</i>	Southern Forest Bat	Probable	7	Tree hollows

Species Name	Common Name	Confidence Rating	Total Calls	Roost Preference
<i>Vespadelus sp/Chalinolobus morio</i>	Chocolate Wattled Bat	Species group	7	Tree hollows/tree hollows, caves, disused fairy martin nests, bridges, culverts and buildings
<i>Vespadelus troughtoni</i> (Vulnerable TSC Act)/ <i>vulturinus/pumilus</i>	Eastern Cave Bat/ Little Forest Bat/ Eastern Forest Bat	Species group	14	Caves and buildings/tree hollows/tree hollows
Other bats	-	-	18	NA

3.4.1 GeoLINK bat survey

The GeoLINK bat survey is attached as Appendix H. The results of the GeoLINK survey are summarised below:

- Potential microbat roosting habitat occurs throughout Tabulam Bridge, including decking gaps across the bridge, split timber headstocks on the approach span and timber joints at the piers. Rotted timber features suitable for microbat roosts were uncommon.
- No significant bat colonies were recorded roosting at Tabulam Bridge. An individual microbat likely to be from the family Vespertilionidae (probably a Large-footed Myotis but unable to be confirmed due to the roosting location) was recorded roosting in the bridge decking.
- A total of 254 call sequences were analysed. Three species were recorded as definite: the threatened Little Bentwing-bat (*Miniopterus australis*), the threatened East-coast Freetail-bat (*Mormopterus norfolkensis*) and *Mormopterus* sp. Six species were recorded as probable, including the threatened Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Large-footed Myotis (*Myotis macropus*).
- Approximately 91 microbats were recorded roosting in the Clarence River Overflow Structure 1 which is a concrete plank bridge approximately 100 m west of Tabulam Bridge. They were likely to be from the family Vespertilionidae, with probable Large-footed Myotis and bentwing bats observed.

3.5 Fauna habitats

The proposal site contains limited habitat for terrestrial flora and fauna species. With the exception of the bridge and overflow structures as roosting habitat for microbats, and aquatic habitat associated with the Clarence River, there are no important fauna habitat features at the site. Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species potentially present in the proposal site. Important habitat resources are mapped on Figure 3-1.

The habitat assessment identified three main habitat types in the proposal site:

- Exotic vegetation
- Bridge and overflow structures
- Clarence River

These habitat types are described below and represented in Figure 3-1.

3.5.1 Exotic vegetation

This habitat type is dominated by exotic grasses and weeds, with occasional exotic and native isolated trees and shrubs. Structural diversity of the vegetation and density of leaf litter is low, and the proposal site is unlikely to provide important shelter and foraging resources for native invertebrates, reptiles and ground-dwelling mammals.

There is no intact native canopy or shrub layer and the proposal site is unlikely to provide foraging habitat for forest birds or arboreal mammals. Foraging habitat is available for birds that use open grasslands such as raptors and ravens. There are no hollow-bearing trees and the proposal site would not provide nesting or denning habitat for hollow-dependant arboreal mammals, bats or birds.

3.5.2 Bridge and overflow structures

The existing timber bridge has concrete in-water pylons and timber/steel on-bank supports. The deck consists of timber slats on a metal frame. Potential microbat roosting habitat occurs throughout Tabulam Bridge, including decking gaps across the bridge, split timber headstocks on the approach span and timber joins at the piers. Welcome Swallows (*Hirundo neoxena*) were noted nesting in the existing bridge rails.



Plate 3-4 The existing Tabulam Bridge

The Clarence River Overflow Structure 1 and 2 are concrete plank bridges with concrete pylons and surfaces with gaps underneath that provide microbat roosting habitat (Plate 3-5). Guano staining occurs surrounding the concrete gaps on the underside of the overflow, indicating microbat usage (Plate 3-6). Disused Fairy Martin (*Hirundo ariel*) nests also provide potential microbat roosting habitat (Plate 3-7). GeoLINK (2014) have recorded Sothorn Myotis roosting in other concrete plank bridges within the Clarence River catchment.



Plate 3-5 Clarence River Overflow Bridge No. 2

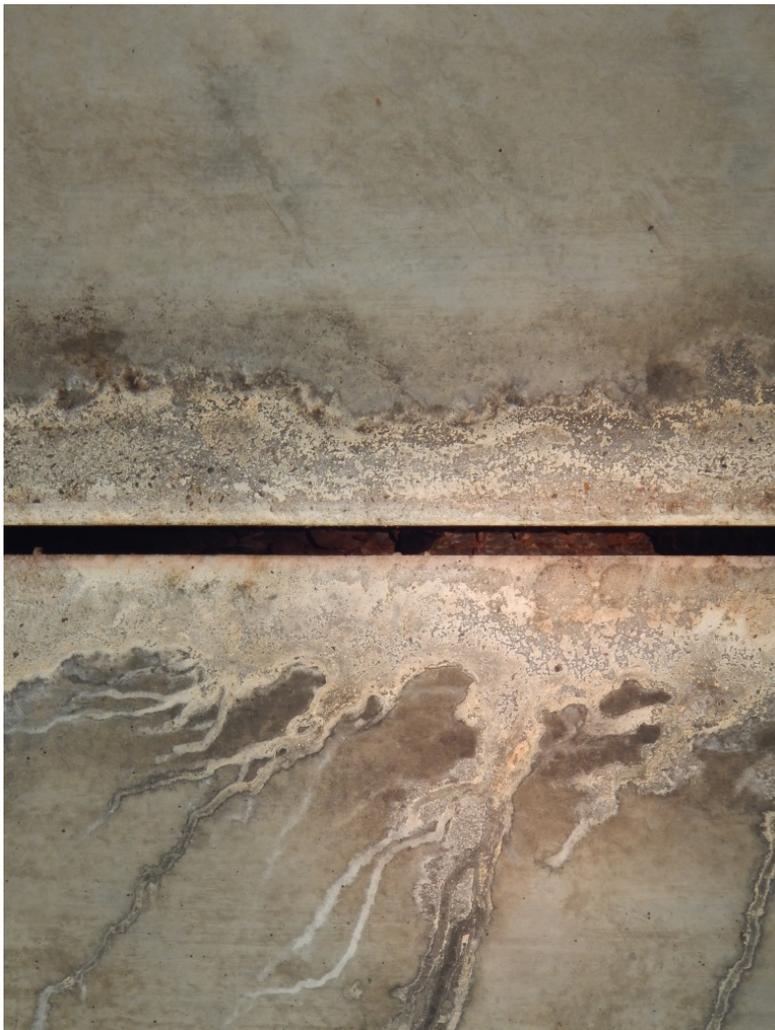


Plate 3-6 Guano staining underneath the overflow structure and microbat roosting habitat



Plate 3-7 Disused Fairy Martin nests on the underside of the overflow provide microbat roosting habitat

3.5.3 Clarence River

The Clarence River is shallow (approximately 2 metres deep and 100 metres wide) with slow flowing freshwater. There are no riffles, sandbanks, emergent woody snags or backwaters within the proposed site, although emergent woody snags occur upstream and downstream of the site. Riparian vegetation consists of exotic grasses and weeds, occasional native Weeping Bottlebrush and dense stands of the exotic Castor Oil Plant. There is a moderate amount of aquatic vegetation present, including native species of Ribbonweed (*Vallisneria sp.*) and Swamp Lily (*Ottelia ovalifolia*). The introduced aquatic plant, Dense Water Weed (*Egeria densa*) was also present.

It is considered highly likely that Platypus (*Ornithorhynchus anatinus*) occurs at the site as water ripples consistent with Platypus activity were observed. There is abundant instream and fringing aquatic reeds and sedges, providing potential habitat for aquatic macroinvertebrates and fish. The river also offers potential foraging habitat for microbats, birds, frogs and reptiles, including the threatened East-coast Free-tailed Bat (*Mormopterus norfolkensis*) and Large-footed Myotis (*Myotis macropus*) which has been previously recorded (probable confidence rating) foraging beneath the bridge.



Plate 3-8 Clarence River at the proposal site with dense Castor Oil Plant on the eastern bank

3.6 Threatened ecological communities

3.6.1 TSC Act

The desktop review indicates six EECs listed under the TSC Act known to occur in the locality (10 km radius of the proposal site). These include:

- Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and Southeast Corner Bioregions
- Littoral Rainforest in the NSW North Coast, Sydney Basin and Southeast Corner Bioregions
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland

The vegetation community that occurs at the site is not characteristic of an EEC listed under the TSC Act.

3.6.2 EPBC Act

The desktop review indicates two EECs listed under the EPBC Act known to occur in the locality (10 km radius of the proposal site). These include:

- Lowland Rainforest of Subtropical Australia
- White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The vegetation community that occurs at the site is not characteristic of an EEC listed under the EPBC Act.

3.7 Groundwater dependent ecosystems

The *Risk Assessment Guidelines for Groundwater Dependent Ecosystems – The Conceptual Framework* (Serov *et. al.*, 2012) developed by the NSW Office of Water (NOW) and the OEH provides an approach to GDE identification, classification, ecological valuation, and ecological risk assessment for a given activity or potential impact on a groundwater source. It also details a series of steps to identify and infer the level of groundwater dependency and provides a summary of risk assessment guidelines for GDEs.

A search of the NSW Natural Resource Atlas was undertaken to determine groundwater levels within the proposal site. Two boreholes have been drilled west of the Clarence River in Tabulam. These bore holes identified the standing water level at 11.8 metres.

Given the relatively deep groundwater levels recorded at the proposal site it is unlikely that the exotic vegetation occurring at the proposal site has the potential to be drawing on groundwater.

3.8 Threatened species and endangered populations

3.8.1 Database search results

TSC Act

The NSW Wildlife Atlas search identified 14 threatened fauna and four threatened flora species listed under the TSC Act that have previously been recorded within a 10 kilometre radius of the proposal site (Figure 3-2). No endangered populations have been previously recorded within the locality. An assessment of the likelihood of threatened species to occur within the proposal site is provided in Appendix A.

A copy of the NSW Wildlife Atlas search is provided in Appendix B.

EPBC Act

The EPBC Act Protected Matters search identified the following threatened species that have either been recorded or are predicted to occur within a 10 kilometre radius of the proposal site:

- 11 threatened flora species
- 15 threatened fauna species

An assessment of the likelihood of threatened species to occur within the site is provided in Appendix A.

A copy of the EPBC Act Protected Matters search is provided in Appendix C.

3.8.2 Flora

TSC Act

The desktop literature review indicates that four threatened plant species listed under the TSC Act have been previously recorded or are predicted to occur in the locality. The full list of plant species of conservation significance predicted to occur or previously recorded in the locality, including habitat requirements and conservation status, is presented in Appendix A.

No threatened flora was recorded at the proposal site during the field surveys. The threatened flora species known or predicted to occur in the locality are considered unlikely to occur on the site as they have limited ranges and/or habitat requirements, which are not present at the site or surrounding the proposal site.

EPBC Act

The desktop review indicated 11 threatened flora species listed under the EPBC Act previously recorded, or predicted to occur in the locality. The full list of plant species of conservation significance predicted to occur or previously recorded in the locality, including their habitat requirements and conservation status is presented in Appendix A.

No threatened flora was recorded at the proposal site during the field surveys. The threatened flora species known or predicted to occur in the locality are considered unlikely to occur on the site as they have limited ranges and/or habitat requirements which are not present at the site or surrounding the proposal site.

3.8.3 Fauna

TSC Act

The desktop literature review indicates 14 threatened fauna species listed under the TSC Act that have been previously recorded in the locality. Two species of microbat have been previously recorded with a definite confidence rating by GHD (2014) and/or GeoLINK (2014) during previous assessments at the proposal site:

- Little Bentwing-bat (*Miniopterus australis*)
- East Coast Freetail-bat (*Mormopterus norfolkensis*)

Additionally, four microbats have been recorded with a probable confidence rating by GHD (2014) and/or GeoLINK (2014) during previous assessments at the proposal site:

- Large-footed Myotis (*Myotis macropus*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

There is potential foraging habitat associated with the Clarence River and roosting habitat associated with the bridge and overflow structures for these six microbats, two of which are known to occur and four of which are highly likely to occur. Additionally, Beccari's Freetail Bat (*Mormopterus beccarii*) has been previously recorded at Tabulam and is highly likely to occur at the proposal site. Of these threatened microbats, East Coast Freetail-bat, Greater Broad-nosed Bat and Beccari's Freetail Bat primarily roost in tree hollows and buildings rather than culverts/tunnels or bridges. Little Bentwing-bat and Eastern Bentwing-bat may roost in the overflow structures and existing Tabulam bridge outside of breeding season, but these sites are highly unlikely to be maternity roosts as the species have very specific maternity sites. Large-footed Myotis could potentially utilise Tabulam bridge and overflow structures as maternal roost sites.

There are numerous records of Black-necked Stork (*Ephippiorhynchus asiaticus*) associated with the Clarence River floodplains east and west of the proposal site. Although there are no wetlands or floodplains and no potential roosting trees at the proposal site, the Clarence River provides potential foraging habitat for the species and there is a moderate likelihood that it could occur at least on occasion. The proposal site is unlikely to be important habitat for the species in the locality, but the species would nevertheless occur at the proposal site on occasion as part of a wider area of occupancy.

The full list of threatened fauna identified in the desktop review, including their conservation status, habitat requirements, and likelihood of occurrence is presented Appendix A.

EPBC Act

The desktop review indicated 15 threatened fauna species listed under the EPBC Act that are predicted to occur in the locality. The threatened fauna predicted to occur in the locality are considered unlikely to occur on the site as they have limited ranges and/or habitat requirements which are not present at the site or surrounding the proposal site.

3.9 Migratory and marine species

An EPBC Act Protected Matters search identified the following migratory and marine species that have either been recorded or are predicted to occur within the locality:

- 12 listed migratory species
- 15 listed marine species

No migratory species listed under the EPBC Act were recorded during field surveys. Based on a desktop review of known habitat association and the field survey, there is broadly suitable foraging habitat for three migratory species at the proposal site:

- Cattle Egret (*Ardea ibis*)
- Great Egret (*Ardea alba*)
- Rainbow Bee-eater (*Merops ornatus*)

The full list of migratory fauna identified in the desktop review, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Appendix A.

3.10 Other EPBC Act listed matters

There are no World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park or Commonwealth Marine Areas within the locality of the site and the proposal will not impact any of these listed MNES.

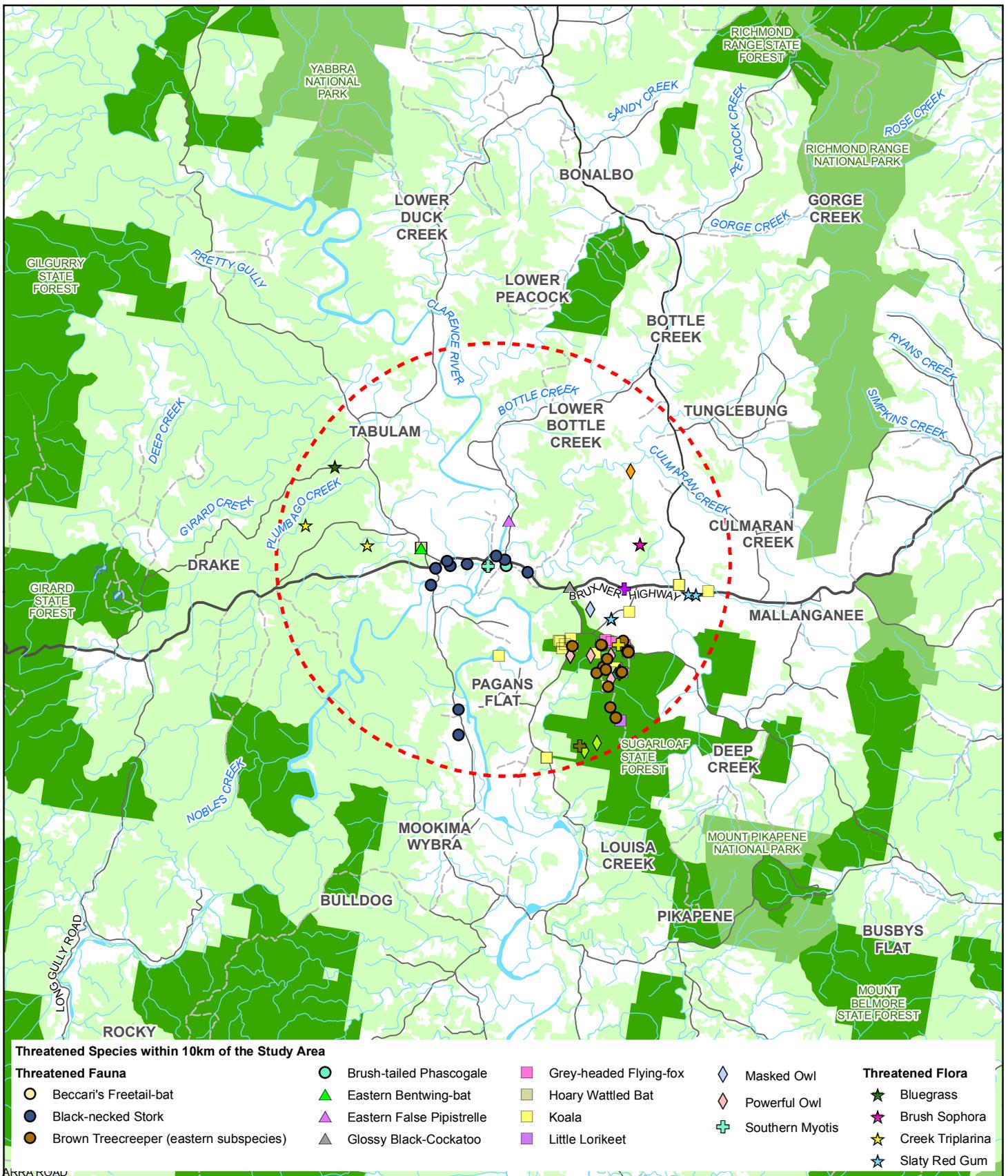
3.11 Wildlife connectivity corridors

The proposal does not intersect any key habitats or corridors mapped by OEH. The nearest areas of OEH mapped key fauna habitat is approximately 2 km north and south of the proposal site. There are no fauna corridors within the vicinity of the proposal site.

The vegetation at the proposal site is highly modified, consisting of predominantly exotic grasses and weeds. Wildlife movements through the proposal site are likely to be generally limited to the aquatic corridor associated with the Clarence River. The proposal would not interfere with fauna movement along the Clarence River and is not likely to fragment any vegetation or wildlife corridors.

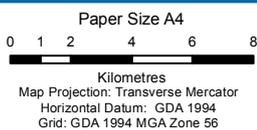
3.12 SEPP 44 koala habitat

Clause 6 of SEPP 44 states that the SEPP applies only to land 'in relation to which a development application has been made'. Clause 94 of ISEPP precludes the proposed works from requiring consent therefore Part 2 of SEPP 44 does not apply to the proposal. It is Roads and Maritime's policy, however, to consider environmental issues relating to their works to the fullest extent possible, including impacts on Koalas. The proposal site does not contain any koala feed tree species listed on schedule 2 of SEPP44 therefore the area does not constitute potential koala habitat.



LEGEND

- Principal Road
- Secondary Road
- Minor Road
- Track
- ~ Watercourse
- Waterbody
- Nature Conservation Reserve
- State Forest
- Forest Or Shrub
- 10km Radius



Roads and Maritime Services
Tabulam New Bridge
Flora and Fauna Assessment

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Threatened Flora and Fauna previously recorded in locality (OEH 2014)

Figure 3-2

4. Potential impacts of the proposal

This section assesses the potential impacts of the proposal, including a quantitative assessment of direct impacts of construction based on concept designs for the proposed works. It also considers potential secondary impacts on native biota within the study area.

The potential impacts considered include:

- Loss of vegetation/habitat
- Habitat fragmentation
- Wildlife injury and mortality
- Weeds
- Pests and pathogens
- Noise, vibration and light
- Key threatening processes
- Cumulative impacts

4.1 Loss of vegetation/habitat

4.1.1 Flora and ecological communities

This proposal site contains 11.12 hectares of exotic vegetation and scattered native trees (approximately four Weeping Bottlebrush); these vegetation types are not characteristic of a threatened ecological community listed under the TSC Act or EPBC Act. No important terrestrial habitat features (including hollow-bearing trees) would be cleared.

Site specific safeguards would be included in REF to address impacts on flora and ecological communities including:

- Marking the limit of works
- Limiting clearing onsite to minimise vegetation to be removed and avoiding impacts on adjacent vegetation
- Weed management in accordance with requirements of local weed authority
- Identify revegetation with appropriate natives

4.1.2 Impacts on native fauna

The proposal would clear up to 11.12 hectares of exotic vegetation with scattered occurrences of native shrubs and trees (as shown in Plate 1 and 2). The area of clearing is likely to be less than this. The proposal would not clear any important terrestrial foraging habitat (such as native canopy trees or structurally and floristically diverse native shrub and groundcover layers), hollow logs, hollow-bearing trees or stags.

The Clarence River is the most important fauna habitat feature of the proposal site, and a range of fauna including birds, microbats and amphibians may potentially forage at the proposal site on a transient and opportunistic basis as part of a wider area of occupation. The proposal would not result in the loss of this potential foraging habitat; however any fauna at the site would be impacted by potential indirect impacts during construction, including noise and vibration as discussed in Section 4.7.

The proposal does not involve any structures that would pose a significant obstruction or hazard to the flight of birds or bats in the context of existing land uses in the locality.

4.1.3 Impacts on microbats

The proposal would clear up to 11.12 hectares of exotic vegetation scattered occurrences of native shrubs and trees, unlikely to represent foraging habitat for these species. The aquatic corridor associated with the Clarence River is likely to be an important foraging resource for these threatened microbats, particularly Large-footed Myotis, however the proposal would not result in the loss of this important foraging resource.

The proposal would remove the existing bridge and result in the loss of microbat roosting habitat, however the overflow structures, where the vast majority of microbats were recorded, are being retained (note that microbats utilising these structures would be subject to indirect noise and vibration impacts as discussed in Section 4.7). Only one microbat was recorded roosting under the existing bridge (GeoLINK 2014), whereas 91 were recorded roosting in the Overflow Structures 1 (GeoLINK 2014) and 54 by GHD in Overflow Structure 2. Additionally, the new bridge would provide potential microbat roosting habitat once constructed.

East Coast Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle and Beccari's Freetail Bat primarily roost in tree hollows and buildings rather than culverts/tunnels or bridges. Little Bentwing-bat and Eastern Bentwing-bat may roost in the Tabulam Bridge and overflow structures outside of breeding season, but these sites would not be maternity roosts for these species as they have very specific maternity sites which have been mapped. Large-footed Myotis could potentially utilise Tabulam Bridge and overflow structures as maternal roost sites. There are other bridges (Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) in the wider area that all contain large maternity colonies of the threatened Large-footed Myotis (GeoLINK 2014). These other bridges are structurally similar to Tabulam Bridge, therefore Tabulam bridge could also be utilised as a maternal colony site. However, alternative roosting habitat (including hollow-bearing trees) occurs along the Clarence River north of the site and the loss of the existing Tabulam Bridge would not result in the loss of all potential roosting habitats in the locality.

No barriers to movement of microbats are anticipated. The proposal would remove the existing bridge and construct new instream pylons for the new bridge, but would allow for movement under and around the structure. The proposed works do not involve any structures that would pose a significant obstruction or hazard to the flight of birds or bats in the context of existing land uses in the locality.

The removal of the bridge may cause death or injury to any bats that may be roosting in the bridge at the time of demolition. The REF includes a site specific microbat management plan to address impacts on working adjacent to known bat habitat (overflow 1 and 2) which was developed by GeoLINK (refer to Appendix I).

4.2 Habitat fragmentation

The proposal does not intersect any key habitats or corridors mapped by OEH. The proposal involves constructing a new bridge and road adjacent to the existing bridge and road which would therefore not constitute a new impact. The severity of impacts arising from fragmentation, edge effects would be limited by the presence of existing disturbance.

4.3 Wildlife injury and mortality

The proposed works present an inherent risk of injury and mortality to native fauna. Specific risks include:

- Machinery and plant during clearing and construction
- Operational traffic after completion, likely to be similar to the existing environment
- Removal of existing bridge

Site specific mitigations measures and safeguards would be included in the REF and used to inform the CEMP. The CEMP would then be developed by the contractor to reflect the REF requirements in accordance with the specifications set out in the RMS QA Specifications G36 Environment Protection (Management System).

4.4 Weeds

Construction may increase the degree of weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of adjacent native vegetation via wind, water, workers shoes and clothing, and construction vehicles. Vehicles and people should be excluded from adjacent areas of native vegetation to assist in the management of weeds.

A vegetation management plan is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the proposed development (refer Section 5.2). Given these mitigation measures the proposal is likely to result in a minor increase in weed infestation.

4.5 Pests and pathogens

Construction activities within the proposal site have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*) and Myrtle Rust (*Uredo rangellii*) through vegetation disturbance. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats.

A 'clean on entry, clean on exit' policy should be implemented during construction activities as outlined in Section 5 to prevent the introduction or spread of these pathogens.

4.6 Aquatic habitat

The proposal would remove the existing instream pylons and new ones would be installed. At the time of survey there was no large emergent instream woody debris at the proposal site that would need to be cleared. If large emergent instream woody debris observed prior to construction then removal and relocation would be done in accordance with advice from Department of Primary Industries (Fisheries).

Potential sources of impacts to the Clarence River include:

- Water quality impacts associated with removal of existing pylons, bridge deck concrete works and installation of new pylons.
- Runoff from areas stripped of vegetation.
- Runoff from soil stockpiles.
- Runoff from hardstand areas, including roads, processing areas and site facilities.

- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops.
- Refuelling bays and fuel, oil and grease storages.

Soil protection measures and techniques would be implemented during and following construction. Any localised increases in erosion hazard as a result of construction would be limited to the immediate construction footprint and there would be appropriate control devices and buffers between the proposal site and sensitive receptors.

The proposal site currently contains both hardstand areas and vegetated areas. The proposal would result in a slight increase in hardstand areas but not to the extent that significant changes to surface water flows or quality are likely to occur. Existing flows to and through existing overflow structures would be maintained. The new bridge instream pylons would not alter existing flows or impede fish passage, and would likely act in a similar way to the existing instream pylons. The proposal is unlikely to result in changes to the existing hydrological regimes at the proposal site.

A more detailed aquatic impact assessment is currently being undertaken by Hydrosphere.

4.7 Noise, vibration and light

4.7.1 Noise and vibration

The proposal site is partially within an existing road corridor with relatively low but constant traffic volumes. Habitats adjacent to the proposal site therefore already experience exposure to traffic noise, light and vibration. Construction of the proposal would occur within 100 m of Overflow Structure 1 and adjacent to Overflow Structure 2, over approximately 18 months (note the overflow structures are not being removed or altered). Construction is likely to result in noise and vibration impacts for microbats occurring at the proposal site. At the completion of construction site conditions would return to those currently experienced. Site specific mitigations measures and safeguards would be included in the REF and used to inform the CEMP. The CEMP would then be developed by the contractor to reflect the REF requirements in accordance with the specifications set out in the RMS QA Specifications G36 Environment Protection (Management System).

4.7.2 Artificial lighting

The site currently experiences some artificial lighting impacts from traffic, adjacent residential areas and street lighting. Night-time security lighting can potentially discourage habitat use where diffuse light penetrates into adjoining areas of vegetation. The foraging regimes of some nocturnal native mammals and birds can be disrupted by lighting and make them vulnerable to predation by cats, dogs and foxes. Such lighting should be designed as 'down lights' wherever practicable and be directed inwards so as to not spill into the overflow structures which are being utilised as microbat roost sites. No permanent artificial lighting is proposed for the new bridge.

The magnitude of impacts from artificial lighting during construction would be low, as resident fauna are likely to have already adapted to conditions at the site.

4.8 Key threatening processes

A key threatening process (KTP) is defined under the TSC Act (OEH 2014c) as an action, activity or proposal that:

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

There are currently 36 KTPs listed under the TSC Act, seven listed under the FM Act and 19 under the EPBC Act. A number of KTPs are listed under more than one Act. KTPs relevant to the proposal site are summarised in Table 4-1.

Table 4-1 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act; EPBC Act	Clearing of native vegetation has occurred historically within and around the proposal site. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. Approximately 11.12 hectares of exotic vegetation (with some scattered native trees) would be cleared.
Loss of hollow-bearing trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow-bearing trees. At present there is a mixture of mature and immature vegetation (primarily exotic with scattered native trees) within the proposal site. No hollow-bearing trees would be cleared for the proposal.
Removal of dead wood and dead trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow-bearing trees. At present there is a mixture of mature and immature vegetation within the proposal site. No dead wood or trees would be cleared for the proposal.
Invasion of plant communities by perennial exotic grasses	TSC Act	The site has been subject to historical disturbance and consequently there are a number of invasive exotic perennial grasses that have invaded areas of native vegetation. This KTP is unlikely to be exacerbated on site or in adjoining areas with the implementation of weed management measures.
Invasion establishment and spread of <i>Lantana camara</i>	TSC Act	The site has been subject to historical disturbance and consequently <i>Lantana</i> has invaded small patches of the proposal site. This KTP is unlikely to be exacerbated on site or in adjoining areas with the implementation of weed management measures.
The removal of large woody debris from NSW rivers and streams	FM Act	At the time of survey there were no large emergent instream woody debris at the proposal site that would need to be cleared. If large emergent instream woody debris observed prior to construction then removal and relocation would be done in accordance with advice from Department of Primary Industries (Fisheries).
The degradation of native riparian vegetation along NSW water courses	FM Act	Clearing of riparian vegetation has occurred historically within and around the proposal site. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. Approximately 11.12 hectares of exotic vegetation (with some scattered native trees) would be cleared.

KTP	Status	Comment
Instream structures and other mechanisms that alter natural flow	FM Act	The existing bridge alters flow on a small scale however fish passage is not impeded. The new bridge would result in similar small-scale flow alterations and would not impede fish passage.

4.9 Duration of impacts

It is anticipated that construction would occur over approximately 18 months.

4.10 Cumulative impacts

There are no other known development proposals in the vicinity of the proposal site.

5. Mitigation measures

The proposal has been designed with reference to the hierarchy of avoid, minimise, and mitigate impacts. Despite this, the proposal would result in some unavoidable residual adverse impacts imposed upon some elements of the environment, including removing and disturbing (through indirect noise and vibration impacts) microbat roosting habitat as well as instream works. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened biota and their habitats which occur in the site.

5.1 Avoidance and minimisation of impacts

The proposal has been designed to avoid and minimise impacts on areas with high biodiversity values such as remnant native vegetation and hollow-bearing trees on the northern side of the existing bridge, and important aquatic habitat features such as instream woody snags north and south of the proposal site.

5.2 Mitigation of impacts

5.2.1 Construction environmental management plan

Site specific mitigations measures and safeguards would be included in REF and used to inform the CEMP. The CEMP would then be developed by the contractor to reflect the REF requirements in accordance with the specifications set out in the RMS QA Specifications G36 Environment Protection (Management System) and G38 Soil and Water Management (Soil & Water Management Plan).

5.2.2 Construction phase site management

All works are to be undertaken in accordance with the CEMP and RTA *Biodiversity Guidelines*. The following principals should be followed throughout the construction phase as outlined in Table 5-1. Note that mitigation measures relating to aquatic species and habitat have been outlined by Hydrosphere.

Table 5-1 Recommended environmental safeguards

Impact	Environmental Safeguards	Responsibility	Timing
<p>Potential for direct impacts on native fauna species</p>	<ul style="list-style-type: none"> • A pre-clearance procedure is to be developed and implemented in accordance with the RTA <i>Biodiversity Guidelines (Guide 1: Pre-clearing process)</i> (RTA 2011) and include inspection of the existing bridge and overflow structures for microbats. • A microbat management plan was developed by GeoLINK (Appendix I) to manage the potential impacts on microbats. The plan includes: <ul style="list-style-type: none"> – Recommendations for bridge removal work to be undertaken between May and September to avoid breeding season for the Large-footed Myotis – Pre-demolition survey methodology to be used by suitable ecologist – Management measures to be applied if demolition works can't be completed during the recommended period – Roost exclusion assessment methodology, types of exclusion measures to be used and the exclusion process to be followed (if > 20 microbats are identified by pre-demolition surveys between May and September) – Methodology for removal of individual Microbats – Outline of the monitoring program to be conducted throughout the duration of the proposal – Recommendations for the protection of known roost habitat (Clarence River Overflow Structures), which includes: <ul style="list-style-type: none"> ○ Establishing a 30 m exclusion zone around Clarence River Overflow Structures ○ Monitoring access to exclusion zone ○ Monitoring of Clarence River Overflow Structures – Types of microbat habitat to be recreated under the new bridge – Environmental Work Method Statements (EWMS) to be prepared for all activities potentially impacting microbats – Daily microbat inspections by an ecologist or contractor – Inductions to be prepared and delivered to all personnel involved with the project 	<p>Construction contractor</p>	<p>Pre-construction</p>
<p>Potential for direct impacts on native fauna species</p>	<ul style="list-style-type: none"> • Fauna handling is to be conducted in accordance with the RTA <i>Biodiversity Guidelines (Guide 9: Fauna handling)</i> (RTA 2011). • Any unexpected threatened species finds will be dealt with in accordance with the <i>Biodiversity Guidelines</i> (RTA, 2011). • Limit vehicular and personnel entry into adjacent remnant vegetation during construction and operation through appropriate fencing. 	<p>Construction contractor</p>	<p>Construction</p>

Impact	Environmental Safeguards	Responsibility	Timing
Direct impacts to vegetation	<ul style="list-style-type: none"> Exclusion zones are to be identified and demarcated in accordance with the RTA <i>Biodiversity Guidelines (Guide 2: Exclusion zones)</i> (RTA 2011). 	Construction contractor	Construction
Direct impacts to vegetation	<ul style="list-style-type: none"> Protocols for clearing of vegetation is to be developed in accordance with the RTA <i>Biodiversity Guidelines (Guide 4: Clearing of vegetation and removal of bushrock)</i> (RTA 2011). 	Construction contractor	Construction
Direct impacts to vegetation	<ul style="list-style-type: none"> Protocols for preventing or minimising the spread of noxious and environmental weeds is to be developed in accordance with the RTA <i>Biodiversity Guidelines (Guide 6: Weed Management)</i> (RTA 2011). 	Construction contractor	Construction

6. Assessments of significance

Assessments of significance have been completed for those threatened species recorded or identified as likely to occur within the proposal site. These include:

- Eight threatened fauna species
- Three migratory species

6.1 Threatened species

6.1.1 TSC Act

Assessment of Significance pursuant to section 5A of the EP&A Act have been completed for those threatened species recorded, or with a moderate to high likelihood of occurrence (Table 6-1) and are included in Appendix D. The results of the assessments are summarised below.

Table 6-1 Threatened fauna recorded or considered likely to occur within the proposal site (TSC Act)

Species Name	Common Name	TSC Act Status*	EPBC Act Status	Microbat Roost Preference
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	NA
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	Caves, tunnels, tree hollows, mines, stormwater drains, culverts, bridges
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Caves, mines, tunnels, buildings
<i>Myotis macropus</i>	Large-footed Myotis	V	-	Caves, mine shafts, tree hollows, stormwater channels, buildings, bridges
<i>Mormopterus norfolkensis</i>	East-coast Free-tailed Bat	V	-	Tree hollows and buildings
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Tree hollows and buildings
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Tree hollows and buildings
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	V	-	Tree hollows and buildings

*V = vulnerable; E = endangered

Black-necked stork

Consideration of the seven factors under s.5A of the EP&A Act indicates that the proposal is unlikely to impose a significant impact on the Black-necked Stork given:

- The proposal would not result in the loss of potential foraging, roosting or nesting habitat. The proposal has the potential to indirectly impact aquatic habitat through erosion and sedimentation downstream of the site, and result in indirect noise and vibration impacts during construction, however these impacts would be short term, minor scale and unlikely to result in a significant impact on the species.
- The proposal is highly unlikely to fragment an existing population as habitat connectivity would be maintained via the Clarence River aquatic habitat corridor.
- The proposal would not form a barrier to movement of these highly mobile species.

Threatened microbats

Consideration of the seven factors under s.5A of the EP&A Act indicates that the proposal is not likely to result in significant impacts on threatened microbats given:

- No important foraging resources (such as native vegetation or the Clarence River) would be cleared for the proposal.
- The proposal would remove the existing bridge and result in the loss of potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. The overflow structures, where the vast majority of microbats were recorded, are important microbat roosting habitat and are being retained. These overflow structures offer potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. Additionally, the new bridge would provide potential microbat roosting habitat and alternative roosting habitat for all these threatened species (including hollow-bearing trees) which occur along the Clarence River north of the site.
- The proposal would result in indirect construction noise and vibration impacts. These indirect impacts are not likely to alter foraging behaviour but may impact roosting at the overflow structures. Alternative roosting habitat is available along the Clarence River and in the wider area. At the completion of construction site conditions would return to the existing environment following completion of construction.
- A microbat management plan was developed by Geolink which includes pre construction surveys, exclusion measures and monitoring throughout construction (refer to Appendix I).
- The proposal would not fragment or isolate movement corridors or foraging habitat.
- The proposal would not form a barrier to movement of these highly mobile species.

6.1.2 EPBC Act

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' may be affected. Under the Act any action, which "has, will have, or is likely to have a significant impact on a matter of national environmental significance" is defined as a "controlled action", and requires approval from the Minister for the Environment.

Three migratory fauna species have the potential to occur in the proposal site (Table 6-2). An EPBC Act assessment has been prepared for migratory species (Appendix E) and is summarised below.

Table 6-2 Migratory fauna species likely to occur within the proposal site (EPBC Act)

Species Name	Common Name	EPBC Act Status
<i>Ardea ibis</i>	Cattle Egret	M
<i>Ardea alba</i>	Great Egret	M
<i>Merops ornatus</i>	Rainbow Bee-eater	M

Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposal is unlikely to impose a significant impact on migratory species as it is unlikely to:

- Substantially modify and/or destroy an area of important habitat for a migratory species. Habitat that occurs within the proposal site, whilst suitable as foraging for the above migratory species, does not constitute important habitat as defined under the EPBC Act Significant Impact Guidelines (Department of the Environment 2013).
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species. An ecologically significant proportion of a migratory species has been determined to comprise 0.1% flyway population (i.e. the population that migrates to/from Australia) of the species (EPBC Act Policy Statement 1) (DEWHA 2009b).
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

A summary of the assessments of significance is provided in Table 6-3 below.

Table 6-3 Summary of assessments of significance- TSC Act

Species Name	Common Name	Status	Significance Assessment Question a	Significance Assessment Question b	Significance Assessment Question c	Significance Assessment Question d	Significance Assessment Question e	Significance Assessment Question f	Significance Assessment Question g	Likely Significant Impact
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	No	NA	NA	No	No	No	No	No
<i>Miniopterus australis</i>	Little Bentwing-bat	V	No	NA	NA	No	No	No	No	No
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	No	NA	NA	No	No	No	No	No
<i>Myotis macropus</i>	Large-footed Myotis	V	No	NA	NA	No	No	No	No	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	No	NA	NA	No	No	No	No	No
<i>Mormopterus norfolkensis</i>	East-coast Free-tailed Bat	V	No	NA	NA	No	No	No	No	No
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	No	NA	NA	No	No	No	No	No
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	V	No	NA	NA	No	No	No	No	No

Table 6-4 Summary of assessments of significance for migratory species listed under the EPBC Act

Species Name	Common Name	Status	Important Population	Likely Significant Impact
<i>Ardea ibis</i>	Cattle Egret	M	No	No
<i>Ardea alba</i>	Great Egret	M	No	No
<i>Merops ornatus</i>	Rainbow Bee-eater	M	No	No

7. Conclusions

7.1 Flora and fauna impacts

The proposed development would clear up to 11.12 hectares of vegetation. This area is dominated by exotic vegetation with scattered occurrences of native shrubs and trees. The proposal site is of limited value for most native fauna as it is highly modified with no important fauna habitat features such as wetlands, rocky outcrops, hollow-bearing trees or stags.

The proposal site contains foraging habitat (terrestrial and aquatic) for a range of microbats including threatened species, and man-made structures including the bridge and overflow structures that provide diurnal roost sites for some of the microbats recorded or considered likely to occur. Tabulam Bridge and Overflow 1 and 2 are potential maternal roost sites for the threatened Large-footed Myotis.

Site specific environmental mitigation measures and safeguards to address the identified impacts have been detailed in the REF for the proposal, and would be used to inform a construction environment management plan CEMP. GeoLINK has developed a microbat management plan for the proposal (refer to Appendix I). The CEMP would be developed by the contractor to reflect the REF requirements in accordance with the specifications set out in the RMS QA Specifications G36 Environment Protection (Management System).

7.2 Threatened biota listed on the TSC Act

The site provides potential habitat for one threatened bird and seven threatened microbats listed under the TSC Act. Consideration of the seven factors under s.5A of the EP&A Act concluded that the proposal is not 'likely' to have 'a significant effect' on any threatened species or communities listed on the TSC Act and a species impact statement is therefore not required.

7.3 EPBC Act matters

The site provides potential habitat for three migratory species listed under the EPBC Act. Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposal is unlikely to impose a significant impact on these EPBC Act migratory species and therefore referral of this proposal to the Department of the Environment is not required with respect to these species.

8. References

- Bureau of Meteorology (2014) Daily weather observations
<http://www.bom.gov.au/climate/dwo/201311/html/IDCJDW2097.201311.shtml>
- Churchill, S. 2008. *Australian Bats*, Allen and Unwin, Australia
- Cropper, S.C. 1993. *Management of Endangered Plants*. East Melbourne, Victoria: CSIRO
- Department of Environment and Conservation (DEC) 2004. *Natural Resource Management Advisory Series Note 15: Wildlife Corridors*
- Department of the Environment and Climate Change 2007. *Threatened species assessment guidelines: The assessment of significance*, Sydney
- Department of the Environment (DotE), Heritage and the Arts 2013. *Matters of National Environmental Significance Significant Impact Guidelines 1. 1*, Department of the Environment, Canberra
- Department of the Environment (DotE) 2014a. Protected Matters Search Tool, accessed 16 June 2014, <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>
- Department of the Environment (DotE) 2014b. Species Profile and Threats Database. Online resource <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.p>, Department of Sustainability, Environment, Water, Population and Communities, accessed June 2014
- Duffy, A.M., Lumsden, L.F., Caddle, C.R., Chick, R.R. and Newell, G.R. 2000. The efficacy of Anabat ultrasonic detectors and harp traps for surveying microchiropterans in southeastern Australia, *Acta Chiropterologica* 2: 127-144
- GeoLINK (2014) Tabulam Bridge Microbat Survey Results. Unpublished report for RMS April 2014
- Harden, G. (Ed) 1992-2003. *Flora of New South Wales – Vols 1 – 4*. University of New South Wales Press, Sydney
- Mills, DJ, Norton, T.W., Parnaby, H.E., Cunningham, R.B. & Nix, H. 1996, Designing surveys for microchiropteran bats in complex forest landscapes – a pilot study from south-east Australia. *Forest Ecology and management* 85(1-3):149-161
- NSW Office of Environment and Heritage 2014a, Threatened species advanced search, accessed on 16 June 2014, <http://www.environment.nsw.gov.au/threatenedSpeciesApp/>
- NSW Office of Environment and Heritage, 2014b, Office of Environment and Heritage (NSW) NSW Threatened Species Profiles, accessed 16 June 2014, <http://www.environment.nsw.gov.au/threatenedspecies/>
- NSW Office of Environment and Heritage, 2014c, List of key threatening processes, <http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm> (accessed 16 June 2014)
- NSW Office of Environment and Heritage, 2014d, Search for Priority Actions, accessed on 16 June 2014, <http://www.environment.nsw.gov.au/threatenedSpeciesApp/PasSearch.aspx>
- NSW Office of Environment and Heritage 2014e, Critical Habitat Register, accessed 7 July 2014, <http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm>
- Pennay, M., Law, B., and Lunney, D. 2011. Review of the Distribution and status of the bat fauna of NSW and the ACT. Pp. 226-256 in *The Biology and Conservation of Australian Bats*, edited by Law., B Eby., P, Lunney., D

Pennay, M, Law, B, Reinhold, L 2004. *Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats*, NSW Department of Environment and Climate Change, Hurstville

Serov, P., Kuginis, L., Byrne, G.T., Williams, J.P. 2012. *Risk Assessment Guidelines for Groundwater Dependent Ecosystems in NSW*. National Water Commission and NSW Office of Water

9. Limitations

This report: has been prepared by GHD for Roads and Maritime Services and may only be used and relied on by Roads and Maritime Services for the purpose agreed between GHD and the Roads and Maritime Services as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Roads and Maritime Services 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 (Section 2.5). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Appendices

Appendix A – Likelihood of occurrence

Threatened Biota Habitat Table

Databases Searched

Office of Environment and Heritage (OEH) (2014a) Threatened species profiles- threatened ecological communities known or predicted to occur within the Northern Rivers CMA subregion.

Department of the Environment (DoE) (2014) EPBC PMST Online Search 16 June 2014 - 10 km buffer.

Department of Primary Industries (DPI) (2014) Records viewer search for threatened and protected aquatic species - Northern Rivers CMA.

Office of Environment and Heritage (OEH) (2014b) NSW Wildlife Atlas Search - threatened species results within a 10 km buffer.

Likelihood of Occurrence

The likelihood of occurrence is defined as follows:

<i>Present</i>	Recorded during current survey.
<i>High</i>	Presence of potential high value habitat (e.g. breeding and foraging habitat; important movement corridors).
<i>Moderate</i>	Presence of potential medium value habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors).
<i>Low</i>	Presence of potential low value habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors).
<i>Unlikely</i>	No preferred habitat or corridors present.
<i>Absent</i>	Does not occur within the proposal site.

Matters considered in determining the likelihood of occurrence include:

Known natural distributions including prior records (database searches) and site survey results.

Geological/ soil preferences.

Specific habitat requirements (e.g. aquatic environs, seasonal nectar resources, tree hollows etc).

Climatic considerations (e.g. wet summers; snow fall).

Home range size and habitat dependence.

Topographical preferences (e.g. ridgetops, coastal headlands, midslopes, closed depressions).

Threatened ecological communities known or predicted to occur in the locality, community description and presence/absence in the proposal site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence at Proposal Site	Impact Consequence	Risk
Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion		EEC		This community is associated with clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include <i>Eucalyptus tereticornis</i> (forest red gum), <i>E. siderophloia</i> (grey ironbark), <i>Corymbia intermedia</i> (pink bloodwood) and, north of the Macleay floodplain, <i>Lophostemon suaveolens</i> (swamp turpentine).	Absent from the proposal site.	Nil	Nil
Swamp Sclerophyll Forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC		Usually occurs below 20m asl (sometimes up to 50m). Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, with trees up to or higher than 25 m. Includes areas of fern land and tall reed or sedge land, where trees are sparse or absent.	Absent from the proposal site.	Nil	Nil
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney		EEC		Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20 m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually	Absent from the proposal site.	Nil	Nil

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence at Proposal Site	Impact Consequence	Risk
Basin and South East Corner Bioregions				dominated by herbaceous plants and has few woody species.			
Littoral Rainforest in the NSW North Coast, Sydney Basin and southeast Corner Bioregion		EEC		Occurs along the NSW coast, usually within 2 km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally rainforest species with vines a major component.	Absent from the proposal site.	Nil	Nil
Low land Rainforest of Subtropical Australia		EEC	CE	Occurs along the NSW coast, usually within 2 km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally rainforest species with vines a major component.	Absent from the proposal site.	Nil	Nil
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		EEC	CE	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. White Box Yellow Box Blakely's Red Gum Woodland is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box <i>Eucalyptus albens</i> , Yellow Box <i>E. melliodora</i> and Blakely's Red Gum <i>E. blakelyi</i> .	Absent from the proposal site.	Nil	Nil

Threatened flora known or predicted from the locality, habitat associated and likelihood of occurrence.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Allocasuarina defungens</i>	Dwarf Heath Casuarina	E	E	The Dwarf Heath Casuarina grows in a humid warm-temperate to sub-tropical climate. The Dwarf Heath Casuarina is found in coastal areas of wet to dry, dense, low, closed heath land growing on Pleistocene marine aeolian derived soils. A few populations occur in coastal clay heath on bedrock soils, and on hinterland sandstone. These soils are humus podzols. The drier heath is on podzols with a sub-soil hard pan. Both soil types are subject to a high watertables during the rainy season.	Unlikely Suitable habitat types not present within the proposal site.	5	L
<i>Arthraxon hispidus</i>	Hairy-join Grass	V	V	Occurs over a wide area in south-east Queensland, and on the northern tablelands and north coast of NSW, but is never common. Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps	Unlikely Suitable habitat types not present within the proposal site.	5	L
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	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 <i>Cryptostylis subulata</i> and <i>Cryptostylis erecta</i> . Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-	Unlikely Suitable habitat types not present within the proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				February.			
<i>Dichanthium setosum</i>	Bluegrass	V	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Unlikely Suitable habitat types not present within the proposal site.	5	L
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland.	Unlikely. No suitable open-heathy forest on hills and slopes present.	5	L
<i>Haloragis exalata subsp. velutina</i>	Tall Velvet Sea-berry	V	V	This subspecies of Tall Sea-berry occurs on the north coast of NSW and southeastern Queensland. It is plentiful in inaccessible areas of the upper Macleay River. Grows in damp places near watercourses.	Unlikely Suitable habitat types not present within the proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Lepidium peregrinum</i>	Wandering Pepper Cress	E	E	Thought to be extinct until recently rediscovered in NSW and Queensland. Targeted searches conducted in 2001 confirmed the species occurs in scattered refugia in north-eastern NSW (near Tenterfield) and south-eastern Queensland. The largest site containing most of the known <i>Lepidium peregrinum</i> population is in a designated Travelling Stock Reserve	Unlikely. No suitable heath or woodland on sandstone present.	5	L
<i>Marsdenia longiloba</i>	Slender Marsdenia	E	V	Scattered sites on the north coast of NSW north from Barrington Tops. Also occurs in south-east Queensland. Found in subtropical and warm temperate rainforest, low land moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	Unlikely Suitable habitat types not present within the proposal site.	5	L
<i>Persicaria elatior</i>	Tall Knotweed	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Unlikely Suitable habitat types not present within the proposal site.	5	L
<i>Sophora fraseri</i>	Brush Sophora	V	V	North from the Casino district in north-east NSW, where it is very rare. Also in south-east Queensland where it is widespread but not common.	Unlikely Suitable habitat types not present within the proposal site.		
<i>Triplarina imbricata</i>	Creek Triplarina	E	E	Found only in a few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. Usually found along watercourses in low open forest with Water Gum (<i>Tristaniopsis laurina</i>).	Unlikely Suitable habitat types not present within the proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Strelbus pendulinus</i>	Siah's Backbone, Sia's Backbone, Isaac Wood		E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island (ATRP 2010; Jessup 2003; The Royal Botanic Gardens and Domain Trust 2011). Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).	Unlikely Suitable habitat types not present within the proposal site.	5	L

Threatened fauna known or predicted from the locality, habitat association and likelihood of occurrence in the proposal site

Birds

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				densities in habitat that have not been burnt for over 15 years.			
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. This species breeds during summer, nesting in or near a freshwater swamp	Moderate. Potential foraging habitat occurs at site. Numerous recent local records of the species in the locality. No tall trees (potential nesting sites) occur at the site.	5	L
<i>Erythrotriorchis radiatus</i>	Red Goshawk	CE	V	The Red Goshawk is restricted to coastal and sub-coastal regions of Australia. Its range extends from the Kimberleys in Western Australia to the north coast of Australia extending as far south as the eastern coast of NSW. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	Low. Preferred habitat absent from proposal site, although species may occur occasionally as part of a wider area of occupation for opportunistic foraging associated with the Clarence River. No important habitat features (eg potential nest sites) occur at the site.	5	L
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands Eucalyptus albens and E. melliodora are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially Eucalyptus viminalis, E. blakelyi and E. dealbata. Most breeding records are from the western slopes.	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Lathamus discolor</i>	Swift Parrot	E	E,M	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. Eucalyptus robusta, Corymbia maculata and C. gummifera dominated coastal forests are also important habitat.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Ninox strenua</i>	Powerful Owl	V	-	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	Low. Preferred habitat absent from proposal site, although species may occur occasionally as part of a wider area of occupation for opportunistic foraging associated with the Clarence River. No important habitat features (eg potential nest sites) occur at the site.	5	L
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Turnix melanogaster</i>	Black-breasted Button-quail	CE	V	There have been few recent records in north-eastern NSW, with only ten records, from six localities, in the 20 years to 2000, though there are many records directly adjacent to NSW across the Queensland border. There have been no published reports since 2000. Preferred habitat includes drier low closed forests, including dry rainforests, vine forest and vine thickets, often in association with Hoop Pine, and Bottle tree 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.	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	Low . Preferred habitat absent from proposal site, although species may occur occasionally as part of a wider area of occupation for opportunistic foraging associated with the Clarence River. No important habitat features (eg potential nest sites) occur at the site.	5	L
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	Unlikely . Preferred habitat absent from proposal site.	5	L

Mammals

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Aepyprymnus rufescens</i>	Rufous Bettongs	V	-	The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. They inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Low. Preferred habitat absent from proposal site.	5	L
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	V	-	Widely distributed across northern Australia although absent from the arid centre. In north east NSW it extends from Port Macquarie in the south, north to the Queensland border. The species has been recorded as far west as Armidale and Ashford. Occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	High. Potential foraging habitat occurs and potential roosting habitat occurs under the bridge and overflow structures. Species	4	M

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				Roost mainly in tree hollows but will also roost under bark or in man-made structures.	recorded with a definite confidence rating by GHD (2014) and GeoLINK (2014).		
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	High. Potential foraging habitat occurs and potential roosting habitat occurs under the bridge and overflow structures. Species recorded with a probable confidence rating by GHD (2014).	4	M
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. 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. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	High. Potential foraging habitat along the Clarence River and potential roosting habitat present under the bridge and overflow structures. Species recorded with a probable confidence rating by GHD (2014) and definite by GeoLINK (2014).	4	M
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	High. Potential foraging habitat along the Clarence River and potential roosting habitat present under the bridge and overflow structures. Species recorded with a probable confidence rating by GHD (2014) and GeoLINK (2014).	4	M
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	V	E	Widely distributed across northern Australia from Western Australia to Queensland, extending south to the north-east corner of NSW. The only confirmed record in NSW is of a colony found in the roof of a house in Murwillumbah, however, calls have been detected from a few other locations in the far north east of the State. Inhabit a range of vegetation types in northern Australia, from rainforests to open forests and woodlands, and are often recorded along watercourses.	High. Potential foraging habitat along the Clarence River and potential roosting habitat present under the bridge and overflow structures.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Myotis macropus</i>	Southern Myotis	V	-	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 (Campbell 2011). Breeds November or December (Churchill 2008).	High. Potential foraging habitat along the Clarence River and potential roosting habitat present under the bridge and overflow structures. Species recorded with a probable confidence rating by GHD (2014) and GeoLINK (2014).	4	M
<i>Petaurus australis</i>	Yellow-Bellied Glider	V	-	Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of 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.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Phascolarctos cinereus</i>	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Potorous tridactylus</i>	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Pseudomys oralis</i>	Hastings River Mouse	E	E	A patchy distribution spanning the Great Dividing Range from the Hunter Valley, south of Mt Royal, north to the Bunya Mountains near Kingaroy in south-east Queensland, at elevations between 300 m and 1100 m. Found in a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands,	Unlikely. Species may overfly the site as part of a wider range of occupation. No potential foraging habitat or roosting habitat occurs	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	at the site. Potential foraging habitat occurs in the remnant vegetation approximately 100 m north of the site.		
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	High. Potential foraging habitat along the Clarence River and potential roosting habitat present under the bridge and overflow structures. Species recorded with a probable confidence rating by GHD (2014).	4	M

Amphibians

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).	Unlikely. Preferred habitat absent from proposal site.	5	L

Reptiles

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink	V	V	The Three-toed Snake-tooth Skink occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. It is very uncommon south of Grafton. Found in rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. The Three-toed	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				Snake-tooth Skink lives in loose soil, leaf litter and rotting logs, and feeds on earthworms and beetle grubs.			
<i>Delma torquata</i>	Collared Delma	-	V	The Collared Delma is endemic to Queensland and normally inhabits eucalypt-dominated woodlands and open-forests in Queensland Regional Ecosystem Land Zones.	Unlikely. Preferred habitat absent from proposal site.	5	L

Fish

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
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Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Maccullochella ikei</i>	Eastern Freshwater Cod	E	E	Found in clear, flowing streams with rocky beds and deep holes, in areas that have plenty of boulders or large woody debris (snags) (NSW Fisheries 2004, NSW DPI 2012). Riparian vegetation, large boulders and snags provide a complex array of habitats for each stage of the Eastern Freshwater Cod life cycle and influence the quality and quantity of food and shelter (NSW DPI 2012). There are over 60 records of the species in the Northern Rivers CMA on the NSW DPI threatened species records viewer, including one record of the species at the proposal site from 2003, four upstream from the proposal site (dated 2003 and 2004) and 19 downstream of the proposal site between 2001-2009 (NSW DPI 2014).	High. Species has been previously recorded upstream and downstream of the site in the Clarence River. Potential foraging, shelter and breeding habitat occurs in the Clarence River.	4	M
<i>Mogurnda adpersa</i>	Purple Spotted Gudgeon	V		The Purple Spotted Gudgeon is a benthic species, usually found in rivers, creeks and billabongs with slow-moving or still waters; often amongst weeds, rocks or snags (NSW DPI 2013). Most remnant populations occur in small to medium sized streams, and they feed mainly on small fish, insect larvae, worms, tadpoles, and some plant matter (NSW DPI 2013).	Moderate. The species is usually found in smaller systems than the Clarence River, and may be present in the Tabulam Rivulet.	5	L

All information in this table is taken from NSW OEH and Commonwealth DoE Threatened Species profiles (OEH 2014, DoE 2014) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community, M- migratory, Ma – marine.

EPBC Act-listed migratory fauna known or predicted from the locality, habitat association and suitable habitat present at the subject site

Migratory Birds – Wetland of Marine species

Scientific Name	Common Name	TSC/F M Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Apus pacificus</i>	Fork-tailed Swift	-	M	Recorded in all regions of NSW. Non-breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	Low. May overfly the proposal site.	5	L
<i>Ardea alba</i>	Great Egret	-	M	Occurs across NSW. Within NSW there are breeding colonies within the Darling Riverine Plains and Riverina regions, and minor colonies across its range including the north and north-east of the state. Reported from a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	Moderate. Potential foraging habitat available at the proposal site.	5	L
<i>Ardea ibis</i>	Cattle Egret	-	M	Occurs across NSW. Principal breeding sites are the central east coast from Newcastle to Bundaberg. Also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Uses predominately shallow, open and freshwater wetlands with low emergent vegetation and abundant aquatic flora. Sometimes observed in swamps with tall emergent vegetation and commonly use areas of tall pasture in moist, low-lying areas.	Moderate. Potential foraging habitat available at the proposal site.	5	L
<i>Gallinago hardwickii</i>	Latham's Snipe		M	Occurs along the coast and west of the Great Dividing Range. Non-breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl.	Unlikely. Preferred habitat absent from proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.			

Terrestrial species

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	-	M	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	Unlikely. Species is primarily coastal.	5	L
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	Low. May overfly the proposal site.	5	L
<i>Merops ornatus</i>	Rainbow Bee-eater	-	M	Widespread across mainland Australia. Mainly inhabits open forests and woodlands and shrublands, often in proximity to permanent water. Also occurs in cleared/semi-cleared habitats including farmland and residential areas. Excavates a nest burrow in flat/sloping ground in banks of waterways, dams, roadside cuttings, gravel pits or cliff faces. Southern populations	Moderate. Broadly suitable habitat present in proposal site.	5	L

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Likelihood of Occurrence in the Proposal Site	Impact Consequence	Risk
				migrate north for winter after breeding.			
<i>Monarcha melanopsis</i>	Black-faced Monarch		M	Summer breeding migrant to south-east. Occurs along the coast of NSW. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (Birds Australia 2005).	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Monarcha trivirgatus</i>	Spectacled Monarch	-	M	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	M	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	Unlikely. Preferred habitat absent from proposal site.	5	L
<i>Rhipidura rufifrons</i>	Rufous Fantail	-	M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	Unlikely. Preferred habitat absent from proposal site.	5	L

All information in this table is taken from NSW OEH and Commonwealth Department of the Environment Threatened Species profiles (OEH 2013a, DoE 2013a) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community; VEC- vulnerable ecological community, M - migratory.

Likelihood of Occurrence

Matters considered in determining the likelihood of occurrence include:

- Known natural distributions including prior records (database searches) and site survey results.
- Geological/ soil preferences.
- Specific habitat requirements (e.g. aquatic environs, seasonal nectar resources, tree hollows etc).
- Climatic considerations (e.g. wet summers; snow fall).
- Home range size and habitat dependence.
- Topographical preferences (e.g. coastal headlands, ridgetops, midslopes, gilgai, wetlands).

The likelihood of occurrence scale is defined as follows:

Likelihood of Occurrence Scale

Scale	Description
Known	Species known to occur within the site (e.g. breeding and foraging habitat; foraging habitat; movement corridors). Detected on or immediately adjacent to the site.
High	Presence of high value suitable habitat (e.g. breeding and foraging habitat; important movement corridors). Not detected.
Moderate	Presence of medium value suitable habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors). Not detected.
Low/Unlikely	Presence of low value suitable habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors). Not detected.
None	No suitable habitat or corridors linking suitable habitat present. Not detected.

Impact Consequence

Matters considered in determining impact consequence include:

- The listed status of the threatened biota (i.e. critically endangered, endangered, vulnerable)
- The quantum of historical records within the locality.
- The quantum of historical records within the region.
- The impact on habitat area relative to local and regional abundance.
- The location of the impact site relative to the extant distribution of the threatened biota.

- The habitat area impact/ avoidance within the site relative to the species home range/ area occupied within the locality.

The impact consequence scale is defined as follows:

Impact Consequence Scale

Scale	Description
1	Cause the extinction of threatened biota over its extant range or at a local level (e.g. loss of an important population)
2	Substantially contribute to the extinction of threatened biota over its extant range or at a regional level by significantly impacting an important population
3	Contribute to the extinction of threatened biota at a local level
4	Contribute to the decline of threatened biota through impacts on populations not regarded as important
5	Minimal impact (e.g. partial loss of unoccupied suitable habitat; marginal increase in fragmentation)

Risk Analysis

The matrix created by the two variables provides a risk rating for the proposed project, as follows:

Threatened Biota Risk Analysis Matrix – Impact Consequence Scale

Likelihood of Occurrence Scale	5	4	3	2	1
Known	M	M	H	H	H
High	L	M	M	H	H
Moderate	L	L	M	M	H
Low	L	L	L	M	M
None	L	L	L	L	L

L = Low M = Medium H = High

Threatened biota identified as having a risk analysis score exceeding low (i.e. medium and high) are regarded as having the potential to be adversely impacted by the project. A medium to high risk is considered to have the potential for a direct adverse impact on threatened biota or effect its recovery potential. The impacts on these species therefore must be assessed through the preparation of a seven part test of significance.

Appendix B – NSW Wildlife Atlas threatened species search results

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodi comprehensive inventory, and may contain errors and omissions.

Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded Copyright the State of NSW through the Office of Environment and Heritage.

Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities South: -28.93] returned a total of 37 records of 14 species.

Report generated on 16/06/2014 11:15 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic
Animalia	Aves	Ciconiidae	0183	<i>Ephippiorhynchus asiaticus</i>	
Animalia	Aves	Cacatuidae	0265	<i>^Calyptorhynchus lathami</i>	
Animalia	Aves	Psittacidae	0260	<i>Glossopsitta pusilla</i>	
Animalia	Aves	Strigidae	0248	<i>Ninox strenua</i>	
Animalia	Aves	Tytonidae	0250	<i>Tyto novaehollandiae</i>	
Animalia	Aves	Climacteridae	8127	<i>Climacteris picumnus victoriae</i>	
Animalia	Mammalia	Dasyuridae	1017	<i>Phascogale tapoatafa</i>	
Animalia	Mammalia	Phascolarctidae	1162	<i>Phascolarctos cinereus</i>	
Animalia	Mammalia	Pteropodidae	1280	<i>Pteropus poliocephalus</i>	
Animalia	Mammalia	Molossidae	1330	<i>Mormopterus beccarii</i>	
Animalia	Mammalia	Vespertilionidae	1354	<i>Chalinolobus nigrogriseus</i>	
Animalia	Mammalia	Vespertilionidae	1372	<i>Falsistrellus tasmaniensis</i>	
Animalia	Mammalia	Vespertilionidae	1834	<i>Miniopterus schreibersii oceanensis</i>	
Animalia	Mammalia	Vespertilionidae	1357	<i>Myotis macropus</i>	

ans. The data are only indicative and cannot be considered a

d to 0.1°; ^^ rounded to 0.01°).

in selected area [North: -28.83 West: 152.51 East: 152.62

Common Name	NSW status	Comm. status	Records	Info
Black-necked Stork	E1,P		8	
Glossy Black-Cockatoo	V,P,2		1	
Little Lorikeet	V,P		3	  
Powerful Owl	V,P,3		2	
Masked Owl	V,P,3		1	
Brown Treecreeper (eastern subspecies)	V,P		3	
Brush-tailed Phascogale	V,P		1	 
Koala	V,P	V	7	
Grey-headed Flying-fox	V,P	V	1	
Beccari's Freetail-bat	V,P		1	 
Hoary Wattled Bat	V,P		5	
Eastern False Pipistrelle	V,P		2	
Eastern Bentwing-bat	V,P		1	
Southern Myotis	V,P		1	

Appendix C – Protected matters search tool results



EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 16/06/14 10:54:20

[Summary](#)

[Details](#)

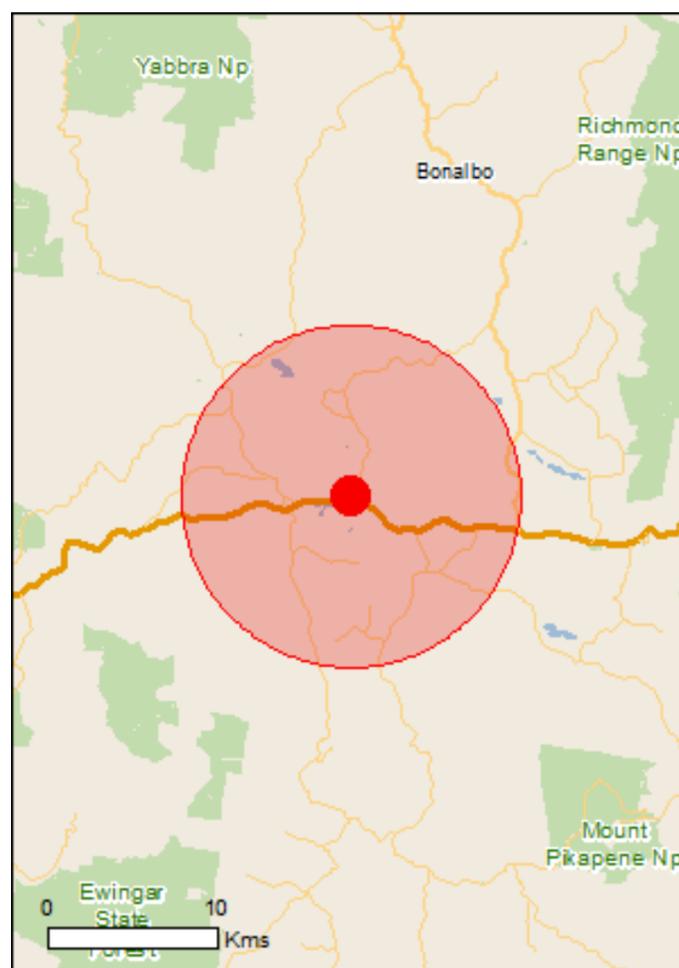
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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

[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	28
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As [heritage values](#) of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	2
State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	32
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[\[Resource Information \]](#)

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

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat likely to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pseudomys oralis Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood	Endangered	Species or species

Name	Status	Type of Presence
[21618]		habitat likely to occur within area
Triplarina imbricata [64543]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Delma torquata Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [[Resource Information](#)]

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

Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Indigenous		
Dingo Nob Bora Ground	NSW	Indicative Place
Historic		
Clarence River Road Bridge	NSW	Registered

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [\[Resource Information \]](#)

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Coordinates

-28.88581 152.56539

Caveat

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

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

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix D – Flora species list

Family	Exotic	Noxious	Scientific Name	Common Name
Alliaceae	*		<i>Agapanthus praecox subsp. Orientalis</i>	Agapanthus
Amaranthaceae	*		<i>Alternanthera pungens</i>	Khaki Weed
Amygdalaceae	*		<i>Prunus</i> spp.	Fruit tree
Anacardiaceae	*		<i>Schinus terebinthifolius</i>	Brazilian Pepper Tree
Apiaceae			<i>Centella asiatica</i>	Indian Pennywort
Apiaceae	*		<i>Daucus carota</i>	Wild Carrot
Apocynaceae	*		<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush
Asteraceae	*	N	<i>Ageratina adenophora</i>	Crofton Weed
Asteraceae	*		<i>Ageratum houstonianum</i>	Blue Billygoat Weed
Asteraceae	*	N	<i>Ambrosia artemisiifolia</i>	Annual Ragweed
Asteraceae	*		<i>Bidens pilosa</i>	Cobbler's Pegs
Asteraceae	*		<i>Cirsium vulgare</i>	Spear Thistle
Asteraceae	*		<i>Conyza bonariensis</i>	Flaxleaf Fleabane
Asteraceae	*		<i>Conyza sumatrensis</i>	Tall Fleabane
Asteraceae	*		<i>Hypochaeris radicata</i>	Catsear
Asteraceae	*		<i>Lactuca serriola</i>	Prickly Lettuce
Asteraceae	*		<i>Onopordum acanthium subsp. acanthium</i>	Scotch Thistle
Asteraceae			<i>Pseudognaphalium luteoalbum</i>	Jersey Cudweed
Asteraceae	*		<i>Senecio madagascariensis</i>	Fireweed
Asteraceae	*		<i>Sonchus oleraceus</i>	Common Sowthistle
Asteraceae	*		<i>Tagetes minuta</i>	Stinking Roger
Asteraceae	*	N	<i>Xanthium occidentale</i>	Noogoora Burr
Bignoniaceae	*		<i>Jacaranda mimosifolia</i>	Jacaranda
Brassicaceae	*		<i>Lepidium africanum</i>	Common Peppergrass
Chenopodiaceae	*		<i>Chenopodium album</i>	Fat Hen
Commelinaceae			<i>Commelina cyanea</i>	Native Wandering Jew
Commelinaceae	*		<i>Tradescantia fluminensis</i>	Wandering Jew

Family	Exotic	Noxious	Scientific Name	Common Name
Convolvulaceae	*		<i>Ipomoea indica</i>	Morning Glory
Cupressaceae	*		<i>Athrotaxis cupressoides</i>	Pencil Pine
Cupressaceae	*		<i>Cupressus</i> spp.	
Cyperaceae	*		<i>Cyperus brevifolius</i>	
Cyperaceae	*		<i>Cyperus eragrostis</i>	Umbrella Sedge
Cyperaceae			<i>Cyperus</i> spp.	
Dennstaedtiaceae			<i>Pteridium esculentum</i>	Bracken
Euphorbiaceae			<i>Chamaesyce drummondii</i>	Caustic Weed
Euphorbiaceae	*		<i>Ricinus communis</i>	Castor Oil Plant
Fabaceae (Caesalpinioideae)	*		<i>Gleditsia triacanthos</i>	Honey Locust
Fabaceae (Faboideae)			<i>Glycine clandestina</i>	Twining glycine
Fabaceae (Faboideae)			<i>Glycine tabacina</i>	Variable Glycine
Fabaceae (Faboideae)	*		<i>Trifolium repens</i>	White Clover
Fabaceae (Faboideae)	*		<i>Vicia sativa</i>	Common vetch
Fabaceae (Mimosoideae)			<i>Acacia implexa</i>	Hickory Wattle
Fabaceae (Mimosoideae)			<i>Acacia irrorata</i>	Green Wattle
Geraniaceae			<i>Geranium solanderi</i>	Native Geranium
Geraniaceae	*		<i>Geranium</i> spp.	
Hydrocharitaceae	*		<i>Egeria densa</i>	Dense Waterweed
Hydrocharitaceae			<i>Vallisneria australis</i>	Eelweed
Juncaceae			<i>Juncus usitatus</i>	
Lythraceae	*		<i>Lagerstroemia</i> sp.	Crepe Myrtle
Malaceae	*		<i>Cotoneaster</i> sp.	
Malvaceae	*		<i>Modiola caroliniana</i>	Red-flowered Mallow
Malvaceae	*		<i>Pavonia hastata</i>	
Malvaceae	*		<i>Sida rhombifolia</i>	Paddy's Lucerne
Moraceae	*		<i>Morus alba</i>	White Mulberry
Myrtaceae			<i>Callistemon viminalis</i>	Weeping Bottlebrush
Myrtaceae	*		<i>Corymbia torelliana</i>	Cadaghi

Family	Exotic	Noxious	Scientific Name	Common Name
Myrtaceae			<i>Eucalyptus tereticornis</i>	Forest Red Gum
Nymphaeaceae	*		<i>Ottelia ovalifolia</i>	Swamp Lily
Oleaceae	*		<i>Fraxinus angustifolia</i> <i>subsp. angustifolia</i>	Desert Ash
Oleaceae	*	N	<i>Ligustrum sinense</i>	Small-leaved Privet
Oxalidaceae	*		<i>Oxalis corniculata</i>	Creeping Oxalis
Passifloraceae	*		<i>Passiflora</i> spp.	Passionfruit
Poaceae			<i>Bothriochloa macra</i>	Red Grass
Poaceae	*		<i>Bromus catharticus</i>	Praire Grass
Poaceae	*		<i>Chloris gayana</i>	Rhodes Grass
Poaceae			<i>Cynodon dactylon</i>	Common Couch
Poaceae			<i>Imperata cylindrica</i>	Blady Grass
Poaceae	*		<i>Melinis repens</i>	Red Natal Grass
Poaceae			<i>Microlaena stipoides</i>	Weeping Grass
Poaceae	*		<i>Panicum maximum</i> <i>var. maximum</i>	Panicum
Poaceae	*		<i>Paspalum dilatatum</i>	Paspalum
Poaceae			<i>Paspalum distichum</i>	Water Couch
Poaceae	*		<i>Paspalum urvillei</i>	Vasey Grass
Poaceae	*		<i>Pennisetum clandestinum</i>	Kikuyu Grass
Poaceae	*		<i>Setaria pumila</i>	Pale Pigeon Grass
Poaceae	*		<i>Setaria sphacelata</i>	South African Pigeon Grass
Poaceae	*	N	<i>Sorghum halepense</i>	Johnson Grass
Poaceae	*		<i>Sporobolus</i> spp.	Rat's Tail Couch
Poaceae	*		<i>Stenotaphrum secundatum</i>	Buffalo Grass
Polygonaceae	*		<i>Acetosa sagittata</i>	Rambling Dock
Polygonaceae			<i>Persicaria attenuata</i>	
Polygonaceae			<i>Persicaria prostrata</i>	Creeping Knotweed
Polygonaceae			<i>Rumex brownii</i>	Swamp Dock
Polygonaceae	*		<i>Rumex crispus</i>	Curled Dock
Proteaceae			<i>Grevillea robusta</i>	Silky Oak
Rosaceae	*	N	<i>Rubus fruticosus</i> aggregate	Blackberry

Family	Exotic	Noxious	Scientific Name	Common Name
Salicaceae	*		<i>Populus alba</i>	White Poplar
Sapindaceae	*		<i>Cardiospermum grandiflorum</i>	Balloon Vine
Scrophulariaceae	*		<i>Verbascum thapsus subsp. thapsus</i>	Great Mullein
Solanaceae	*		<i>Cestrum parqui</i>	Green Cestrum
Solanaceae	*	N	<i>Solanum mauritianum</i>	Wild Tobacco Bush
Solanaceae	*		<i>Solanum nigrum</i>	Black-berry Nightshade
Urticaceae	*		<i>Urtica dioica</i>	Giant Nettle
Verbenaceae	*	N	<i>Lantana camara</i>	Lantana
Verbenaceae	*		<i>Verbena bonariensis</i>	Purpletop
Verbenaceae	*		<i>Verbena quadrangularis</i>	
Verbenaceae	*		<i>Verbena rigida var. rigida</i>	Veined Verbena

Appendix E – Assessment of significance for species listed under the TSC Act

Assessments of significance for state-listed threatened biota

Seven-Part Tests have been undertaken with reference to DECC's *Threatened species assessment guidelines: The assessment of significance* (DECC 2007) to determine the significance of impacts of the proposal on threatened species listed on Schedules 1, 1A and 2 of the NSW *Threatened Species Conservation Act 1995* (TSC Act). The Assessment of Significance has been conducted for those threatened fauna species that were recorded or are considered to have a moderate to high likelihood of occurrence at the proposal site. These are:

- Black-necked Stork (*Ephippiorhynchus asiaticus*)
- Little Bentwing-bat (*Miniopterus australis*)
- East Coast Freetail-bat (*Mormopterus norfolkensis*)
- Large-footed Myotis (*Myotis macropus*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Beccari's Freetail-bat (*Mormopterus beccarii*)

THREATENED FAUNA

Black-necked Stork (Ephippiorhynchus asiaticus)

In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, Black-necked Stork primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. The species feeds in shallow, still water and build large nests high in tall trees close to water (OEH, 2014b).

Although Black-necked Stork was not recorded at the site, there are numerous records of Black-necked Stork associated with the Clarence River floodplains east and west of the proposal site. Although there are no wetlands or floodplains and no potential roosting trees at the proposal site, the Clarence River provides potential foraging habitat for the species and there is a moderate likelihood that it could occur at least on occasion. The proposal site is unlikely to be important habitat for the species in the locality, but the species would nevertheless occur at the proposal site on occasion as part of a wider area of occupancy.

Although there would be no direct loss of potential foraging or roosting habitat, as a precautionary measure an assessment of significance has been undertaken to assess potential indirect impacts on the species' habitat.

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.

There is potential for Black-necked Stork to forage at the proposal site along the Clarence River. The species feeds in shallow, still water and there are several recent records of the species in Tabulam (from nearby wetlands). There are no potential roosts or nesting sites (tall trees near the river) at the proposal site. There would be no direct loss of potential foraging aquatic habitat as a result of the proposal. The proposal has the potential to indirectly impact aquatic habitat through erosion and sedimentation, and result in indirect noise and vibration impacts during construction. However, factors impacting the lifecycle of the species, such as access to foraging, roosting and breeding habitat, would not be impacted by the proposal. The proposal is therefore unlikely to affect the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable to this threatened species.

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.

Not applicable to this threatened species.

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

The proposal would clear up to 11.12 hectares of exotic vegetation, however this exotic vegetation is unlikely to be utilised by the Black-necked Stork. If present at the proposal site, the species is likely to occur associated with aquatic habitat at the Clarence River and downstream within wetland and floodplain areas. There would be no direct loss of potential foraging aquatic habitat or roost sites as a result of the proposal.

The proposal has the potential to indirectly impact aquatic foraging habitat (through erosion and sedimentation) downstream of the proposal site, however these impacts would be short term and small scale.

(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

The Clarence River currently has instream pylons for the existing bridge. These would be removed and replaced with new instream pylons for the new bridge. These instream pylons would not fragment or isolate potential aquatic foraging habitat. The proposal site has been previously cleared and is located within an already fragmented landscape with existing roads and residential areas. The proposal would result in an incremental increase in fragmentation of potential foraging habitat for the species in the local area, but not to the extent that habitat connectivity be impacted for these highly mobile species. Habitat connectivity would be maintained around the proposal via the Clarence River aquatic corridor.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal would clear up to 11.12 hectares of exotic vegetation, however no important habitat features (such as potential roost or nesting sites) would be impacted. There would be no direct loss of potential foraging aquatic habitat as a result of the proposal.

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 these species by the NSW Office of Environment and Heritage.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plans have been prepared for this species.

The proposal would not result in the loss of potential foraging, roosting or nesting habitat, and is unlikely to impact the recovery of the species.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is defined under Part 1 of the TSC Act, as "a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities" (OEH, 2014c). Key threatening processes are listed under Schedule 3 of the Act.

The proposed action could potentially contribute to the operation of one KTP, Invasion, establishment and spread of *Lantana camara*, which is of relevance to this species.

The proposed works could result in the operation of *invasion, establishment and spread of Lantana camara*, which is present at the site. The implementation of suitable weed controls, as set out in the Construction Environmental Management Plan (CEMP), would prevent the proposed works exacerbating this threatening process. This includes hygiene procedures for equipment, footwear and clothing, and weed disposal protocols.

Conclusion

Consideration of the seven factors under s.5A of the EP&A Act indicates that the proposal is unlikely to impose a significant impact on the Black-necked Stork given:

- The proposal would not result in the loss of potential foraging, roosting or nesting habitat. The proposal has the potential to indirectly impact aquatic habitat through erosion and sedimentation downstream of the site, and result in indirect noise and vibration impacts during construction, however these impacts would be short term, minor scale and unlikely to result in a significant impact on the species.
- The proposal is highly unlikely to fragment an existing population as habitat connectivity would be maintained via the Clarence River aquatic habitat corridor.
- The proposal would not form a barrier to movement of these highly mobile species.

MICROCHIROPTERAN BATS

Two species of microbats have been recorded with a definite confidence rating by GHD (2014) and/or GeoLINK (2014) during previous assessments at the proposal site:

- Little Bentwing-bat (*Miniopterus australis*)
- East Coast Freetail-bat (*Mormopterus norfolkensis*)

Additionally, four microbats have been recorded with a probable confidence rating by GHD (2014) and/or GeoLINK (2014) during previous assessments at the proposal site:

- Large-footed Myotis (*Myotis macropus*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

There is potential foraging habitat associated with the Clarence River for these six microbats, two of which are known to occur and four of which are highly likely to occur. Additionally, Beccari's Freetail Bat (*Mormopterus beccarii*) has been previously recorded at Tabulam and is highly likely to occur at the proposal site.

Of these threatened microbats, East Coast Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle and Beccari's Freetail Bat primarily roost in tree hollows and buildings rather than culverts/ tunnels or bridges. Little Bentwing-bat and Eastern Bentwing-bat may roost in the Tabulam bridge and overflow structures outside of breeding season, but these sites would not be maternity roosts as the species have very specific maternity sites which have been mapped. Large-footed Myotis roost near water in caves, tree hollows, among vegetation, underbridges, disused Fairy Martin nests and in mines, tunnels, culverts and drains (Churchill 2008). Large-footed Myotis could potentially utilise Tabulam bridge and overflow structures as maternal roost sites.

Introduction

The Little Bentwing-bat (*Miniopterus australis*) inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost sites (Churchill, 2008).

The East Coast Freetail-bat (*Mormopterus norfolkensis*) is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range, and roost mainly in tree hollows but will also roost under bark or in man-made structures.

The Large-footed Myotis (*Myotis macropus*) is mainly coastal but may occur inland along large river systems. This species is usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. It forages over streams and watercourses feeding on fish and insects from the water surface and 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 (Churchill, 2008).

The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures outside the breeding season. Breeding takes place from October to April in a number of maternity caves that host up to 100,000 females (Churchill, 2008).

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) occurs on the east coast and Great Dividing Range and inhabits a variety of habitats from woodland to wet and dry sclerophyll

forests and rainforest, remnant paddock trees and timber-lined creeks, typically below 500 metres above sea level. This species forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Churchill 2008).

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees taller than 20 m and generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings (Churchill 2008).

The Beccari's Freetail Bat (*Mormopterus beccarii*) is widely distributed across northern Australia from Western Australia to Queensland, extending south to the north-east corner of NSW. The only confirmed record in NSW is of a colony found in the roof of a house in Murwillumbah, however, calls have been detected from a few other locations in the far north east of the State. The species has been recorded in a range of vegetation types in northern Australia, from rainforests to open forests and woodlands, and are often recorded along watercourses, and roost mainly in tree hollows but relatively large colonies have been found under house roofs in urban areas in Queensland (Churchill 2008).

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.

Factors that affect the lifecycle of these threatened microbats include foraging, roosting and breeding habitat, and barriers to movement.

The proposal would clear up to 11.12 hectares of exotic vegetation, unlikely to represent foraging habitat for these species. The aquatic corridor associated with the Clarence River is likely to be an important foraging resource for these threatened microbats, particularly Large-footed Myotis, however the proposal would not result in the loss of this important foraging resource.

The proposal would remove the existing bridge and result in the loss of microbat roosting habitat, however the overflow structures, where the vast majority of microbats were recorded, are being retained. Only one microbat was recorded roosting under the existing bridge, whereas over 150 were recorded roosting in the overflow structures. Additionally, the new bridge would provide potential microbat roosting habitat once constructed. East Coast Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle and Beccari's Freetail Bat primarily roost in tree hollows and buildings rather than culverts/tunnels or bridges. Little Bentwing-bat and Eastern Bentwing-bat may roost in the Tabulam Bridge and overflow structures outside of breeding season, but these sites would not be maternity roosts for these species as they have very specific maternity sites which have been mapped. Large-footed Myotis could potentially utilise Tabulam Bridge and overflow structures as maternal roost sites. Alternative roosting habitat (including hollow-bearing trees) occurs along the Clarence River north of the site. There are other bridges (Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) in the wider area that all contain large maternity colonies of the threatened Large-footed Myotis (GeoLINK 2014).

There is potential for indirect construction noise and vibration to impact microbats roosting in the overflow structures over the proposed 18 month construction period. Microbats at the site are currently exposed to low but constant noise and vibration from traffic and would be somewhat adapted to this impact. Daytime construction noise and vibration would be unlikely to impact night time foraging behaviour. Construction noise and vibration may temporarily impact roosting at the overflow structures, however alternative roosting habitat (including hollow-bearing trees) occur along the Clarence River north of the site. At the completion of construction site conditions would return to the existing environment and the overflow structures would return to being microbat roosting habitat. .

No barriers to movement of microbats are anticipated. The proposal would remove the existing bridge and construct new instream pylons for the new bridge, but would allow for movement under and around the structure. The proposed works do not involve any structures that would pose a significant obstruction or hazard to the flight of birds or bats in the context of existing land uses in the locality.

The proposal is therefore unlikely to have an adverse effect on the life cycle of these threatened microbats.

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.

There are no listed endangered populations of these microchiropteran bats.

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.

These microchiropteran bats are threatened species, therefore this criteria is not applicable.

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

The proposal would clear up to 11.12 hectares of exotic vegetation, unlikely to represent foraging habitat for these species. The important aquatic foraging corridor of the Clarence River would not be impacted by the proposal.

(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

The Clarence River currently has instream pylons for the existing bridge. These would be removed and replaced with new instream pylons for the new bridge. These instream pylons would not fragment or isolate movement corridors or foraging habitat for microbats. Habitat connectivity would be maintained around the proposal via the Clarence River aquatic corridor.

(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal would remove the existing bridge and result in the loss of potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. The overflow structures, where the vast majority of microbats were recorded, are important microbat roosting habitat and are being retained. These overflow structures offer potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. Additionally, the new bridge would provide potential microbat roosting habitat and alternative roosting habitat for all these threatened species (including hollow-bearing trees) occur along the Clarence River north of the site. There are other bridges (Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) in the wider area that all contain large maternities colonies of the threatened Large-footed Myotis (GeoLINK 2014).

No important foraging resources (such as native riparian vegetation or aquatic habitat in the Clarence River) would be cleared or altered for the proposal.

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 these species listed by the NSW Office of Environment and Heritage.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No recovery plans exist for these species.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A threatening process is defined under Part 1 of the TSC Act, as “a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities” (OEH, 2014c). Key threatening processes are listed under Schedule 3 of the Act.

The proposed action could potentially contribute to the operation of one KTP, Invasion, establishment and spread of *Lantana camara*, which is of relevance to this species.

The proposal could result in the operation of *invasion, establishment and spread of Lantana camara*, which is present at the site. The implementation of suitable weed controls, as set out in the Construction Environmental Management Plan (CEMP), would prevent the proposed works exacerbating this threatening process. This includes hygiene procedures for equipment, footwear and clothing, and weed disposal protocols.

No hollow-bearing trees are being cleared by the proposal.

Conclusion

- No important foraging resources (such as native vegetation or the Clarence River) would be cleared for the proposal.

- The proposal would remove the existing bridge and result in the loss of potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. The overflow structures, where the vast majority of microbats were recorded, are important microbat roosting habitat and are being retained. These overflow structures offer potential non-maternal Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and maternity roosting habitat. Additionally, the new bridge would provide potential microbat roosting habitat and alternative roosting habitat for all these threatened species (including hollow-bearing trees) occur along the Clarence River north of the site. There are other bridges (Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) in the wider area that all contain large maternities colonies of the threatened Large-footed Myotis (GeoLINK 2014).
- The proposal would result in indirect construction noise and vibration impacts. These indirect impacts are not likely to alter foraging behaviour but may impact roosting at the overflow structures. Alternative roosting habitat is available along the Clarence River and in the wider area. At the completion of construction site conditions would return to the existing environment following completion of construction.
- A microbat management plan was developed by GeoLINK (refer to Appendix I) and includes pre construction surveys, exclusion measures and monitoring throughout construction.
- The proposal would not fragment or isolate movement corridors or foraging habitat.
- The proposal would not form a barrier to movement of these highly mobile species.

Appendix F – Assessment of significance for species listed on the EPBC Act

Assessments of significance for Commonwealth-listed migratory biota

An assessment of migratory species identified in the Protected Matters Search Tool with potential to occur at the proposal site indicates three species have a moderate likelihood of occurrence:

- Great Egret (*Ardea alba*)
- Cattle Egret (*Ardea ibis*)
- Rainbow Bee-eater (*Merops ornatus*)

Migratory Species

The Significant Impact Guidelines 1.1 (DotE 2013) lists criteria which are used to determine whether an action is likely to have a significant impact on migratory species. An action is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

Substantially modify and/or destroy an area of important habitat for a migratory species

An area of 'important habitat' for a migratory species is defined in the Significant Impact Guidelines (DotE 2013) as:

Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species:

Habitat within the proposal area does not support an ecologically significant proportion of the population for cattle egret, great egret or rainbow bee-eater. An ecologically significant proportion of a migratory species has been determined to comprise 0.1% flyway population (i.e. the population that migrates to/from Australia) of the species (EPBC Act Policy Statement 1) (DEWHA 2009b). These migratory species would be seasonal visitors to the area, only occurring on a transient basis to forage associated with the Clarence River. The value of the potential foraging habitat at the proposal site would be decreased due to the high level of exotic grasses and weeds, lack of wetlands, floodplains or backwaters, proximity to the existing road and past history of clearing and disturbance.

The proposal would reduce this area of potential seasonal foraging habitat by only a very small amount (up to 11.12 hectares). The habitat proposed to be cleared has been previously cleared and is highly modified and invaded by exotic grasses and weeds. There are large areas of alternative native vegetation present within adjoining areas to the proposal site and in the broader locality likely to comprise habitat for these species.

The proposal would therefore contribute to the incremental loss of potential seasonal foraging habitat affecting these species at a very small scale.

Habitat that is of critical importance to the species at particular life-cycle stages:

Habitat within the proposal site is not considered critical during the lifecycle of cattle egret, great egret or rainbow bee-eater. These migratory species, if present in at the proposal site, would likely be seasonal visitors to the area, only occurring on a transient basis to forage associated with the Clarence River.

The proposal however would reduce this area of potential seasonal foraging habitat by only a very small amount (up to 11.12 hectares). The habitat proposed to be cleared has been previously cleared and is highly modified. There are large areas of alternative native vegetation present within adjoining areas to the proposal site including grasslands and native riparian vegetation, and in the broader locality likely to comprise habitat for these species. The proposal would therefore contribute to the incremental loss of potential seasonal foraging habitat affecting these species at a very small scale.

Habitat utilised by a migratory species which is at the limit of the species range:

Habitat within the proposal site is not at the limit of species range for any of the migratory species considered in this report. Distribution of habitat for these species extends well beyond (north and south) the location of the proposal site throughout all of coastal NSW.

Habitat within an area where the species is declining:

Populations of cattle egret and great egret are considered relatively stable throughout Australia. Populations of rainbow bee-eater are in decline (DotE 2014).

However there is no evidence to suggest that the proposal site contains known habitat for these species (such as recent records of the species). The proposal site contains potential foraging habitat for these species, as broadly suitable habitat occurs within the exotic grasslands and the Clarence River, however the value of the potential foraging habitat at the proposal site would be decreased due to the high level of exotic grasses and weeds, lack of wetlands, floodplains or backwaters, proximity to the existing road and past history of clearing and disturbance.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

The proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species. An ecologically significant proportion of a migratory species has been determined to comprise 0.1% flyway population (i.e. the population that migrates to/from Australia) of the species (EPBC Act Policy Statement 1) (DEWHA 2009b). Habitat within the proposal site is not considered critical during the lifecycle of cattle egret, great egret or rainbow bee-eater. These migratory species, if present in the proposal site, would be seasonal visitors to the area, likely only occurring on a transient basis to forage only.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

The proposal is unlikely to introduce invasive species that may prevent migratory species becoming established in the proposal site. There are small thickets of noxious weeds including *Lantana camara* (Lantana) within the edge of habitat for these species. The proposal site is currently dominated by exotic grasses and weeds. The CEMP and would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat.

Conclusion

Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposal is unlikely to impose a significant impact on migratory species as it is unlikely to:

- Substantially modify and/or destroy an area of important habitat for a migratory species. Habitat that occurs within the proposal site, whilst suitable as foraging for the above migratory species, does not constitute important habitat as defined under the EPBC Act Significant Impact Guidelines (Department of the Environment 2013).

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. The proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species. An ecologically significant proportion of a migratory species has been determined to comprise 0.1% flyway population (i.e. the population that migrates to/from Australia) of the species (EPBC Act Policy Statement 1) (DEWHA 2009b).

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

Appendix G – Fauna species list

Birds

Common Name	Scientific Name	Location/Time	Observation Method
Australasian Darter	<i>Anhinga novaehollandiae</i>	In water, evening	Visual
Australian Magpie	<i>Cracticus tibicen</i>	In <i>Eucalypts</i> downstream	Auditory
Australian Raven	<i>Corvus coronoides</i>	Flying, all day	Visual, auditory
Australian Wood Duck	<i>Chenonetta jubata</i>	On water, evening	Visual
Black-faced Cuckoo Shrike	<i>Coracina novaehollandiae</i>	In Jacaranda tree	Visual
Black-throated Finch	<i>Poephila cincta</i>	In shrubs/tall grasses, all day	Visual
Common Myna*	<i>Acridotheres tristis</i>	In <i>Eucalypts</i> upstream, all day	Visual, auditory
Crested Pigeon	<i>Ocyphaps lophotes</i>	In shrubs, all day	Visual
Dollarbird	<i>Eurystomus orientalis</i>	In <i>Casuarina</i> downstream, midday	Visual
Eastern Whipbird	<i>Psophodes olivaceus</i>	In <i>Melaleuca</i> shrubs, morning	Auditory
Eastern Yellow Robin	<i>Eopsaltria australis</i>	On road eating spider, midday	Visual
Galah	<i>Cacatua roseicapilla</i>	Flying, all day	Visual, auditory
House Sparrow*	<i>Passer domesticus</i>	Flying by	Visual
King Parrot	<i>Alisterus scapularis</i>	Flying to <i>Eucalypts</i> upstream	Visual
Laughing Kookaburra	<i>Dacelo leachii</i>	Power lines, all day	Visual, auditory
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	Flying over water, evening	Visual
Little Friarbird	<i>Philemon citreogularis</i>	In <i>Melaleuca</i> shrubs, morning	Visual, auditory
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	Flying upstream, morning	Visual
Moorhen	<i>Gallinula sp.</i>	Heard downstream	Auditory
Pelican	<i>Pelecanus conspicillatus</i>	Flying north, upstream, evening	Visual
Pied Cormorant	<i>Phalacrocorax varius</i>	Over water, all day	Visual
Pied Currawong	<i>Strepera graculina</i>	<i>Eucalypts</i> upstream, evening	Visual, auditory

Common Name	Scientific Name	Location/Time	Observation Method
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	Flying, Eucalypts upstream	Visual, auditory
Red-backed Fairy Wren	<i>Malurus melanocephalus</i>	In tall grasses, evening	Visual
Red-browed Finch	<i>Neochmia temporalis</i>	In shrubs/ tall grasses, all day	Visual
Spotted Dove	<i>Streptopelia chinensis</i>	In shrubs, all day	Auditory
Striated Pardalote	<i>Pardalotus striatus</i>	In tall grasses	Visual
Superb Fairy Wren	<i>Malurus cyaneus</i>	In shrubs/ tall grasses, all day	Visual
Tawny Grassbird	<i>Megalurus timoriensis</i>	In tall grass, midday	Visual, auditory
Welcome Swallow	<i>Hirundo neoxena</i>	Over water, bridge rails, all day	Visual
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	Flying south, morning	Visual
White-faced Heron	<i>Egretta novaehollandiae</i>	Flying near water	Visual
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	In shrub, evening	Visual

Mammals

Common Name	Scientific Name	Location/Time	Observation Method
East-coast Free-tailed Bat (vulnerable TSC Act)	<i>Mormopterus norfolkensis</i>	Flying beneath bridge	Anabat
Greater Broad-nosed Bat (vulnerable TSC Act)/ Eastern Broad-nosed Bat/ Eastern False Pipistrelle (vulnerable TSC Act)	<i>Scoteanax rueppellii</i> / <i>Scotorepens orion</i> / <i>Falsistrellus tasmaniensis</i>	Flying beneath bridge	Anabat
Large-footed Myotis	<i>Myotis macropus</i>	Flying beneath bridge	Anabat
-	<i>Nyctophilus</i> sp.	Flying beneath bridge	Anabat
-	<i>Mormopterus species</i>	Flying beneath bridge	Anabat
Eastern Forest Bat	<i>Vespadelus pumilus</i>	Flying beneath bridge	Anabat
Little Bentwing-bat (vulnerable TSC Act)	<i>Miniopterus australis</i>	Flying beneath bridge	Anabat
Eastern Cave Bat (vulnerable TSC Act)/ Little Forest Bat/ Eastern Forest Bat	<i>Vespadelus troughtoni</i> / <i>vulturinus</i> / <i>pumilus</i>	Flying beneath bridge	Anabat
Southern Forest Bat	<i>Vespadelus regulus</i>	Flying beneath bridge	Anabat
Eastern Bentwing-bat (vulnerable TSC Act)	<i>Miniopterus schreibersii oceanensis</i>	Flying beneath bridge	Anabat

Common Name	Scientific Name	Location/Time	Observation Method
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	Flying beneath bridge	Anabat
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	Flying beneath bridge	Anabat
Grey-headed Flying Fox	<i>Pteropus poliocephalus</i>	Flying downstream at dusk	Visual
Large Forest Bat	<i>Vespadelus darlingtoni</i>	Flying beneath bridge	Anabat
Smaller Horseshoe Bat	<i>Rhinolophus megaphyllus</i>	Flying beneath bridge	Anabat
White-striped Free-tailed Bat	<i>Tadarida australis</i>	Flying beneath bridge	Anabat

Reptiles

Common Name	Scientific Name	Location/Time	Observation Method
Black Snake	(Un-identified)	In grazed grass near water	Anecdotal (driller)
Garden skink	<i>Lampropholis guichenoti</i>	On tank stand	Visual
Longneck Turtle	<i>Chelodina longicollis</i>	In water, evening	Visual
Waterdragon	<i>Physignathus lesueurii</i>	Heard leaving the bank into the water	Anecdotal auditory (geotech)

Amphibians

Common Name	Scientific Name	Location/Time	Observation Method
Eastern Dwarf Tree Frog	<i>Litoria fallax</i>	Up and down eastern bank	Auditory

Other species

Common Name	Scientific Name	Location/Time	Observation Method
Wanderer Butterfly	<i>Danaus plexippus</i>	In tall grasses, all day	Visual
Small Silver Fish	Unknown species	Jumping at dusk	Visual

Appendix H – GeoLINK report

30 April 2014
Ref No.: 2363-1003
GHD
Level 3, GHD Tower
24 Honeysuckle Drive
NEWCASTLE NSW 2300
Attention: Mr Lewis Schneider

Dear Lewis

Tabulam Bridge Microbat Survey Results

Introduction

GeoLINK was engaged to undertake microbat surveys of Tabulam Bridge over the Clarence River at Tabulam. NSW Roads and Maritime Services propose to construct a new bridge over the Clarence River at Tabulam and remove the existing timber bridge. GHD are currently working on the route development assessment for the new bridge which required additional microbat surveys of the existing bridge to identify if it is occupied as a microbat roost.

Tabulam Bridge is located on the western side of Tabulam. It was built in 1903 and is approximately 297.5 m in length. It consists of 15 approach spans (11 to the east and four to the west, and three main spans over the river. During normal flow events, the bridge is approximately 15 m above the Clarence River water level. The bridge is a 4.6 m wide single lane structure. The locality comprises mostly cleared floodplain and foothills with native vegetation on steeper slopes.

Preliminary microbat surveys involving anabat recording, spotlighting and dusk surveys on and below the bridge decking on the approach spans did not detect any microbat roost sites (GHD 2014).

A review of the roosting habitat requirements of threatened microbat species known to occur within a 10 km radius of the site (refer to **Attachment 1**), identified the following species as potentially roosting in timber bridges:

- Large-footed Myotis (*Myotis macropus*): Known to utilise timber bridges as breeding roosting habitat; and
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*): Known to utilise timber bridges as non-breeding roosting habitat (Dr Greg Richards, pers. comm.).

These species are listed as 'Vulnerable' under the *Threatened Species Conservation Act 1995*. Large-footed Myotis comprises the main threatened species which poses a constraint for the project as it readily occupies bridges and culvert structures as maternity habitat.



Methodology

Microbat surveys at Tabulam Bridge were undertaken on 8 - 10 April 2014, coinciding with the end of the Large-footed Myotis breeding season in the region (October to mid-April). Initial habitat assessment was undertaken to identify the presence/absences of potential microbat roosting habitat features, as well as identifying suitable survey methods. A combination of below deck and above deck surveys were undertaken using a mix of direct observation/ inspection cameras, spotlighting, thermal imagery cameras and anabat surveys as summarised in Table 1.

Table 1 Microbat Survey Methods and Effort

Method	Description	Survey Effort
Above Deck Surveys - Direct inspection	Involved inspecting the gaps between the transverse decking from above the bridge using a torch and inspection camera surveying the entire bridge. Undertaken once on 8 th April and once on 9 th April 2014 during the day.	10 person hours
Above Deck Surveys - Anabat and listening for bat 'chatter'	A transect of the entire bridge using an anabat and listening for bat 'chatter' from above the bridge was undertaken on 8 th April 2014 during the day.	1 person hour
Below Deck Surveys - Inspection via spotlighting and thermal imagery camera	Involved inspecting the entire bridge from below the bridge decking via spotlighting and thermal imagery camera. Undertaken on 8 th , 9 th and 10 th April 2014 during daylight hours. Vessels (canoe and kayaks) were used for inspecting the spans over water.	18 person hours
Below Deck Surveys - Dusk and dawn survey	Involved surveying the bridge spans over water for roosting microbats via spotlighting, anabat and thermal imagery camera. Each span was surveyed twice at dusk and dawn. Dusk surveys were undertaken on 8 th and 9 th April 2014 from 5.30 pm to 7 pm. Dawn surveys were undertaken on 9 th and 10 th April 2014 from 4 am to 5.45 am. Vessels (canoe and kayaks) were used for inspecting the spans over water.	13 person hours

The Clarence River Overflow Bridge was also inspected (as a matter of interest as this was not part of the brief) for microbats. The cracks between each of the concrete planks beneath the bridge were inspected using head torches.

Thermal imagery cameras were not used during above deck surveys as they were unlikely to be effective. Weather conditions during the survey were mostly fine, with maximum day time temperatures of approximately 27°C. Isolated showers on 8th April 2014 occurred locally but did not occur at the site during the survey. Ambient dusk and dawn survey temperatures were low enough for use of the thermal imagery cameras (<25 and <20°C respectively) allowing detection of individual flying bats and bats roosting in the Clarence River Overflow 1 Bridge (refer to results).

Results

Potential Microbat Roosting Habitat

Potential microbat roosting habitat occurs throughout Tabulam Bridge (refer to Plates 1-4) and includes:

- Decking gaps (i.e. below longitudinal decking, between transverse decking and predominantly above the stringers). These features occur across the bridge.
- Split (two piece) timber headstocks. These features are uncommon and restricted to the piers on the approach span.
- Timber joins: Present mainly at the piers.



Plate 1 View below longitudinal decking and between transverse decking



Plate 2 View below longitudinal and transverse decking



Plate 3 Underside of stringers



Plate 4 Join at headstock

Rotted timber features suitable for microbat roosts were uncommon and generally in exposed locations or not well formed. Bird nests (*Welcome Swallow* *Hirundo neoxena* and *Fairy Martin* *H. ariei*) and mud dauber wasp nest would also be expected to occur at least periodically and provide mostly non-breeding roosting opportunities.

Potential Microbat Foraging Habitat

The study area comprises a mostly cleared floodplain landscape. It offers potential aerial foraging habitat for microbat species capable of foraging in modified or non-forested landscapes. Aquatic foraging habitat for the Large-footed Myotis is present over the Clarence River.

Microbats at Tabulam Bridge

The bat call identification results of the Anabat surveys are provided in **Attachment 2**. A total of 254 call sequences were analysed including confident identification (definite or probable) of seven different species including eight probable passes of Large-footed Myotis.

Recorded Roosting Microbats

- No significant bat colonies were recorded roosting at Tabulam Bridge. An individual microbat likely to be from the family Vespertilionidae (probably a Large-footed Myotis but unable to be confirmed due to the roosting location) was recorded roosting in the bridge decking above the water in a transverse decking gap of approximately 40 mm above a stringer in span 14 (over the river) numbering east to west.
- Approximately 91 microbats were recorded roosting in the Clarence River Overflow Bridge which is a concrete plank bridge approximately 100 m north of Tabulam Bridge. They were likely to be from the family Vespertilionidae, with probable Large-footed Myotis and bentwing bats observed. Species identification was unable to be confirmed due to the bats location in the bridge and night surveys targeted Tabulam Bridge. Staining and guano was evident (refer to **Plate 5**).



Plate 5 Roosting microbats in Clarence River Overflow Bridge and staining



Plate 6 Underside of Clarence River Overflow Bridge

Discussion/ Recommendations

- Tabulam Bridge provides structurally similar habitat to other timber bridges (such as Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) which all contain large maternities colonies of the threatened Large-footed Myotis.
- Should works that may disturb the bats at the Clarence River Overflow Bridge which is a concrete plank bridge roost be required (eg activities that create significant vibrations, concrete bridge widening or demolition, etc), additional surveys of the concrete bridge should be undertaken to confirm species identification and inform later impact assessments.

- The impact assessment should consider Tabulam Bridge as potential microbat roosting habitat (particularly for the Large-footed Myotis), though noting it currently does not support large numbers of bats and is not being utilised as a maternity roost site. The impact assessment should include safeguards for managing (detecting, capture and relocating) microbats during bridge demolition.

Yours sincerely

GeoLINK



Veronica Silver

Ecologist/ Associate

Attach: Attachment 1: BioNet Results of Threatened Microbats within 10 km of Tabulam Bridge

Attachment 2: Bat Call Identification (Echo Ecology April 2014)

Attachment 1

Table 1 BioNet Results of Threatened Microbats within 10 km of Tabulam Bridge

Scientific Name	Common Name	Legal Status - TSC Act	Legal Status	Roosting Habitat	No. Atlas of NSW Records	Roosting Potential at Tabulam Bridge
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	V	-	Tree hollows in eucalypt trees, rock crevices (Churchill 2008).	5	Low
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Moist and dry eucalypt forest and rainforest, particularly at high elevations.	2	Low
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures (OEH 2012; Van Dyck and Strahan 2008).	1	Possible as opportunistic non-breeding roosting habitat. Recorded as probable in Anabats surveys.
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	V	-	Mainly in tree hollows; also recorded under house roofs in urban areas (OEH 2012).	1	Low. Possible as opportunistic non-breeding roosting habitat.
<i>Myotis macropus</i>	Large-footed Myotis	V	-	Caves, mines, tree hollows, aqueduct tunnels and under bridges/ culverts and in dense vegetation (the latter in the tropics) in the vicinity of bodies of slow-flowing or still water (Van Dyck and Strahan 2008).	1	High. Structurally similar habitat to other timber bridges (with large maternities colonies. Recorded as probable in Anabats surveys.

Key:

TSC Act: *Threatened Species Conservation Act 1995*
 EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999*
 V: Vulnerable
 E: Endangered

Table 2 Assessment of Additional Threatened Microbats (not identified within BioNet)

Scientific Name	Common Name	Legal Status - TSC Act	Legal Status - EPBC Act	Roosting Habitat	Roosting Potential at Tabulam Bridge
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Typically requires sandstone escarpments (or occasionally volcanic rock types) to provide roosting habitat that is adjacent to higher fertility sites which are used for foraging. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (<i>Hirundo ariel</i>) nests. It also possibly roosts in the hollows of trees. The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs with indentations. (DoE 2012).	Low. Possible as non-breeding roosting habitat in Fairy Martin nests.
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	Caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings (OEH 2012). Breeding colonies are restricted to specific breeding caves (predominantly limestone) (Van Dyck and Strahan 2008).	Possible as non-breeding roosting habitat. Recorded as definite in Anabat surveys.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	Mainly in tree hollows but will also roost under bark or in man-made structures (OEH 2012).	Low. Usage is most likely to be opportunistic non-breeding roosting habitat. Recorded as definite in Anabat surveys.
<i>Nyctophilus bifax</i>	Eastern Long-eared Bat	V	-	Tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings (OEH 2012).	Low – prefers more intact habitats.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	Tree hollows mainly but also recorded on buildings, in animal burrows, in cracks in dry clay and under slab rocks (Churchill 2008).	Low – prefers more intact habitats.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Usually tree hollows, but also recorded in buildings (OEH 2012).	Low. Usage is most likely to be opportunistic non-breeding roosting habitat.
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	-	Caves but also disused mine workings (OEH 2012).	Unlikely.

Key:

TSC Act: Threatened Species Conservation Act 1995
 EPBC Act: Environment Protection and Biodiversity Conservation Act 1999
 V: Vulnerable
 E: Endangered

References for Attachments 1 and 2

- Churchill, S. (2008). *Australian Bats* (2nd Edition). Jacana Books, Crows Nest NSW.
- Department of the Environment [DoE], (2014). *Species Profiles and Threats Database - Chalinolobus dwyeri — Large-eared Pied Bat, Large Pied Bat*. Australian Government Department of Environment.
- Evans, L. N. (2009). *Roosting behaviour of urban microbats: the influence of ectoparasites, roost microclimate and sociality*. PhD thesis, Faculty of Veterinary Science, The University of Melbourne.
- Office of Environment and Heritage [OEH], (2012). *Threatened Species Profile*. NSW Office of Environment and Heritage website: <http://www.environment.nsw.gov.au/threatenedspeciesapp/>. Accessed 22/04/2014
- Van Dyck, S. and Strahan, R. (2008). *The Mammal of Australia* (Third Edition). Reed New Holland.



**ECHO
ECOLOGY**

Bat Call Identification

**Tabulam Bridge,
Tabulam, NSW**

**Prepared for
GeoLINK
Environmental Management and Design
Level 1, 64 Ballina St.
Lennox Head, NSW, 2478**

Job Reference BC_GEO1 - April 2014

This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

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1.0 INTRODUCTION

This report has been commissioned by GeoLINK Environmental Management and Design to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Tabulam Bridge, over the Clarence River, at Tabulam, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Version 3.9f) software. The identification of calls was undertaken with reference to Pennay and others (2004) and through the comparison of recorded reference calls from north-eastern NSW. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Such comparisons are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

2.1 Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus*, by characteristic frequency or the presence of a down-sweeping tail on pulses. Call sequences which had a majority of pulses containing an up-sweeping tail were assigned to *Vespadelus pumilus*.

Miniopterus schreibersii oceanensis was differentiated by *Vespadelus* sp. by a combination of uneven consecutive pulses and the presence of a down-sweeping tail. Long, high quality call sequences with regularly-spaced consecutive pulses, few down-sweeping tails and higher or lower characteristic frequencies were assigned to *Vespadelus darlingtoni* or *Vespadelus regulus*.

Calls from *Mormopterus* sp. were differentiated by the presence of mainly flat pulses. *Mormopterus norfolkensis* was differentiated from *Mormopterus* species 2 in long call sequences where pulses alternated, often with a downward sloping tail.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Chalinolobus nigrogriseus, *Falsistrellus tasmaniensis*, *Scotorepens greyii* and *Scotorepens* species 1 were unable to be differentiated from one another.

Myotis macropus was differentiated from *Nyctophilus* sp. by calls with pulse intervals < 75 ms, initial slope > 400 OPS and often with a central kink. *Nyctophilus* sp. calls were identified from *Myotis macropus* by pulse intervals > 95 ms and an initial slope of < 300 OPS. *Nyctophilus geoffroyi* and *Nyctophilus gouldi* were unable to be differentiated.

3.0 RESULTS

A total of 338 call sequences were recorded, of which 254 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 24 call sequences (9 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Miniopterus australis* (Little bentwing bat)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)
- *Mormopterus norfolkensis* (East-coast freetail bat)
- *Mormopterus* species 2 (Eastern freetail bat)
- *Myotis macropus* (Large-footed myotis)
- *Vespadelus darlingtoni* (Large forest bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Chalinolobus nigrogriseus* (Hoary wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scotorepens greyii* (Little broad-nosed bat)
- *Scotorepens* species 1 (undescribed broad-nosed bat)
- *Vespadelus pumilus* (Eastern forest bat)
- *Vespadelus regulus* (Southern forest bat)
- *Vespadelus trouhntoni* (Eastern cave bat)
- *Vespadelus vulturinus* (Little forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 8/04/2014	Anabat 9/04/2014
DEFINITE		
<i>Miniopterus australis</i>	1	-
<i>Mormopterus norfolkensis</i>	4	-
<i>Mormopterus species 2</i>	1	-
PROBABLE		
<i>Chalinolobus gouldii</i>	2	-
<i>Miniopterus australis</i>	1	-
<i>Miniopterus schreibersii oceanensis</i>	1	-
<i>Mormopterus norfolkensis</i>	1	-
<i>Mormopterus species 2</i>	3	-
<i>Myotis macropus</i>	7	1
<i>Vespadelus darlingtoni</i>	1	1
POSSIBLE		
<i>Mormopterus norfolkensis</i>	1	-
<i>Myotis macropus</i>	1	1
<i>Vespadelus darlingtoni</i>	3	-
SPECIES GROUPS		
<i>Chalinolobus gouldii</i> / <i>Mormopterus norfolkensis</i> / <i>Mormopterus species 2</i>	6	1
<i>Chalinolobus gouldii</i> / <i>Mormopterus species 2</i>	1	-
<i>Chalinolobus morio</i> / <i>Miniopterus schreibersii oceanensis</i> / <i>Vespadelus vulturnus</i>	1	-
<i>Chalinolobus morio</i> / <i>Vespadelus pumilus</i> / <i>Vespadelus vulturnus</i> / <i>Vespadelus troughtoni</i>	32	4
<i>Chalinolobus nigrogriseus</i> / <i>Falsistrellus tasmaniensis</i> / <i>Scotorepens greyii</i> / <i>Scotorepens species 1</i>	4	-

IDENTIFICATION	Anabat 8/04/2014	Anabat 9/04/2014
<i>Chalinolobus nigrogriseus</i> / <i>Scotorepens greyii</i> / <i>Scotorepens</i> species 1	61	4
<i>Miniopterus australis</i> / <i>Vespadelus pumilus</i>	1	-
<i>Miniopterus schreibersii oceanensis</i> / <i>Vespadelus darlingtoni</i>	12	1
<i>Miniopterus schreibersii oceanensis</i> / <i>Vespadelus darlingtoni</i> / <i>Vespadelus regulus</i>	1	-
<i>Miniopterus schreibersii oceanensis</i> / <i>Vespadelus regulus</i>	4	-
<i>Mormopterus norfolkensis</i> / <i>Mormopterus</i> species 2	1	-
<i>Myotis macropus</i> / <i>Nyctophilus geoffroyi</i> / <i>Nyctophilus gouldi</i>	38	16
<i>Scotorepens greyii</i> / <i>Scotorepens</i> species 1 / <i>Vespadelus darlingtoni</i>	27	-
<i>Vespadelus pumilus</i> / <i>Vespadelus vulturnus</i> / <i>Vespadelus trouhntoni</i>	7	2
UNKNOWN		
'Noise' files	25	10
Unknown	42	7
TOTAL	290	48

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

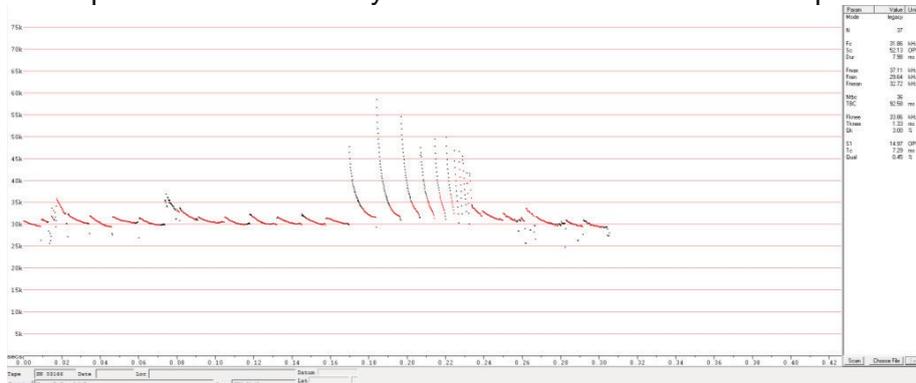


Figure 4-1: *Chalino lobus gouldii* probable call



Figure 4-2: *Mini oterus australis* definite call



Figure 4-3: *Mini oterus schreibersii oceanensis* probable call

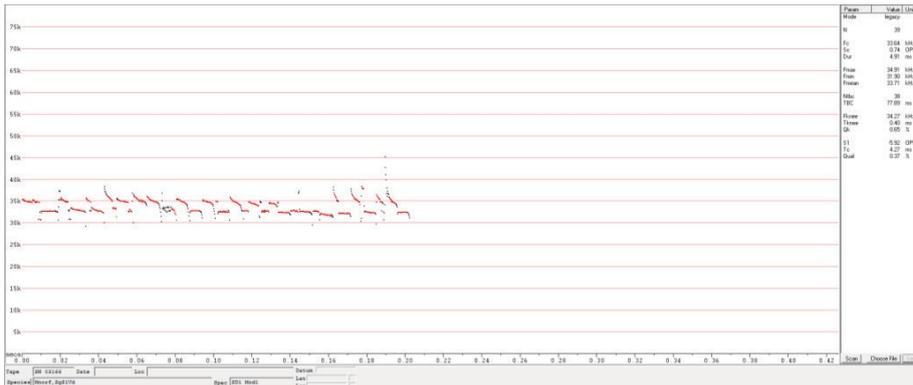


Figure 4-4: *Mormopterus norfolkensis* definite call



Figure 4-5: *Mormopterus* species 2 definite call

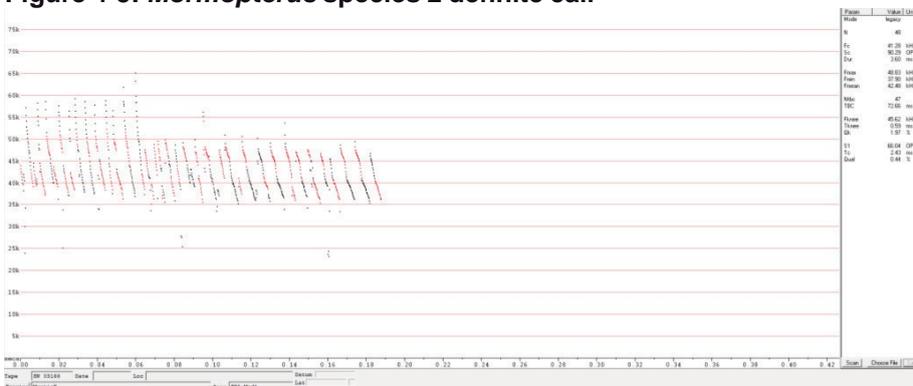


Figure 4-6: *Myotis macropus* probable call

5.0 REFERENCES

Adams, M., Reardon, T.R., Baverstock, P.R. and Watts, C.H.S. (1988). Electrophoretic resolution of species boundaries in Australian Microchiroptera. IV. The Molossidae (Chiroptera). *Australian Journal of Biological Sciences* 41: 315-326.

Australasian Bat Society Incorporated (undated) *Standards for reporting bat detector surveys*, http://batcall.csu.edu.au/abs/issues/ABS_Anabat_survey_standards.pdf

- Churchill, S. (2008). *Australian Bats*. Second Edition Allen & Unwin; Crows Nest, NSW.
- Hoye, G.A, Law, B.S. and Lumsden, L.F. (2008). Eastern Free-tailed Bat *Mormopterus* sp. Pp. 493-495 in *The Mammals of Australia: Third Edition* (S. van Dyck and R. Strahan, Eds.); New Holland; Sydney.
- Law, B.S., Turbill, C. and Parnaby, H. (2008). Eastern Forest Bat *Vespadelus pumilus*. Pp. 567-568 in *The Mammals of Australia: Third Edition* (S. van Dyck & R. Strahan; Eds.); New Holland; Sydney.
- Law, B.S., Reinhold, L. and Pennay, M. (2002). Geographic variation in the echolocation calls of *Vespadelus* spp. (Vespertilionidae) from New South Wales and Queensland, Australia. *Acta Chiropterologica* 4: 201-215.
- Pennay, M., Law, B. and Reinhold, L. (2004). *Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats*. NSW Department of Environment and Conservation, Hurstville.
- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001a). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Queensland Department of Natural Resources and Mines, State Forests of New South Wales, University of Southern Queensland, and New South Wales National Parks and Wildlife Service, Australia.
- Reinhold, L., Herr, A., Lumsden, L., Reardon, T., Corben, C., Law, B., Prevett, P., Ford, G., Conole, L., Kutt, A., Milne, D. and Hoye, G. (2001b). Geographic variation in the echolocation calls of Gould's wattled bat *Chalinolobus gouldii*. *Australian Zoologist* 31: 618-624.
- Richards, G.C., Ford, G.I. and Pennay, M. (2008). Inland Free-tailed Bat *Mormopterus* sp. Pp. 494-495 in *The Mammals of Australia: Third Edition* (S. van Dyck and R. Strahan, Eds.); New Holland; Sydney.
- Thomas, D.W., Bell, G.P. and Fenton, M.B. (1987). Variation in echolocation call frequencies recorded from North American vespertilionid bats: a cautionary note. *Journal of Mammalogy* 68: 842-847.
- Van Dyck, S. and Strahan, R. (Eds.) (2008). *The Mammals of Australia: Third Edition*. New Holland; Sydney.

Appendix I – GeoLINK microbat management plan

Microbat Management Plan

Tabulam Bridge Upgrade Geolink Environmental Management and Design

Prepared for: -GHD

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<i>UPR</i>	<i>Description</i>	<i>Date Issued</i>	<i>Issued By</i>
2363-1006	Version 1	27/09/2014	VJS
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1. Introduction

1.1 Introduction

NSW Roads and Maritime Services (RMS) propose to construct a new bridge over the Clarence River at Tabulam and remove the existing timber bridge. GHD Pty Ltd (GHD) was engaged by RMS to undertake a flora and fauna assessment for the removal of the existing bridge and construction of a new bridge. Initial surveys indicated that Tabulam Bridge may provide suitable habitat for a number of threatened microbat species. GeoLINK was engaged by GHD to undertake targeted microbat surveys of Tabulam Bridge which confirmed that Tabulam Bridge does hold preferable habitat features for roosting microbats.

Old road bridges are recognised as suitable roosting habitat for a number of microbat species (Churchill 2008). The design of the substructure can often create ideal microhabitat for roosting individual microbats and colonies of microbats, including maternity colonies. Microbats that have been recorded using road bridges previously include species that are generally recognised as obligate cave-roosting microbats such as the Eastern Bentwing (*Miniopterus schreibersii oceanensis*), as well as those recognised as having a general preference for roosting in trees (i.e. fissures in trunks, hollows in branches and under decorticating bark) such as *Nyctophilus* spp. Species such as the Large-footed Myotis (*Myotis macropus*) are recorded more commonly roosting in the substructure of bridges associated with open bodies of water.

This Microbat Management Plan (MMP) relates to the proposal to remove and construct a new bridge over the Clarence River at Tabulam.

1.2 Tabulam Bridge

Tabulam Bridge is located on the Bruxner Highway on the western side of Tabulam (refer to **Illustration 1.1**). It was built in 1903 and is a state heritage listed structure approximately 297.5 m in length. It consists of 15 approach spans (11 to the east and four to the west) and three main spans over the Clarence River. During average flow events, the bridge is approximately 15 m above the Clarence River water level. The bridge is a 4.6 m wide single lane structure. It is primarily constructed of timber comprising of timber approach spans and composite timber/ steel De Burgh truss central spans. The main spans are supported by concrete piers located in the river whilst the approaches are supported by timber trestles (GHD 2014). The locality comprises mostly cleared floodplain and foothills with native vegetation on steeper slopes.

Tabulam Bridge has been surveyed by GeoLINK in April 2014 and GHD in January and June 2014. Tabulam Bridge is not known to support a breeding colony of microbats.

Clarence River Overflow structures No. 1 and 2 are located approximately 100 m west and 350 m south-west of Tabulam Bridge. These structures are concrete plank bridges with concrete pylons and gaps underneath that provide microbat roosting habitat.

1.3 Purpose and Objectives

This MMP outlines the proposed management measures to be implemented for microbats and their habitat and provides a program for monitoring of the effectiveness of these measures. The objective of the MMP is to provide measures that minimise impacts to microbats associated with removal and replacement of Tabulam Bridge.

More specifically, the MMP aims to:

- Provide recommendations in terms timing of key activities.
- Provide allowance for early detection of any breeding/ roosting microbats.
- Provide exclusion techniques and management when required.
- Ensure monitoring would be directly linked to the purpose with corrective actions connected to the management actions.

- Provide an assessment of replacement habitat requirements.

Detail safeguards/ mitigation measures to alleviate the impacts of the project on microbats.

1.4 Construction Environmental Management Plan

All direction and construction requirements described in this MMP would be included in the Construction Environmental Management Plan (CEMP).

1.5 Proposed Works

The works to which this MMP applies are:

- Removal of the existing timber bridge that spans the Clarence River at Tabulam.
- Construction of a new modern concrete span bridge (refer to **Appendix A**).

These works are expected to occur over an 18-month period with works commencing in 2015.



0 150



2. Subject Species and their Roosts

2.1 Subject Species

A review of the roosting habitat requirements of threatened microbat species known to occur within a 10 km radius of the site from the NSW Bionet database and those recorded during surveys are listed in **Table 2.1**.

Table 2.1 Results of Threatened Microbats Recorded From Tabulam Bridge and 10 km Radius

Scientific Name	Common Name	Legal Status TSC Act	Legal Status EPBC Act	Roosting Habitat	No. of Bionet Records	Roosting Potential at Tabulam Bridge
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Typically requires sandstone escarpments (or occasionally volcanic rock types) to provide roosting habitat that is adjacent to higher fertility sites, which are used for foraging. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (<i>Hirundo ariel</i>) nests. It also possibly roosts in the hollows of trees. The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs with indentations. (DoE 2012).	0	Low. Possible as non-breeding roosting habitat in Fairy Martin nests.
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	V	-	Tree hollows in eucalypt trees, rock crevices (Churchill 2008).	5	Low. Recorded in species group in Anabat surveys (GeoLINK 2014).
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Moist and dry eucalypt forest and rainforest, particularly at high elevations (NPWS 2002).	2	Low. Recorded as probable in Anabat surveys (GHD 2014).

Scientific Name	Common Name	Legal Status TSC Act	Legal Status EPBC Act	Roosting Habitat	No. of Bionet Records	Roosting Potential at Tabulam Bridge
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	Caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings (OEH 2012). Breeding colonies are restricted to specific breeding caves (predominantly limestone) (Van Dyck and Strahan 2008).	0	High. Possible as non-breeding roosting habitat. Recorded as definite in Anabat surveys (GeoLINK 2014). Recorded as probable in Anabat surveys (GHD 2014).
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Caves are the primary roosting habitat, but also use derelict mines, stormwater tunnels, buildings and other man-made structures (OEH 2012; Van Dyck and Strahan 2008).	1	High. Possible as non-breeding roosting habitat. Recorded as probable in Anabat surveys (GeoLINK 2014 and GHD 2014).
<i>Mormopterus beccarii</i>	Beccari's Freetail-bat	V	-	Mainly in tree hollows; also recorded under house roofs in urban areas (OEH 2012).	1	Low. Possible as opportunistic non-breeding roosting habitat.
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	Mainly in tree hollows but will also roost under bark or in man-made structures (OEH 2012).	0	Low. Possible as opportunistic non-breeding roosting habitat. Recorded as definite in Anabat surveys (GeoLINK 2014 and GHD 2014).

Scientific Name	Common Name	Legal Status TSC Act	Legal Status EPBC Act	Roosting Habitat	No. of Bionet Records	Roosting Potential at Tabulam Bridge
<i>Myotis macropus</i>	Large-footed Myotis	V	-	Caves, mines, tree hollows, aqueduct tunnels and under bridges/ culverts and in dense vegetation (the latter in the tropics) in the vicinity of bodies of slow flowing or still water (Van Dyck and Strahan 2008).	1	High. Structurally similar habitat to other timber bridges (with large maternities colonies). Recorded as probable in Anabat surveys (GeoLINK 2014 and GHD 2014).
<i>Nyctophilus bifax</i>	Eastern Long-eared Bat	V	-	Tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings (OEH 2012).	0	Low. Prefers more intact habitats.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	Tree hollows mainly but also recorded on buildings, in animal burrows, in cracks in dry clay and under slab rocks (Churchill 2008).	0	Low. Prefers more intact habitats.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Usually tree hollows, but also recorded in buildings (OEH 2012).	0	Low. Possible as opportunistic non-breeding roosting habitat. Recorded as probable in Anabat surveys (GHD 2014).

Scientific Name	Common Name	Legal Status TSC Act	Legal Status EPBC Act	Roosting Habitat	No. of Bionet Records	Roosting Potential at Tabulam Bridge
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	V	-	Caves but also disused mine workings (OEH 2012).	0	Low. Possible as non-breeding roosting habitat in Fairy Martin nests.

2.1.1 Microbat Surveys

Initial surveys carried out by GHD Pty Ltd in January and June 2014 involved two Anabat detectors positioned under the existing bridge on the eastern and western banks and the Clarence River (January 2014), and at Clarence River Overflow Structure No. 2 (June 2014). These surveys identified six microbat species at the definite level including one threatened species, the East-coast Free-tailed Bat (*Mormopterus norfolkensis*). The five common species recorded at definite level include Gould's Wattled Bat (*Chalinolobus gouldii*), Smaller Horseshoe Bat (*Rhinolophus megaphyllus*), White-striped Freetail-bat (*Tadarida australis*), Large Forest Bat (*Vespadelus darlingtoni*) and Southern Forest Bat (*Vespadelus pumilus*). A further five threatened species including Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Little Bentwing-bat (*Miniopterus australis*) and Large-footed Myotis (*Myotis macropus*) were identified at the probable confidence level from underneath the bridge and Clarence River Overflow Structure No. 2 (GHD 2014). 54 microbats (specific species not identified) were observed in the gaps between the concrete planks under Clarence River Overflow Structure No. 2 (GHD 2014) when searched with torches.

Targeted surveys conducted by GeoLINK in April 2014 found that no significant microbat colonies were recorded roosting in Tabulam Bridge. However one microbat likely to be from the family Vespertilionidae (probably a Large-footed Myotis (*Myotis macropus*)) was recorded roosting in the bridge decking above the water in a transverse decking gap.

Approximately 91 microbats were recorded roosting in Clarence River Overflow Structure No. 1, which is a 50 m long concrete plank bridge located approximately 100 m west of Tabulam Bridge. They were also likely to be from the family Vespertilionidae, probably Large-footed Myotis, Eastern Bentwing and or Little Bentwing-bats (GeoLINK 2014).

Although the surveys undertaken by GeoLINK in April 2014 did not identify any breeding colonies of threatened microbats utilising Tabulam Bridge, the surveys did record suitable habitat that would be preferential for Large-footed Myotis and potential overwintering habitat for Bentwing-bats.

Should another species of microbat be located within the bridge, the general aims of the avoidance of harm to an individual would apply both for other species listed on the TSC Act as well as for unlisted species. No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed species are expected to utilise the bridge.

2.2 Potential Roosting Habitat

Surveys identified potential microbat roosting habitat features throughout Tabulam Bridge (refer to **Plates 2.1 to 2.4**) that include:

- Decking gaps (i.e. below longitudinal decking, between transverse decking and predominantly above the stringers): These features occur across the bridge.
- Split (two piece) timber headstocks: These features are uncommon and restricted to the piers on the approach span.
- Timber joins: Present mainly at the piers (GeoLINK 2014).

Rotted timber features suitable for microbat roosts were uncommon and generally in exposed locations or not well formed. Bird nests (*Welcome Swallow* *Hirundo neoxena* and Fairy Martin *H. ariel*) and mud dauber wasp nest would also be expected to occur at least periodically and provide mostly non-breeding roosting opportunities (GeoLINK 2014).

Tabulam Bridge was found to provide structurally similar habitat to other timber bridges in the region (such as Glebe Bridge, Sportsmans Creek Bridge and McFarlane Bridge) which all contain large maternity colonies of the threatened Large-footed Myotis (GeoLINK 2014). As a consequence Tabulam Bridge is considered potential microbat roosting habitat (particularly for the Large-footed Myotis), though noting it currently does not support large numbers of microbats and is not being utilised as a maternity roost site.



Plate 2.1 View below longitudinal decking and between transverse decking



Plate 2.2 View below longitudinal and transverse decking



Plate 2.3 Underside of stringers



2.4 Join at headstock

2.3 Confirmed Roosting Habitat

Tabulam Bridge is not known to provide breeding habitat despite displaying features that would be favoured by Large-footed Myotis. Clarence River Overflow Structure No. 1 was confirmed as microbat roosting habitat by GeoLINK in April 2014 when approximately 91 microbats were recorded roosting within the expansion gaps between the bridge planks. Staining and guano was evident indicating that this is a well-used roost site (refer to **Plates 2.5** and **2.6**). Clarence River Overflow Structure No. 2 was confirmed as microbat roosting habitat by GHD in June 2014 when approximately 54 microbats were recorded roosting within the expansion gaps between the bridge planks.



Plate 2.5 Roosting microbats in Clarence River Overflow Structure No. 1 and staining



Plate 2.6 Underside of Clarence River Overflow Structure No. 1

2.4 Impacts on Microbats

As identified in the Flora and Fauna Assessment (GHD 2014) the potential impacts on microbats include:

- Removal of the existing bridge which may result in the loss of potential non-breeding Little Bentwing-bat and Eastern Bentwing-bat roosting habitat, and potential Large-footed Myotis roosting and breeding habitat.
- Indirect construction noise and vibration impacts. This is a particular threat if breeding colonies are present and it is acknowledge that the project would overlap two microbat breeding seasons.
- Potential direct mortality or injury (e.g. if roosting in the works area) as well as potential loss of young if adults abandon dependent young at the roost.

2.5 Goals for Management

The main goals of this MMP are as follows:

- To ensure no significant impact on threatened microbats using Tabulam Bridge or the Clarence River Overflow Structures No. 1 & 2 by minimising the risk of direct impacts to non-breeding roosting bats during works (ie. death and injury).
- Reduce the potential for injury or death to microbats during the proposed works.
- Ensure roosting opportunities provided continue to be available after completion of works.
- Allow for construction of the new bridge to be undertaken during the Large-footed Myotis breeding period.



3. Management Measures

3.1 Overview

Management measures to protect microbats pre, during and post construction involve the following main components:

1. Recommended timing of works.
2. Engage Ecologist.
3. Pre-demolition surveys.
4. Assessment of when roost exclusion is required.
5. Roost exclusion techniques.
6. Removal of individual microbats.
7. Monitor demolition of key habitat features.
8. Demolition of Tabulam Bridge.
9. Protection of known roost (Clarence River Overflow Structures No. 1 and 2).
10. Creation of roost habitat.

3.2 Recommended Timing of Works

The proposed works would commence in 2015 and are expected to take up to 18 months to complete. It is preferable that the demolition component of the project be undertaken between May and September. This timing is recommended so that demolition works are undertaken outside the breeding season for the Large-footed Myotis (October to April inclusive). The breeding season of Large-footed Myotis is focused upon as it is the only threatened species known to breed in such structures rather than just utilise the structure as a roost.

If present, the potential for injury and death to microbats is much higher during October to April due to the presence of heavily pregnant females, dependant (flightless) young and/ or juveniles.

Dependant young are unlikely to vacate the roost and there is a high risk that adults if disturbed would abandon juveniles in the roost. There is a high risk that attempts to remove juveniles from the roost would result in death or injury due to stress or animals requiring care and rehabilitation.

It is acknowledged however that compliance with the recommended timing (ie. demolition of Tabulam Bridge between April and September) may not be practical. Strict compliance with the management measures outlined below are therefore required. It must be noted however that works must cease if pre-demolition surveys indicate more than 20 microbats present during October to April as exclusion devices must not be installed during the Large-footed Myotis breeding period UNLESS staged exclusion is undertaken prior to the breeding season. The management measures and methodology provided have been developed based on previous surveys which indicate that this situation is unlikely to occur. Having stated this, animals can display unpredicted or unexpected behaviour and therefore an adaptable approach with contingency measures to deal with a range of potential outcomes is required.

3.3 Engage Ecologist

An appropriately qualified, suitably licensed and vaccinated (Lyssa virus) Ecologist experienced in handling microbats would be engaged prior to commencement of the project. The Ecologist would document and record implementation of all management measures and report to RMS's Environmental Officer and the Works Supervisor. The Ecologist would instigate contact with a local veterinary hospital and wildlife carer to ensure that any microbats or animals of any taxa that are injured during the works are appropriately cared for. Contact numbers for the wildlife carers, veterinary hospital and Ecologist would be posted in the site compound. The Ecologist would provide training to construction contractors regarding how to undertake daily inspections.

3.4 Pre-demolition Surveys

Pre-demolition surveys of Tabulam Bridge would be undertaken two weeks prior to scheduled demolition to identify if any microbats are present using the bridge as a roost. This procedure would be repeated one week prior to demolition if demolition is scheduled during October and April. Surveys would involve surveying the entire bridge utilising the same methodology as that employed by GeoLINK in April 2014. Surveys would be undertaken by two Ecologists. The aims of these surveys are to identify any issues prior to scheduled demolition.

3.5 Assessment for Requirement of Exclusion

The decision making process to assess if exclusion from Tabulam Bridge is required is represented in **Figure 3.1**. Note: this sequence of works is only applicable from May to September as exclusion and hand removal of microbats is not permitted during the Large-footed Myotis breeding season.

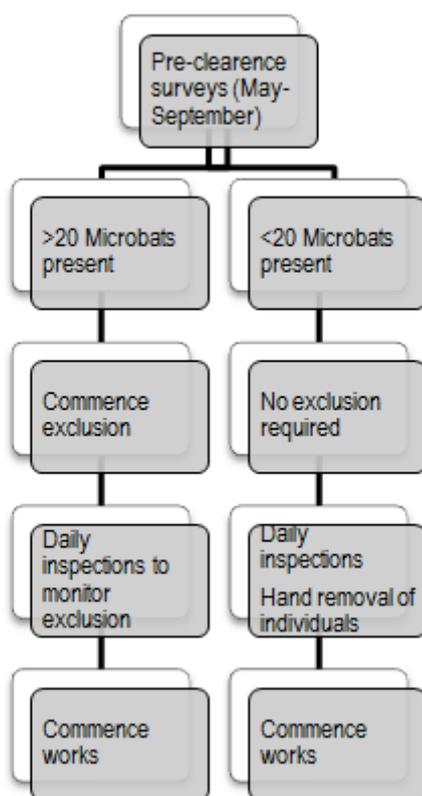


Figure 3.1 Decision making process (May-September) to assess the need for exclusion

As illustrated above, if the pre-demolition surveys do not detect any microbats (numbering greater than 20) roosting in the bridge, then no exclusion devices would be required. Individual microbats (numbering less than 20) would be removed following completion of the pre-demolition inspections. If microbats are present numbering greater than 20 individuals, then exclusion techniques would be applied in accordance with timing outlined in **Section 3.6.1**.

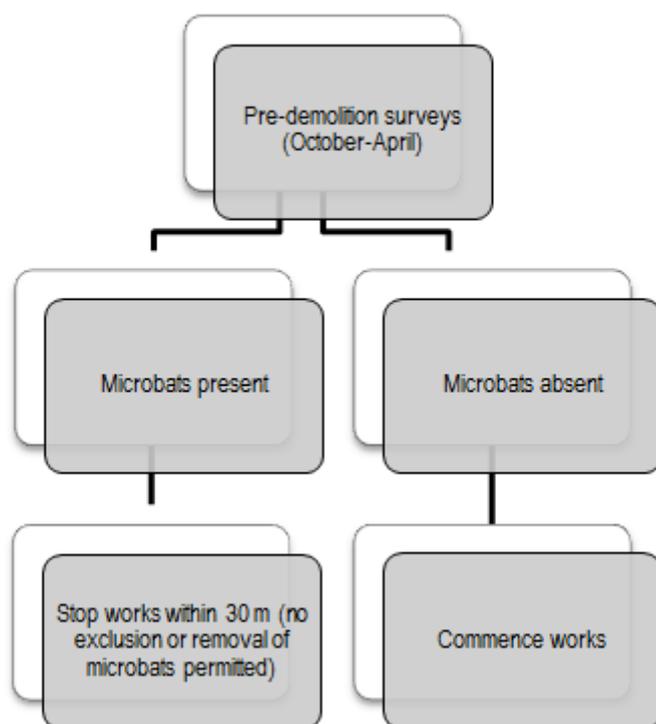


Figure 3.2 Decision making process (October-April)

3.6 Roost Exclusion

Tabulam Bridge is not known as breeding roosting habitat. Due to lack of recorded microbats roosting within Tabulam Bridge, it is not expected that exclusion would be required. Exclusion of microbats would only be required when greater than 20 microbats are identified by pre-demolition surveys between May and September (refer to **Section 3.5**) or if the risk of identifying microbats is deemed unacceptable by the construction contractor and staged exclusion is chosen (refer to **Section 3.6.4**).

3.6.1 Timing of Exclusion

If required, exclusion would occur between May and September (inclusive). Exclusion would not occur during forecast periods of heavy rain (>20 mm in 24 hours according to the Bureau of Meteorology).

3.6.2 Exclusion Devices

Exclusion devices comprise a combination of the following techniques depending on the specific location and type of habitat occupied by microbats within Tabulam Bridge:

- Plastic sheeting.
- Exclusion curtains.
- Flood lights.
- Gap filler or expandable foam.
- Plywood secured with adhesive (i.e. liquid nails).
- One-way flap (for small cracks/ fissures).

Each of the exclusion devices discussed below, assumes that access would be available via a suspended platform below the bridge.

Plastic Sheeting

Plastic sheeting is the preferred method for exclusion and involves wrapping the targeted span substructure with clear plastic sheeting from the outside kerb of one side under and across to the outside kerb on the other side. The ends would be capped with plastic curtains tailored to fit around the corbels. This method was chosen as it limits the extent of decision making available to microbats. The intent is to place a physical barrier between the microbats and the span such that re-entry is not physically possible (refer to **Plate 3.1**). It is expected that this technique would deliver the most reliable exclusion of microbats from the subject span.

The risk with this procedure is the potential to trap microbats inside the wrapping. As such, the installation of the device on the first night would occur in the presence of an Ecologist after the span has been vacated and any remaining microbats have been physically removed. An Ecologist and a suitably qualified and trained assistant would monitor the fly-out of the microbats and check the span using an inspection camera, torch and thermal imager to detect any remaining microbats. Once the Ecologist is satisfied that no microbats are within the span, the wrap and capping can be installed. During this procedure, the Ecologist and assistant would continue to monitor the presence of microbats near the subject span using a spotlight and thermal imager. Any microbats landing on the span would be removed.

After the wrap is installed, the Ecologist and assistant would remain to monitor the inside of the wrapping for at least one hour to detect trapped microbats. Trapped microbats would be removed if possible. The functionality of the wrapping would be maintained through repairs made immediately, should it be required to cut or detach parts of the wrapper to access microbats. In the event that trapped microbats cannot be captured, it is acceptable for one or two microbats to remain trapped for one night as long as these individuals are caught the next day and supplied with meal worms prior to release that evening. No more than one night of being trapped is considered acceptable.

After the first night of exclusion, the Ecologist and assistant would return to the site at least one hour prior to dawn. They would check the wrapping for trapped microbats and observe the behaviour of microbats when returning to roost. Attempts at re-entry would be observed and any breaches noted for repair/ alteration. Any microbats attempting to roost in inappropriate locations would be removed and released if still dark or removed and held until they could either be placed into a bat box, placed under Clarence River Overflow Structure No. 1 or 2 or held during the day for release that evening.

The exclusion device would require monitoring the following day and until such time as the Ecologist is satisfied that microbats are neither trapped inside nor choosing to roost inappropriately during the day. Alternative measures described in subsequent sections may also be employed if required.

The following sections describe alternative techniques that were assessed for suitability and deemed possible to use if the favoured technique described above does not work.



Plate 3.1 Plastic sheeting (Source: A. Lloyd)

Exclusion Curtains

Exclusion curtains would be made from 2 m lengths of slippery but thick plastic (e.g. enviroguard <http://www.burwell.com.au/catalogue/containmentscreen/Enviroguard>). Curtains would be made to run longitudinally (long curtains – running along length of girders) and transversely (trans curtains – running along the length of the transverse decking at the start and end of the long curtains). Long curtains could be made in whatever widths are deemed manageable, however enough sections would be needed to span the following:

- Long curtains would be installed either side of each girder so would effectively be a little less than 1 m apart.
- Sections of curtain can overlap, so if they are made longer they can be adjusted to suit both spans and re-used.
- Curtain tops would be attached to wooden batons enabling them to be screwed into place and removed and reattached as required.
- The corners of the curtains could be taped together if it is windy. If required, weights or wooden batons could be attached to the base. This is unlikely to be required.
- Monitoring during dusk/ dawn fly out/ in would show whether the curtains are effective, and if not, where the weaknesses are. A range of additional measures are described below should additional measures be required.

If microbats are able to access the span by flying up between the curtains the following could be added:

- A sheet of plastic across the base of the curtains, deployed by Ecologists at night when the microbats have left.
- Additional trans curtains to reduce the length of the space available for microbats to fly up into the span.
- Install valves along the base to create funnels, which the microbats could exit through, but not re-enter.

Flood Lights

Floodlights could be installed to shine directly onto the curtains, and although the plastic proposed for use is opaque, light would still be able to penetrate through. Four floodlights (6,000w each) would be used. Two would be attached below the curtains, directing light up into the curtains. The other two would be attached at either end of the span and would shine light onto the curtains.

Gap Filler or Expandable Foam

Gap filler or expandable foam can be used to fill gaps and crevices. This method would need to completely fill the gap therefore would only be suitable for gaps < 5.0 cm deep. Where this cannot be achieved (i.e. due to an obscure cavity), plywood secured with adhesive or one-way plastic flaps would be installed. One disadvantage of gap filler (or equivalent) is that microbats can still grip the foam and use it as an exposed hold point.

Plywood

Plywood secured with adhesive (i.e. liquid nails) and or nails into timber sections is an effective way of excluding microbats where the gaps are along a straight surface (refer to **Plate 3.2**).

One-way Flap

Installation of a one-way flap involves attaching a plastic shield over the exit hole/ gap, extending at least 80 mm from the hole to ensure a non-grip surface (Temby 2012). Then hang a flap of plastic sheeting over the exit point, so that microbats can leave but not re-enter (refer to **Plate 3.3**). One-way plastic flaps would be used where a cavity cannot be fully inspected. A delay of 72 hours is required however between installation of a one-way flap and demolition to ensure that all microbats have vacated.



Plate 3.2 Plywood, liquid nails and expandable foam beneath Mororo Bridge



Plate 3.3 One-way flap

3.6.3 Exclusion Process

The Ecologist would recommend which of the above listed exclusion methodologies would be used at the time of exclusion as there are advantages and disadvantages for each exclusion methodology.

If exclusion was not effective, a thermal imaging camera or night vision scope would be used to observe microbats to determine where the breach is occurring. Actions would be undertaken to remedy any breaches or improve the methodology.

Exclusion of microbats from Tabulam Bridge would be undertaken in accordance with **Section 3.6**. Timing of exclusion would be in accordance with that outlined in **Section 3.6.1**. Roost exclusion would involve the following process:

- Watching the roost prior to the dusk fly-out to identify when microbats have vacated the roost.
- The roost would then be inspected one hour after the first microbat emerges (to ensure the peak activity associated with emergence has passed), by an Ecologist with microbat experience to confirm that no microbats are present.
- Once this is confirmed, exclusion devices would be deployed. Exclusion structures would be deployed gradually (i.e. one span each night, or specific sections of Tabulam Bridge) to

encourage microbats to find roosting sites elsewhere, limiting the number of microbats 'caught short' and potentially roosting in inappropriate locations.

Table 3.1 Exclusion Process for Tabulam Bridge

Task	Responsibility	Procedure
Observe fly-out	Ecologist	<ul style="list-style-type: none"> ▪ Watch from suspended platform beneath bridge. ▪ Watch from bank (using binoculars or thermal imager).
Install exclusion devices	Ecologist with assistance from Contractor	<ul style="list-style-type: none"> ▪ Exclude microbats from the bridge to encourage microbats to use the nearby Clarence River Overflow Structures. This may be undertaken over two-three nights or staged as required during demolition of deck and trusses.
Monitor exclusion devices	Ecologist	<ul style="list-style-type: none"> ▪ Watch from suspended work platform to see if microbats return. ▪ Note if microbats were able to re-gain access. ▪ Identify where breaches occur. ▪ Check for microbats roosting in unsafe areas as a result of exclusion. ▪ Remove microbats that are roosting in unsafe areas and place in Clarence River Overflow Structure.
Modify exclusion devices (if required)	Contractor under guidance of Ecologist	<ul style="list-style-type: none"> ▪ Wrap sections in plastic. ▪ Block off cavities and crevices using appropriate exclusion techniques.
Confirm exclusion successful	Ecologist	<ul style="list-style-type: none"> ▪ Physical inspection for microbats on the day before and the morning of demolition work. ▪ Remove any microbat individuals that have not left.

3.6.4 Staged Exclusion

It is expected that the risk of identifying microbats within Tabulam Bridge during the breeding season and therefore requiring exclusion is low however if demolition cannot be scheduled outside of the breeding season and the construction contractor determines that the risk of ceasing works within 30 m of identified microbats is unacceptable, then staged microbat exclusion would be undertaken prior to bridge demolition to ensure no microbats are able to gain access to the underside of the bridge. The aim is to have the bridge completely free of roosting microbats prior to demolition.

The exclusion process would include the following stages:

1. Install microbat roosting habitat below the new bridge decking (one lattice style bat box and a light-weight concrete block) one month prior to exclusion.
2. Install exclusion devices on sections of the bridge without roosting microbats (e.g. approach spans, rotted timber girder ends, potential roost sites in pier cavities).
This would occur following inspections by an Ecologist to confirm no microbats are present.
The Ecologist would ensure the exclusion is impenetrable for microbats before commencing exclusion further.
3. Exclude microbats from the remainder of the bridge in stages affecting a maximum of 35% of the population at a time, with a minimum week period between these exclusion events.
The Ecologist would inspect the subject section of the bridge prior to installing the exclusion. Installation of exclusions in areas with no microbats or small groups of bats (<20) may occur during the day following removal of the microbats by the Ecologist. Installation of exclusions in areas with larger groups of microbats (>20) or where smaller groups were not able to be removed would be undertaken at night. Once the microbats have flown-out or are removed by the Ecologist and the subject section of the bridge is confirmed to be microbat free (following

inspection with an inspection camera, torch and thermal imagery device), the exclusion can be installed, accompanied by ongoing inspection by the Ecologist to ensure no microbats enter the exclusion area.

Exclusion of microbats is not permitted during the Large-footed Myotis breeding season (October to April inclusive). Further details regarding the exclusion process would follow those outlined in **Section 3.6.3**.

3.7 Removal of Individual Microbats

In the case where the pre-demolition surveys have identified less than 20 individuals utilising the bridge, it is feasible (during May-September inclusive) that individuals be removed by an Ecologist prior to commencement of works and placed in one of the nearby Clarence River Overflow Structures in a cavity that is not in use by other individuals. This would take place in the morning post sunrise and individuals would be relocated as soon as possible. Once placed in the new roost microbats would be monitored to ensure no fly-outs occur. If it is likely that a fly-out would occur due to the microbats being agitated, the relocation would be abandoned and microbats would be held until sunset and released on site.

Note: Removal of microbats is not permitted during the Large-footed Myotis breeding season (October to April inclusive).

3.8 Monitor Demolition of Key Microbat Habitat Features

If microbats are observed during the pre-demolition surveys, an Ecologist would monitor the demolition of key habitat features to carefully inspect timbers and rescue any animals that may have gone undetected during the pre-demolition surveys. This would entail an inspection of areas identified as good habitat with a torch and if required an inspection camera. Where individuals are located, works would not commence until those individuals are removed and translocated to one of the Clarence River Overflow Structures (refer to **Section 3.7**).

3.9 Demolition of Tabulam Bridge

The demolition process of Tabulam Bridge involves the following (as described by GHD):

- An assessment of any potential lead paint or other potentially hazardous waste.
- Dismantling each truss using a crane and personnel on the deck with lanyards or on an access boom lift.
- Removing the trusses using the crane.
- Strategically cutting the bridge to enable removal in segments.
- Dismantling and removing the northern portion of the spans.
- Removing the northern piers via excavation and cutting of the piers.
- Removing and reinstating the northern abutment using an excavator.
- Transferring the crane to southern side of the river by walking across new bridge.
- Dismantling and removing the southern portion of the spans.
- Removing the southern piers via excavation and cutting the piers.
- Removing and reinstating the southern abutment using an excavator.

Disposal of the bridge components would involve:

- Stockpiling material at approved locations on both sides of the bridge.
- Using an excavator or crane to load the demolition materials.
- Removing the material via contractors or to an approved waste facility.
- Recovering selected hardware and fittings associated with the bridge to be transported to the Council's Works Depot for future re-use or display.

Rehabilitation of the site would involve:

- Minor earthworks and landscaping to reform the land.
- Reinstating the pad used by the crane and support props.
- Revegetation (as required) using native, endemic (and/ or sterile non-invasive) species. Erosion and sedimentation control would remain in place until the site is appropriately reinstated and revegetated.

It is recommended that each section be thoroughly inspected by the Ecologist prior to cutting and removal to remove any microbats that may be hidden within the structure.

3.10 Protection of Known Roosts (Clarence River Overflow Structures No. 1 & 2)

Clarence River Overflow Structure No. 1 is a known microbat roost located approximately 100 m west of Tabulam Bridge. Although unconfirmed at the time, the species using this structure are likely to be Bentwing-bats (*Miniopterus schreibersii oceanensis* and *Miniopterus australis*) and/ or Large-footed Myotis (*Myotis macropus*), all of which are listed as Vulnerable under the TSC Act. Other unlisted species such as the Chocolate Wattled Bat (*Chalinobulus morio*) may also be using this structure.

Clarence River Overflow Structure No. 2 is also a known microbat roost located approximately 350 m south-west of Tabulam Bridge. The species using this structure are likely to be similar to those listed above.

The Clarence River Overflow Structures could potentially be breeding roosts for the Large-footed Myotis and the Chocolate Wattled Bat and an important over wintering roost for Bentwing-bats.

It is imperative that noisy activities (those above general highway traffic) and the use of heavy machinery around this area be limited. An exclusion zone of 30 m around this structure would be established where noisy activities and the use of heavy machinery are prohibited and access into this zone would be controlled (personnel must be accompanied by the Ecologist). The exclusion zone would be sign posted and taped off with flags. No machinery or equipment would be stored within this zone. Access into the exclusion zone would only be with the Ecologist. The intention of this zone is to ensure that Clarence River Overflow Structures No. 1 & 2, which are known microbat roosting habitat, are not disturbed by the proposed works and disturbance is minimised.

Table 3.2 outlines the processes for the protection of known important microbat habitat.

Table 3.2 Protection of Known Roosts (Clarence River Overflow Structures No. 1 & 2)

Task	Responsibility	Timing	Procedure
Establish 30 m exclusion zone around Clarence River Overflow Structures	Ecologist and Works Supervisor	1 week prior to commencement of work	<ul style="list-style-type: none"> ▪ Mark out a 30 m radius of the structure with star pickets and tape and or flags.
Monitor access to exclusion zone	Works Supervisor	Daily	<ul style="list-style-type: none"> ▪ Works Supervisor to monitor and ensure no breaches into the exclusion zone.
Monitor Clarence River Overflow Structures	Ecologist	Once a week Once a month	<ul style="list-style-type: none"> ▪ Clarence River Overflow Structures would be monitored by an Ecologist on a weekly basis during the demolition of Tabulam Bridge. ▪ Clarence River Overflow Structures would be monitored by an Ecologist on a monthly basis during construction of the new Tabulam Bridge. ▪ Data recorded would include number of microbats using the roost, species, roost layout and position of roosting microbats within the roost, weather conditions and a measurement of the noise and noting of activities in the general area. ▪ Other data including the status of the colony i.e. presence of pregnant females and juveniles would also be noted. ▪ If there is a decline in the use of the roost that is related to work activities the exclusion zone would be reviewed and expanded by 20 m. ▪ The 30 m exclusion zone may be reduced if the Ecologist identifies that microbats are displaying tolerance to the works.

3.11 Creation of Roost Habitat

It is recommended that the following design features be incorporated into the new bridge to recreate (potential) microbat habitat that is removed during demolition of Tabulam Bridge. These features include:

- Maximise cavities and around piers/ headstocks.
- Minimise gaps (10 cm wide) between super-T girders.
- Unsealed cavities between the concrete Super-T girder joins.
- Rough concrete.
- Concrete ledges and concrete angles.
- A lattice style bat box (refer to **Plate 3.4**).
- Light weight concrete block with drill holes (refer to **Plate 3.5**).



Plate 3.4 Lattice style bat box beneath Halfway Creek Bridge (Source: V. Silver)



Plate 3.5 Light weight concrete blocks with drill holes secured beneath bridge (Source: N. Williams)

It is acknowledged that Tabulam Bridge is **not known** as microbat breeding habitat however it is a large timber structure that provides a significant area of **potential** microbat breeding habitat. It is therefore recommended to retro-fit the new Tabulam Bridge with microbat habitat so that potential habitat in addition to the known microbat habitat of Clarence River Overflow Structures No. 1 & 2 is also available.

3.12 Mitigation Measures

In general, the proposed microbat mitigation measures comprise of the following components:

1. Environmental Work Method Statements (EWMS).
2. Daily microbat inspections.
3. Inductions.

3.12.1 Environmental Work Method Statements

EWMS would be prepared for all activities potentially impacting microbats. The EWMS would provide an opportunity to assess any risks to microbats from the works and to incorporate mitigation measures into work methodologies to minimise the potential for impacts. Where an EWMS identifies risks to fauna, the Ecologist would be consulted to provide input where necessary.

3.12.2 Daily Microbat Inspections

Following completion of the pre-demolition surveys which would be undertaken one week prior to works and one day prior to works (refer to **Section 3.4**), daily microbat inspections would also be undertaken. Prior to the start of work each day, the specific area of the bridge to be demolished would be actively searched for microbats or evidence of their occurrence using appropriate techniques to ensure a reasonable level of confidence as to whether roosting microbats are present. Searches would be undertaken using a torch/ spotlight and binoculars. Due to the height of Tabulam Bridge, a suspended platform would be required. Boat mounted scaffolding based inspection would be used where appropriate if a suspended platform is unavailable. Pole mounted cameras (or equivalent) would be used in areas which cannot be directly thoroughly inspected without aid. Searches would include looking for individual microbats or evidence of microbat occurrence including guano, stains, chatter/ calls. Construction personnel would need to sign off that these searches were undertaken daily. Training would be provided to the responsible works crew members by the Ecologist if an Ecologist is unable to undertake these searches.

If no microbats are detected during the daily microbat inspections, the works may cautiously commence as required. If microbats are detected, the relevant works would stop and the Works Supervisor would be contacted immediately. If microbats are detected, the following procedure would continue:

- If microbats are detected or disturbed during the works, they would be allowed to fly out if such an attempt is made. Otherwise works would be delayed to allow adults time to warm up and fly out in response to the works disturbance.
- After 30 minutes, the cavity supporting the microbats would be re-checked for the presence of microbats. If microbats are still present, the Ecologist would remove the microbats (during May-September inclusive only) and provide an appropriate exclusion device for that location. Upon removal, the microbats would be placed within a cotton bag with a sealed opening and hung in a cool, shady undisturbed place. Microbats would not be overcrowded in a bag (e.g. no more than five per pillow case). Large microbats (head and body 80-95 mm) would not be grouped with smaller microbats (head and body <75 mm) as some larger species predate on smaller species. The Ecologist is subsequently responsible for the appropriate release of the microbats in the evening.
- If the microbats are unable to be captured (e.g. due to their location) works would be deferred until the following day to allow microbats to depart at dusk for evening fly out followed immediately by the installation of exclusion structures within the works areas.

Table 3.3 Procedure for Daily Microbat Inspections

Procedure

<i>Action</i>	<i>Timing</i>	<i>Responsibility</i>	<i>Procedure</i>
Daily microbat inspection	On the day of work.	Ecologist/ Contractor	Check the structure for the presence of microbats.

Mitigation Steps

<i>Outcome of inspections</i>	<i>Response</i>	<i>Timing</i>	<i>Responsibility</i>	<i>Steps/ Notes</i>
Microbats not present	Proceed with work.	-	Contractor	-

Outcome of inspections	Response	Timing	Responsibility	Steps/ Notes
Microbats present (May-September)	Contact RMS's Environmental Officer/ Ecologist and decide: <ul style="list-style-type: none"> ▪ Avoid microbat/s by working elsewhere; ▪ Exclude after dusk fly-out (<u>May-September ONLY</u>); ▪ Remove microbats (<u>May-September ONLY</u>); ▪ Stop works until exclusion can be undertaken between <u>May-September ONLY</u>. 	Prior to any work during May to September	Contractor but Ecologist to remove microbats	Handling of microbats only in accordance with Section 3.13.1 .
Microbats present (October-April)	<ul style="list-style-type: none"> ▪ Contact RMS's Environmental Officer, Ecologist and Works Supervisor; ▪ Cease works within 30 m of microbats; ▪ Avoid microbat/s by working elsewhere. 	Prior to any work during October to April	Contractor/ Ecologist	-

3.12.3 Inductions

An environmental induction would be prepared and delivered to all personnel involved with the project. Relevant points to be delivered in this induction in relation to microbat management are as follows:

- Presence on site (identification and potential habitat).
- Identification of signs of microbat use (guano and staining).
- Pre-demolition requirements.
- Requirements for works to cease within 30 m of any unexpected microbats detected within the bridge structure until authorisation has been given for works to commence from the Environmental Officer/ Ecologist.
- Requirements for works to cease if microbats take flight from bridge during daylight hours until authorisation has been given for works to commence from the Environmental Officer/ Ecologist.

3.13 Contingency Measures

3.13.1 Capture and Release of Microbats

All handling of microbats would be undertaken by a qualified and vaccinated Ecologist experienced in handling microbats. The Ecologist would hold an Animal Care and Ethics Committee approval and an OEH Scientific Licence for handling native fauna. Any microbats captured would be housed in small cloth bags. Bags containing microbats would be hung in a cool, dry place off the ground, preferably within a wire box, like a cat carry cage for safety. Microbats of the same species would be housed together with no more than five in any one bag. In the unlikely event that other species are captured, large microbats (head and body 80-95 mm) would not be grouped with smaller microbats (head and body <75 mm) as some larger species predate on smaller species. The Ecologist is responsible for relocating the microbats to the nearby Clarence River Overflow Structures, or released in the evening at the site.

Any microbats captured during the day would be hung in a dry and undisturbed place out of the direct sun. Microbats would be kept in a cool environment and be assessed for heat stress as required. The microbats would be relocated or released that evening (on the same day). The Ecologist would assess whether microbats can be introduced into the Clarence River Overflow

Structures during the day, based on the likelihood of them staying within the roost until an appropriate fly-out time.

Microbats would not be held for any period longer than 24 hours. It is expected that microbats captured at night would be released that night if dawn is more than two hours away. If dawn is less than two hours away, microbats would be released the following night. Any microbats captured during the day would be released that night. Therefore, the longest anticipated holding time for microbats is 16 hours.

Note: Any microbats captured would be released at the site. A license from the Office of Environment and Heritage would be required to release any bats off site, as it would be considered 'relocation'.

3.13.2 Injured or Dead Microbats

If microbats are unexpectedly injured during works, the Ecologist would carefully remove the microbat with a cloth (for example with a hand encased within the cloth bag, gently grab the bat and turn the bag inside out to free your hand and capture the bat). Place immediately in a cloth bag or pillow case, tie off the entrance of the bag and hang up in a cool, sheltered, undisturbed place. Ideally, no more than five microbats would be placed in a single pillowcase sized bag. Large microbats (head and body 80-95 mm) would not be grouped with smaller microbats (head and body <75 mm) as some larger species predate on smaller species.

The local wildlife carer group or veterinary hospital would be contacted immediately for collection of the injured microbat/s and the matter reported to the Works Supervisor.

Ensure that the microbat rescue equipment/ PPE is onsite before works commence (pillowcases with ties and/ or soil sample cotton bags, thick rubber gloves, hand sanitiser or soap and water to wash hands).

If a dead or injured microbat is found the Works Supervisor and Ecologist would be notified immediately. Any dead microbats would be collected and retained for the Ecologist. The Ecologist would lodge bodies with the Australian Museum as specimens for future research and study.

3.13.3 Additional Microbat Handling Measures

Additional general microbat handling mitigation measures:

- Contract staff are prohibited from handling microbats unless microbats are injured or killed during works and advice has been sought from the Ecologist about the collection of the injured/ dead microbat.
- In the case of above, the contractor may carefully remove the injured/ dead microbat with a cloth (e.g. cloth bag), by gently encasing the animal and turning the cloth over or inside-out over the microbat to encase it. The microbats would be placed in a cloth bag that is carefully tied off so that parts of the microbats are not crushed and stored in a cool (not cold), quiet and dark location for collection by a wildlife carer or Ecologist.
- Large microbats (80-95 mm head and body length) would not be placed with small microbats (<75 mm) to avoid predation.
- Arrangements for the care and welfare of captured microbats would be made immediately upon discovery/ capture of injured microbat.
- Microbat rescue equipment and PPE for workers would be available on site. Equipment includes pillowcases, small cloth bags (e.g. soil sample bags), string to tie off pillowcase, thick rubber gloves or Nitrile Grip rubber gloves, hand sanitiser, soap and water to wash hands and laminated information sheet on Lyssa virus.
- In the unlikely event that a contractor is bitten by a microbat, medical treatment from a doctor would be sort immediately.



4. Monitoring Program

4.1 Monitoring Objectives

Monitoring of Clarence River Overflow Structures No. 1 and 2 would be undertaken to determine the effectiveness of the MMP in maintaining a microbat population throughout the demolition and construction period. It would also provide useful information on breeding, age class and therefore population dynamics and population survival post-construction. The information would be useful for future projects involving exclusion of microbats and works in proximity to microbat roosts.

Monitoring of Tabulam Bridge would also be undertaken throughout the demolition period in the form of daily pre-start microbat inspections as outlined in **Section 3.12**.

4.2 Pre-construction Monitoring

The pre-demolition surveys, surveys undertaken by GeoLINK in April 2014 and GHD in January and June 2013 form the pre-construction monitoring. The information collected during those surveys provide baseline information from which the effectiveness of this MMP would be assessed as the project progresses.

4.3 Monitoring Methodology

The following monitoring methodology would be undertaken for Clarence River Overflow Structures No. 1 and 2 weekly during demolition of Tabulam Bridge and monthly post-demolition for the duration of works. Monitoring of the features listed below would also be undertaken on the new Tabulam Bridge only if microbats are observed within Tabulam Bridge prior to Tabulam Bridge demolition.

An Ecologist would physically inspect Clarence River Overflow Structure to record the following:

- Evidence of microbats (guano and/ or staining).
- Number of microbats present.
- Identification of species.
- Indications of breeding activity.
- Date and time of inspection.
- Roost features present.
- Record of rainfall during monitoring period.

It should be noted that evidence of microbats in the form of guano maybe influenced by wet weather. Less guano would be expected following significant periods of rainfall.

4.4 Reporting

Progressive reporting of the monitoring data would be presented to RMS's Environmental Officer along with any recommendations or improvements that may arise during the demolition period. Details of microbats captured and translocated would be progressively reported to RMS's Environmental Officer. The Works Supervisor would also be informed throughout the implementation of the procedures detailed in this plan.

A log would be maintained of the decisions made and installation/ removal of exclusion devices. **Appendix B** includes a suggested log.

4.5 Performance Measures and Corrective Actions

The goals and relevant management measures that would be employed prior to the commencement of works, during works and post works is provided within **Table 4.1**. **Table 4.1** also describes how the identified mitigation measures would be monitored, the timing and frequency of monitoring, the parties responsible for implementing the measures, the performance thresholds that each goal is measured against and the corrective actions if deviation from the performance criteria occurs.

4.6 Roles and Responsibilities

Contractor work crews, the Ecologist, Works Supervisor and RMS's Environmental Officer form a team that would work together to deliver the aims of this MMP.

All handling of microbats would be undertaken by a qualified and vaccinated Ecologist experienced in handling microbats. An exception is the management of injured or dead microbats, or microbats at risk of injury should an Ecologist or Environmental Officer not be present. It is the responsibility of any worker that identifies a dead or injured microbat to notify the Works Supervisor, Ecologist or Environmental Officer immediately.

The construction contractor would be responsible for providing exclusion material and installation of exclusion devices. An Ecologist would be present to supervise the installation.

Trained contractor staff or an Ecologist would undertake daily microbat checks. Care would be taken during exclusion events, as microbats may be found roosting in inappropriate locations (e.g. handrail or on top of the decking).

The decision on the method of exclusion to be utilised would be guided by the Ecologist and the decision framework as described in **Section 3.5**. The Ecologist would provide guidance to the construction staff such that the aims of the MMP are achieved and impact to microbats is minimised.

4.7 Adaptive Procedures

It is not desirable to design a rigid plan when dealing with fauna related issues. Animals can display unpredicted or unexpected behaviour and therefore management plans such as this need to be adaptable to deal with a range of potential outcomes. The procedures of this plan may be adapted in response to factors such as pace of the works, or results of inspections. Modifications to the exclusion procedure may be undertaken, for example, minor modification may be required to the exclusion devices to improve their success.

The aim is to facilitate the identification of the best course of action for the particular situation, including time and logistical constraints, as well as the biological constraints posed by the microbats. This would only be successful, however, if open communication occurs between the Works Supervisor, RMS's Environmental Officer and the Ecologist.

4.8 Monitoring Program

A summary of the monitoring program is provided in **Table 4.1**.

Table 4.1 Monitoring Program

Monitoring Component	Goal	Timing/Frequency	Responsibility	Performance Threshold	Corrective Actions if Deviation from Performance Criteria
Clarence River Overflow Structures	Monitor existing microbat population in roost site	Weekly during demolition of Tabulam Bridge. Monthly during general works.	Ecologist	A major shift in numbers utilising roost	Review exclusion zone and monitor conditions daily.
Exclusion Zone	Minimise access to and activities in proximity to Clarence River Overflow Structure	Daily	Works Supervisor	Breaches of exclusion zone	Reinforcement of the importance of the exclusion zone.
Exclusion devices (if required)	Ensure exclusion devices remain effective	Daily leading up to demolition	Ecologist/ Construction Contractor	Any breach of exclusion devices	Re-instate damaged exclusion devices (e.g. apply additional gap filler or replace plywood with liquid nails).
Daily Microbat Inspections	Mitigate any harm, death or injury to microbats	Daily	Ecologist/trained contractor	No harm injury or death to microbats during the project period	Notification to DoE, EPA if a microbat mortality is recorded on the project. Adaptive management response plan to be provided by Ecologist if mortality recorded. Stop works and review the MMP procedures for exclusion and removal of microbats. Preparation of an EWMS for all construction activities and where necessary, include measures to minimise risk to microbats. Induction of all personnel involved with construction activities would be undertaken to communicate microbat management requirements.
New Tabulam Bridge (only if microbats observed in Tabulam Bridge prior to demolition)	Identify if new bridge is utilised by microbats	Monthly during general works.	Ecologist	-	-



5. References

Churchill, S. (2008). *Australian Bats*, Second Edition. New Holland Publishers

GeoLINK (2014). *Tabulam Bridge Microbat Survey Results*. Unpublished report to GHD April 2014.

GHD (2014). *Tabulam New Bridge Draft Terrestrial Flora and Fauna Assessment*. Unpublished report to RMS September 2014.

Van Dyck, S. and Strahan, R. (2008). *The Mammal of Australia* (Third Edition). Reed New Holland.



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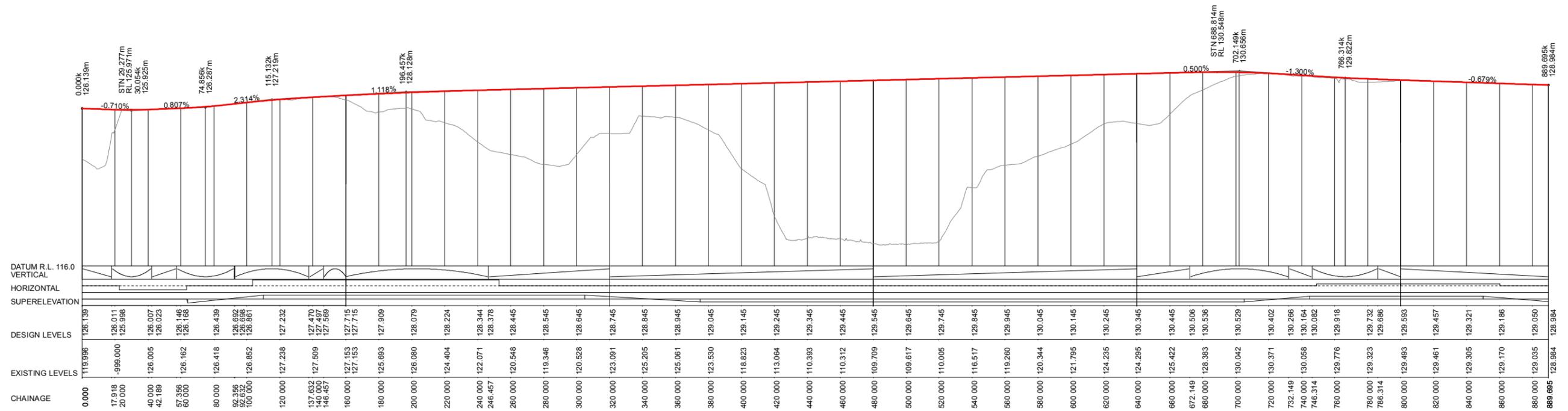
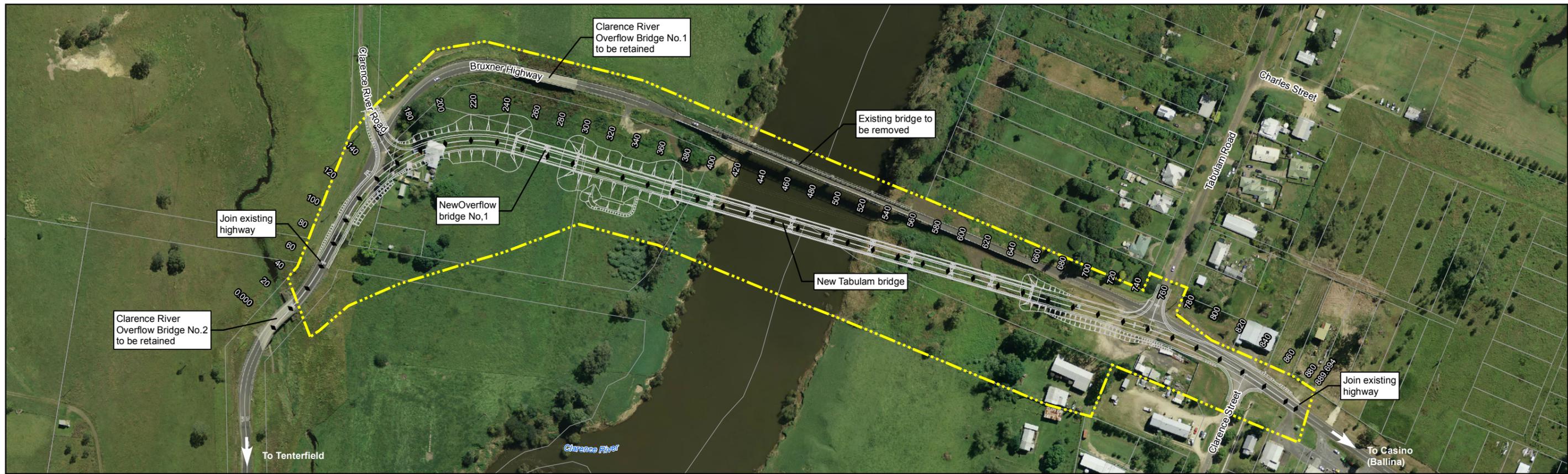
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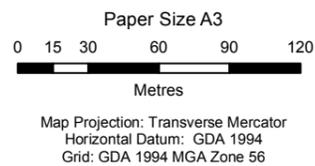
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Appendix A Bridge Plans



LONGITUDINAL SECTION - TABULAM BRIDGE



- LEGEND
- ▬ Proposal site
 - ▬ Preferred Option
 - Cadastre

Roads and Maritime Services
 Tabulam New Bridge
 Review of Environmental Factors

Job Number | 22-16888
 Revision | 0
 Date | 09 Feb 2015

Proposal design

Figure A-1

Appendix B Exclusion Log

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