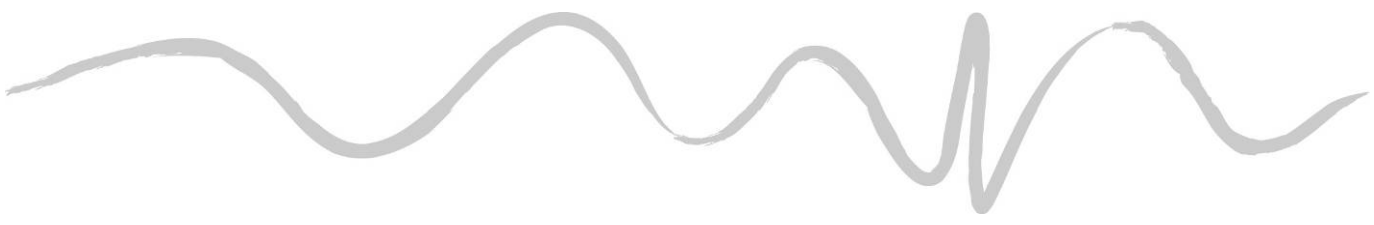
Appendix E

Biodiversity Assessment

Biodiversity Assessment

Sportsmans Creek New Bridge



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Biodiversity Assessment

Sportsmans Creek New Bridge

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Executive Summary

The NSW Roads and Maritime Services (RMS) propose to demolish and replace the existing bridge over Sportsmans Creek, located on the southern approach to the village of Lawrence within the Clarence Valley Council (CVC) Local Government Area (LGA). The existing bridge is to be replaced under the RMS Timber Truss Heritage Conservation Strategy which has been endorsed by the NSW Heritage Office.

As preliminary investigations of the existing Sportsmans Creek Bridge identified a breeding population of the Large-footed Myotis (*Myotis macropus*), a separate Microbat Survey and Impact Assessment Report has been prepared for the project by GeoLINK (2014) which is included as an Appendix to this report (refer to Appendix A). A summary of the findings of this report are included in this Biodiversity Assessment.

Kellogg Brown and Root (KBR) have been engaged by RMS to prepare two separate Reviews of Environmental Factors (REFs) for the construction of the new Sportsmans Creek Bridge and the demolition of the existing Sportsmans Creek Bridge. KBR have engaged GeoLINK to prepare a biodiversity assessment to support these REFs. The purpose of this report is to provide information on the known biodiversity constraints associated with the study area based on desktop studies and flora and fauna field assessments.

The Biodiversity Assessment involved a comprehensive review of biodiversity information available on the study area and surrounds, including the search results from a number of database searches and registers as well as a literature review of ecological studies previously undertaken in the area and liaison with local ecologists.

Additionally, flora and fauna habitat field assessments of the study area were conducted on 8 July 2014. Assessments examined flora and fauna values of the study area and aimed to determine ecological constraints and opportunities associated with the proposal. Targeted searches were conducted in areas of preferred habitat for threatened flora and fauna species and threatened ecological communities identified in desktop database searches as having potential to occur in the study area.

Results of field assessments found that the study area represents a highly modified agricultural landscape, previously cleared of indigenous vegetation. Pasture grasses dominate and remnant vegetation is degraded and generally exhibits low diversity with significant weed cover. Trees are few, generally isolated and mostly exotic.

A listed threatened flora species, Durobby (*Syzygium moorei*) was recorded in Flo Clark Park. The tree has been planted and is of low conservation significance due to it occurring well outside its natural range. No other threatened flora species were recorded in the study area during the survey. This includes the two targeted threatened flora species, Hairy Jointgrass (*Arthraxon hispidus*) and Maudia (*Maundia triglochinoides*) which have been recorded locally and were assessed as having potential to occur within the study area.

A number of listed Important Wetlands occur in proximity to the study area including the Everlasting Swamps, the Broadwater and the Clarence River Estuary. However, no listed Important Wetlands occur within the study area. Vegetation communities within the study area were not considered to represent any NSW State or Commonwealth listed Threatened/ Endangered Ecological Community. Constructed drainage lines in the western portion of the study area contain flora assemblages that are indicative of the NSW State listed Freshwater Wetlands EEC. However, drain maintenance and other agricultural practices for livestock and crop production have resulted in a substantially modified vegetation community that is not considered to meet the criteria of to the Freshwater Wetlands Endangered Ecological Community.

A fauna habitat assessment found that habitat values are generally low in terrestrial areas and medium in the aquatic environment and associated riparian area of Sportsmans Creek. No mapped wildlife corridors or areas of nominated key habitats exist in the study area. However, Sportsmans Creek represents a regional corridor for bird species moving between habitats associated with the upstream reaches of Sportsmans Creek and the Everlasting Swamps and habitats associated with the lower Clarence River. Field assessments found that vegetation generally lacked connectivity apart from pasture grasses and the dense mat of understorey vegetation adjacent to both sides of Sportsmans Creek.

No threatened fauna species (apart from the already identified colony of Southern Myotis) were recorded in the study area during the field assessment. Based on a fauna habitat assessment of the study area it is considered unlikely that the study area represents a significant area of habitat for any of the threatened fauna species that have been recorded in the locality. This includes species such as the Black-necked Stork and Brolga which have potential to utilise the ephemeral wetlands to the west of the study area for foraging, and other species such as the Eastern Osprey and Grey-headed Flying-fox which are expected to occasionally fly over the site or occupy it briefly.

The Microbat Impact Assessment (GeoLINK, 2014) found that Sportsmans Creek Bridge supports a large and important Large-footed Myotis breeding colony. This species is listed as vulnerable under the TSC Act. Large breeding colonies are uncommon in the lower Clarence and are not in close proximity to the Sportsmans Creek Bridge (>10 kilometres along waterways). Surveys of drainage structures in the locality found that potential unoccupied alternative breeding roost drainage structures within the locality are uncommon and likely to have a lower roost carrying capacity to occupied sites.

Sportsmans Creek Bridge also offers potential non-breeding roosting habitat for two other threatened species; the Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii*).

Seven-part Tests of Significance in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* for the Large-footed Myotis, Little Bentwing-bat and Eastern Bentwing-bat have been undertaken (refer to Appendix A). These assessments concluded:

- Large-footed Myotis: The proposal involves removal of habitat occupied by a large breeding colony. Although it is expected that the local Large-footed Myotis population will relocate to the habitat to be provided on the new bridge, in accordance with the precautionary approach adopted in accordance with OEH guidelines: *Threatened species assessment guidelines, The assessment of significance* (DECC, 2007), removal of the existing bridge is likely to significantly affect the local Large-footed Myotis population. Therefore a Species Impact Statement (SIS) for the Large-footed Myotis is required.
- Little and Eastern Bentwing-bats: A significant impact on these species is considered unlikely. No breeding habitat would be affected by the proposal and alternative potential roosting habitat in their non-breeding range in the lower Clarence is available to support the local potential occurrences of these species.

No other threatened or migratory flora/ fauna species or Endangered/ Threatened Ecological Communities listed under the TSC Act or EPBC Act are considered likely to be impacted by the proposal. As such no other Section 5A Assessments were considered necessary for this proposal.

Opportunities exist to improve biodiversity values as part of the development by way of indigenous riparian plantings along Sportsmans Creek which represents the area with the highest biodiversity conservation values.

1 Introduction

1.1 Background

The NSW Roads and Maritime Services (RMS) propose to demolish and replace the existing bridge over Sportsmans Creek, located on the southern approach to the village of Lawrence within the Clarence Valley Council (CVC) Local Government Area (LGA). Lawrence is located 25 kilometres north of Grafton on the Lawrence Road (MR152) which is managed and maintained by CVC. The location of the existing bridge site is shown on Illustration 1.1.

The existing bridge is to be replaced under the RMS Timber Truss Heritage Conservation Strategy which has been endorsed by the NSW Heritage Office. Replacement of this bridge relates to issues of poor sight distance, poor alignment and no pedestrian access. Additionally, the bridge presents significant transport limitations at the present and in the future due to its geometry and design limitations.

Kellogg Brown and Root (KBR) have been engaged by RMS to prepare two separate Reviews of Environmental Factors (REFs) for the construction of the new Sportsmans Creek Bridge and the demolition of the existing Sportsmans Creek Bridge. KBR have engaged GeoLINK to prepare a biodiversity assessment to support these REFs. The footprint of the old bridge and proposed new bridge (comprising the study area) is shown in Illustration 1.2.

The purpose of the biodiversity assessment report is to:

- Describe ecological values of the site.
- Assess ecological constraints and opportunities associated with the proposal.

For the purposes of this assessment:

- *'the site'* refers to the area directly affected by the proposed new bridge construction and old bridge demolition.
- *'the study area'* refers to the site and any additional areas that are likely to be affected by the proposal, either directly or indirectly.
- *'the locality'* refers to land within a 10 kilometre radius of the site.

As preliminary investigations of the existing Sportsmans Creek Bridge identified a breeding population of the Large-footed Myotis (*Myotis macropus*), a separate Microbat Survey and Impact Assessment Report has been prepared for the project by GeoLINK (2014) which is included as an Appendix to this report (refer to Appendix A). A summary of the findings of this report are included in this Biodiversity Assessment.

Information shown is for illustrative purposes only

Drawn by: KHP Checked by: RE Reviewed by: DGH Date: July 2014
Source of base data: Tyndale 95384N and Maclean 95393S 1:25,000 Topographic Maps

0 2 km

North

Site Locality Map

Biodiversity Assessment: Sportsmans Creek New Bridge
2228-1001

Illustration 1.1

Information shown is for illustrative purposes only

Drawn by: KHP Checked by: RE Reviewed by: DGH Date: July 2014
Source of base data: Kellogg Brown and Root

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North

The Proposal

2 Methodology

2.1 Database Searches

The following database searches were undertaken to identify potential biodiversity constraints associated with the site:

- A 10 kilometre radius search of the Atlas of NSW Wildlife (OEH) to identify threatened flora/ fauna species and Endangered Ecological Communities (EECs) known to occur within the search area.
- A 10 kilometre radius search of the EPBC Protected Matters Search Tool for federally listed threatened flora/ fauna species and ecological communities predicted to occur within the search area.
- Searches of the NSW Department of Primary Industries (DPI) Fisheries Records Viewer for threatened aquatic fauna occurring within the CVC LGA.
- Searches of current noxious weed declarations for the Clarence Valley control area (NSW DPI Biosecurity website).

2.2 Literature Review

A comprehensive literature review of information pertaining to the study area was undertaken. Key sources of information reviewed include:

- OEH Critical Habitat Register.
- Areas listed on the Register of National Estate (RNE).
- Directory of Important Wetlands in NSW (DIWA) Spatial Database.
- Key Fish Habitat mapping for Clarence Valley LGA (NSW DPI).
- Mapped bird routes of the Clarence Valley (Clarence Valley Birdos, 2006).
- Department of Planning (DoP) State Environmental Planning Policy (SEPP) 14 – Coastal Wetland and SEPP 26 – Littoral Rainforest mapping.
- Clarence Valley Estuary Management Plan (Umwelt, 2003).
- Terrestrial and Aquatic Flora and Fauna Assessment: Proposed Replacement of the Sportsmans Creek Bridge, Lawrence (D and D Consultants, 2002).
- Environmental Impact Statement for Demolition of Existing Bridge and Construction of New Bridge over Sportsmans Creek, Lawrence (Maclean Shire Council, 2002).
- Bat Survey and Impact Assessment: Sportsmans Creek Bridge, Lawrence NSW (Ecotone, 2007).
- Technical paper – A review of the Status of Breeding Osprey in 2006 (Ekert and Brady, 2007).

2.3 Liaison

In order to collect anecdotal information on biodiversity associated with the study area the following individuals/ agencies were contacted:

- Mr Martin Swain, Clarence Valley Council Ecologist.
- Mr Greg Clancy, local ecologist and avifauna researcher.

2.4 Review of Aerial Photography

In addition to the above, up to date aerial photographs of the study area were reviewed to identify vegetation extent, wetland areas and other ecological features of the site.

2.5 Flora Assessment

A flora assessment of the study area was conducted on 8 July 2014 to enable vegetation to be described and to provide an indicative list of flora species occurring at the site. Considering the size and character of the study area, the random meander method (DEC 2004) was chosen as an appropriate method to survey vegetation. The survey method included thorough and targeted searches in areas of preferred habitat for threatened flora species identified in desktop database searches as having potential to occur in the study area.

Plant species were identified and recorded in the field with the aid of identification keys and photographic indexes as required. The structure of vegetation communities was also recorded. A total survey effort of five field hours was dedicated to the flora survey and fauna habitat assessment.

Vegetation types recorded were compared with EEC descriptions in final determinations of the NSW Scientific Committee under the NSW *Threatened Species Conservation Act 1995* (TSC Act), and Threatened Ecological Communities (TECs) listed by the Commonwealth Threatened Species Scientific Committee under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

For the purposes of this assessment the areas shown in Illustration 2.1 were considered as areas which could be cleared as part of the Proposal. They include areas which may require clearing associated with the bridge approaches as well as land which could be used for compound/ lay down areas during the construction of the new bridge. It is likely that all of these areas will not require clearing.

2.6 Fauna Assessment

A fauna assessment of the site was undertaken in addition to previous survey work undertaken to identify threatened microbats on the existing Sportsmans Creek bridge.

The fauna assessment of the study area was based on a review of database records and fauna habitat features. This methodology was deemed adequate due to the disturbed nature of the site and lack of native vegetation occurring within the site.

Fauna habitat features were observed over the study area and the suitability for threatened species recorded in the locality. Five field hours was dedicated to a combined fauna habitat assessment and flora survey.

Fauna habitat surveys targeted the following fauna habitat features and resources. Where they were encountered, a close examination was made in relation to threatened species and their habitat requirements.

- Vegetation structure.
- Dominant plant species and plant diversity.
- Levels of disturbance.
- Leaf litter.
- Fauna scats.
- Fauna tracks, diggings and burrows.
- Signs of fauna feeding.
- Tree scratch/ claw marks.
- Tree hollows, stags and fallen logs.

- Vegetation connectivity.
- Rock outcrops and ledges.
- Availability of water.

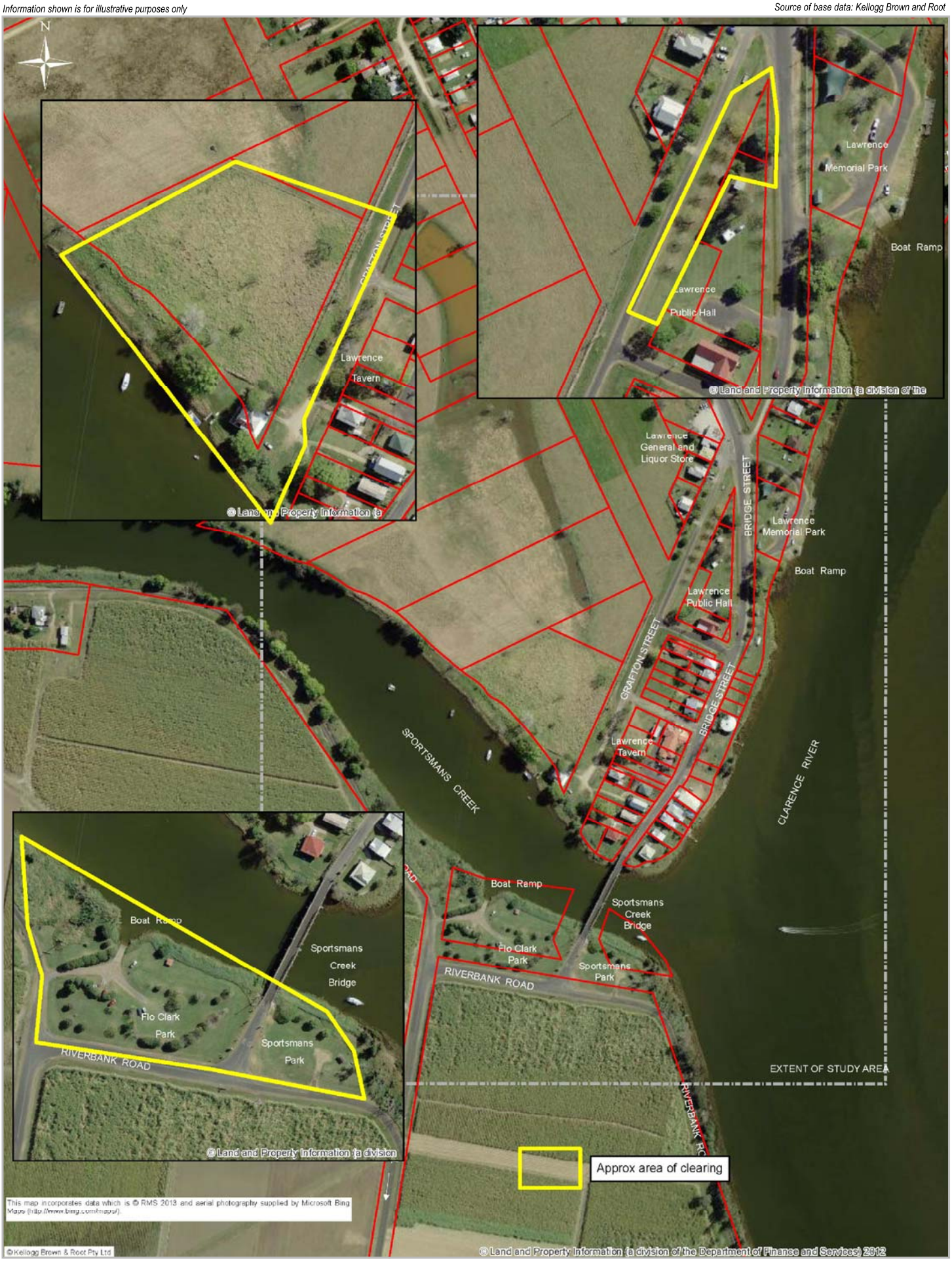
2.7 Survey Limitations

Considerable effort was made to sample vegetation and fauna habitat features within the study area, however not all flora and fauna that may occur on the site were able to be recorded. Seasonal surveys are required to detect species that are inconspicuous due to their rarity, elusive nature or sporadic use of the site. Such species may have gone undetected in the survey. It is, however, unlikely that species with high conservation significance have been overlooked due to the thorough and methodical nature of the assessment. Habitat evaluation and application of the precautionary principle has however been adopted to address survey limitations.

Drawn by: RE Checked by: DGH Reviewed by: DGH Date: August 2014

Source of base data: Kellogg Brown and Root

Information shown is for illustrative purposes only



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North

Indicative Clearing Areas

Biodiversity Assessment: Sportsmans Creek New Bridge

2228-1021

Illustration 2.1

3

Results

3.1 Flora

3.1.1 Vegetation Communities

Vegetation communities present at the site are highly modified and have low conservation value, having been cleared of indigenous riparian vegetation which would have once covered the site and much of the locality. Vegetation communities associated with the site are shown in Illustration 3.1.

3.1.1.1 Parkland

Vegetation associated with the southern bank of Sportsmans Creek has been cleared in the past and is now Flo Clark Park (to the west of the existing Sportsmans Creek Bridge) and Sportsmans Park (to the east of the existing bridge). Cultivated native trees have been planted in these areas such as Bottlebrush (Callistemon sp), Cadagi (*Corymbia torreliana*), Jacaranda (*Jacaranda mimosifolia*), African Tulip Tree (*Spathodea companulata*) and Water Gum (*Tristaniopsis laurina*) in order to landscape the area (refer to Plate 2 in Appendix E). This vegetation is of low conservation value.

3.1.1.2 Riparian Zones

Riparian zones associated with the southern and northern banks of Sportsmans Creek have been cleared and are largely free of native vegetation. Vegetation within these areas is dominated by exotic grasses and weeds, particularly Para Grass (*Urochloa mutica*) which thrives with the exotic vine, Coastal Morning Glory (*Ipomoea cairica*) as a dense matt in the high-disturbance flood-zone adjacent to both sides of Sportsmans Creek (refer to Plates 3 and 6 in Appendix E). The native Common Reed (*Phragmites australis*) emerges in isolated patches on the southern side of Sportsmans Creek (refer to Plate 4 in Appendix E). A juvenile Forest Red Gum (*Eucalyptus tereticornis*) occurs on the southern bank.

Aquatic vegetation was not identified at the time of survey associated with the site. Mapped areas of seagrass and saltmarsh were identified within the Clarence River to the east of the site, from a literature review of information pertaining to the site (refer to Illustration 3.1). No saltmarsh or seagrass beds were identified within the subject site during the field surveys.

3.1.1.3 Cleared Pasture Land

On the northern side of Sportsmans Creek, a large area of cleared pasture land occurs on the western side of Grafton Street. This area may be used as a compound/ lay down area for the construction of the new bridge. It comprises a range of grass species dominated by Kikuyu (*Pennisetum clandestinum*), Common Couch (*Cynodon dactylon*) and *Paspalum* spp. A number of mature trees are present on the house block associated with this site including mature Camphor Laurel (*Cinnamomum camphora*) trees and Silky Oak (*Grevillea robusta*) (refer to Plate 11 in Appendix E). A regenerating Moreton Bay Fig (*Ficus macrophylla*) is present beneath one of the Camphor Laurels (refer to Plate 7 in Appendix E).

3.1.1.4 Avenue Tree Plantings

Avenue tree plantings occur along parts of Grafton Street (refer to Illustration 2.1) and may require some clearing as part of the new road configuration on the northern approach to the new bridge site. These consist of typical streetscape trees such as Leopardwood (*Flindersia maculosa*), Jacaranda and Cadagi.

3.1.2 Noxious Weeds

Five listed 'Noxious weeds' declared for the Clarence Valley control area were detected during the survey (refer to Table 3.1). Two of these species, Lantana (*Lantana camara*) and Fireweed (*Senecio madagascariensis*) are also listed as Weeds of National Significance (WoNS). The invasion, establishment and spread of Lantana is also listed as a Key Threatening Process under the TSC Act. Photographs of noxious weeds occurring at the site are shown in Plates 9, 10 and 13.

Table 3.1 Listed Noxious Weeds Identified on the Site

Scientific Name	*Common Name*	*Listing*	*Extent/ Location*
Ambrosia artemisiifolia	Annual Ragweed	N5	Scattered occurrences throughout the site
Cinnamomum Camphora	Camphor Laurel	N4	A number of mature Camphor Laurels recorded on the site
Erythrina sp	Coral Tree	N3	One mature tree occurring on the site
Senecio madagascariensis	Fireweed	N4	Common occurrence in cleared pasture areas associated with the site
Lantana camara	Lantana	N4, WoNS	A small number of occurrences throughout the site

Noxious weeds declared under the *Noxious Weeds Act,* are required by law to be controlled by all landholders within a given control area. The control requirements for noxious weed classes identified on the site are provided below:

- N5: There are no requirements to control existing plants of Class N5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.
- N4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.
- N3: The plant must be fully and continuously suppressed and destroyed.

3.1.3 Threatened Flora

3.1.3.1 Database Results

The OEH Atlas of NSW Wildlife search and Protected Matters Search Tool identified records of 14 flora species listed under the TSC Act and/ or EPBC Act previously recorded or having habitat within the search area (10 kilometre radius around the site) (refer to Appendix B). An assessment of the likely occurrence of these species within the study area is provided in Appendix C.
Of the threatened flora species identified in the database searches, based on habitat requirements the following two species were considered to have potential to occur at the site:

- Hairy Jointgrass (*Arthraxon hispidus*): Considered to have a moderate potential to occur in cleared paddocks to the west of Lawrence.
- Maundia (*Maundia triglochinoides*): Considered to have a moderate potential to occur within areas of ephemeral wetland to the west of the study area.

3.1.3.2 Survey Results

One threatened flora species, Durobby (*Syzygium moorei)* was recorded in Flo Clark Park which occurs on the southern bank of Sportsmans Creek (refer to Illustration 3.1). This tree has been planted and is of low conservation significance due to it occurring well outside its natural range (usually in lowland subtropical rainforest, north from the Richmond River). This tree may require removal as part of the Proposal.

No other threatened flora species were recorded in the study area during the survey. This includes the two targeted threatened flora species, Hairy Jointgrass (*Arthraxon hispidus*) and Maudia (*Maundia triglochinoides*) which have been recorded locally and were assessed as having potential to occur within the study area. Consequently, no assessments of significance were required for threatened flora species.

3.1.4 Endangered/ Threatened Ecological Communities

3.1.4.1 Database Results

The OEH Atlas of NSW Wildlife search indicated nine EECs occurring within the search area (10 kilometre radius around the site). Based on a review of aerial photographs covering the site and previous vegetation mapping, the following TECs/ EECs (marked in **bold**) were considered likely to occur at the site:

- Coastal Cypress Pine Forest in the NSW North Coast Bioregion.
- **Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions**.
- **Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions**.
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions.
- Lowland Rainforest on Floodplain in the NSW North Coast Bioregion.
- **Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion**.
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
- Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

The Protected Matters Search Tool also indicated that the TEC, Lowland Rainforest of Subtropical Australia as potentially occurring at the site. It was assessed that this TEC is unlikely to occur at the site.

3.1.4.2 Survey Results

Vegetation communities within the study area were not considered to represent any NSW State or Commonwealth listed TEC or EECs. Constructed drainage lines in the western portion of the study area contain flora assemblages that are indicative of the NSW State listed Freshwater Wetlands EEC, including commonly occurring rushes (*Juncus* spp.) and smartweeds (*Persicaria* spp.). However, drain maintenance and other agricultural practices for livestock and crop production have resulted in a substantially modified vegetation community that is not considered to meet the criteria of the Freshwater Wetlands EEC.

Consequently no assessments of significance were required for EECs/ TECs.

Information shown is for illustrative purposes only

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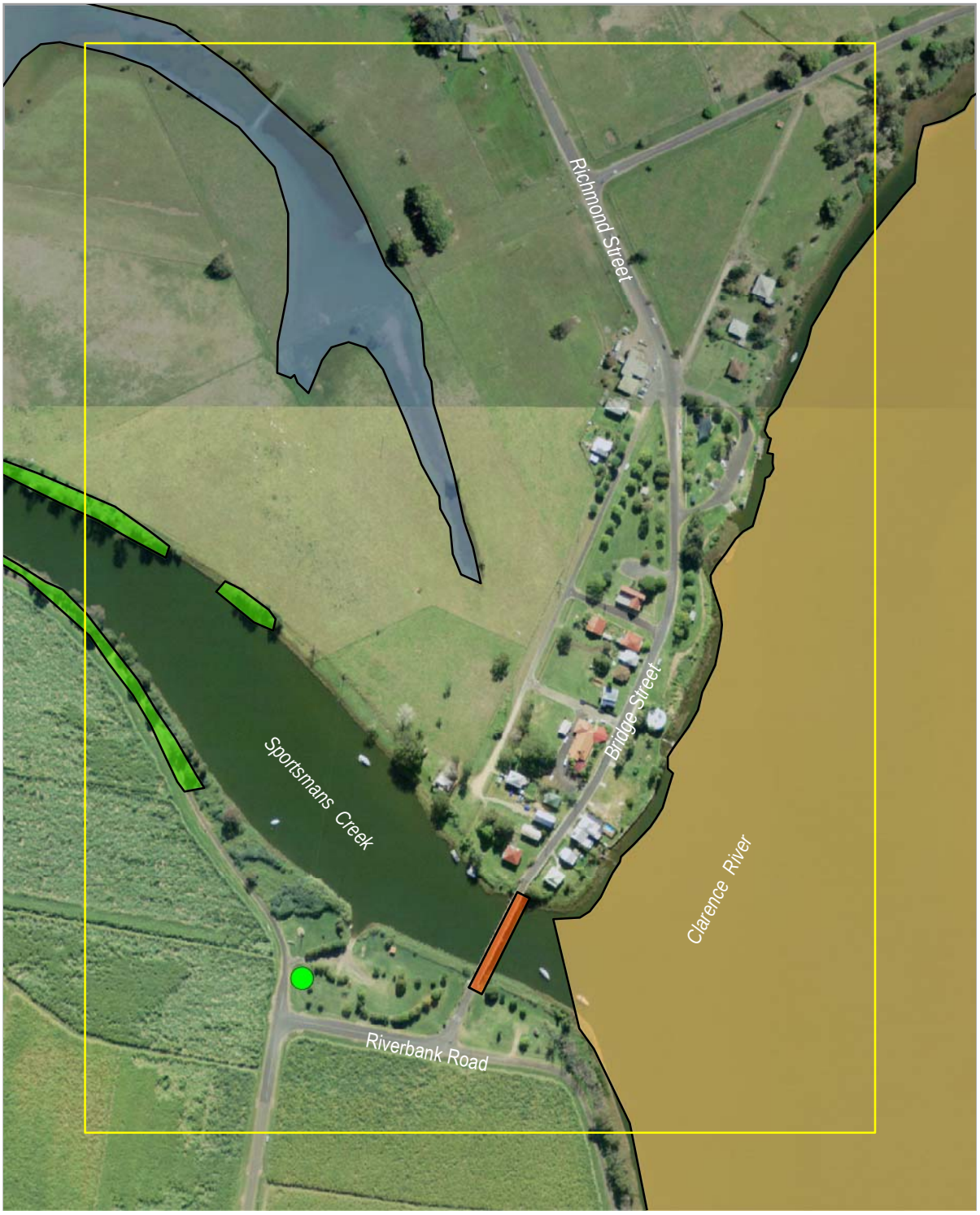
Source of base data: Kellogg Brown and Root



LEGEND

- Study area
- Existing Bridge - Represents known site of roosting colony of Large footed Myotis (TSC Act)
  Represents a potential non-breeding roosting habitat for the Eastern Osprey (TSC Act)
- Ephemeral Wetland - *Likely Freshwater Wetland Endangered Ecological Community* (TSC Act). To be confirmed during field surveys. Habitat value for listed threatened / migratory wetland bird species.
- Likely *Subtropical Coastal Floodplain Forest Endangered Ecological Community* (TSC Act)
  To be confirmed during field surveys
- Saltmarsh, Wetland of National Importance and Seagrass beds
- Planted threatened tree (Durobby)

North

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Ecological Constraints Associated with the Study Area

3.2 Fauna

3.2.1 Threatened Fauna

3.2.1.1 Microbat Impact Assessment

Sportsmans Creek Bridge was found to support a large and important Large-footed Myotis breeding colony. This species is listed as vulnerable under the TSC Act. Large breeding colonies are uncommon in the lower Clarence and are not in close proximity to the Sportsmans Creek Bridge (>10 kilometres along waterways). Surveys of drainage structures in the locality found that potential unoccupied alternative breeding roost drainage structures within the locality are uncommon and likely to have a lower roost carrying capacity to occupied sites.

Sportsmans Creek Bridge also offers potential non-breeding roosting habitat for two other threatened species; the Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii*).

3.2.1.2 Database Results

The OEH Atlas of NSW Wildlife search and Protected Matters Search Tool identified records of 43 threatened fauna species listed under the TSC Act and/ or EPBC Act previously recorded or having habitat within the search area (10 kilometre radius around the site) (refer to Appendix B). An assessment of the likely occurrence of these species within the study area is provided in Appendix C.

Of the threatened fauna species identified by the database searches, the following 16 species are considered to have a moderate or high potential to occur in the study area (based on habitat requirements) on occasion:

- Magpie Goose (*Anseranas semipalmata*).
- Australasian Bittern (*Botaurus poiciloptilus*).
- Black-necked Stork (*Ephippiorhynchus asiaticus*).
- Brolga (*Grus rubicund*).
- Pied Oyster Catcher (*Haematopus longirostris*).
- Comb-crested Jacana (*Irediparra gallinacean*).
- Black-tailed Godwit (*Limosa limosa*).
- Eastern Osprey (*Pandion cristata*).
- Grey-crowned Babbler (*Pomatostomus temporalis*).
- Australian Painted Snipe (*Rostralula benghalensis australis*).
- Estuary Rock Cod (*Epinephelus coioides) (discussed further in Section 3.2.6)*.
- Little Bentwing-bat (*Miniopterus australis)*.
- Eastern Bentwing-bat (*Miniopterus shreibersii*).
- Large-footed Myotis (*Myotis adversus)*.
- Large-eared Pied Bat (*Chalinolobus dwyeri*).
- Grey-headed Flying-fox (*Pteropus poliocephalus)*.

The species listed above would be likely to utilise the study area on occasion as part of a broader foraging area occurring in the locality.

3.2.1.3 Survey Results of Fauna Habitat Assessment

Apart from the Southern Myotis previously recorded on the existing Sportsmans Creek bridge, no threatened fauna species were recorded in the study area during the fauna habitat assessments. Based on a fauna habitat assessment of the study area it is considered unlikely that the study area represents a significant area of habitat for any of the above-listed threatened fauna species with the exception of a number of microbat species (refer to Section 3.2.1.1).

A number of threatened wetland bird species are regularly observed around Sportsmans Creek and its surrounds including the Black-necked Stork and Brolga. Although neither species was observed during field assessments, it is considered that both of these species have potential to utilise the ephemeral wetlands to the west of the study area for foraging. Nesting areas for both of these species are likely to be associated with the nearby Everlasting Swamps (G. Clancy, pers. comm 2013).

The existing bridge represents potential non-breeding roosting habitat for the Eastern Osprey which has been recorded nesting on a number of timber truss bridges on the north coast of NSW. There are no known records of Osprey utilising the Sportsmans Creek Bridge as a nesting site. However, a known Osprey nest is located adjacent to the Lawrence Road a few kilometres to the south of the site (G. Clancy, pers. comm 2013).

In reference to the likelihood of occurrence assessment (Appendix C), the potential impacts of the project upon threatened fauna species of moderate to high likelihood of occurrence are very minimal and in some instances negligible. Therefore 7-part Tests in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* are unlikely to be required for any of these species.

3.2.2 Migratory Species

A total of 31 migratory species listed under the EPBC Act were identified in the EPBC Protected Matters Search Tool for the search area. Eight are listed as 'migratory terrestrial species', 12 are listed as 'migratory wetland species' and 11 are listed as 'migratory marine species'. An assessment of the likely occurrence of these species within the study area is provided in Appendix C.

Although no listed migratory species were observed during field assessments, the following nine species are considered to have some potential to occur within the study area:

- Eastern Osprey.
- Fork-tailed Swift (*Apus pacificus*).
- White-bellied Sea Eagle (*Haliaeetus leucogaster*).
- White-throated Needletail (*Hirundapus caudacutus*).
- Rainbow Bee-eater (*Merops ornatus*).
- Satin Flycatcher (*Myiagra cyanoleuca*).
- Great Egret (*Ardea alba*).
- Cattle Egret (*Ardea ibis*).
- Latham's Snipe (*Gallinago hardwickii*).

In reference to the likelihood of occurrence assessment (Appendix C), the potential impacts of the project upon migratory species that are considered to have some potential to occur in the study area are very minimal and in some instances negligible. Therefore, significant impact assessments in accordance *Matters of National Environmental Significance - Significant Impact guidelines 1.1* are unlikely to be required for any migratory species.

3.2.3 Wildlife Corridors and Key Habitats

A review of NPWS wildlife corridor and key habitat mapping indicated no mapped wildlife corridors or areas of nominated key habitats associated with the study area. Field assessment of fauna habitat features supported these findings. Vegetation was found to be fragmented and lacking connectivity, apart from pasture grasses and the dense mat of understorey, weed-dominated vegetation adjacent to both sides of Sportsmans Creek.

Sportsmans Creek would however act as a regional corridor for bird species moving between habitats associated with the upstream reaches of Sportsmans Creek and the Everlasting Swamps and habitats associated with the lower Clarence River.

Lawrence and environs is described by Clarence Valley Birdos (2006) as being one of the Bird Routes of the Clarence Valley. The following species are listed as being potential occurrences in this area:

- Pied Oystercatcher.
- Brolga.
- Egrets.
- Waterbirds.
- Raptors.

3.2.4 Critical Habitat

A review of the OEH Critical habitat register (24/07/2013) found no areas of critical habitat relevant to the study area.

3.2.5 Endangered Populations

The following two endangered populations listed under the TSC Act were identified as occurring within 10 kilometres of the study area:

- Emu Population in the NSW North Coast Bioregion and Port Stephens local government area.
- *Allocasuarina inophloia* (F.Muell. and F.M. Bailey) L.A.S. Johnson Population in the Clarence Valley Local Government Area.

The site assessment found no evidence of either of these endangered populations which were assessed as highly unlikely to occur within the study area based on their habitat preferences.

3.2.6 Fisheries

A search of the NSW DPI (Fisheries) Records Viewer for threatened aquatic fauna did not find any records of threatened aquatic fauna in the vicinity of the study area. Previous studies for the existing Sportsmans Creek Bridge identified that the bridge would be likely to provide habitat for the Estuary Rock Cod (*Epinephelus coioides*) which is listed as protected under the *Fisheries Management Act 1994* (FM Act).

Additionally, Sportsmans Creek would provide habitat for a number of other fish species, including the Australian Bass (*Macquaria novemaculeata*) which would be likely to spawn within this estuary. The creek is a known breeding ground for crustaceans which were observed along with small fish in Sportsmans Creek during the fauna habitat assessment.

Sportsmans Creek is also included as part of an area of mapped Key Fish habitat within the CVC LGA. The construction of the bridge would be undertaken in a manner sensitive to fish habitat.

The results of previous studies and database searches were considered sufficient to inform this biodiversity assessment and as such aquatic field surveys were not considered necessary.

3.2.7 Fauna Habitat Assessment

Observations within the study area of fauna habitat features and resources are noted as follows, particularly in relation to the habitat requirements of threatened species recorded in the locality.

- Low species diversity of mostly exotic grasses and weeds dominate the vegetation cover. Three species of birds, i.e. Red-browed Finch (*Neochima temporalis*), Superb Fairy Wren (*Malurus cyaneus*) and Little Grassbird (*Megalurus gramineus*), were observed in the dense matt of Para Grass (*Urochloa mutica*) and Coastal Morning Glory (*Ipomoea cairica*) adjacent to Sportsmans Creek. The dense vegetation cover may also provide cover and breeding opportunities for ground dwelling birds and mammals. The lack of camouflage and tall, dense vegetation such as bullrushes and spikerushes is considered to make it unsuitable for the Australian Bittern (*Botaurus poiciloptilus*). No threatened ground dwelling birds and mammals have been recorded in the locality.

- Vegetation structure lacks complexity with regrowth of mostly low-growing, groundcover species dominating following past clearing of indigenous vegetation. This has created a general open landscape which lacks vegetation stratification and cover required by many fauna species.
- The native Common Reed (*Phragmites australis*) emerges in small, isolated patches from the dense mat of understorey vegetation on the southern creek bank. It offers only limited bird habitat value since dense stands are generally required as shelter for bird species.
- A single Brush Mistletoe (*Amylotheca dictyophleba*) was observed growing on a Camphor Laurel (*Cinnamomum camphora*). Mistletoes offer habitat for species such as mistletoe birds, honeyeaters, possums and invertebrates.
- Exotic pasture grasses cover parts of the site, particularly at the northern extent. Pasture grasses support commonly occurring herbivorous mammals such as macropods. No threatened macropod species have been recorded in the locality.
- Few trees are present to provide perching and roosting opportunities for birds. Most trees in the study area are exotic species occurring as isolated trees.
- Fruit from Camphor Laurel (*Cinnamomum camphora*) may support native birds such as fruit pigeons. No threatened bird species recorded in the locality are likely to rely on the fruit of this species.
- A basal cavity/ tree hollow was observed in an isolated Camphor Laurel (*Cinnamomum camphora*) near the northern extent of the site (refer to Plate 13 in Appendix E). A close examination of the hollow with the aid of a pointed metal probe and high-powered torchlight revealed no signs of fauna occupation. No tree stags or fallen logs were observed.
- Due to a lack of over-storey vegetation, leaf litter is generally sparse offering very little habitat for leaf litter dependant frogs and ground dwelling birds.
- No fauna scats were detected.
- No fauna tracks, diggings or burrows were detected.
- There were no obvious signs of fauna feeding.
- No scratch or claw marks were observed on smooth-barked trees.
- Vegetation connectivity exists in the dense matt vegetation adjacent to Sportsmans Creek which extends to the east and west. Otherwise, existing vegetation is generally fragmented.
- No significant surface rock, rock outcrops or ledges were observed to offer habitat for reptiles and ground-dwelling mammals. A small built rock wall on the southern side of the residential house block may support commonly occurring lizard species.
- Sportsmans Creek provides watering opportunities and aquatic habitat for a range of fauna. The creek and riparian area represents the zone with the greatest fauna habitat and habitat diversity.

3.3 Wetlands

3.3.1 Directory of Important Wetlands in NSW (DIWA) Spatial Database

Four Important Wetlands listed in the NSW DIWA Spatial Database were identified in the EPBC Act Protected Matters Search as occurring within a 10 kilometres radius of the site. These are:

- Clarence River Estuary.
- Everlasting Swamp.
- The Broadwater.
- Upper Coldstream.

Two of these wetlands occur in proximity to the study area namely, Everlasting Swamp which occurs approximately 500 metres west of the study area and the Clarence River Estuary which occurs within the Clarence River immediately east of the existing Sportsmans Creek Bridge. The location of nearby listed wetlands in relation to the study area is shown in Illustration 3.2.

3.3.2 SEPP 14 Coastal Wetlands

No occurrences of SEPP 14 Coastal Wetlands occur within the study area. The nearest SEPP 14 mapped areas are shown on Illustration 3.3.

3.3.3 Places on the Resister of the National Estate (RNE)

The following natural areas are listed on the RNE and occur in the locality:

- Lower Clarence River Area.
- Sportsmans Creek Proposed Nature Reserve.

Neither of these areas is located in proximity to the site.

3.3.4 Wetlands within the Study Area

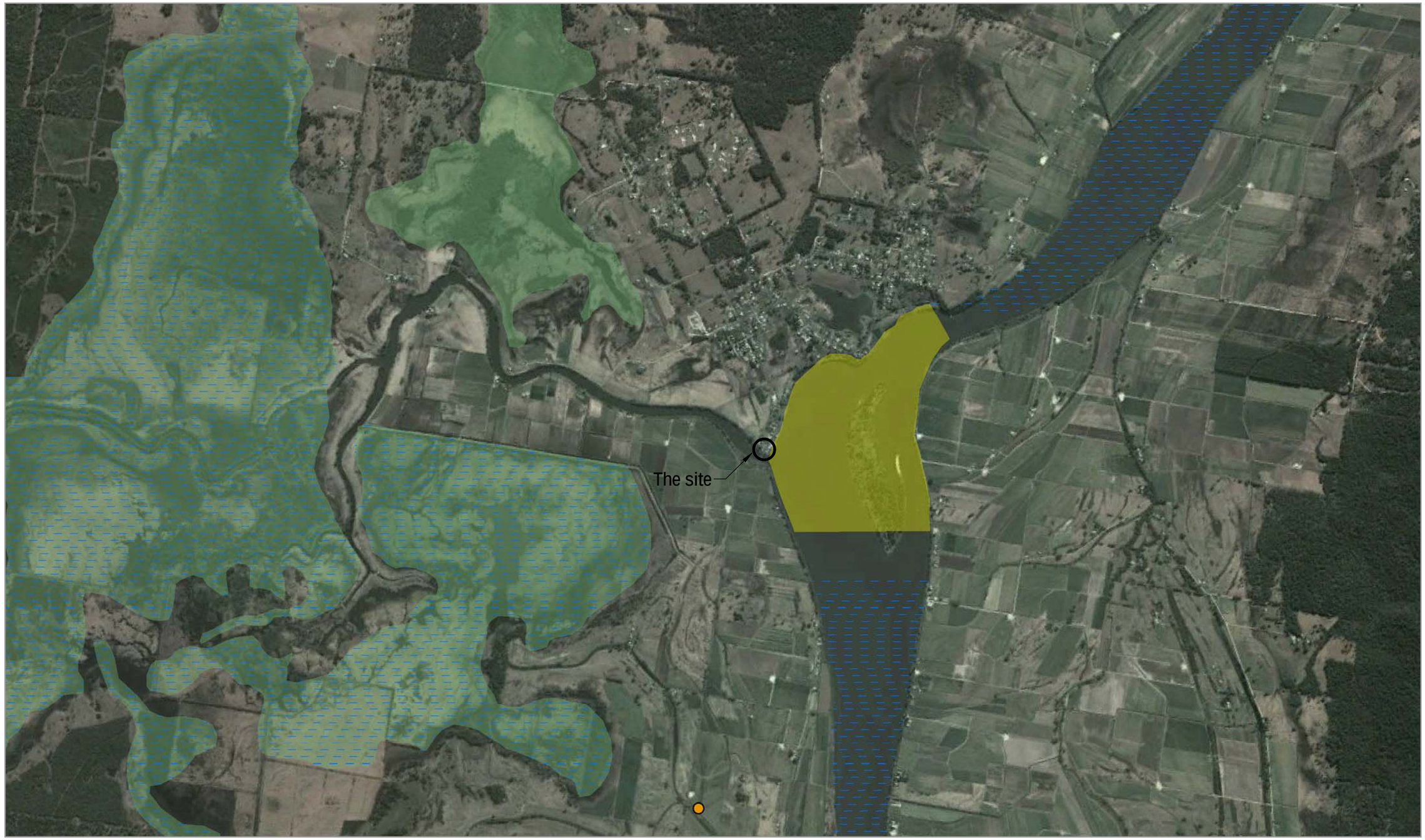
A review of aerial photographs indicates that wetland areas occur in the western portion of the study area (refer to Illustration 3.3). These wetland areas largely consist of constructed ephemeral drainage lines which drain excess water from farm paddocks to Sportsmans Creek. They occur on the periphery of the Little Broadwater system of wetlands, located to the west of the study area. Although not formally listed as Important Wetlands, the Little Broadwater system of wetlands are likely to have significant habitat value to locally occurring wetland bird species such as the Black-necked Stork (*Ephippiorhynchus asiaticus*) and Brolga (*Grus rubicund*) and other threatened/ migratory wetland birds listed in Section 3.2.

Constructed drainage lines within the study area contain flora assemblages that are indicative of the NSW State listed Freshwater Wetlands EEC, including commonly occurring rushes (*Juncus* spp.) and smartweeds (*Persicaria* spp.). However, these drainage lines occur on agricultural land zoned RU1, Primary Production, under the Clarence Valley Local Environmental Plan 2011. Drain maintenance and other routine agricultural practices for livestock and crop production have substantially impacted vegetation and fauna habitat values.

It is conceivable that threatened and migratory wetland birds may occasionally feed and otherwise occupy wetland drainage lines in the western portion of the study area. However, more suitable and relatively intact habitat exists for these species directly west of the study area in the Little Broadwater system of wetlands.

Information shown is for illustrative purposes only

Drawn by: KHP Checked by: RE Reviewed by: DGH Date: July 2014 Source of base data: Six Maps



LEGEND

- Migratory wading bird roost site (Clancy, 1993)
- Saltmarsh
- Swamp / land subject to inundation
- Wetlands of national importance

0 600

North

GeoLINK environmental management and design

Biodiversity Assessment: Sportsmans Creek New Bridge
2228-1018

Clarence Valley Council Wetland Mapping

Illustration 3.2

Information shown is for illustrative purposes only

Drawn by: KHP Checked by: RE Reviewed by: DGH Date: July 2014
Source of base data: Google Earth, 2004 (Accessed 25/07/13)

LEGEND

SEPP 14 Coastal Wetalnd

0 400

North

SEPP 14 Wetland Mapping

4

Impacts and Mitigation

4.1 Potential Biodiversity Impacts

The study area represents a highly modified agricultural landscape, cleared of indigenous vegetation. Remnant vegetation that remains is degraded and generally exhibits low diversity with significant weed cover. Fauna habitat values are generally low in terrestrial areas and medium in the aquatic environment associated with Sportsmans Creek.

A summary of anticipated biodiversity impacts are as follows:

- Removal of microbat roosting habitat, which would significantly affect the dependant Large-footed Myotis breeding colony.
- Direct mortality/injury to roosting microbats and potential to interrupt the peak breeding season and breeding success of the population during bridge demolition.
- Vegetation clearing of areas of planted landscape trees within Flo Clark Park and Sportsmans Park (refer to Plate 2 in Appendix E).
- Clearing of a number of avenue tree plantings including Jacaranda, Cadagi and Silky Oak (refer to Plate 11 in Appendix E).
- Clearing/ disturbance to an area of cleared pasture land to the west of Grafton Street on the northern side of Sportsmans Creek (refer to Plate 14 in Appendix E).
- One hollow-bearing tree is proposed to be removed, being a Camphor Laurel (*Cinnamomum camphora*) with a basal cavity near the northern end of the site. A close examination of the hollow with the aid of a pointed metal probe and high-powered torchlight revealed no signs of fauna occupation (refer to Plate 13 in Appendix E).
- Potential spread of noxious weeds although the occurrence and distribution of weed species is not likely to substantially increase and may be reduced as a result of weed control and landscaping works following construction.
- Fauna passage across the study area is not likely to be impacted.
- The construction of the new Sportsmans Creek bridge would have potential impacts to aquatic environments however implementation of standard water quality mitigation measure (refer to CEMP) would be likely to minimise such impacts. No aquatic fauna species would be likely to be significantly impacted by the proposal.
- The proposal would not impact on areas of high conservation value wetland areas or ephemeral wetlands in the western portion of the study area.
- There is not likely to be any significant impact on Key Threatening Processes listed in schedules of the FM Act or TSC Act.

4.2 Statutory Assessments

Seven-part Tests of Significance in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* for the Large-footed Myotis, Little Bentwing-bat and Eastern Bentwing-bat have been undertaken (refer to Appendix A). These assessments concluded:

- Large-footed Myotis: The proposal involves removal of habitat occupied by a large breeding colony. Although it is expected that the local Large-footed Myotis population will relocate to the habitat to be provided on the new bridge, in accordance with the precautionary approach adopted in accordance with OEH guidelines: *Threatened species assessment guidelines, The assessment of significance* (DECC, 2007), removal of the existing bridge is likely to significantly affect the local Large-footed Myotis population. Therefore a Species Impact Statement (SIS) for the Large-footed Myotis is required.
- Little and Eastern Bentwing-bats: A significant impact on these species is considered unlikely. No breeding habitat would be affected by the proposal and alternative potential roosting habitat in their non-breeding range in the lower Clarence is available to support the local potential occurrences of these species.

As mentioned previously, one Durobby tree (listed as Vulnerable under the TSC Act and EPBC Act) occurs within Flo Clark Park and may require clearing. As this species occurs well outside its range (usually in lowland subtropical rainforest, north from the Richmond River) a section 5A Assessment has not been completed for this species.

No other threatened or migratory flora/ fauna species or Endangered/ Threatened Ecological Communities listed under the TSC Act or EPBC Act are considered likely to be impacted by the proposal. As such no other Section 5A Assessments were considered necessary for this proposal.

4.3 Biodiversity Impact Avoidance and Mitigation

- Project safeguards for threatened microbats are detailed in the Microbat Impact Assessment (refer to Appendix A) and key project safeguards include the provision of alternative roosting habitat on the new bridge; and staged microbat exclusion on the old bridge prior to demolition outside the Large-footed Myotis breeding period. These methods have been effective on other similar bridge and culvert works projects involving breeding Large-footed Myotis colonies. Monitoring pre, during and post exclusion is also proposed to ensure any issues can be identified and addressed at the earliest possibility.
- Bridge construction is to be undertaken in accordance with Fish Passage Requirements for Waterway Crossing (NSW DPI, 2003) to minimise impacts to fish habitat.
- Tree Protection Zones (TPZ) zones should be implemented around trees to be retained in proximity to the proposed works in accordance with the Australian Standard AS 4970-2009 Protection of trees on development sites to prevent machinery impacts to trees.
- To minimise flora and fauna impacts from construction activities, vegetation clearing and riparian zone management should be undertaken in accordance with the NSW Roads and Traffic Authority 2011, *Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects*, RTA Environmental Branch.
- To minimise sedimentation impacts to waterways and wetlands, controls should be implemented in accordance with the NSW Roads and Traffic Authority 2008, *Erosion and Sedimentation Management Procedure*, v2.

4.4 Opportunities to Enhance Biodiversity Values

Any landscape plantings following construction in the riparian zone of Sportsmans Creek should be indigenous riparian plantings sourced from local propagation stock. Since the Sportsmans Creek aquatic and riparian zone has the highest biodiversity and conservation values in the study area, this area should be prioritised for vegetation rehabilitation works. Species selections should also consider the habitat requirements of locally occurring threatened and migratory species.

Subject to resource and funding availability, an opportunity exists for broader rehabilitation of the Sportsmans Creek riparian area in a planned and staged manner.

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Appendix A

Microbat Impact Assessment

Mircobat Impact Assessment

Construction of a new Sportsmans Creek Bridge and Demolition of the existing Sportsmans Creek Bridge

quality solutions sustainable future

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Microbat Impact Assessment

Construction of a new Sportsmans Creek Bridge and Demolition of the existing Sportsmans Creek Bridge

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UPR	*Description*	*Date Issued*	*Issued By*
2311-1005	Version 1	21/03/2014	David Havilah
2311-1010	Version 2	12/08/2014	Veronica Silver

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Executive Summary

NSW Roads and Maritime Services (RMS) propose to demolish and replace the existing bridge over Sportsmans Creek, located on the southern approach to the village of Lawrence within the Clarence Valley Council (CVC) Local Government Area (LGA). This assessment aims to assess the impacts of the Proposal on threatened microbats listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/ or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The methodology for this assessment comprised desktop assessment and field surveys. Field surveys comprised targeted microbat surveys at Sportsmans Creek Bridge and surveys for other Large-footed Myotis (*Myotis macropus*) breeding colonies within drainage structures within a 10 km radius of the site.

Sportsmans Creek Bridge was found to support a large and important Large-footed Myotis breeding colony. This species is listed as vulnerable under the TSC Act. Large breeding colonies are uncommon in the lower Clarence and are not in close proximity to the Sportsmans Creek Bridge (>10 km along waterways). Surveys of drainage structures in the locality found that potential unoccupied alternative breeding roost drainage structures within the locality are uncommon and likely to have a lower roost carrying capacity to occupied sites.

Sportsmans Creek Bridge also offers potential non-breeding roosting habitat for two other threatened species; the Little Bentwing-bat (*Miniopterus australis*) and Eastern Bentwing-bat (*Miniopterus schreibersii*). These species may utilise the bridge as non-breeding roosting habitat.

Key potential Proposal impacts include:

- Removal of microbat roosting habitat, which would significantly affect the dependant Large-footed Myotis breeding colony.
- Direct mortality or injury during demolition.

Key project safeguards include the provision of alternative roosting habitat on the new bridge; and staged microbat exclusion on the old bridge prior to demolition outside the Large-footed Myotis breeding period. These methods have been effective on other similar bridge and culvert works projects involving breeding Large-footed Myotis colonies. Monitoring pre, during and post exclusion is also proposed to ensure any issues can be identified and addressed at the earliest possibility.

Seven-part Test of Significance Assessments in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* for the Large-footed Myotis, Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bathave been undertaken. The assessment concluded:

- Large-footed Myotis: The Proposal involves removal of habitat occupied by a large breeding colony. Although it is expected that the local Large-footed Myotis population will relocate to the habitat to be provided on the new bridge, in accordance with the precautionary approach adopted in accordance with OEH guidelines: *Threatened species assessment guidelines, The assessment of significance* (DECC, 2007), removal of the existing bridge is likely to significantly affect the local Large-footed Myotis population. Therefore a Species Impact Statement (SIS) for the Large-footed Myotis is required.
- Little and Eastern Bentwing-bats and Large-eared Pied-bat: A significant impact on these species is considered unlikely. No breeding habitat would be affected by the Proposal and alternative potential roosting habitat in their non-breeding range in the lower Clarence is available to support the local potential occurrences of these species.

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1 Introduction

1.1 Background

NSW Roads and Maritime Services (RMS) propose to demolish and replace the existing bridge over Sportsmans Creek, located on the southern approach to the village of Lawrence within the Clarence Valley Council (CVC) Local Government Area (LGA) (refer to Illustration 1.1). Lawrence is located 25 km north of Grafton on Lawrence Road (MR152), which is managed and maintained by CVC.

The existing Sportsmans Creek Bridge is located at the mouth of Sportsmans Creek, approximately 40 m from where it adjoins the Clarence River. It was built in 1911 and is 91.7 m in length. It consists of three timber beam approach spans and two timber Dare Truss spans. The bridge is a wide single lane structure with a carriageway of 5.5 m.

The locality comprises mostly cleared floodplain used for agriculture (sugar cane and grazing). Native vegetation in proximity to the existing bridge is limited to scattered trees.

The existing bridge is to be replaced under the RMS Timber Truss Heritage Conservation Strategy (2012) which has been endorsed by the NSW Heritage Office. Replacement of this bridge relates to issues of poor sight distance, poor alignment and no pedestrian access. Additionally, the bridge presents significant transport limitations at the present and in the future due to its geometry and design limitations.

The Proposal involves two key components:

- Construction of a new concrete bridge, located approximately 120 m west (upstream) of the existing bridge. The bridge will be a concrete 'super T' design' with a total length of approximately 145 m. Concept designs of the proposed new bridge are shown in Appendix A.
- Demolition of the existing timber bridge upon completion of construction of the new bridge.

The study area comprises Sportsmans Creek timber truss bridge, the location of the new proposed Sportsmans Creek Bridge (approximately 120 m west/ upstream), the realigned section of road north to Richmond Street and south to Riverbank Road and the approaches (refer to Illustration 1.2).

The purpose of this report is to assess the impacts of the Proposal on threatened microbats (Order Chiroptera; Suborder Microchiroptera) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/ or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Sportsmans Creek Bridge is known to support a Large-footed Myotis (*Myotis macropus*) breeding colony (Ecotone 2007). This species is listed as 'Vulnerable' under the TSC Act.

Information shown is for illustrative purposes only

Drawn by: GJM Checked by: VJS Reviewed by: DGH Date: August 2014
Source of base data: Tyndale 95384N and Maclean 95393S 1:25,000 Topographic Maps

0 2 km

North

Site Locality

GeoLINK environmental management and design

Microbat Impact Assessment - Construction of a new Sportsmans Creek Bridge and Demolition of the existing Sportsmans Creek Bridge
2311-1005

Illustration 1.1

Drawn by: DSA Checked by: VJS Reviewed by: DGH Date: August 2014
Source of base data: Kellogg Brown and Root

Information shown is for illustrative purposes only

LEGEND

Study area

North

0 100

Study Area

GeoLINK environmental management and design

Microbat Impact Assessment - Construction of a new Sportsmans Creek Bridge and Demolition of the existing Sportsmans Creek Bridge

2311-1007

Illustration 1.2

2 Methodology

2.1 Methodology

The methodology for this assessment comprised desktop assessment and field surveys.

2.1.1 Desktop Assessment

A desktop assessment was undertaken to identify threatened microbat records relevant to the Proposal. This included:

- A search on the EPBC Protected Matters Search Tool for federally listed threatened microbat species known or predicted to occur within a 10 km radius of Sportsmans Creek Bridge (search date: 10/03/2013).
- A search on the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database to identify threatened microbat records within 10 km of Sportsmans Creek Bridge (search date: 10/03/2013).
- Review of D&D Consultants (2002) *Terrestrial and Aquatic Flora and Fauna Assessment: Proposed Replacement of the Sportsmans Creek Bridge, Lawrence*.
- Review of Ecotone (2007) *Bat Survey and Impact Assessment: Sportsmans Creek Bridge, Lawrence NSW*.

2.1.2 Field Surveys

Field surveys comprised targeted microbat surveys at Sportsmans Creek Bridge and surveys for other Large-footed Myotis breeding colonies within a 10 km radius of the site. The surveys were undertaken between December 2013 and February 2014.

2.1.2.1 Sportsmans Creek Bridge Surveys

Direct inspections of the bridge for roosting microbats were undertaken on 16 December 2013 and 3 February 2014. This involved torch and pole mounted camera inspection of the entire bridge for roosting microbats from a boat with scaffolding at spans/ piers over water; and a ladder at spans/ piers over land. The two inspection periods were proposed to coincide with the two Large-footed Myotis breeding events in the north coast of NSW (October to mid-April inclusive). The following information was recorded:

- Potential microbat roosting features.
- Species present.
- Location and size of any microbat colonies.
- Description of occupied roost sites.
- Breeding status of microbats recorded.

2.1.2.2 Surveys for other Large-footed Myotis Breeding Colonies

Surveys for other Large-footed Myotis breeding colonies within a 10 km radius of the site involved direct inspection (torch searches) of other accessible road drainage structures (bridges and culverts > 500 mm diameter) on public land within the search area. The drainage structures were identified via GIS analysis (topographic maps and aerial photographs), targeting drainage structures adjacent to open water. The surveys were undertaken on 3 and 4 February 2014, with the following information recorded at each site:

- Potential microbat roosting features.
- Species present.
- Location and size of any microbat colonies.
- Description of occupied roost sites.
- Breeding status of microbats recorded.

A dwelling at the new bridge site which is proposed to be demolished was also inspected on 30 January 2014. While the Large-footed Myotis may also occupy tree hollows as breeding roost sites (Campbell, 2009), no hollow-bearing trees occur within the study area and are uncommon across the majority of the locality.

2.1.2.3 Survey Conditions

Weather conditions during the surveys were dry, warm and humid. No significant rainfall events (> 50 mm in a single event) had been experienced since late November 2013 (Bureau of Meteorology website: www.bom.gov.au).

2.1.2.4 Survey Limitations

The main limitation of this assessment is associated with microbat species behaviour/ ecology. Microbat roosts are important for providing shelter, protection from predators and an appropriate microclimate for energy conservation and reproduction. To satisfy different seasonal and lifecycle requirements and to respond to ecological interactions with other species (e.g. parasites), microbats often make use of multiple roosting sites, shifting between roosts regularly (Evans, 2009), though this varies per species and is dependent on lifecycle periods. To counter these limitations, this assessment has used both desktop assessment and two seasonal surveys of Sportsmans Creek Bridge to maximise the validity of that information gathered for which the impact assessment is based.

3

Results

3.1 Desktop Assessment

Threatened microbat species recorded from the desktop assessment and their roosting habitats are listed in Appendix B. One threatened microbat, the Large-eared Pied Bat (*Chalinolobus dwyeri*), was identified in the EPBC Protected Matters Search Tool database search as '*Species or species habitat may occur within area*'. Five threatened microbat species were identified from the Atlas of NSW Wildlife database search: Hoary Wattled Bat (*Chalinolobus nigrogriseus*), Little Bentwing-bat (*Miniopterus australis*), Large-footed Myotis, Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Eastern Cave Bat (*Vespadelus troughtoni*).

An ecological survey at Sportsmans Creek Bridge in 2002 recorded a colony of Large-footed Myotis numbering eight to 15 individuals in span 3. Anabat analysis conducted by D and D Consultants in 2002 also recorded 'probable' Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bentwing-bat (*Miniopterus schreibersii*) recordings (2002). D and D Consultants (2002) note however that no bat species recorded in the area, other than the Large-footed Myotis colony, appeared to use the bridge as a roost. The Large-eared Pied Bat and Eastern Bentwing-bat anabat recordings were therefore of foraging individuals.

A microbat survey at Sportsmans Creek Bridge in 2007 recorded a colony of >30 Large-footed Myotis in span 2. The survey found the bridge to support a number of potential microbat roost sites across the bridge. The Large-footed Myotis and Little Bentwing-bat were also recorded foraging below the bridge (Ecotone 2007).

Appendix B shows the threatened microbat species known or potentially occurring within the locality, Sportsmans Creek Bridge provides known/ potential roosting habitat for three species:

- Large-footed Myotis: Provides known breeding roosting habitat.
- Little Bentwing-bat: Provides potential non-breeding roosting habitat.
- Eastern Bentwing-bat: Provides potential non-breeding roosting habitat.
- Large-eared Pied Bat (*Chalinolobus dwyeri*): Provides potential non-breeding roosting habitat in bird nests under bridge.

These species are listed as 'Vulnerable' under the TSC Act, with Large-eared Pied Bat (*Chalinolobus dwyeri*) also listed as 'Vulnerable' under the EPBC Act. Profiles of these species are provided in Section 6.

3.2 Field Survey Results

3.2.1 Sportsmans Creek Bridge Surveys

Potential Microbat Roosting Habitat

Potential microbat roosting habitat occurs throughout Sportsmans Creek Bridge and includes:

- Split (two piece) stringers (refer to Plate 3.1). These features are common across the bridge.
- Decking gaps (i.e. below longitudinal decking, between transverse decking and most above or directly adjacent to the middle three stringers) (refer to Plate 3.2). These features are common across the bridge.
- Rotted timber features (primarily girder) (refer to Plate 3.3). Uncommon feature 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.

No hollow-bearing trees, caves or mines occur within the study area. While a local building may provide roosting opportunities for some microbat species, inspection of the dwelling proposed for demolition as part of the Proposal failed to record any bats. The potential for the dwelling affected by the Proposal to provide significant threatened microbat roosting habitat is low.

Plate 3.1 Two piece (split) stringer

Plate 3.2 Large-footed Myotis roosting in bridge decking

Plate 3.3 Cavity at the end of a rotted girder

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 coastal landscapes. Aquatic foraging habitat for the Large-footed Myotis is present locally, including Sportsmans Creek and the Clarence River. Aerial and aquatic microbat foraging habitat of similar value occurs throughout the locality.

Microbats at Sportsmans Creek Bridge

The results of the Sportsmans Creek Bridge microbat surveys are provided in Appendix C. Approximately 300 Large-footed Myotis were recorded roosting at Sportsmans Creek Bridge during both the December 2013 and February 2014 surveys (numbering 308 and 301 respectively). No other microbat species were recorded. Twenty-one roost sites within the bridge were recorded (19 in December 2013 and nine in February 2014); all located above the water in spans 2 and 3. Occupied roosting habitat features included:

- Split (two piece) stringers: Six in total.
- Decking gaps: Twenty in total.

Occupied cavities ranged between 11 and 108 mm wide, with an average of approximately 39 mm. Other sections of the bridge supported similar structures, providing potential bat roosting habitat however were not occupied at the time of the survey. This included some areas showing signs of previous usage (stained/ 'polished' timber).

The Large-footed Myotis population comprised adults and young indicating a breeding population. Population fluctuations would be expected throughout the year with a peak in late February/ March following the completion of the second seasonal birthing period (the number of new born bats during the second survey were low suggesting the second seasonal birthing period was not complete).

3.2.1.1 Surveys for Other Large-footed Myotis Breeding Colonies

The results of the surveys for other Large-footed Myotis breeding colonies within a 10 km radius of the site are provided in Appendix C. Site visits were undertaken at 66 drainage structures (five bridges and 61 culverts – refer to Illustration 3.1), of which 55 were able to be inspected for microbats. The remaining 11 drainage structures (all culverts) were unable to be inspected due to access constraints (e.g. inlet on private property; outlets with floodgates, etc). Most of these however were located in floodplain environments and susceptible to complete inundation, reducing their potential to support Large-footed Myotis breeding colonies.

Microbats or evidence of microbat occurrence was recorded in ten drainage structures (three bridges and seven culverts). Three microbat species were recorded:

- Large-footed Myotis: Recorded at three drainage structures, with one non-breeding colony (Poverty Creek Bridge) and two breeding colonies recorded (pipe culvert – Pringles Way and Shark Creek Bridge – Pacific Highway - refer to Section 3.2.1.3). Evidence of microbat activity was also recorded at Coldstream Bridge (Pacific Highway) which is reported to also support a Large-footed Myotis colony (refer to Section 3.2.1.3).
- Chocolate Wattled Bat (*Chalinolbus gouldii*): Two non-breeding colonies were recorded at two culverts, numbering three and nine bats.
- Little Bentwing-bat: An individual was recorded at one drainage structure (pipe culvert).

Five microbats (likely to comprise a non-breeding colony) were also recorded at another pipe culvert, though were unable to be identified due to the depth of water in the channel inhibiting access. Small guano accumulations were present at another two culverts evidencing usage by a small number of microbats or irregular usage.

Most of the inspected drainage structures support potential microbat roost features (e.g. rough concrete, culvert cell joins and lift holes), however offered low suitability as important roost features for threatened microbats due to their high flood susceptibility and presence of only exposed roost opportunities etc.

3.2.1.2 Other Local Large-footed Myotis Breeding Colonies

Sportsmans Creek Bridge provides non-breeding roosting habitat for four threatened microbat species however it is known to support a large and important Large-footed Myotis breeding colony. Large breeding colonies are uncommon in the lower Clarence and are not in close proximity to the Sportsmans Creek Bridge (>10 km along waterways which is how Large-footed Myotis would be expected to disperse). Other local Large-footed Myotis breeding colonies are therefore addressed further (whereas other local threatened microbat colonies are not).

In addition to Sportsmans Creek Bridge, three other Large-footed Myotis breeding colonies were recorded or are known to occur within a 10 km radius of Sportsmans Creek Bridge (refer to Table 3.1 and Illustration 3.1). Only three of the other drainage structures inspected (all culverts) were considered to provide potentially suitable Large-footed Myotis breeding habitat (refer to Appendix C), though were not occupied by this species during the survey and offer potential habitat only for small colonies (<30 bats). Three other known Large-footed Myotis breeding colonies in the lower Clarence River area are listed in Table 3.2 and shown in Plate 3.4.

Table 3.1 Known Large-footed Myotis Populations Within 10 km of Sportsmans Creek Bridge

Structure Name	*Structure Type*	*Population Size*	*Direct Distance (km)*	*Direct Along Waterways (km)*
Coldstream Bridge (Pacific Highway)	Concrete bridge	Unknown	7.4	13.8
Shark Creek Bridge (Pacific Highway)	Concrete plank bridge	> 300	8.8	16.8
Pipe culvert – Pringles Way (4 x 1,800 mm diameter pipes)	Reinforced concrete pipe culvert	> 20	4.1	6.1

Table 3.2 Other Large-footed Myotis Populations in the Lower Clarence > 10 km from Sportsmans Creek Bridge

Structure Name	*Structure Type*	*Population Size*	*Direct Distance (km)*	*Distance Along Waterways (km)*
McFarlane Bridge (Lawrence Road)	Timber Bridge	Varies between 200 and >600	10.3	11.4
Mororo Bridge (Pacific Highway)	Concrete bridge	Approximately 30	21.1	>23
Oyster Creek Channel	Unknown	Unknown	22.2	>33

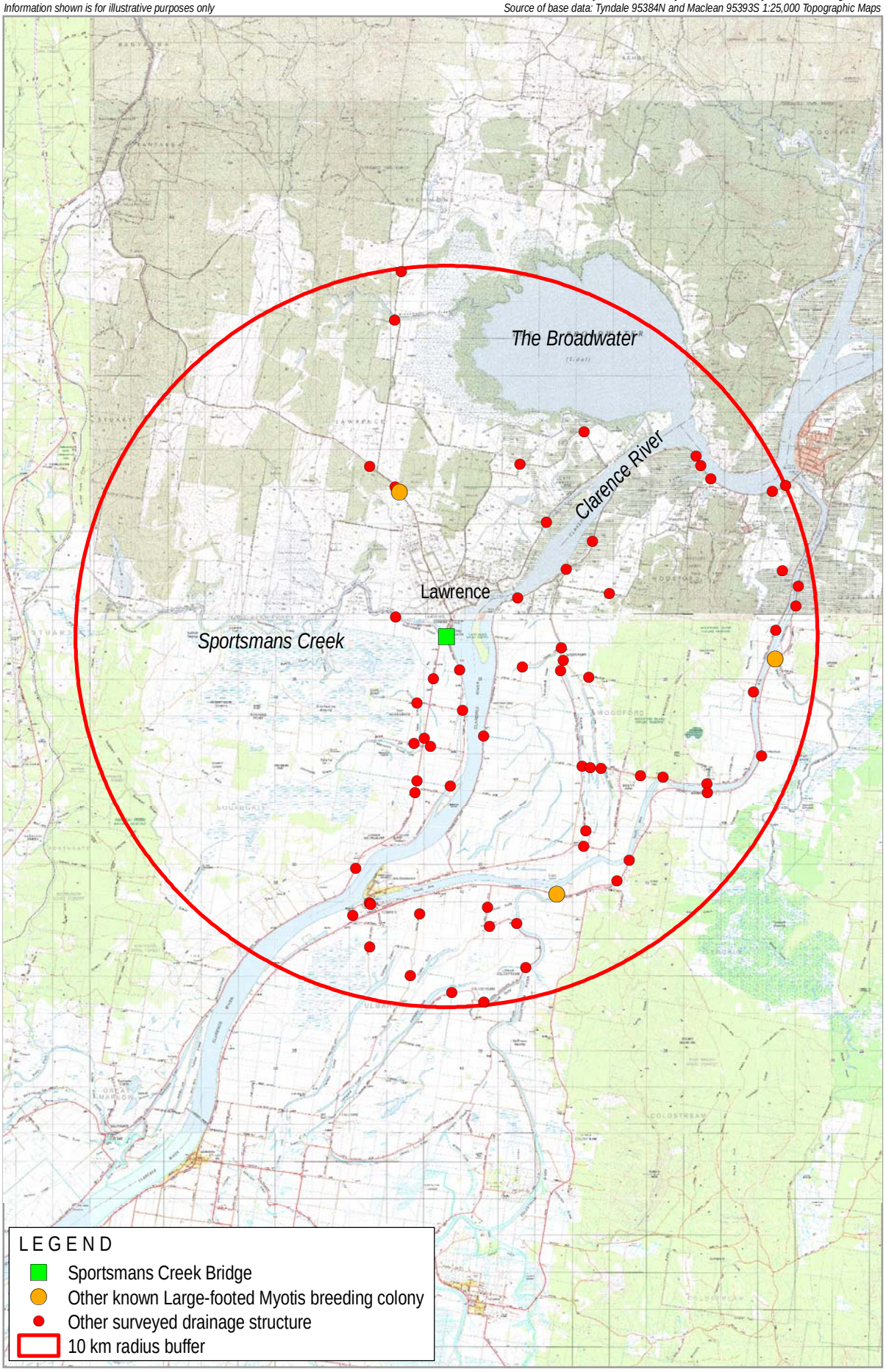
There are no known cave or other subterranean (e.g. disused mines or tunnel) roosting opportunities within the locality for the Large-footed Myotis and the other threatened microbat species. Hollow-bearing trees are uncommon as the local landscape is largely cleared. While Large-footed Myotis hollow-bearing tree breeding roosts may occur within the locality, they are unlikely to support large populations (e.g. > 30 bats).

Plate 3.4 Known Large-footed Myotis breeding colonies in the lower Clarence

Source: Google Earth 2014

Information shown is for illustrative purposes only

Drawn by: GJM Checked by: VJS Reviewed by: DGH Date: August 2014
Source of base data: Tyndale 95384N and Maclean 95393S 1:25,000 Topographic Maps



Surveyed Drainage Structures and Known Large-footed Myotis Breeding Colonies

0 3 km

North

3.3 Discussion of Sportsmans Creek Bridge Threatened Microbat Roost Values

Sportsmans Creek Bridge supports a large and important Large-footed Myotis breeding colony. Large breeding colonies are uncommon in the lower Clarence and are not in close proximity to the Sportsmans Creek Bridge (>10 km along waterways which is how Large-footed Myotis would be expected to disperse). Surveys of drainage structures in the locality found that potential unoccupied alternative potential breeding roost drainage structures within the locality are uncommon and likely to have a lower roost carrying capacity than occupied sites.

While some Myotis genetic exchange is likely to occur between the Sportsmans Creek Bridge and other Large-footed Myotis populations in the lower Clarence, the Sportsmans Creek Bridge population must be considered a single population (the subject) for the purposes of the impact assessment (refer to Section 4). This is based on the findings of Campbell *et al., (*2009) which:

- Suggested that distances covered while foraging may not be a good indicator of dispersal capabilities (Large-footed Myotis can travel up to 22 km between foraging and day roost sites within a single night (Caddle, 1998, cited in Cambell *et al.,* 2009).
- Found significant genetic structuring between Large-footed Myotis populations 15 km apart (along waterways) in a modified agricultural landscape with degraded riparian zones (Campbell *et al.,* 2009), similar to that in the locality.

Other potential important roost values of Sportsmans Creek Bridge for the Clarence region Large-footed Myotis population include:

- Refuge during permanent or temporary loss of other roost sites (e.g. flood inundation).
- Forms part of a network of roosts within the lower Clarence in nightly movement distance of each other to facilitate broad range dispersal.

Sportsmans Creek Bridge also provides potential non-breeding roosting habitat for the Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied Bat.

4 Impact Assessment

4.1 Potential Impacts

Potential impacts of the Proposal on threatened microbats are listed in Table 4.1. They are divided into 'direct impacts' (those that directly affect habitat and individuals) and 'indirect impacts' (occur when project-related activities affect habitat and individuals in a manner other than direct loss). Key potential impacts include habitat removal which is likely to have a significant impact on the subject Large-footed Myotis population and potential mortality/ injury during demolition. Safeguards and management measures to alleviate potential impacts are listed in Table 4.1 and discussed in detail in Section 5.

Table 4.1 Potential Impacts of the Proposal on Threatened Microbats

Potential Impact (risk)	*Impacts to the Large-footed Myotis*	*Impacts to the Subject Bentwing-bats and Large-eared Pied Bat*	*Safeguards and Management Measures*
Direct Impacts			
Habitat Removal (definite) The Proposal will result in the demolition of the existing timber Sportsmans Creek Bridge and replacement with a new concrete bridge approximately 120 m upstream. The demolition is proposed to commence post completion of the new bridge.	Significant – the Proposal will see removal of habitat occupied by a large Large-footed Myotis breeding colony. The colonies response is unknown but potentially includes adoption of alternative roosting habitat within the locality, either as a single unit or fragmented into smaller groups. Alternative roosting habitat locally is mainly provided by culverts, most of which are susceptible to flooding which poses a risk to the future breeding success of the population. The colony or part thereof may also disperse and join part of other colonies in the broader locality (e.g. McFarlanes Bridge). The species ability to do this is however unknown.	Low – the Proposal will see removal of potential non-breeding roosting habitat. No breeding habitat would be affected and alternative habitat is available in the region for use as seasonal non-breeding roosting habitat.	▪ Provide alternative roosting habitat on the new bridge. ▪ Reproduce as closely as possible the current roosting spaces, particularly those that hold large numbers of bats.

Potential Impact (risk)	*Impacts to the Large-footed Myotis*	*Impacts to the Subject Bentwing-bats and Large-eared Pied Bat*	*Safeguards and Management Measures*
Mortality or Injury during Demolition (high) The Proposal poses a high risk of mortality and injury to microbats roosting at the bridge during demolition. There is a particular risk to juvenile bats if the demolition or exclusion works were scheduled during the Large-footed Myotis breeding period or when juveniles are flightless and dependent.	Potentially significant – Sportsmans Creek Bridge supports a large Large-footed Myotis breeding colony.	Potentially significant – Sportsmans Creek Bridge offers potential non-breeding roosting habitat. None of these species were recorded during the summer surveys. The potential for Bentwing species to occur is greatest over winter.	▪ Provide alternative roosting habitat on the new bridge. ▪ Undertake staged exclusion of microbats from the old bridge prior to demolition and outside the Large-footed Myotis breeding period, when juveniles are flightless and dependent. ▪ April to August is the optimal time to demolish the bridge to avoid impacts on the Myotis breeding population. While programming works to avoid torpor periods plus Myotis breeding season (spring / summer) is desirable, avoiding significant cold may not be achievable. ▪ Where > 20 microbats are present at the time of exclusion devices installation, install exclusion devices at nights after fly-out. ▪ Check exclusion devices to avoid bat entrapment or breaches. ▪ Ecologist to be present during exclusion installation to ensure the welfare of animals is maintained; and available for call-outs during demolition.

Potential Impact (risk)	*Impacts to the Large-footed Myotis*	*Impacts to the Subject Bentwing-bats and Large-eared Pied Bat*	*Safeguards and Management Measures*
Fly-way Impacts (unlikely) The new bridge will be of a similar height above the water as the old bridge, with similar distances between piers. No fly-way impacts are considered likely.	Unlikely	Unlikely	N/A
Indirect Impacts			
Foraging Habitat Degradation (low) The Proposal affects existing cleared land in an agricultural area. No forest/ woodland habitats would be affected. During the construction stage of the Proposal there is a risk of water quality impacts which could reduce the foraging habitat values of local waterways for the Large-footed Myotis (e.g. from chemical spills, erosion and turbidity impacts, etc). Construction works would however be undertaken in accordance with RMS QA *Specification G36 Environmental Protection* ensuring the risk and the magnitude of potential indirect impacts that may affect the foraging carrying capacity of the study area is low. Post construction it is unlikely that the flow of Sportsmans Creek Bridge would be modified to the point of affecting the foraging habitat values of Sportsmans Creek.	Low	Low	N/A – Managed under Proposal Part 5A *Environmental Planning and Assessment Act 1979* environmental assessment.

5

Safeguards and Monitoring

5.1 Safeguards and Mitigation Measures

Table 5.1 describes safeguards and mitigation measures proposed to be implemented as part of the Proposal which aim to minimise the impacts on threatened microbat species, particularly the Large-footed Myotis. They were developed and refined during a meeting with the RMS Project Team on the 19 February 2014, attended by the Project Manager, bridge designers, construction managers, GeoLINK ecologists, RMS environmental (including biodiversity) officers and CVC staff responsible for the long-term management of the bridge. The aim of the meeting was to identify safeguards and best practice microbat management that would enable the project to proceed and ensuring safeguards were within realistic construction limitations (including constructability issues, time and budget constraints, etc). These safeguards collectively form part of the 'Proposed Activity' in the statutory assessments in Section 6. Impacts to non-threatened microbat species that may potentially roost at the bridge will also be managed through implementation of these safeguards.

Key project safeguards include the provision of alternative roosting habitat on the new bridge; and staged microbat exclusion on the old bridge prior to demolition, outside the breeding season. These methods have been effective on other similar bridge and culvert works projects involving breeding Large-footed Myotis colonies (Ecotone, 2001; Hoye and Hoye, 1999; GeoLINK 2014; David Andrighetto, GeoLINK, pers. obs.).

The design of the permanent alternative habitat on the new bridge is yet to be finalised. It is proposed to comprise a long-lasting lattice structure (or similar) with design features similar to that of the four chamber (Hollow Log Home designed) bat boxes used at McFarlane Bridge, Mororo Bridge, and Binna Burra culvert replacement, which have all supported breeding Large-footed Myotis colonies (GeoLINK, 2014; unpublished), though designed and constructed to offer longer-lasting durability. Lattice structures have been successful in providing alternative Large-footed Myotis breeding habitat on other projects (Marshall, 2011). The final design of the alternative roosts would be developed following advice from a bat ecologist in consultation with the Project Team. The alternative roosts are proposed to be installed in several locations in span three of the new bridge (refer to Plate 5.1), which offers the best flood immunity, lowest risk of human encounters and is positioned in the middle of the bridge over water.

Microbat safeguards that were considered and ultimately rejected during the project meeting include:

- Retention of the existing bridge (or part of). Dismissed due to asset management and public liability issues.
- Provisions of alternative roosting habitat on the river bank. Dismissed as considered unlikely to be as effective as alternative habitat below the new bridge. Also management issues due to the flood susceptibility of the local landscape.
- Provisions of alternative roosting habitat on the new bridge via bat boxes only. Despite uptake of multiple-chambered (Hollow Log Home designed) microbat boxes and usage as breeding roosting habitat by the Large-footed Myotis at McFarlane Bridge (GeoLINK, 2014), Mororo Bridge (GeoLINK, 2013) and Binna Burra, bat boxes do not provide the same amount of habitat and do not provide 'like for like' replacement when compensating for the habitat loss imposed by the Proposal.

In this section, an 'ecologist' refers to a person with:

- Minimum three years' experience working as an ecologist with extensive microbat experience (including any microbat specific graduate studies).
- A NPWS Scientific Licence and ACEC approval.
- Current Lyssavirus vaccinations.

Table 5.1 Proposed Safeguards and Mitigation Measures

Safeguard	*Details*	*Timing*	*Performance Indicators*	*Responsibility*
1. Provide Alternative Roosting Habitat – Targeted Large-footed Myotis Habitat	Alternative roosting habitat (as discussed in Section 5.1) would be established on the new bridge at least one month prior to demolition of the old bridge. *Note: This timeframe may change dependent on OEH and SIS. OEH has previously recommended alternative roosts be established well prior to exclusion.* The design would comprise a long-lasting lattice structure (or similar) and developed following advice from a bat ecologist. The alternative habitat would be installed below the central span of the new bridge and located on the central Super T Girders (refer to Plate 5.1 and 5.2). It would comprise a minimum carrying capacity equivalence of 30 x four chambered bat boxes (Hollow-log Homes design). Should the design allow, some of the alternative microbat roosting habitat (up to 30 %) would temporarily be attached below the old bridge one month prior to exclusion and outside the breeding season to encourage microbat uptake. During exclusion, this would then be transferred to the new bridge.	Install at least one month prior to microbat exclusion from the old bridge.	▪ Alternative roosting habitat based on a design known to be used by Large-footed Myotis as breeding habitat is installed below the new bridge.	RMS project design and construction team.
2. Provide Alternative Roosting Habitat - Super T Girder Joins.	The concrete Super T Girder joins support a cavity on the underside of the bridge approximately 20 mm wide and 75 mm deep (dimensions may vary slightly during installation). These cavities would remain unsealed to provide potential supplementary microbat roosting habitat in addition to lattice boxes. *Note: the potential for microbat roost uptake may be improved if the concrete is roughed and a 'lip' is present to allow microbats to grip and access the cavity.*	During bridge design and construction stages.	▪ Bridge designs specify the cavity at the Super T Girder joins remain unsealed. ▪ Super T Girder joins remain unsealed post construction.	RMS project design and construction team.
3. Staged Microbat Exclusion	Staged microbat exclusion would be undertaken prior to bridge demolition and ensuring no microbats are able to gain access to the underside of the bridge. The aim is to have the old bridge completely free of roosting microbats prior to demolition. An ecologist would be engaged to help manage and provide advice throughout the exclusion and demolition process. Management of microbats during demolition is provided in Safeguard 4. The exclusion process would include the following stages:	Prior to bridge demolition. To commence and be completed outside the Large-footed Myotis breeding season (October to mid-April inclusive).	▪ Microbats completely excluded from the old bridge prior to demolition. ▪ No or very low morality/ injury occurs as a result of exclusion. ▪ The new bridge is occupied as roosting habitat by a significant proportion of the subject Large-footed Myotis colony.	RMS, contractors and project ecologist.

Safeguard	*Details*	*Timing*	*Performance Indicators*	*Responsibility*
	1. Installing temporary microbat roosting habitat below the old bridge decking (either a portion of the alternative habitat to be installed below the new bridge decking and/or four chamber bat boxes – equivalent roosting capacity as approximately 10 x four chamber bat boxes) 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 bats are present. The ecologist would ensure the exclusion is impenetrable for microbat 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 bats (>20) or where smaller groups were not able to be removed would be undertaken at night. Once the bats have flown-out or are removed by the ecologist and the subject section of the bridge is confirmed to be bat 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 bats enter the exclusion area. After the first night of exclusion when roosting bats have been displaced, the ecologist would return to the site at least 1 hour prior to dawn and check for trapped bats and observe the behaviour of bats when returning to roost. Attempts at re-entry would be observed and any breaches noted for repair/alteration.		Note: as indicated in Section 3, the Sportsmans Creek Bridge population is considered a single population (the local population) being the subject Large-footed Myotis colony.	

Safeguard	Details	Timing	Performance Indicators	Responsibility
	Any bats 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 the temporary bat habitat on the old bridge, the bat habitat on the new bridge or held during the day for release that evening. When exclusion installation is undertaken at night, the following morning, the exclusion would be removed to allow inspection to ensure no bats were trapped or were able to penetrate the exclusion. The exclusion would then be re-instated. By the end of this stage, the below deck area of the bridge should be effectively impenetrable for microbats, with only the temporarily installed exclusion devices remaining accessible to the bats. They may be moved around the bridge during the exclusion process and aim to be used as a tool to manage the location of bats while the exclusion is being installed. 4. Transfer temporary microbat roosting habitat from the old bridge to the new bridge. The rate and timing of the transfer would follow advice from the ecologist and depend on the rate of microbat uptake on the new bridge. Should small numbers of bat be occupying the alternative habitat feature, the base would be covered and sealed with a non-transparent breathable material (e.g. fabric), removed and installed directly onto the new bridge provided the process does not result in significant harm or stress to resident bats (e.g. from significant noise and vibrations). Should large numbers of bats be present, the relocation would occur at night once the bats have flown out. If temporary bat boxes are used during the relocation process, the ecologist would assess the need to relocate the temporary bat boxes onto the new bridge. Flexibility in the microbat exclusion process would be required following advice from the ecologist. The ecologist would be responsible for managing the microbats, including capture and release of bats throughout the exclusion process, identify if there are potential issues with bats in torpor and the need for the exclusion to be delayed, etc.			

Safeguard	*Details*	*Timing*	*Performance Indicators*	*Responsibility*
	The ecologist will also need to identify if individual bridge structures (e.g. with deep cavities that will not be able to be confidently inspected to ensure they are free of bats) need to be fitted with a one-way exclusion device that allows bats to escape but not re-enter, prior to installing the non-penetrable exclusion which covers large sections of the bridge (*note: based on existing information of microbat usage at the site, this is unlikely to be necessary*). The exclusion would aim to effective seal/wrap the bridge to prevent microbat access using predominantly industrial plastic which bats are unable to grip onto (refer to Plate 5.3 and 5.4), with only the temporarily installed roosting habitat remaining accessible. Other materials such as expandable foam and timber may also be used. If expandable foam is used (particularly at night), exposed areas would be covered to prevent bats trying to access the bridge making contact with the foam prior to it hardening. Systematic inspection of both bridges would be undertaken the morning prior to commencing exclusion installation and the morning following each exclusion stage where >20 bats have been displaced to document bat numbers and roost locations. Both bridges would be re-inspected prior to commencing demolition and, prior to the start of the Large-footed Myotis breeding season (October to mid-April inclusive) if demolition is proposed during the breeding season, to ensure no bats are roosting on the old bridge. The need for an ecologist to inspect the old bridge and bridge timber sections during demolition would be determined upon completion of the exclusion process.			
4. Demolition Microbat Management	The following microbat management actions would be undertaken during the demolition stage of the Proposal: ▪ Demolition contractors would undertake microbat awareness training during the project inductions, including what microbats are, signs of bats to be aware of during the works and the importance of keeping exclusion in place throughout the demolition process. ▪ Daily inspections for microbats would be undertaken in affected work areas.	Throughout demolition works.	▪ Demolition contractors are aware of microbats and microbat management requirements. ▪ Microbat management requirements implemented as required.	RMS, contractors, project ecologist.

Safeguard	*Details*	*Timing*	*Performance Indicators*	*Responsibility*
	▪ At completion of each day's work, exclusion devices are to be checked and ensure they are impenetrable for microbats. ▪ Should microbats be detected on the old bridge during demolition works, works would stop and an ecologist engaged to relocate the bats. Review of exclusion devices may be required. This would be communicated to the RMS Project Manager and Environmental Officer.			
5. Vet/ Wires Contact Details	Injured fauna would be taken to WIRES. The contact details of WIRES (Clarence Valley – 02 6643 4055) would be known to the bat exclusion and bridge demolition foreman, and the project ecologist.	Throughout exclusion and demolition works.	▪ Contact details of WIRES known to bat exclusion and bridge demolition foreman, and the project ecologist. ▪ Injured bats are promptly cared for.	RMS, contractors, project ecologist.

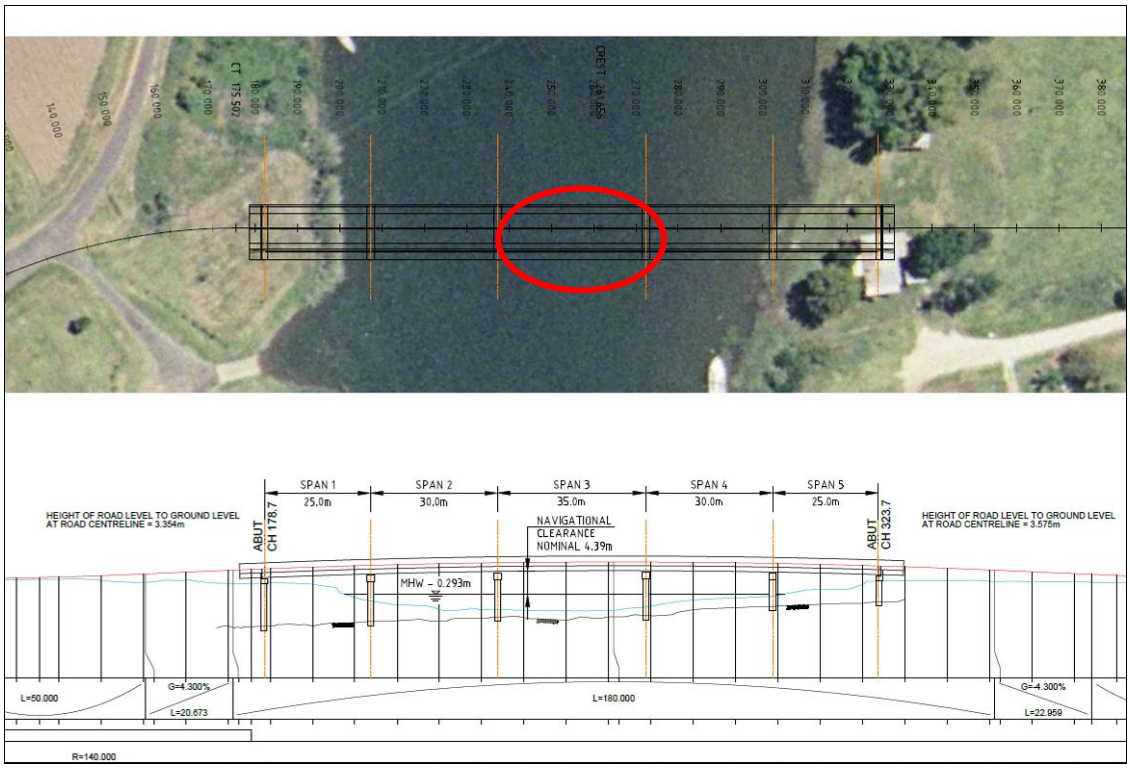


Plate 5.1 Concept bridge long-section design and proposed alternative microbat roosting habitat (Span 3)

Source: KBR, 2014

The red circle shows the location of Span 3, where alternative microbat roosting habitat is proposed.

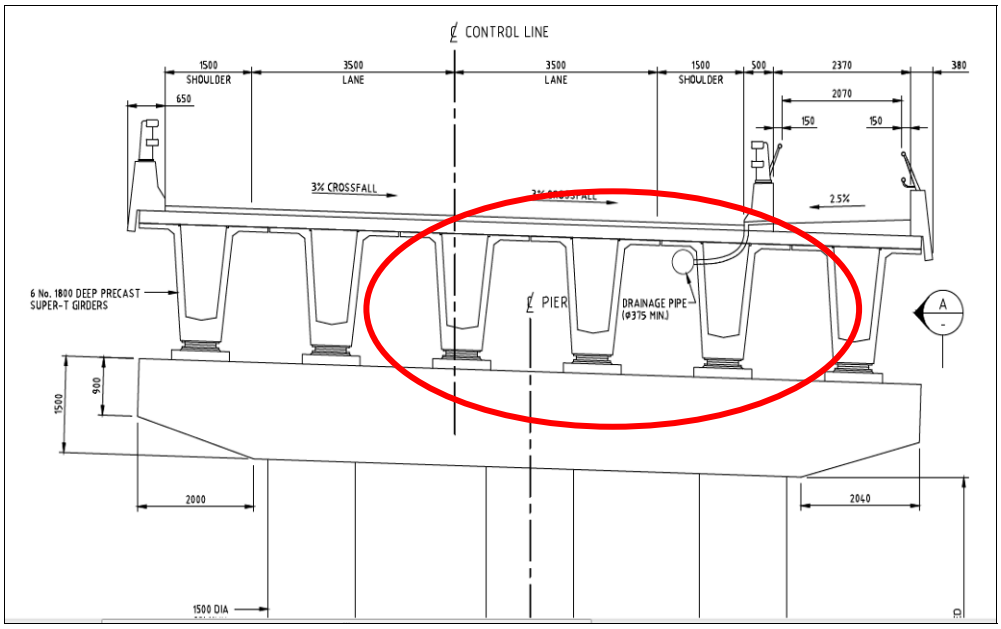


Plate 5.2 Concept bridge cross-section design and proposed alternative microbat roosting habitat (Span 3)

Source: KBR, 2014

The red circle shows the preferred locations for alternative microbat roosting habitat is to be installing in reference to the Super T Girders (not near the piers).

Plate 5.3 Effective plastic microbat exclusion installation at McFarlane Bridge, a similar structured timber bridge

Underneath is a single sheet of plastic with small holes to allow drainage. At the piers, smaller sheets of plastic hang down from the decking between the corbels and stringers to 'seal' the exclusion.

Plate 5.4 McFarlane Bridge microbat exclusion viewed from side-on

Timber was placed to cover the gaps between the stringers and transverse decking. This could be undertaken in preparation for installation the plastic exclusion sheeting.

5.2 Safeguard Implementation Management

5.2.1 Capturing and Releasing Healthy Microbats

Only an ecologist would handle the microbats (exceptions are provide in Section 5.2.2)-. Any microbats captured during nocturnal or diurnal inspections are to be housed in small cloth bags. Bags containing bats would be hung in a cool, dry place off the ground, preferably within a wire box, like a cat carry cage for safety. Bats 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 bats (head and body 80-95 mm) would not be grouped with smaller bats (head and body <75 mm) as some larger species predate on smaller species. The ecologist is responsible for releasing the bats in the evening at the site.

Any bats captured during the day would be hung in a dry and undisturbed place out of the direct sun. Bats would be kept in a cool environment and be assessed for heat stress as required. The bats would be released that evening (on the same day). Bats captured during the day can be released into one of the available bat boxes provided as alternative habitat at the site. The ecologist would assess whether bats can be introduced into the bat boxes during the day, based on the likelihood of them staying within the box until an appropriate fly-out time.

Bats would not be held for any period longer than 24 hours. It is expected that bats 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 (unless release into a bat box is likely to be successful). Any bats captured during the day would be released that night (unless release into a bat box is likely to be successful). Therefore, the longest anticipated holding time for microbats is 16 hours.

Note: Any bats captured during the works must 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'.

5.2.2 Injured or Dead Microbats

If bats are unexpectedly injured during works when an ecologist is not present, an RMS worker may carefully remove the bat with a cloth bag. With a gloved hand encased within the cloth bag, the worker would gently pick up the bat and then turn the bag inside out to free their gloved hand and capture the bat. The bag would be tied off at the entrance and hung in a cool, shaded and sheltered location.

The local wildlife carer group would be contacted immediately for collection of any injured bat/s captured. Options for treatment and future release would be decided at the discretion of the wildlife carer. Any costs for treatment would be the responsibility of the RMS.

If a dead or injured microbat is found during the works, RMS's Works Supervisor, Project Manager and Environmental Officer must be notified immediately.

Where possible, all dead microbats are to be collected and retained for the ecologist. The ecologist would lodge bodies with the Australian Museum as specimens for future research and study.

Additional general bat handling mitigation measures:

- RMS staff are prohibited from handling bats unless:
  - Bats are injured or killed during works and advice has been sought from the RMS environmental officer about the collection of the injured/ dead bat.
  - In the case of above, the RMS worker may carefully remove the injured/ dead bat with a cloth (e.g. cloth bag), by gently encasing the animal and turning the cloth over or inside-out over the bat to encase it. The bats should be placed in a cloth bag that is carefully tied off so that parts of the bat are not crushed and stored in a cool (not cold), quiet and dark location for collection by WIRES or RMS environmental officer.

- Large bats (80-95 mm head and body length) should not be placed with small bats (<75 mm) to avoid predation.

- Arrangements for the care and welfare of captured bats must be made immediately upon discovery/ capture of injured bat.

Bat rescue equipment and PPE for workers must 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, soap and water to wash hands and laminated info sheet on Lyssavirus.

5.2.3 Roles and Responsibilities

RMS work crews/ contractors, ecologist, Project Manager and Environmental Officer form a team that work together to deliver the aims of the bat management safeguards. The RMS or construction contractor would be responsible for providing exclusion material and installation of exclusion devices. An ecologist would be present during installation.

RMS work crew are to continue daily bat checks and be careful during exclusion events, as bats may be found roosting in inappropriate locations (e.g. handrail or on top of the decking)

The decision on the final design of the alternative roosting habitat and method of exclusion would be guided by the ecologist. The ecologist is to provide guidance to RMS such that the aims of the safeguards are achieved and impact to bats is minimised. Any decision relating to RMS meeting its statutory obligations would be discussed or referred to the Project Manager and Environmental Officer.

5.2.4 Reporting and Communication

The results of microbat inspections made throughout the project, particularly during the exclusion and demolition phases would be progressively reported to the RMS Environmental Officer for the project. The RMS project manager and works supervisor would also need to be informed throughout the implementation of the safeguards of this report. A log should be maintained of the decisions made and installation of exclusion devices to be included in formal monitoring reporting (refer to Section 5.3).

5.2.5 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 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 bats. This would only be successful, however, if open communication occurs between the works supervisor, project manager, RMS environmental officer and ecologist.

5.2.6 Risks

Some of the procedures detailed within the plan pose various risks to human safety including working from heights. Microbats can carry diseases, particularly Lyssavirus which can be passed onto humans if bitten. It is therefore recommended that any persons handling bats have the relevant vaccinations and annual boosters as required. It is recommended that appropriate bat rescue equipment/ PPE is made available on site before works commence (cotton bags, gloves, soap and water to wash hands).

5.3 Monitoring

Microbat monitoring would be undertaken by the ecologist pre, during and post exclusion, with the objectives of:

- Identifying the need to implement additional contingency measures to minimise impacts to the subject Large-footed Myotis colony.
- Determining whether the Proposal has been successful in relocating the subject Large-footed Myotis breeding colony from the old bridge to the new bridge and avoiding a significant impact on the local population.
- Identifying whether and how the microbat management safeguards of this report have been implemented and their success.
- Providing further recommendations for consideration on future projects with similar impacts on threatened microbats.

The project will be considered successful if a significant portion of Large-footed Myotis roost in the new bridge (with numbers proportional to the baseline data recorded throughout the year pre-exclusion) and utilise the alternative habitat as a breeding site.

Throughout the monitoring and implementation of the Project, the Ecologist would be responsible for identifying the need to trigger and implement contingency/ corrective measures, as outlined in Table 5.2. The monitoring strategy focuses on uptake by Large-footed Myotis of the new bridge with monitoring of alternative roosts within 10 km as a contingency measure only triggered if new bridge is not occupied by a significant proportion of the subject Large-footed Myotis colony. A reduction in numbers breeding on the new bridge may not mean a significant impact to the local population. A significant proportion of the subject Large-footed Myotis colony is likely to be in the order of two thirds of the numbers previously recorded at Sportsmans Creek Bridge. The exact numbers are difficult to define as the estimated local population of approximately 300 bats previously observed is only based on two surveys in December 2013 and February 2014.

The results of each monitoring phase would be emailed to the RMS Project Manager and Environmental Officer, along with a summary of key outcomes/ findings to date. A comprehensive report would be provided upon completion of the monitoring program.

Table 5.2 Monitoring Schedule

Monitoring Phase	*Objective*	*Monitoring Effort*	*Timing and Frequency*	*Continence Triggers and Potential Measures*
Pre Exclusion	▪ Develop baseline data of the Large-footed Myotis population numbers over the 12 month period prior to exclusion. ▪ Identify any uptake of the alternative roosts on the new bridge prior to excluding the colony on the old bridge.	Direct inspection of the entire old bridge using torch and pole mounted camera from a boat with scaffolding at spans/ piers over water; and a ladder at spans/ piers over land; documenting: ▪ Species present. ▪ Locations of roosting microbats. ▪ Total number of individuals and groups per occupied roost site. ▪ Locations of roosting microbats. ▪ Description of occupied roost sites. ▪ Breeding status of the colony, including approximate adult to juvenile ratios. Monitoring during this period would extend to the new bridge if constructed using the same methodology. Secondary quality habitat (i.e. drainage structures that support potential microbat roost features within a 10 km radius of Sportsmans Creek Bridge) would be monitored as a contingency only if new bridge is not occupied by a significant proportion of the subject Large-footed Myotis colony.	Key seasonal times (winter, spring, summer) prior to exclusion.	N/A

Monitoring Phase	*Objective*	*Monitoring Effort*	*Timing and Frequency*	*Continence Triggers and Potential Measures*
During Exclusion	▪ Monitor Large-footed Myotis roosting behaviour response to exclusion activities.	Direct inspection of the entire old bridge and new bridge (targeting alternative roosting habitat and Super T Girder joins). Methodology as for Pre Exclusion Monitoring.	Commence prior to commencement of exclusion step one (install temporary microbat roosting habitat on the old bridge. Systematic inspection of both bridges would be undertaken the morning prior to commencing exclusion installation and the morning following each exclusion stage where >20 bats have been displaced.	Following initial displacement of microbats from the bridge (up to 35% of the population), if bats (based on pre-disturbance numbers) are not locatable in the alternative roosting habitat or remaining available habitat in the old bridge, the Ecologist is to investigate the whereabouts of the bats (breaches in the exclusion, inspect other drainage structures within a 10 km radius of the site, etc) as well as additional management measures. This may include: ▪ Modifying the alternative roosting habitat. ▪ Installing additional alternative habitat on the new bridge in spans 2 and 4. ▪ Reviewing and modify the exclusion method (e.g. reducing the rate and extent of bridge excluded during each exclusion stage).
During Exclusion	▪ Document exclusion activities and outcomes to identify the effectiveness of proposed exclusion activities and changes to exclusion activities.	No additional surveys/ effort.	During exclusion.	N/A
Post Exclusion	▪ Identify the number of potential alternative potential roosts (drainage structures) within a 10 km radius occupied upon completion of exclusion.	Inspect the 45 drainage structures that support potential microbat roost features within a 10 km radius of Sportsmans Creek Bridge (refer to Appendix C) via direct inspection and document Large-footed Myotis roosts and bat numbers.	One event within one week of completion of exclusion installation.	N/A

Monitoring Phase	*Objective*	*Monitoring Effort*	*Timing and Frequency*	*Continence Triggers and Potential Measures*
Post Exclusion	▪ Document Large-footed Myotis population numbers within the new bridge over the 12 month period post exclusion.	Direct inspection of the entire old bridge and new bridge (targeting alternative roosting habitat and Super T Girder joins). Methodology as for Pre-exclusion Monitoring.	Key seasonal times (winter, spring, summer) for 12 months post exclusion.	Should only a small population of microbats be present in the new bridge the ecologist is to investigate the whereabouts of the bats (breaches in the exclusion, inspect other drainage structures within a 1km radius of the site, etc) as well as additional management measures. This may include the following measures: ▪ Inspect of other drainage structures within the locality. ▪ Modifying the alternative roosting habitat. ▪ Installing additional alternative habitat on the new bridge in spans 2 and 4.

6

Statutory Assessments and Conclusion

6.1 Seven-part Test of Significance Assessment

This section provides the Seven-part Test of Significance Assessments in accordance with Part 5A of the *Environmental Planning and Assessment Act 1979* for the Large-footed Myotis, Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bat. For this assessment the proposed 'activity' constitutes the proposed bridge construction and old bridge demolition, undertaken in accordance with the safeguards provided in Section 5.

Large-footed Myotis

Species Profile

The Large-footed Myotis occurs along the coast from Victoria, up the eastern coastline and west across into the Kimberly region of Western Australia (A. Burbidge pers. comm. in Reardon and Thomson, 2008), and also along the Murray River into South Australia (Duncan *et al*., 1999; Churchill, 2008). This species is known from 0 to 840 m above sea level, but most records are below 300 m in Victoria (L. Lumsden pers. comm. in Reardon and Thomson, 2008), whilst in north-eastern NSW records from OEH Wildlife Atlas and Forests NSW, show that observations and trapping of Large-footed Myotis has occurred at elevations up to 450 m.

The Large-footed Myotis gleans prey from the surface or near surface of smooth water by trawling with its disproportionately large feet, hooking aquatic insects on the surface of pools of water and small fish just below the surface with its claws and assisting the prey to its mouth by scooping with its tail membrane (Jones and Rayner, 1991; Dwyer, 1970a; Thompson and Fenton, 1982; Robson 1984). Foraging habitat for this species includes large and small wetlands, estuaries, forest streams, lakes, dams and reservoirs (Richards *et al*., 2008). The Large-footed Myotis has been recorded travelling up to 22 km in one night, presumably for foraging purposes (Caddle, 1998 in Campbell, 2009) with other studies recording regular feeding distances of 10 km (Barclay *et al*., 2000) and 3 km (Anderson *et al*., 2006). It is expected that the average foraging foray by this species is six to 12 km per night. It is unclear how far the Large-footed Myotis travel to shift roosting sites. It is thought that this species forms stable populations that have a number of roosting sites available or known to the group and that they switch between these roosting sites as required or desired (e.g. to avoid detection by prey, as a response to weather or season or perhaps as required based on breeding requirements). However it is possible that some groups may be reliant on a small number of roosting sites. Structures such as Sportsmans Creek Bridge provide multiple roost sites within a single structure and it is unclear of the relationship of such populations with other known/ potential roost sites within the broader area.

Roosting habitat for the Large-footed Myotis is often reported from old timber bridges, but also within tree hollows (Schedvin, pers. comm. in Lumsden and Menkhorst, 1995), caves (holes in limestone rock overhang two metres above water, Kirkley, 1996), tunnels (e.g. aquaducts, Gratin pers. comm., Campbell, 2009), mines (Richards *et al*., 2008), culverts (author pers. obs.), fairy martin nests (Schulz, 1998) and similar well-insulated cavernous habitats. Cavities used by this species are generally small (compared with obligate cave-dwelling bats such as the Eastern Bent-wing Bat). Animals can roost alone, but are usually found in small groups, or, less frequently, within colonies comprising up to several hundred. During breeding, males collect harems of up to 12 females, whom they defend from other males (Churchill, 2008). Solitary males sometimes roost together.

The Large-footed Myotis is a polyestrus species that breeds up to three times per breeding season across its northern range. In south-eastern Queensland (Dwyer 1970b) and north-eastern NSW (pers. obs, Hoye pers. comm.), Large-footed Myotis has two breeding events, whilst in Victoria, only one breeding event occurs per season. Observations made by Mr Glenn Hoye with regard to breeding cycles for Large-footed Myotis north of the Hunter are as follows:

- 1 October – 28 October; pregnant.
- 27 October – 26 January; lactating.
- 15 January – 10 February; pregnant.
- 10 February – 12 April; lactating.
- 9 March – 29 May; post-lactation.

This indicates that, whilst the first breeding event is relatively synchronous, the second is not. Also perhaps not all females produce two young per season, explaining the detection of post-lactation and non-pregnant females in March.

Subject Population and Local Habitats
Refer to Section 3. The Sportsmans Creek Bridge population is considered the subject population of this assessment.

Little Bentwing-bat

Species Profile
Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day (Dwyer, 2008; OEH, 2012). Maternity colonies form in caves during spring. Only five maternity caves are known in Australia (OEH, 2012).

The Little Bentwing-bat forages at night for small insects beneath the canopy of densely vegetated habitats. They forage in a broad range of habitats ranging including moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH, 2012).

Subject Population and Local Habitats
No breeding roosting habitat for the Little Bentwing-bat occurs in the locality. Sportsmans Creek Bridge provides non-breeding roosting opportunities. The study area forms a fraction of the potential foraging habitat available within the locality for this species.

The range of the local population of this highly mobile species extends well beyond the confines of the site and locality, and would be expected to be largely associated with the key maternity caves in north-east NSW.

Eastern Bentwing-bat

Species Profile
The Eastern Bentwing-bats roost in caves, derelict mines, culverts, bridges tunnels, buildings and other man-made structures. They form discrete populations centred on maternity caves, used annually in spring and summer (OEH, 2012; Dwyer, 2008b). At other times of the year, populations disperse within about 300 km range of maternity caves. The Eastern Bentwing-bat foraging for flying insects above the tree tops. They forage in a broad range of habitats, including rainforest, dry, wet and swamp sclerophyll forests, heath, forested wetlands and water bodies (OEH, 2012).

Subject Population and Local Habitats
As for the Little-bentwing-bat.

Large-eared Pied-bat

Species Profile
The Large-eared Pied-bat roost in caves, near their entrances, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Fairy Martins, frequenting low- to mid-elevation dry open forest and woodland close to these features (NPWS 2002). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. They are often found in well-timbered areas containing gullies where it probably forages for small, flying insects below the forest canopy (OEH 2014).

Subject Population and Local Habitats
As for the Little-bentwing-bat and Eastern Bentwing-bat.

(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,

The potential impacts of the Proposal on threatened microbats are provided in Section 4. Specific impacts for each species are provided below.

Large-footed Myotis
The Proposal will result in the removal of the existing timber Sportsmans Creek Bridge which supports a large breeding colony, with approximately 300 individuals. It is considered to be the core roosting habitat occupied by the subject population. Breeding sites are critical and limited due to the requirement for Large-footed Myotis to be able to maintain warmth and humidity for developing young. Existing alternative potential breeding roosting habitat in the locality is uncommon. The main alternative roosting habitat within 10 km of Sportsmans Creek Bridge available locally comprises flood susceptible culverts associated with table drains (refer to Section 3.3).

The colonies response to the roosting habitat loss is unknown. Safeguards however would be implemented to alleviate potential impacts, including installation of alternative roosting habitat on the new bridge and staged exclusion from the existing bridge outside the breeding period. The methods proposed have been successful on other similar bridge and culvert works projects involving breeding Large-footed Myotis colonies (Ecotone, 2001; Hoye and Hoye, 1999; GeoLINK, 2014; David Andrighetto, GeoLINK, pers. obs.). Records of Large-footed Myotis colonies in artificial structures (such as concrete bridges like Shark Creek Bridge Pacific Highway), demonstrate the species ability to locate and occupy new roosting opportunities.

Mortality or injury during demolition, or entrapment during bridge exclusion poses the main other potential impact, though these threats would be immediately reduced or avoided, because works would follow the safeguards described in Section 5. Should mortality or injury occur, only small numbers of bats are likely to be affected. Hence, a significant impact *per se* is highly unlikely, and a viable local population would not be placed at risk of extinction.

Fly-way and foraging habitat degradation are low risk potential impacts and unlikely to significantly affect the foraging habitat values of the study area (refer to Section 4.1).

Overall, therefore there is reasonable evidence to indicate that, provided that alternative roosting habitat is appropriately located, designed and installed, there is good potential for the subject Large-footed Myotis colony to take-up the alternative roosting habitat provided on the new bridge. Furthermore, the new habitat will be located only 120 m from the existing and will also be located above the same water body.

However, there is limited data about effectively retro-fitting modern bridges with structures suitable for the Large-footed Myotis. As such, it is still early days in terms of predicting the outcomes of habitat re-creation projects that involve this species. Consequently the precautionary principle must be applied. Overall the Proposal poses a real risk of adversely affecting the life cycle of the species and placing the subject Large-footed Myotis population as vulnerable to extinction, unless the proposed mitigation actions are adopted and proved effective.

Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bat
No maternity sites for the subject species would be affected by the Proposal. The Proposal would see the existing available roosting habitat provided by Sportsmans Creek Bridge removed and replaced by the new bridge. Non-breeding roosting opportunities would be provided in the new bridge by the Super T Girder joins and the timber alternative roosting habitat installed.

As for the Large-footed Myotis, the Proposal poses a risk of mortality/ injury during demolition, or entrapment during bridge exclusion, though the threat would be reduced or avoided, if works would follow the safeguards described in Section 5. Should mortality/ injury occur, only small numbers of bats may be directly affected. Fly-way and foraging habitat degradation are low risk potential impacts and unlikely to significantly affect the foraging habitat values of the study area (refer to Section 4.1).

Overall, with consideration of the above, the high mobility of these species as well as the presence of alternative potential non-breeding roosting habitat in the locality (refer to Section 3); an adverse effect on the life cycle of the subject species such that a viable local population of the species is likely to be placed at risk of extinction is not likely to occur as a result of the Proposal.

(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,

No consideration under this part of the assessment is required for the subject 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.

No consideration under this part of the assessment is required for the subject 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,

The Proposal will result in the removal of the existing timber Sportsmans Creek Bridge and construction of a new concrete bridge approximately 120 m to the west, fitted with potential microbat roosting habitat. Impacts per subject species are as follows:

- Large-footed Myotis: The existing timber bridge supports a large breeding colony with approximately 300 individuals and comprises the core roosting habitat for the subject population. Alternative roosting habitat in the new bridge will be designed and constructed to target this species, based on designs of artificial roosts known to support breeding Large-footed Myotis colonies.
- Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bat: The existing bridge provides potential opportunistic non-breeding roosting habitat for the subject species. No maternity habitat would be affected and the new bridge and other known/ potential roosting habitats within the locality will remain available to support non-breeding aggregates when in the locality.

Potential impacts on foraging habitat i.e. water quality of waterways for Large-footed Myotis which eat aquatic insects, small fish and prawns etc and forest habitat for Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bat (which eat flying insects, spiders etc) of the locality would be managed through best practice and general safeguards such as erosion and sediment control.

(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

All Subject Species
The study area comprises a mostly cleared agricultural environment. No direct habitat fragmentation would occur as a result of the Proposal and barriers to fly-ways for bats moving along Sportsmans Creek are unlikely to be created.

Removal of the existing bridge will see the loss of breeding habitat known to be occupied by the Large-footed Myotis and capable of supporting dispersing bats along the lower Clarence River system. Alternative roosting habitat would also be provided on the new bridge (refer to Section 5). This and recorded large movements by all of the subject species (Caddle, 1998, cited in Cambell *et al.,* 2009; Dwyer, 2008a; 2008b) indicates that areas of habitat are unlikely to become fragmented or isolated from other areas of habitat as a result of the Proposal for the subject species.

(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,

Large-footed Myotis

The existing timber Sportsmans Creek Bridge provides important roosting habitat for the subject Large-footed Myotis population. It provides a range of potential roosting opportunities within the one structure and supports a large breeding colony. Other known breeding Large-footed Myotis colonies in the locality are uncommon and not in close proximity to the site (refer to Section 3). Those colonies are similarly vulnerable to disturbance from bridge/ culvert maintenance and repair projects. As the locality comprises a mostly cleared landscape, hollow-bearing trees are not common and unlikely to support large Large-footed Myotis populations. Overall, the existing Sportsmans Creek Bridge is considered important to the long-term survival of the species in the locality. Alternative habitat will be provided on the new bridge and should alleviate impacts of the Proposal on the subject population, though this cannot be guaranteed (refer to response to *(a)*).

Little Bentwing-bat, Eastern Bentwing-bat and Large-eared Pied-bat

The existing bridge provides potential opportunistic non-breeding roosting habitat for the subject species, which primarily breed in caves. No maternity habitat would be affected and the new bridge and other known/potential roosting habitats within the locality will remain available to support non-breeding aggregates when in the locality. Overall thus no habitat important for the long-term survival of the subject species in the locality would be affected by the Proposal.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No areas of critical habitat are listed under the TSC Act for the subject species.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

Part 4 of the TSC Act states '*The object of a recovery plan is to promote the recovery of the threatened species, population or ecological community to which it relates to a position of viability in nature.*" Any action which adversely affects threatened species or their habitat, or contributes to relevant key threatening processes may be interpreted as being inconsistent with this general objective. Specific recovery and threat abatement strategies are discussed below.

No draft or approved recovery plans have been prepared under the TSC Act for the subject species. The proposed works do not affect the aims or proposed actions of any of the prepared threat abatement plans.

Little Bentwing-bat, Eastern Bentwing-bat

Under the OEH *Saving our Species* program, the Little Bentwing-bat and Eastern Bentwing-bat fall under the 'Site-managed species'. The Proposal will not affect any of these sites. The recommended actions of the Action Plan for Australian Bats (Reardon *et al*., 1999) for the Eastern Bentwing-bat are not relevant to the Proposal.

Large-eared Pied-bat

Under the OEH *Saving our Species* program, the Large-eared Pied-bat falls under the 'data deficient species' management stream as there is little known about its distribution, general ecology or the management techniques required to secure it in the wild.

Large-footed Myotis

The following actions are identified for the Large-footed Myotis under the OEH *Saving our Species* program:

1. *Ensure the largest hollow bearing trees in riparian zones are given highest priority for retention in PVP assessments or other land clearing assessment tools.*
2. *Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees.*
3. *Investigate the effectiveness of logging prescriptions.*
4. *Undertake long-term monitoring of populations cross tenure in conjunction with other bat species to document changes.*
5. ***Identify, protect and enhance roost habitat beneath artificial structures (e.g. bridges), especially when due for replacement, and assess effectiveness of the actions.***
6. *Study the ecology, habitat requirements and susceptibility to logging and other forestry practices of this little-known species.*
7. ***Promote roosting habitat in new artificial structures within the species range.***
8. *Better regulate pollution of waterways e.g. sewage and fertilizer run-off (eutrophication) and pesticide/herbicide leakage (chemical pollution) and thermal pollution.*
9. *Encourage recovery of natural hydrological regimes, including retention and rehabilitation of riparian vegetation.*
10. *Research to identify important foraging range and key habitat components for this species. Identify the importance of riparian vegetation to the species.*
11. *Determine susceptibility to logging.*
12. *Identify the spatial population structure, including genetic isolation, movement and persistence across the species range.*
13. *Survey large inland waterways for this species to determine distribution in Murray Darling Basin.*
14. *Resolve species taxonomy by morphology/ genetics and reassess conservation status.*
15. *Assess the importance by survey of estuaries and other tidal waterways for the species across its range.*

Those in bold relate directly to the proposed works. The Proposal aims to be consistent with these actions by installing alternative artificial roosting habitat for the Large-footed Myotis below the new bridge, based on designs of artificial roosting habitat that is known to be used as breeding habitat.

The Action Plan for Australian Bats recommends the following actions for the Large-footed Myotis (Duncan *et al*., 1999):

1. *Complete the review of taxonomy and distribution of this species and its congeners. In particular confirm the placement of northern New South Wales specimens. Morphological parameters of New South Wales specimens should be incorporated into the study of Kitchener et al. (1995). Genetic studies are currently underway at the South Australian Museum.*
2. *Conduct targeted surveys to clarify the status of the inland populations along the Murray River and in northern New South Wales.*
3. ***Assess whether this species is adequately represented in conservation reserves and ensure the security of known maternity sites.***

4. *Carry out ecological research to determine:*
    - *Habitat requirements.*
    - *Roost and maternity site selection, particularly the relative dependence on caves versus tree hollows.*
    - *Sensitivity to changes in water quality.*
    - *Population dynamics.*
    - *Threatening processes.*

5. *Encourage State and local government authorities with responsibility for construction and maintenance of roads to inspect bridges/culverts prior to demolition to reduce impact on colonies utilising these structures.*

Those in bold relate directly to the Proposal. The Proposal aims to be consistent with these actions by:

- Installing alternative artificial roosting habitat for the Large-footed Myotis below the new bridge, based on designs of artificial roosting habitat that is known to be used as breeding habitat.
- Excluding microbats from the bridge outside the breeding season and prior to demolition.

Refer to Section 5 for details of the proposed safeguards.

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

The proposed works were assessed with regards to their potential contribution towards or operation of key threatening processes (KTP) listed under Schedule 3 of the TSC Act as provided below:

- Alteration of habitat following subsidence due to longwall mining.
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Anthropogenic climate change.
- Bushrock removal.
- Clearing of native vegetation.
- Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*).
- Competition and habitat degradation by feral goats (*Capra hircus*).
- Competition from feral honey bees (*Apis mellifera*).
- Death or injury to marine species following capture in shark control programs on ocean beaches.
- Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments.
- Forest Eucalypt dieback associated with over-abundant psyllids and bell miners.
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Herbivory and environmental degradation caused by feral deer.
- Importation of red imported fire ants (*Solenopsis invicta*).
- Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations.
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis.
- Infection of native plants by Phytophthora cinnamomi.
- Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.
- Introduction of the large earth bumblebee (*Bombus terrestris*).
- Invasion and establishment of exotic vines and scramblers.

- Invasion and establishment of Scotch broom (*Cytisus scoparius*).
- Invasion and establishment of the cane toad (*Bufo marinus*).
- Invasion of native plant communities by African Olive *Olea europaea L. subsp. cuspidata*.
- Invasion, establishment and spread of Lantana camara.
- Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed).
- Invasion of native plant communities by exotic perennial grasses.
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW.
- Loss of hollow-bearing trees.
- Loss or degradation (or both) of sites used for hill-topping by butterflies.
- Predation and hybridisation of feral dogs (*Canis lupus familiaris*).
- Predation by the European red fox (*Vulpes vulpes*).
- Predation by the feral cat (*Felis catus*).
- Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish).
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island.
- Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*).
- Removal of dead wood and dead trees.

Overall, the Proposal is not considered likely to contribute significantly towards any listed KTP. Use of equipment and heavy machinery would contribute modestly to anthropogenic climate change, particularly when viewed in conjunction with other carbon emitting/ fossil fuel burning/ greenhouse gas emitting activities in the locality. Whilst modest, the cumulative impacts of such small emissions are significant. Currently, it is not feasible to undertake the works using green energy sources only.

6.2 Conclusion

The Seven-part Test assessment conclusions:

- Large-footed Myotis: The Proposal involves removal of habitat occupied by a large breeding colony. Although it is expected that the local Large-footed Myotis population will relocate to the habitat to be provided on the new bridge, in accordance with the precautionary approach adopted in accordance with OEH guidelines: *Threatened species assessment guidelines, The assessment of significance* (DECC, 2007), removal of the existing bridge is likely to significantly affect the local Large-footed Myotis population. Therefore a Species Impact Statement (SIS) for the Large-footed Myotis is required.
- Little and Eastern Bentwing-bats and Large-eared Pied-bat: A significant impact on these species is considered unlikely. No breeding habitat would be affected by the Proposal and alternative potential roosting habitat in their non-breeding range in the lower Clarence is available to support the local potential occurrences of these species.

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Copyright and Usage

Appendix A

New Sportsmans Creek Bridge Concept Designs

RICHMOND STREET

GRAFTON STREET

BRIDGE STREET

WEIR ROAD

RIVERBANK ROAD

SPORTSMANS CREEK

CLARENCE RIVER

Lawrence General and Liquor Store

Lawrence Memorial Park

Boat Ramp

Lawrence Public Hall

Lawrence Tavern

Boat Ramp

Sportsmans Creek Bridge

Flo Clark Park

Sportsmans Park

TURNING HEAD

20 0 20 40 60 80

SCALE 1: 2000 AT A3

Sportsmans Creek new bridge

February 2014

Aerial Image Supplied By RMS

NSW GOVERNMENT Transport Roads & Maritime Services

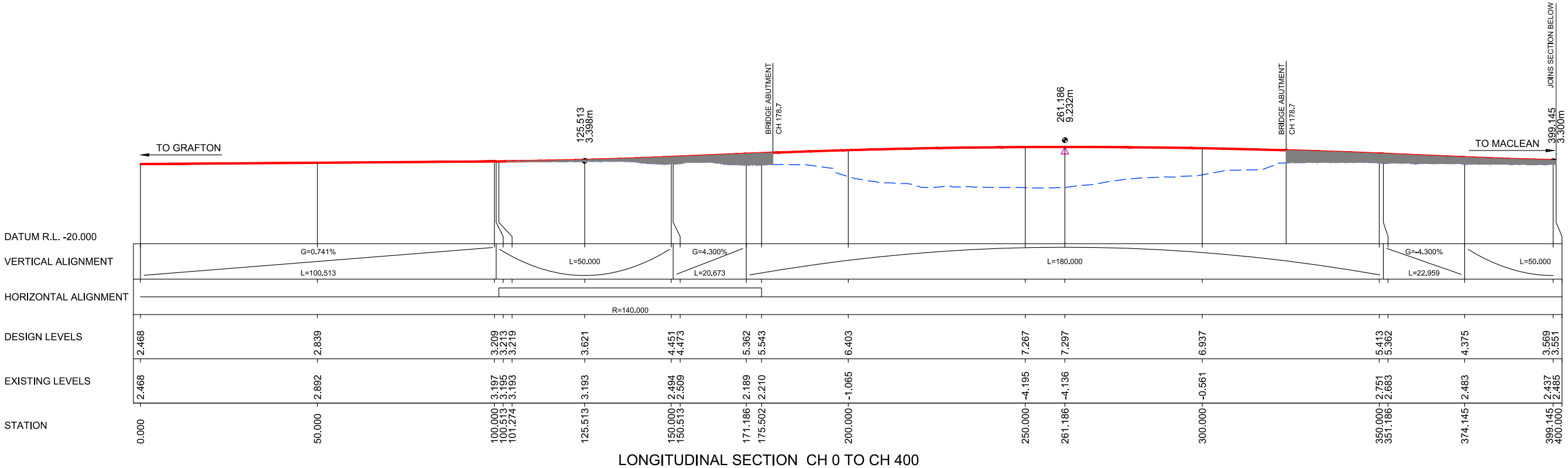
KBR

SCALE 1:1250 AT A3

10 0 10 20 30 40

Sportsmans Creek new bridge

February 2014



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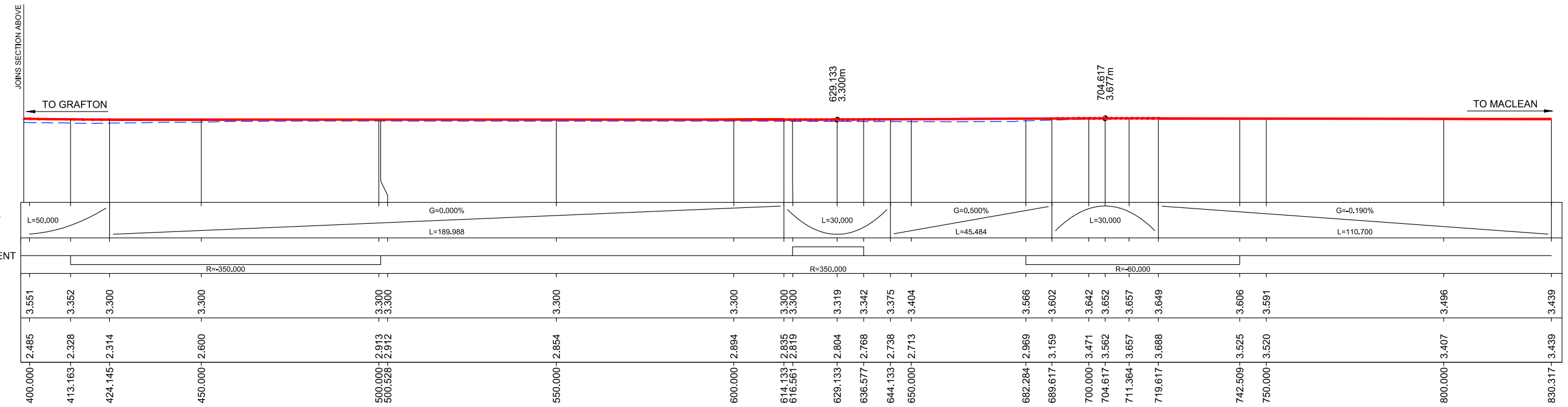

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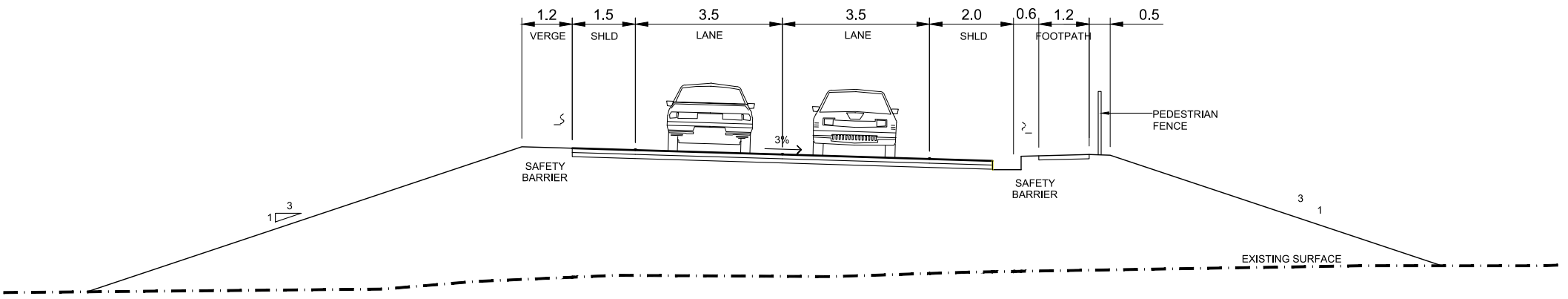

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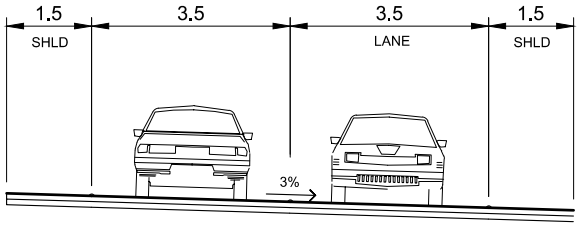

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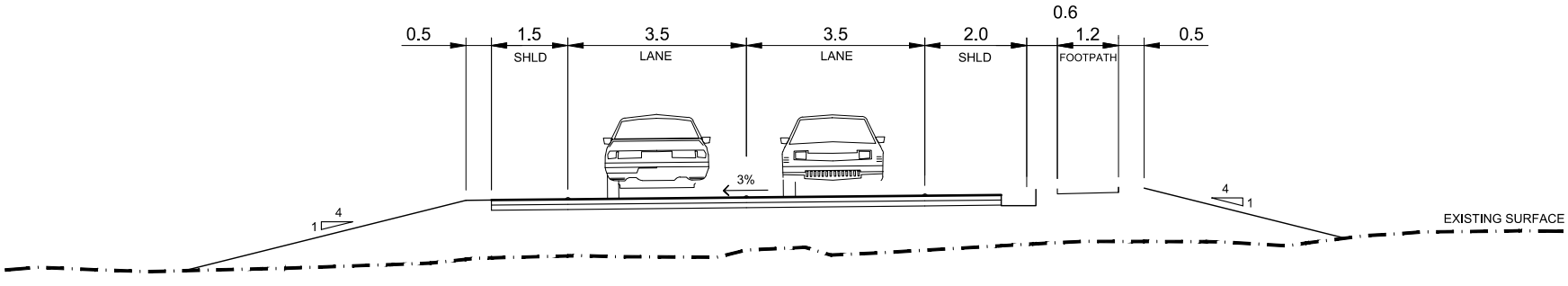
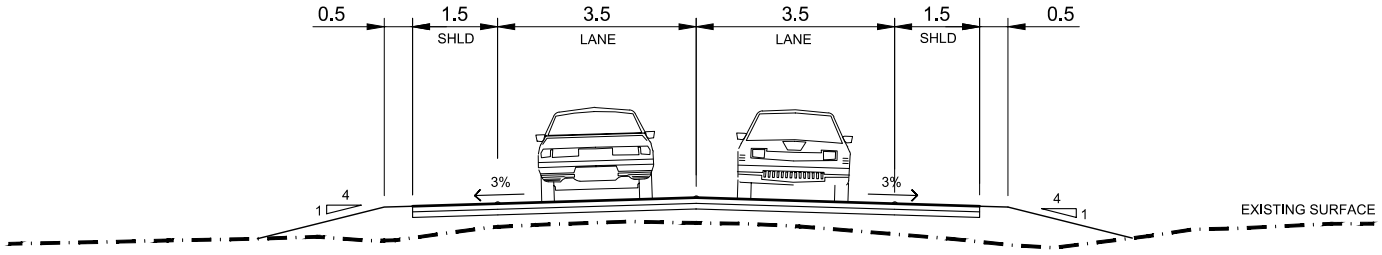
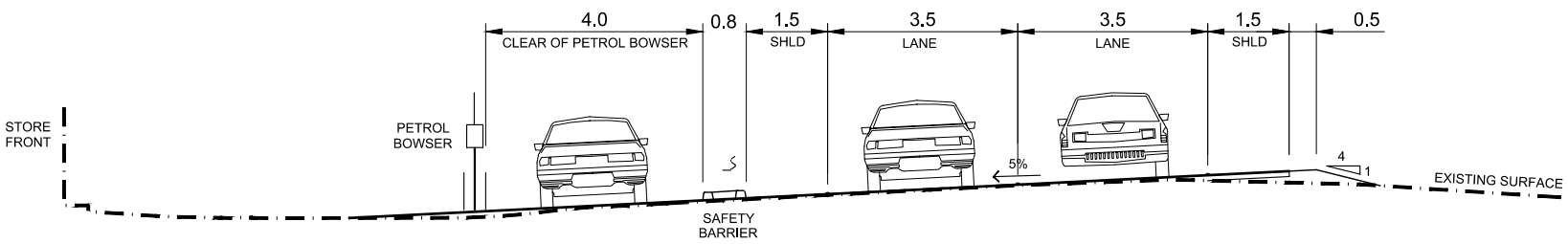


NORTHERN EMBANKMENT CROSS SECTION - CH 410



GRAFTON STREET CROSS SECTION - CH 550



GRAFTON STREET CROSS SECTION AT GENERAL AND LIQUOR STORE - CH 710

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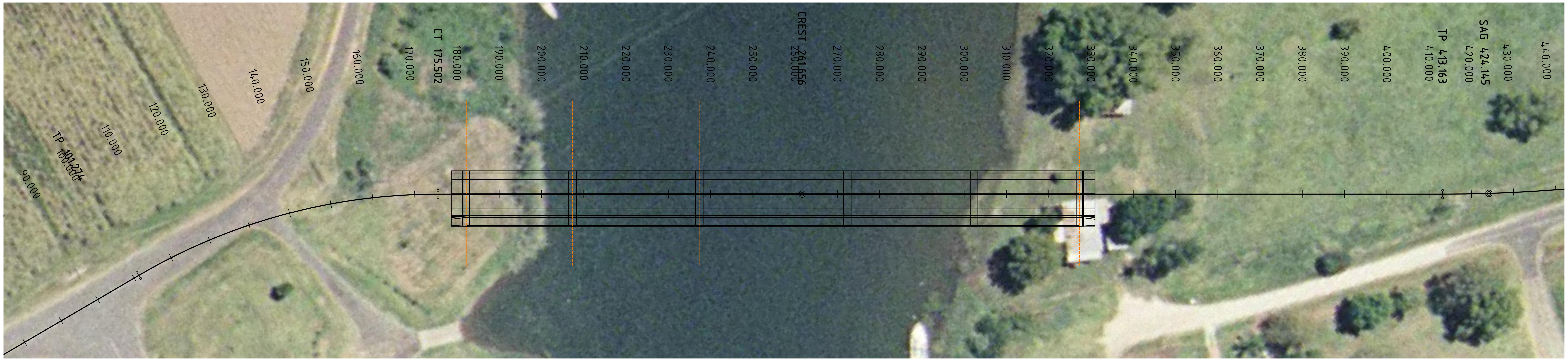
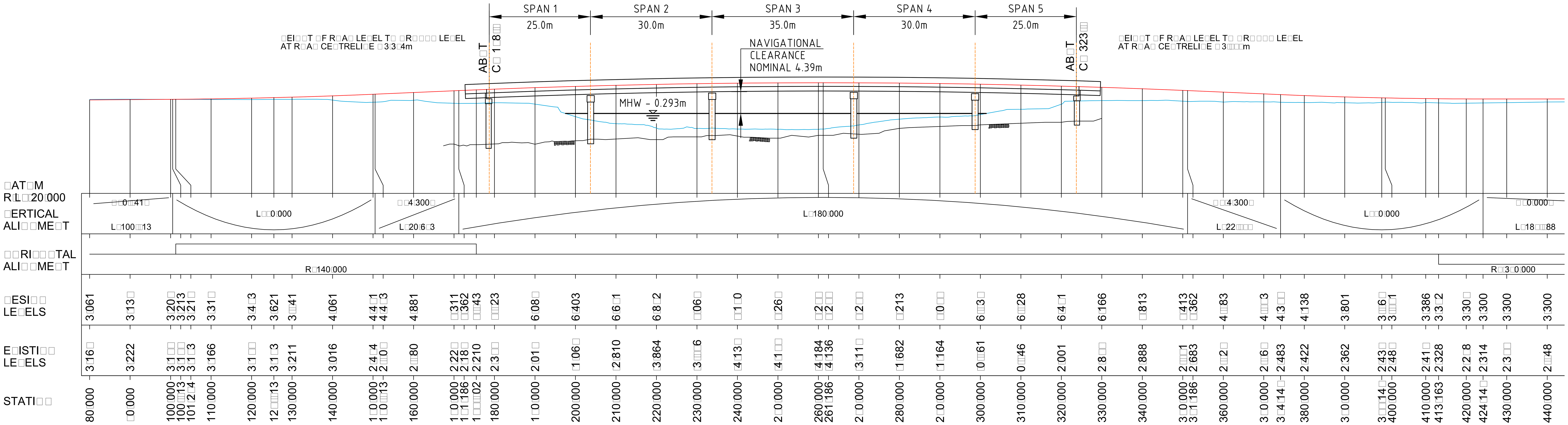
Sportsmans Creek new bridge

February 2014

Transport Roads & Maritime Services

KBR





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Kellogg Brown & Root Pty Ltd

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Kellogg Brown & Root Pty Ltd
ABN 91 007 □□0 317

DRAWING SCALE
SCALE 1:500
DRAFTER: M.HOLBERTON

ORIG. SIZE A1

TITLE
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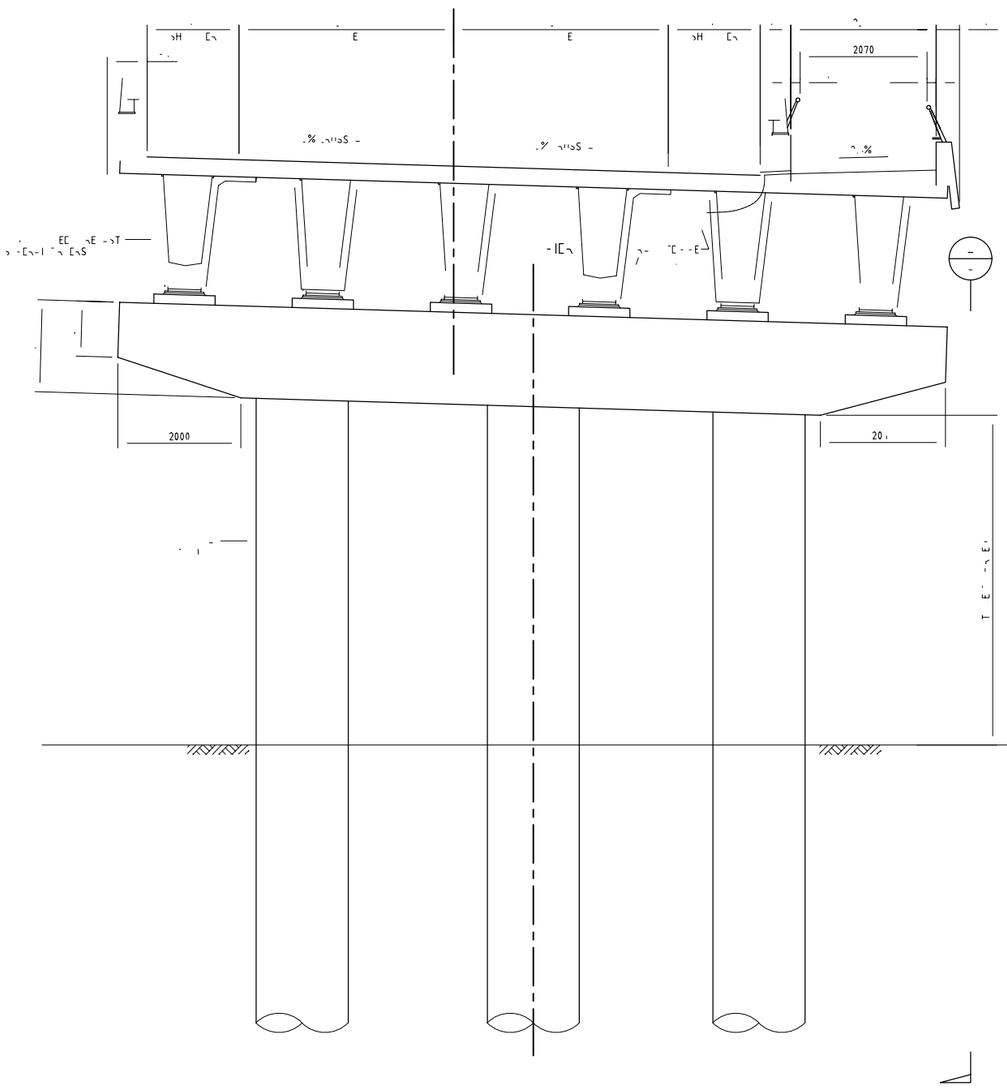

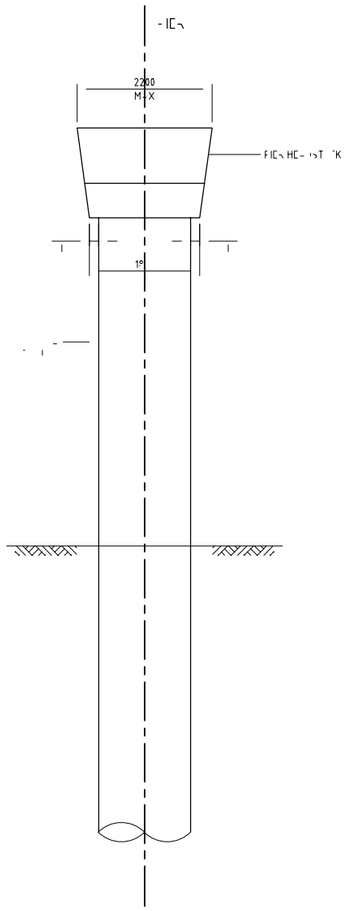

SECTION

Appendix B

Threatened Microbat Roosting Potential Within Sportsmans Creek Bridge

Table B.1 Threatened Microbat Roosting Potential Within Sportsmans Creek Bridge

Scientific Name	*Common Name*	*Legal Status*		*Roosting Habitat*	*No. Atlas of NSW Records*	*Roosting Potential at Sportsmans Creek Bridge*
		TSC Act	*EPBC Act*			
Chalinolobus dwyeri	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 (*Hirundo ariel*) 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. Information from DoE (2012).	0	Possible as opportunistic non-breeding roosting habitat.
*Chalinolobus nigrogriseus**	Hoary Wattled Bat	V	-	Tree hollows in eucalypt trees, rock crevices (Churchill 2008).	6	Low
Miniopterus australis	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).	15	Possible as opportunistic non-breeding roosting habitat.
*Miniopterus schreibersii**	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).	0	Possible as opportunistic non-breeding roosting habitat.
*Mormopterus beccarii**	Beccari's Freetail-bat	V	-	Mainly in tree hollows; also recorded under house roofs in urban areas (OEH, 2012).	0	Low – no local records. Any usage is most likely to be opportunistic non-breeding roosting.
*Mormopterus norfolkensis**	Eastern Freetail-bat	V	-	Mainly in tree hollows but will also roost under bark or in man-made structures (OEH 2012).	0	Low – no local records. Any usage is most likely to be opportunistic non-breeding roosting.
Myotis macropus	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).	6	Known as breeding roosting habitat (Ecotone, 2007; D&D Consultants 2002).

Scientific Name	*Common Name*	*Legal Status*		*Roosting Habitat*	*No. Atlas of NSW Records*	*Roosting Potential at Sportsmans Creek Bridge*
		TSC Act	*EPBC Act*			
*Nyctophilus bifax**	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.
*Saccolaimus flaviventris**	Yellow-bellied Sheathtail-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 and no local records.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Usually tree hollows, but also recorded in buildings (OEH 2012).	2	Low - Any usage is most likely to be opportunistic non-breeding roosting.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Caves but also disused mine workings (OEH 2012).	1	Unlikely

Key:
TSC Act = Threatened Species Conservation Act 1995
EPBC Act = Environmental Protection and Biodiversity Conservation Act 1999
V = Vulnerable
E = Endangered
* = Denotes species consider potential occurrences within the locality however not identified from the database searches.

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Appendix C

Field Survey Results

Table C.1 Sportsmans Creek Bridge Field Survey Results – 16/12/2013

Roost Number	*No. of bat clusters*	*Approximate No. of Bats*	*Species*	*Status*	*Span No.*	*Roosting Habitat*	*Timber Number*	*Gap Size (mm)*	*Other Comment*
C1	1	7	Large-footed Myotis	Adults (no obvious juveniles).	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	-	47	-
C2	1	18	Large-footed Myotis	Adults (no obvious juveniles).	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Near stringer 69	27-30	-
C3	1	3	Large-footed Myotis	Adults (no obvious juveniles) - probably a male group.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 88	36	-
C4	1	20	Large-footed Myotis	Adults and juveniles.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 88	32	Signs of heavy wear on timber at access on stringer below.
C5	2	23	Large-footed Myotis	Adults (no obvious juveniles).	2	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 90	Stringer = 26 mm; decking 32 mm	-
C6	1	9	Large-footed Myotis	Adults and juveniles.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 89	35	-
C7	3	100	Large-footed Myotis	Adults and juveniles.	2	Split (two-piece) stringer and twp bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 90	Stringer = 34 mm; both decking gaps = 55 mm	Signs of heavy wear on timber. Also large guano deposits on top of stringer.
C8	1	2	Large-footed Myotis	Adults (no obvious juveniles) - probably a male group.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Above Stringer 180 near pier 2	37 mm	-
C9	2	10 in total (1 in stringer; 9 in decking)	Large-footed Myotis	Adults (no obvious juveniles) - single bat probably a male.	3	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 259 near pier 3	Stringer = 22 mm; decking gap = 80 mm	-

Roost Number	*No. of bat clusters*	*Approximate No. of Bats*	*Species*	*Status*	*Span No.*	*Roosting Habitat*	*Timber Number*	*Gap Size (mm)*	*Other Comment*
C10	3	29 in total (numbering 10, 13 and 6)	Large-footed Myotis	Adults and juveniles in middle gap/group with 13 bats.	3	Bridge decking - three gaps occupied, each between two transverse decking planks, below longitudinal decking and above a stringer.	Stringer 256	Group of 10 bats = 45 mm; group of 13 bats = 35 mm; group of 6 bats 35 mm	-
C11	1	1	Large-footed Myotis	Adults (no obvious juveniles) - single bat probably a male.	3	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 288	30 mm	-
C12	3	4 in total (numbering 3 the 1)	Large-footed Myotis	Adults (no obvious juveniles) - probably a male group.	3	Split (two-piece) stringer with two groups.	Stringer 2XX, south of girder 45.	Stringer = 20 to 35 mm	-
C13	1	13	Large-footed Myotis	Adults (no obvious juveniles).	3	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Girder 42 (no adjacent stringer number).	35 mm	-
C14	1	1	Large-footed Myotis	Adults (no obvious juveniles) - single bat probably a male.	3	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 191	37 mm	-
C15	3	46 in total (numbering 23, 17 and 6)	Large-footed Myotis	Adults and juveniles in group of 23 and 17.	3	Bridge decking - three gaps occupied, each between two transverse decking planks, below longitudinal decking and above a stringer.	Stringer 292	Group of 23 bats = 70 mm; group of 17 bats = 43 mm; group of 6 bats 36 mm	-
C16	2	11 in total (numbering 6 and 5)	Large-footed Myotis	Adults (no obvious juveniles).	3	Bridge decking - two gaps occupied, each between two transverse decking planks, below longitudinal decking and above a stringer.	Stringer 193	Both 40 mm	-
C17	1	2	Large-footed Myotis	Adults (no obvious juveniles) - probably males.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 181	34 mm	-

Roost Number	*No. of bat clusters*	*Approximate No. of Bats*	*Species*	*Status*	*Span No.*	*Roosting Habitat*	*Timber Number*	*Gap Size (mm)*	*Other Comment*
C18	2	7 and 1	Large-footed Myotis	Adults (no obvious juveniles) - single bat probably a male.	2	Bridge decking - two gaps occupied, each between two transverse decking planks, below longitudinal decking and above a stringer.	Stringer 88	Group of 7 bats = 34 mm; one bat = 41 mm	-
C19	2	15 in stringer; 3 in decking	Large-footed Myotis	Adults and juveniles; separate group of three probably a group of males.	2	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 71	Stringer = 11 to 24 mm; decking = 30 mm	-

Table C.2 Sportsmans Creek Bridge Field Survey Results – 03/02/2014

Roost Number	*No. of bat clusters*	*Approximate No. of Bats*	*Species*	*Status*	*Span No.*	*Roosting Habitat*	*Timber Number*	*Gap Size (mm)*	*Climatic Conditions*	*Other Comment*
C1	Not Occupied	-	-	-	2	-	-	-	-	-
C2	Not Occupied	-	-	-	2	-	-	-	-	-
C3	Not Occupied	-	-	-	2	-	-	-	-	-
C4	Not Occupied	-	-	-	2	-	-	-	-	-
C5	5	57 in total (12 in decking [2,6, 4]; 45 in Stringer)	Large-footed Myotis	Mainly adults size bat. Two obvious juveniles approx. one week old.	2	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 90	Stringer = 15 to 25 mm; Decking 34 to 40 mm	Temp: 27.2°c; Humidity: 61%. Same as ambient conditions below bridge.	Signs of heavy wearing on stringer and decking.
C6	2	11 (10 and 1)	Large-footed Myotis	Adult sized bats only.	2	Bridge decking - between two transverse decking plank, below longitudinal decking and above a stringer.	Stringer 89	33 to 42 mm	Temp: 27.2°c; Humidity: 60.2%. Same as ambient conditions below bridge.	-
C7	3	Approximately 100 in total (25 in decking [10,15]; 95 in stringer)	Large-footed Myotis	Adults and juveniles.	2	Split (two-piece) stringer and two bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Stringer 90	Stringer = 21 to 36 mm; decking gaps = 42 and 55 mm.	Temp: 25.8°c; Humidity: 61.0%. Same as ambient conditions below bridge.	-
C8	Not Occupied	-	-	-	2	-	-	-	-	-
C9	Not Occupied	-	-	-	3	-	-	-	-	-
C10	Not Occupied	-	-	-	3	-	-	-	-	-
C11	Not Occupied	-	-	-	3	-	-	-	-	-

Roost Number	No. of bat clusters	Approximate No. of Bats	Species	Status	Span No.	Roosting Habitat	Timber Number	Gap Size (mm)	Climatic Conditions	Other Comment
C12	2	30 in total (numbering 5 and 25)	Large-footed Myotis	Adults (no obvious juveniles).	3	Split (two-piece) stringer with two groups.	Stringer 2XX, south of girder 45.	30-32 mm	Temp: 26.4°c; Humidity: 61.8%. Same as ambient conditions below bridge.	-
C13	3	48 in total (14 in decking [2, 12]; 34 in Stringer)	Large-footed Myotis	Adults (no obvious juveniles)	3	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer).	Girder 42 (no adjacent stringer number).	Stringer = 25 to 33 mm; decking gaps = 108 and 23 mm.	Temp: 25.6°c; Humidity: 60.3%. Same as ambient conditions below bridge.	-
C14	Not Occupied	-	-	-	3	-	-	-	-	-
C15	2	20 in total (numbering 15 and 5)	Large-footed Myotis	Adults and juveniles	3	Bridge decking - two gaps occupied, each between two transverse decking planks, below longitudinal decking and above a stringer.	Stringer 292	43 and 65 mm	Temp: 24.8°c; Humidity: 60.4%. Same as ambient conditions below bridge.	-
C16	Not Occupied	-	-	-	3	-	-	-	-	-
C17	Not Occupied	-	-	-	2	-	-	-	-	-
C18	2	17 in total (numbering 15 and 2)	Large-footed Myotis	Adult sized bats only.	2	Bridge decking - two gaps occupied, each between two transverse decking planks, below longitudinal decking and above or near a stringer.	Stringer 88	32and 25 mm	Temp: 27.0°c; Humidity: 63.4%. Same as ambient conditions below bridge.	-
C19	2	Approximately 130 in total (90 in stringer; 40 in decking)	Large-footed Myotis	Adult sized bats only.	2	Split (two-piece) stringer and bridge decking (between two transverse decking plank, below longitudinal decking and above a stringer). Part of the group in the decking was not above the stringer, midway between the edge and first stringer.	Stringer 71	Stringer = 15 to 25 mm; decking 30 to 62mm.	Temp: 26.0°c; Humidity: 62.0%. Same as ambient conditions below bridge.	-

Roost Number	*No. of bat clusters*	*Approximate No. of Bats*	*Species*	*Status*	*Span No.*	*Roosting Habitat*	*Timber Number*	*Gap Size (mm)*	*Climatic Conditions*	*Other Comment*
C20	1	4	Large-footed Myotis	Adult sized bats only.	2	Bridge decking - between two transverse decking planks, below longitudinal decking and above or near a stringer.	stringer 70	41 mm	Temp: 27.7°c; Humidity: 62.4%. Same as ambient conditions below bridge.	-
C21	1	4	Large-footed Myotis	Adult sized bats only.	3	Bridge decking - between two transverse decking planks, below longitudinal decking and above or near a stringer.	Stringer 2796	33 mm	Temp: 26.0°c; Humidity: 60.9%. Same as ambient conditions below bridge.	-

Table C.3 Alternative Drainage Structure Survey Results – 03 and 04/02/2014

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1692	-29.488003	153.19244	Pipe culvert	1	1200	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1693	-29.502588	153.19073	Pipe culvert	2	2000	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	No
1694	-29.517585	153.1846	Box culvert	2	2000 x 2000	No	No	Low	Highly susceptible to inundation.	No
1695	-29.539961	153.17162	Pipe culvert	1	1800	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1696	-29.538319	153.1594	Pipe culvert	1	900	Cell joins and lift holes	Yes - minor guano deposits present.	Low	No permanent water directly adjacent to culvert.	No
1697	-29.537942	153.15314	Pipe culvert	3	1600	Cell joins and lift holes	Yes - minor guano deposits present.	Low	No permanent water directly adjacent to culvert.	No
1698	-29.555301	153.1373	Pipe culvert	1	750	Cell joins	No	Low	Highly susceptible to inundation; barbed wire fence along outlet; overgrown vegetation at inlet; no open permanent water.	No
1699	-29.568973	153.07768	Wingfield Bridge over the Clarence River South Arm at Brushgrove/ Cowper	-	-	Exposed roosting opportunities including mainly provided by rough concrete and bird nests.	No	Low - moderate	Not able to be comprehensively inspected. Ability to support a large Myotis breeding colony (>100 individuals) appears low.	No

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1700	-29.569362	153.07811	Pipe culvert	1	2000	Cell joins; rough concrete	Yes - 3 x Chocolate Wattled bats (*C. gouldii*). Moderate guano accumulations throughout.	Moderate	Floodgate at outlet. Flooding susceptibility may reduce suitability.	No
1701	-29.572031	153.07314	Pipe culvert	2	1500	Cell joins and lift holes	No	Low	Highly susceptible to inundation and no deep cavities.	No
1702	-29.551485	153.13796	Pipe culvert	2	600	Cell joins	No	Low	Highly susceptible to inundation; no open water; dense vegetation at inlet and outlet.	No
1703	-29.535751	153.13693	Pipe culvert	2	1200	Cell joins; Fairy Martin nests	No	Low	Highly susceptible to inundation; open water present.	No
1704	-29.536089	153.13911	Pipe culvert	1	600	Cell joins; Fairy Martin nests	No	Low	Highly susceptible to inundation; no open water present.	No
1705	-29.536228	153.14221	Pipe culvert	2	1200	Cell joins	No	Low	Highly susceptible to inundation; no open water present.	No
1706	-29.512485	153.13082	Pipe culvert	1	1200	Cell joins	No	Low	Highly susceptible to inundation; no open water present.	No
1707	-29.509843	153.13161	Pipe culvert	1	2200	Cell joins	No	Low	Highly susceptible to inundation; no open water present.	No
1709	-29.514074	153.13877	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Highly susceptible to inundation; no open water present.	No
1711	-29.506937	153.13106	Pipe culvert	2	1200	Cell joins	No	Low	Highly susceptible to inundation; no open water present.	No

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1712	-29.511571	153.12019	Box culvert	2	1400	Cell joins	No	Low	Highly susceptible to inundation; no open water present.	No
1713	-29.528436	153.1095	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1714	-29.494808	153.1189	Box culvert	1	2000	Cell joins; rough concrete	Yes - 9 x Chocolate Wattled bats (*C. gouldii*).	Moderate	Floodgate at outlet. Flood susceptibility may reduce suitability.	No
1715	-29.493684	153.14439	2 x pipe culvert; 2 x box culvert	4	900 pipes; 1200 x 75 boxes.	Cell joins and lift holes	No	Low	Highly susceptible to inundation; no open water present.	No
1716	-29.579662	153.07787	Pipe culvert	1	450	Cell joins	No	Low	Susceptible to inundation.	No
1717	-29.586708	153.08916	Pipe culvert	1	600	Unknown	Unknown	Low	Inlet and outlet covered with vegetation.	No
1718	-29.571645	153.09171	Pipe culvert	1	450	Unknown	Unknown	Low	Inlet and outlet covered with vegetation.	No
1719	-29.590924	153.10071	Bridge	-	-	Fairy Martin nests; exposed roost features.	No	Low	Good foraging habitat	No
1720	-29.593064	153.10962	Pipe culvert	1	1200	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1721	-29.584732	153.12122	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1722	-29.573967	153.11879	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1723	-29.574805	153.11115	Pipe culvert	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: inlet and outlet access on private property.	Unknown

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1724	-29.570107	153.11068	Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat.	No
1725	-29.566914	153.12985	Coldstream Bridge	-	-	Scuppers, stringer chambers; Fairy Martin nests.	Yes - guano present.	High	Unable to be comprehensively inspected. Previously recorded supporting Large-footed Myotis colony (Alison Martin pers. comm.).	Yes (probable breeding colony)
1726	-29.563564	153.14667	Box culvert	1	2200	Exposed roost features on rough concrete.	No	Low	-	No
1727	-29.558608	153.15001	Box culvert	1	1500 x 1100	Fairy Martin nests; exposed roost features.	No	Low	-	No
1728	-29.509531	153.19059	Shark Creek Bridge	-	-	New Bridge: gaps between concrete planks (large breeding group in a cavity 15mm wide at the bottom; 30 mm wide at the top and approximately 300 mm deep; also a step/lip at the base of the concrete blanks which is likely to be important for allowing the bats to enter the roost). Old Bridge: exposed roosting features.	Yes - >300 Large-footed Myotis (including young) recorded in new bridge. Large guano deposits and staining. Numbering >300 southern span; unknown middle span; 10 northern span.	Known	-	Yes (breeding colony)
1729	-29.491756	153.19693	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Floodgate on outlet. Highly susceptible to inundation.	No
1730	-29.496653	153.19635	Pipe culvert	Unknown	Unknown	Unknown	Unknown	Low	Inundated.	No

Ref. No.	Latitude	Longitude	Feature	No. Cells (Culverts Only)	Approx. Culvert Cell Diameter (mm)	Microbat Roosting Features	Bats /evidence of occurrence	Suitability for Breeding Myotis	Comment	Known Large-footed Myotis Roost Sites
1731	-29.533098	153.18688	Pipe culvert		Unknown	Unknown	Unknown	Low	Unable to be comprehensively surveyed. Half inundated. Highly susceptible to inundation.	No
1732	-29.541998	153.17175	Pipe culvert	4	Unknown	Unknown	Unknown	Low	Unable to be comprehensively surveyed. Half inundated. Highly susceptible to inundation.	No
1733	-29.499398	153.08498	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1734	-29.514446	153.09543	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1735	-29.520354	153.09086	Pipe culvert	2	750	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1736	-29.528909	153.09298	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1737	-29.530856	153.09474	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1738	-29.530165	153.09013	Pipe culvert	1	900	Cell joins and lift holes	No	Low	Highly susceptible to inundation.	No
1739	-29.539196	153.09092	Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat.	No
1740	-29.542241	153.09043	Pipe culvert	1	1500	Cell joins; lift holes and exposed roost.	No	Low	-	No
1741	-29.560613	153.07395	Pipe culvert	2	600	Unknown	Unknown	Low	Unable to be comprehensively surveyed. Mostly inundated. Highly susceptible to inundation.	No

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1742	-29.540584	153.10019	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1743	-29.522152	153.10357	Pipe culvert	-	-	Unknown	Unknown	Low	Not inspected: outlet blocked by floodgate; inundated inlet.	No
1744	-29.512313	153.10277	Culvert (unknown type)	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: outlet blocked by floodgate; inlet access on private property.	Unknown
1745	-29.46899	153.086	Pipe culvert	4	1800	Cell joins and lift holes	Yes - 1 x Little Bentwing Bat in lift hole (northern cell); > 20 Large-footed Myotis including young in lift holes (4 in one group in northern cell; one dead juvenile in southern cell; 3 in lift hole in 2nd from north cell; two breeding groups in lift holes numbering 5 and 6; and one single male in 3rd cell from the north). Large guano accumulations.	Known	Open water for foraging at outlet.	Yes (breeding colony)
1746	-29.46778	153.08491	Pipe culvert	3	1500	Cell joins and lift holes	No	High	Open water for foraging at outlet. Habitat similar to 1745, however inlet and outlet covered with vegetation.	No

Ref. No.	Latitude	Longitude	Feature	No. Cells (Culverts Only)	Approx. Culvert Cell Diameter (mm)	Microbat Roosting Features	Bats /evidence of occurrence	Suitability for Breeding Myotis	Comment	Known Large-footed Myotis Roost Sites
1747	-29.462722	153.07772	Pipe culvert	1	1200	Cell joins and lift holes	No	Low	-	No
1748	-29.427254	153.08472	Broadwater Creek Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat	No
1749	-29.415424	153.08648	Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat	No
1750	-29.462072	153.11955	Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat	No
1751	-29.454297	153.13738	Bridge	-	-	Exposed roost features.	No	Low	Good foraging habitat	No
1752	-29.476221	153.12682	Box culvert	Unknown	Unknown	Unknown	Unknown	Unknown	Not inspected: partly inundated and deep channel.	Unknown
1754	-29.487818	153.13239	Pipe culvert	1	1800	Cell joins and lift holes	Yes - < 5 bats present. Species and breeding status unknown.	Unknown	Channel too deep at inlet and outlet for inspection.	Unknown
1755	-29.480892	153.13974	Box culvert	1	2000	Unknown	Unknown	Unknown	Floodgate on outlet; inlet channel too deep to access. Susceptible to flooding.	Unknown
1756	-29.460164	153.16844	Pipe culvert	1	1200	Cell joins and lift holes	Yes - 1 x Large-footed Myotis (probable male).	Low	Floodgate at outlet. Flooding may reduce suitability.	No
1757	-29.462476	153.16982	Pipe culvert	1	1200	Unknown	Unknown	Unknown	No inspected. Channel too deep to access. Susceptible to frequent inundation.	Unknown
1758	-29.465625	153.17252	Poverty Creek Bridge	-	-	Rough concrete and bird nests.	Yes - approximately 5 x Large-footed Myotis roosting in Welcom Swallow nest. Large staining on rough roof; large guano accumulations.	Low - moderate.	-	Yes (status unknown but unlikely to comprise a breeding colony)

Ref. No.	*Latitude*	*Longitude*	*Feature*	*No. Cells (Culverts Only)*	*Approx. Culvert Cell Diameter (mm)*	*Microbat Roosting Features*	*Bats /evidence of occurrence*	*Suitability for Breeding Myotis*	*Comment*	*Known Large-footed Myotis Roost Sites*
1759	-29.467177	153.19339	Pipe culvert	5	900	Unknown	Unknown	Low	Floodgate on outlet; inlet half inundated. No comprehensively inspected. Susceptible to flooding.	No
1760	-29.468693	153.18977	Pipe culvert	5	1200	Unknown	Unknown	Low	Half inundated. No comprehensively inspected. Susceptible to flooding.	No

Appendix B

EPBC Act Protected Matters Search Tool and OEH BioNet Database Search Results

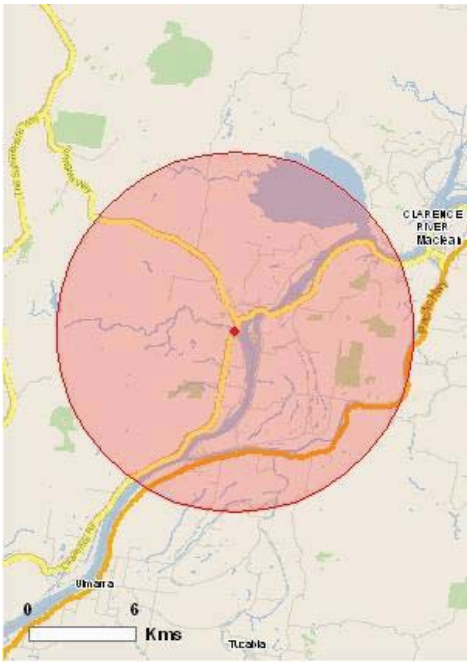
EPBC Act Protected Matters Report

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: 04/07/13 10:15:25



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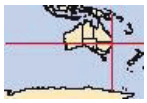

Summary

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:	1
Listed Threatened Species:	39
Listed Migratory Species:	31

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:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	36
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves:	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:	3
State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	41
Nationally Important Wetlands:	4
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

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat may occur within 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 may 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 likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area
Angophora robur Sandstone Rough-barked Apple [56088]	Vulnerable	Species or species habitat likely to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Eucalyptus tetrapleura Square-fruited Ironbark [7490]	Vulnerable	Species or species habitat may occur within area
Grevillea masonii [64523]	Endangered	Species or species habitat likely to occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Melichrus sp. Newfoundland State Forest (P.Gilmour 7852) Hairy Melichrus [82048]	Endangered	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		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 known 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 known 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 known to occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Foraging, feeding or related behaviour likely to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Foraging, feeding or related behaviour known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Trading Bank of Australia

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]		Breeding known to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Foraging, feeding or related behaviour likely to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Foraging, feeding or related behaviour known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Foraging, feeding or related behaviour known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Foraging, feeding or related behaviour known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
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 known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Lower Clarence River Area	NSW	Indicative Place
Sportsmans Creek Proposed Nature Reserve	NSW	Registered
Historic		
Sportsmans Creek Road Bridge	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Everlasting Swamp	NSW
Munro Island	NSW
Warragai Creek	NSW
Woodford Island	NSW

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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
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
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur

Name	Status	Type of Presence
		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
Equus caballus Horse [5]		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
Rattus norvegicus Brown Rat, Norway Rat [83]		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
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		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
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to 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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Clarence River Estuary	NSW
Everlasting Swamp	NSW
The Broadwater	NSW
Upper Coldstream	NSW

Coordinates

-29.50392 153.0992

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.

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Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a
Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°; ^^ rounded to 0.01°).

Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) Plants in selected area [North: -29.45 West: 153.04 East: 153.14 South: -29.55] returned a total of 34 records of 77 species.
Report generated on 4/07/2013 12:07 PM

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
Flora	*Eucalyptus glaucina*	Slaty Red Gum	V,P	V	2
Flora	*Grevillea masonii*	Mason's Grevillea	E1,P,3	E	27
Flora	*Maundia triglochinoides*		V,P		1
Flora	*Melaleuca irbyana*	Weeping Paperbark	E1,P		4

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a
Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°; ^^ rounded to 0.01°).

Search criteria : Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) Animals in selected area [North: -29.45 West: 153.04 East: 153.14 South: -29.55] returned a total of 466 records of 101 species.
Report generated on 4/07/2013 12:04 PM

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
Amphibia	*Crinia tinnula*	Wallum Froglet	V,P		1
Aves	*Anseranas semipalmata*	Magpie Goose	V,P		4
Aves	*Burhinus grallarius*	Bush Stone-curlew	E1,P		1
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		2
Aves	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		308
Aves	*Grus rubicunda*	Brolga	V,P		52
Aves	*Haematopus longirostris*	Pied Oystercatcher	E1,P		19
Aves	*Irediparra gallinacea*	Comb-crested Jacana	V,P		6
Aves	*Limosa limosa*	Black-tailed Godwit	V,P	C,J,K	1
Aves	*Pandion cristatus*	Eastern Osprey	V,P,3		43
Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P		11
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	3
Mammalia	*Miniopterus australis*	Little Bentwing-bat	V,P		1
Mammalia	*Myotis macropus*	Southern Myotis	V,P		1
Mammalia	*Petaurus norfolcensis*	Squirrel Glider	V,P		1
Mammalia	*Phascogale tapoatafa*	Brush-tailed Phascogale	V,P		4
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	6
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	2

Appendix C

Threatened Species Potential Occurrence Assessment

Table C1 Threatened Fauna Search Results - Potential Occurrence Assessment

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Amphibia						
Crinia tinnula	Wallum Froglet	V	-	Acid paperbark and sedge swamps known as 'wallum', this is a banksia-dominated lowland heath ecosystem characterised by acidic waterbodies.	No wallum habitat associated with the site.	Very Low
Mixophyes balbus	Stuttering Frog	V	V	Cool rainforest, moist eucalypt forest and occasionally along creeks in dry eucalypt forest.	No suitable habitat associated with the site.	Very Low
Mixophyes iterates	Giant Barred Frog	E	E	Deep, damp leaf litter in rainforests, moist eucalypt forest and near dry eucalypt forest.	No suitable habitat associated with the site.	Very Low
Avifauna						
Anseranas semipalmata	Magpie Goose	V	-	Shallow wetlands (<1 metre deep), large swamps and dams with dense growth of rushes or sedge.	Potential habitat in ephemeral swamp to the west of the study area	Moderate
Anthochaera phrygia (formerly Xanthomyza phrygia)	Regent Honeyeater	CE	E	Dry open forest and woodland with an abundance of nectar-producing eucalypts, particularly box-ironbark woodland, swamp mahogany forests, and riverine sheoak woodlands.	Minimal suitable foraging habitat associated with the site.	Low
Botaurus poiciloptilus	Australasian Bittern	E	E	Permanent freshwater wetlands with tall dense vegetation, particularly bullrushes and spikerushes.	Marginal habitat associated with ephemeral wetlands and riparian habitats associated with the study area.	Moderate
Burhinus grallarius	Bush Stone-curlew	E	-	Lightly timbered open forest and woodland, and partly cleared farmland with woodland remnants, preferring areas with dry leaf-litter, fallen timber and sparse ground cover.	No suitable habitat present.	Very Low
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Sheoaks in coastal forests and woodlands, timbered watercourses, and moist and dry eucalypt forests of the coast and the Great Divide up to 1,000 m.	No suitable habitat present.	Very Low
Dasyornis brachypterus	Eastern Bristlebird	E	E	High elevation open forest, woodland with dense tussock or sedge understorey adjacent to rainforest or wet eucalypt forest.	No suitable habitat present and site is out of known range.	Very Low

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Diomedea exulans (sensu lato)	Wandering Albatross	E	V	In the Australasian region, it occurs inshore, offshore and in pelagic waters. On breeding islands, the Wandering Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground (Falla 1937; Warham and Bell 1979). Nests of the Wandering Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off (Warham and Bell 1979).	No suitable habitat within the study area.	Very Low
Diomedea exulans antipodensis	Antipodean Albatross	V	V	Nests in open patchy vegetation, such as among tussock grassland or shrubs on ridges, slopes and plateaus	No suitable habitat within the study area.	Very Low
Diomedea exulans exulans	Tristan Albatross	-	E	It forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. It sleeps and rests on ocean waters when not breeding. Breeding occurs on Inaccessible Island and Gough Island in the Atlantic Ocean.	No suitable habitat within the study area.	Very Low
Diomedea exulans gibsoni	Gibson's Albatross	V	V	On breeding islands, the Gibson's Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground (Falla 1937a; Warham and Bell 1979). Nests of the Gibson's Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off (Warham and Bell 1979).	No suitable habitat within the study area.	Very Low
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Swamps, mangroves, mudflats, dry floodplains.	Suitable habitat within ephemeral swamp to the west of the study area. Many records from near the site.	High
Erythrotriorchis radiatus	Red Goshawk	CE	V	Along or near watercourses, swamp forest and woodlands on the coastal plain.	Potential foraging habitat associated with Sportsmans Creek riparian zone.	Moderate
Grus rubicunda	Brolga	V	-	Shallow swamps, floodplains, grasslands and pastoral lands, usually in pairs or parties.	Suitable habitat within ephemeral swamp to the west of the study area. Records known from near the site.	High

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Haematopus longirostris	Pied Oystercatcher	E	-	Open beaches, intertidal flats, sandbanks and occasionally rocky headlands.	Habitat present associated with Sportsmans Creek and the Clarence River. Marginal habitat associated with the study area itself.	Low
Irediparra gallinacean	Comb-crested Jacana	V	-	Among vegetation floating on slow-moving rivers and permanent lagoons, swamps, lakes and dams.	Marginal habitat within Sportsmans Creek itself and the ephemeral wetland to the west.	Moderate
Lathamus discolour	Swift Parrot	E	E	Forests, woodlands, plantations, and banksias.	Minimal suitable foraging habitat associated with the site.	Low
Limosa limosa	Black-tailed Godwit	V	-	Tidal mudflats, sandspits, swamps, shallow river-margins and reservoirs.	Suitable broad habitat types associated with the site.	Moderate
Pandion cristatus (formerly Pandion haliaetus)	Eastern Osprey	V	-	Forage for fish in fresh, brackish or saline waters of rivers, lakes, estuaries with suitable nesting sites nearby.	Suitable habitats occurring at the site including potential non-breeding roosting habitat on the existing Sportsmans Creek Bridge.	High
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.	The study area would have previously represented habitat for this species before being largely cleared.	Low
Rostratula benghalensis australis	Australian Painted Snipe	E	V	Well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, and open timber.	Broad habitat types associated with the site (ephemeral wetland to the west) but poor quality habitat within the study area.	Moderate
Turnix melanogaster	Black-breasted Button-quail	E	V	Drier rainforests and viney scrubs, often in association with Hoop Pine and a deep moist leaf litter layer. During drought it may move to adjacent wetter rainforests.	No suitable habitat within the study area.	Very Low
Mammalia						

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Near cave entrances and crevices in cliffs.	Suitable foraging habitat in area and has been recorded previously at the site. Unlikely to utilise habitat on the existing bridge for roosting.	Moderate
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E	Dry and moist eucalypt forests and rainforests, fallen hollow logs, large rocky outcrops.	No suitable habitat within the study area.	Very Low
Miniopterus australis	Little Bentwing-bat	V	-	Moist eucalypt forest, rainforest and dense coastal scrub.	Likely occurrence on the existing Sportsmans Creek Bridge as an overwintering roost site.	High
Miniopterus schreibersii	Eastern Bentwing Bat	V	-	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures	Potential to utilise the existing Sportsmans Creek bridge as roosting (non-breeding habitat)	High
Myotis macropus	Large-footed Myotis	V	-	Bodies of water, rainforest streams, large lakes, reservoirs.	Known roosting habitat on existing bridge and foraging habitat along Sportsmans Creek/ Clarence River.	Known
Petaurus norfolcensis	Squirrel Glider	V	-	Blackbutt, bloodwood and ironbark eucalypt forest with heath understorey in coastal areas, and box-ironbark woodlands and River Red Gum forest inland.	No suitable habitat within the study area.	Very Low
Petrogale penicillata	Brush-tailed Rock Wallaby	V	V	North-facing cliffs and dry eucalypt forest and woodland, inhabiting rock crevices, caves, overhangs during the day, and foraging in grassy areas nearby at night.	No suitable habitat within the study area.	Very Low
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Drier forests and woodlands with hollow-bearing trees and sparse ground cover.	No suitable habitat within the study area.	Very Low
Phascolarctos cinereus	Koala	V	-	Appropriate food trees in forests and woodlands, and treed urban areas.	Scattered food trees in broader area and some historic records.	Low
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	Cool temperate rainforest, moist and dry forests, and wet heathland, inhabiting dense layers of grass, ferns, vines and shrubs.	No suitable habitat associated with the study area.	Low
Pseudomys novaehollandiae	New Holland Mouse	-	V	Occurs in open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	No suitable habitat associated with the study area.	Low

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Suitable foraging habitat associated with the broader area.	High (relatively common throughout locality)
Xeromys myoides	False Water-rat	-	V	Primarily in habitats mangrove forests but has been recorded in a variety of well-watered habitats including, freshwater lagoons, sedged lakes close to foredunes, and swamps.	Very marginal habitat associated with the site.	Low
Reptiles						
Caretta caretta	Loggerhead Turtle	E	E	Ocean dwellers, females come ashore to lay eggs during warmer months.	No suitable habitat associated with the study area.	Low
Chelonia mydas	Green Turtle	V	V	Ocean-dwelling species spending most of its life at sea with scattered nesting records along the NSW coast.	No suitable habitat associated with the study area.	Low
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	V	V	Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.	No suitable habitat associated with the study area.	Low
Dermochelys coriacea	Leathery Turtle	V	V	Occurs in inshore and offshore marine waters, occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW.	No suitable habitat associated with the study area.	Low
Eretmochelys imbricate	Hawksbill Turtle	_	V	This species settles and forages in tropical tidal and sub-tidal coral and rocky reef habitat. They have also been found (less frequently) within seagrass habitats of coastal waters. Have been observed in temperate regions as far south as northern NSW.	Marginal habitats present mainly in the Clarence River.	Low
Natator depressus	Flatback Turtle	_	V	Known to inhabit soft bottom habitat, feed in turbid, shallow inshore waters, nesting habitat includes sandy beaches in the tropics and sub-tropics with sand temperatures between 25 and 33 degrees Celsius at nest depth.	No suitable habitat associated with the study area.	Low

Table C2 Migratory Species Results - Potential Occurrence Assessment

Scientific Name	*Common Name*	*Status*	*Suitability of Site Habitat*	*Potential Occurrence*
Migratory Marine Birds				
Apus pacificus	Fork-tailed Swift		Suitable habitat associated with the existing Sportsmans Creek Bridge and surrounds.	High
Diomedea antipodensis	Antipodean Albatross	Vulnerable	No suitable habitat within the study area.	Very Low
Diomeda dabbenena	Tristan Albatross	Endangered	No suitable habitat within the study area.	Very Low
Diomedea exulans	Wandering Albatross	Vulnerable	No suitable habitat within the study area.	Very Low
Diomedea gibsoni	Gibson's Albatross	Vulnerable	No suitable habitat within the study area.	Very Low
Migratory Marine Species				
Caretta caretta	Loggerhead Turtle	Endangered	No suitable habitat associated with the study area.	Low
Chelonia mydas	Green Turtle	Vulnerable	No suitable habitat associated with the study area.	Low
Dermochelys coriacea	Leatherback Turtle	Endangered	No suitable habitat associated with the study area.	Low
Eretmochelys imbricata	Hawksbill Turtle	V	Marginal habitats present mainly in the Clarence River.	Low
Natator depessus	Flatback Turtle	V	No suitable habitat associated with the study area.	Low
Sousa chinensis	Indo-Pacific Humpback Dolphin		No suitable habitat associated with the study area.	Low
Migratory Terrestrial Species				
Haliaeetus leucogaster	White-bellied Sea Eagle		Suitable foraging habitat associated with Sportsmans Creek and the Clarence River.	High
Hirundapus caudacutus	White-throated Needletail		Potential foraging habitat throughout the broader area.	Moderate
Merops ornatus	Rainbow Bee-eater		Potential foraging habitat throughout the broader area.	Moderate
Monarcha melanopsis	Black-faced Monarch		Very marginal habitat associated with the study area.	Low
Monarcha trivirgatus	Spectacled Monarch		Very marginal habitat associated with the study area.	Low
Myiagra cyanoleuca	Satin Flycatcher		Potential foraging habitat throughout the broader area.	Moderate
Rhipidura rufifrons	Rufous Fantail		Very marginal habitat associated with the study area.	Low
Xanthomyza Phrygia	Regent Honeyeater	Endangered	Minimal suitable foraging habitat associated with the site.	Low
Ardea alba	Great Egret		Suitable habitat associated with Greenfield parts of the study area.	High (common)
Ardea ibis	Cattle Egret		Suitable habitat associated with Greenfield parts of the study area.	High (common)
Calidris acuminate	Sharp-tailed Sandpiper		Very marginal habitat associated with the study area.	Low
Calidris ruficollis	Red-necked Stint		Very marginal habitat associated with the study area.	Low
Charadrius bicintus	Double-banded Plover		Very marginal habitat associated with the study area.	Low
Charadrius mongolus	Lesser Sand Plover		Very marginal habitat associated with the study area.	Low
Gallinago harwickii	Latham's Snipe		Very marginal habitat associated with wetland areas to the west of the study area	Moderate
Limosa lapponica	Bar-tailed Godwit		Very marginal habitat associated with the study area.	Low
Numenius minutus	Little Curlew		Very marginal habitat associated with the study area.	Low

Scientific Name	*Common Name*	*Status*	*Suitability of Site Habitat*	*Potential Occurrence*
Numenius phaeopus	Whimbrel		Very marginal habitat associated with the study area.	Low
Pluvialis fulva	Pacific Golden Plover		Very marginal habitat associated with the study area.	Low
Rostratula benghalensis (sensu lato)	Painted Snipe	Endangered	Broad habitat types associated with the site but poor quality habitat within the study area.	Moderate

Table C3 Threatened Flora Search Results - Potential Occurrence Assessment

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Flora						
Allocasuarina defungens	Dwarf Heath Casuarina	E	E	Tall heath on sand, also on clay and sandstone.	No suitable habitat associated with the study area.	Low
Angophora robur	Sandstone Rough-barked Apple	V	V	Dry open forest in sandy or skeletal soils on sandstone, or occasionally granite, with frequent outcrops of rock.	No suitable habitat associated with the study area.	Low
Arthraxon hispidus	Hairy Joint Grass	V	V	Moist shady places in or on the edges of rainforest and wet eucalypt forest, often near creeks or swamps.	Potential habitat in green field parts of the study area.	Moderate
Cryptocarya foetida	Stinking Cryptocarya	V	V	Littoral rainforest in sandy soils, mature trees known on basalt soils.	Very marginal habitat present at the site.	Low
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Does not have well defined habitat and is known from a range of communities, including swamp-heath and woodland.	No typical habitat present at the site.	Low
Eucalyptus glaucina	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. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	No suitable habitat occurring at the site.	Low
Eucalyptus tetrapleura	Square-fruited Ironbark	V	V	Dry or moist eucalypt forest on moderately fertile soil, often in low areas with poor drainage.	No suitable habitat occurring at the site.	Low
Grevillea masonii	Mason's Grevillea	E	E	Road verges and pasture at low altitudes in gravelly loam soils.	No suitable habitat occurring at the site.	Low
Marsdenia longiloba	Clear Milkvine	E	V	Subtropical and warm temperate rainforest, lowland moist eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	No suitable habitat occurring at the site.	Low
Maundia triglochinoides	-	V	-	Swamps or shallow fresh water on clay.	Potential habitat within ephemeral swamps to the west of the study area.	Moderate
Melaleuca irbyana	Weeping Paperbark	E	-	Open eucalypt forest in poorly drained, usually clay, soils.	No typical habitat associated with the site.	Low
Melichrus hirsutus	Hairy Melichrus	E	E	Low-altitude eucalypt forest with shrubby understorey on sandy infertile soil with rocky outcrops.	No suitable habitat at the site.	Low

Scientific Name	*Common Name*	*Status*		*Habitat Requirement* (Source: OEH 2013; SEWPaC 2013)	*Suitability of Site Habitat*	*Potential Occurrence*
		TSC Act	*EPBC Act*			
Phaius australis	Southern Swamp Orchid	E	E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest mostly in coastal areas.	Very marginal habitat associated with the western portion of the study area.	Low
Streblus pendulinus	Siah's Backbone	-	E	Found in warmer rainforests, chiefly along watercourses at altitudinal range is from near sea level to 800 metres above sea level. Grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest. On Norfolk Island, the species is found in a variety of forest types, though it is rare.	No suitable habitat at the site.	Low

Appendix D

Flora Species Recorded in the Study Area

Table D1 Flora Species Recorded within the Study Area

Family	*Species* *(* indicates a non-indigenous species)*	*Common Name*
Trees, Palms and Shrubs		
Altingiaceae	* *Liquidambar styraciflua*	Liquidambar
Arecaceae	* *Acer sp.*	A maple (
Arecaceae	* *Syagrus romanzoffiana*	Cocos Palm
Fabaceae (Faboideae)	* *Erythrina crista-galli*	Cockspur Coral Tree
Lauraceae	* *Cinnamomum camphora*	Camphor Laurel
Moraceae	*Ficus macrophylla*	Moreton Bay Fig
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
	* *Corymbia torelliana*	*Cadagi*
Pinaceae	* *Pinus sp.*	A pine
Proteaceae	*Grevillea robusta*	Silky Oak
Grasses, Herbs and Forbs		
Amaranthaceae	* *Alternanthera sp.*	A joyweed
Apiaceae	*Centella asiatica*	Pennywort
Asteraceae	* *Ageratina adenophora*	Crofton Weed
Asteraceae	* *Ageratum houstonianum*	Blue Billygoat Weed
Asteraceae	* *Bidens pilosa*	Cobbler's Pegs
Asteraceae	* *Cirsium vulgare*	Spear Thistle
Asteraceae	* *Conyza bonariensis*	Flaxleaf Fleabane
Asteraceae	* *Gamochaeta americana*	Cudweed
Asteraceae	* *Hypochaeris radicata*	Flatweed
Asteraceae	* *Senecio madagascariensis*	Fireweed
Brassicaceae	* *Rorippa palustris*	Yellow Cress
Convolvulaceae	*Dichondra repens*	Kidney weed
Cyperaceae	*Cyperus odoratus*	Fragrant flatsedge
Euphorbiaceae	* *Ricinus communis*	Castor Oil Plant
Fabaceae (Faboideae)	* *Trifolium repens*	White Clover
Juncaginaceae	*Juncus sp.*	A rush
Malvaceae	* *Modiola caroliniana*	Red-flowered Mallow
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	Eragrostis leptostachya	Paddock Lovegrass
Poaceae	* *Paspalum conjugatum*	Sour Grass
Poaceae	* *Paspalum vaginatum*	Salt-water Couch
Poaceae	* *Pennisetum clandestinum*	Kikuyu Grass
Poaceae	*Phragmites australis*	Common Reed
Poaceae	* *Saccharum spp*	Sugarcane
Poaceae	* *Setaria sphacelata*	Setaria
Poaceae	* *Urochloa mutica*	Para Grass
Polygonaceae	* *Rumex crispus*	Curled Dock
Verbenaceae	* *Verbena bonariensis*	Purpletop
Vines		
Convolvulaceae	* *Ipomoea cairica*	Coastal Morning Glory
Passifloraceae	* *Passiflora subpeltata*	White Passionfruit
Mistletoe		
Loranthaceae	*Amylotheca dictyophleba*	Brush Mistletoe

Appendix E

Photographic Plates

Plate 1 Regularly mowed roadside-verge grassed swales and sugarcane at the southern extent of the site.

Plate 2 Non indigenous tree plantings in Flo Clark Park provide limited food resources and perching opportunities for birds.

Plate 3 Alluvial riparian area of the southern bank featuring a dense matt of exotic Para Grass (*Urochloa mutica*) with emergent Castor Oil Plant (*Ricinus communis*) and a single juvenile Forest Red Gum (*Eucalyptus tereticornis*).

Plate 4 Isolated, indigenous Common Reed (*Phragmites australis*) and a single juvenile Forest Red Gum (*Eucalyptus tereticornis*) struggling under the weight of the vigorous exotic climber, Coastal Morning Glory (*Ipomoea cairica*).

Plate 5 An opportunistic pelican patrols the area near the boat ramp for food offerings.

Plate 6 Exotic Para Grass (*Urochloa mutica*) dominates the steep southern bank. Woody debris (snags) add to aquatic and terrestrial fauna habitat diversity by providing shelter, breeding and ambush sites.

Plate 7 A sapling Moreton Bay Fig (Ficus macrophylla) covered in Coastal Morning Glory (Ipomoea cairica) growing under a mature Camphor Laurel (Cinnamomum camphora) on the residential house block.

Plate 8 Looking south across the site and Sportsmans Creek. Exotic Para Grass (*Urochloa mutica*) and Coastal Morning Glory (Ipomoea cairica) dominate riparian areas.

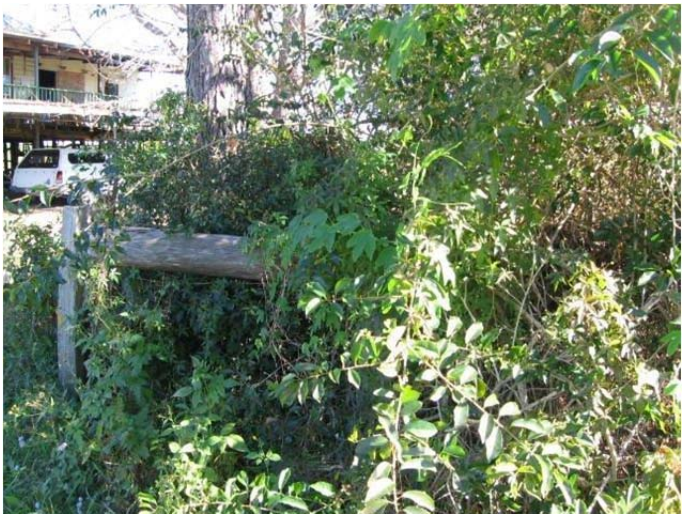

Plate 9 Mostly weed regrowth including Lantana along a fence line bordering the residential house block on site.

Plate 10 Opportunistic and rampant Coastal Morning Glory (Ipomoea cairica) growing between stems of a Camphor Laurel (Cinnamomum camphora) on the residential house block.

Plate 11 Isolated trees in the middle, western portion of the study area. From left to right, Camphor Laurel (*Cinnamomum camphora*), Silky Oak (*Grevillea robusta*) a maple (*Acer sp.*) and a Cocos Palm (*Syagrus romanzoffiana*).

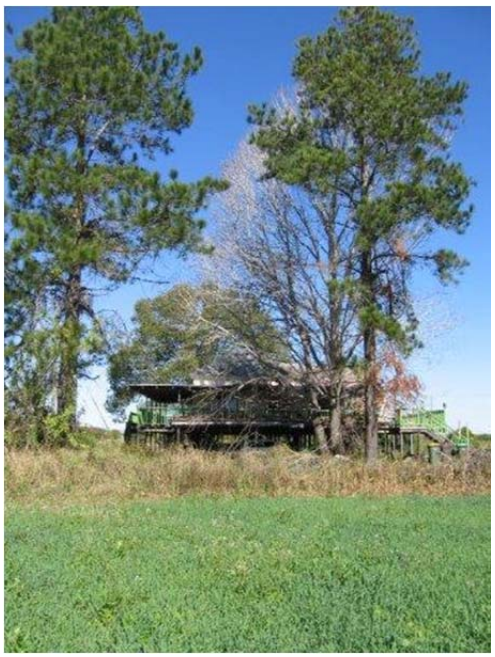

Plate 12 Tall, exotic pines (*Pinus sp.*) and a Liquidambar (Liquidambar styraciflua) on the residential house block on site with improved pasture in foreground.

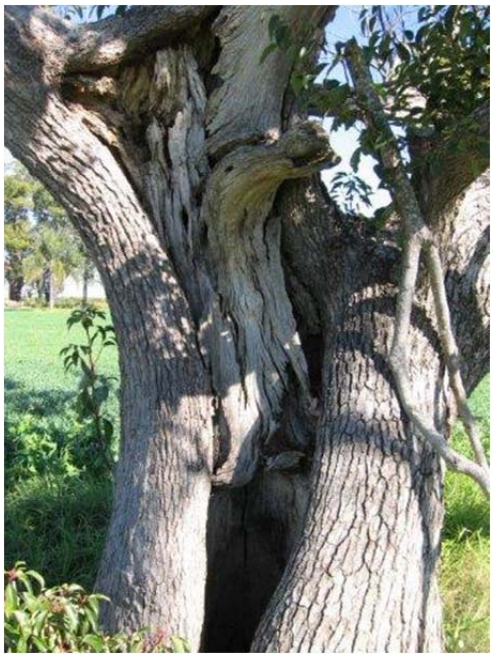

Plate 13 A basal cavity/tree hollow in an isolated Camphor Laurel (*Cinnamomum camphora*) towards the northern end of the site. A close examination of the hollow with the aid of a pointed metal probe and high-powered torchlight revealed no signs of fauna occupation.

Plate 14 Open pasture which makes up the majority of vegetation cover on the site, viewed from near the northern end.