Lemon Tree Creek Bridge replacement

Princes Highway (H1)

REVIEW OF ENVIRONMENTAL FACTORS

AUGUST 2007

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Executive Summary

The Proposal

The NSW Roads and Traffic Authority (RTA) propose to replace the Lemon Tree Creek Bridge on the Princes Highway, 12km south of Ulladulla (the Proposal).

Statutory Position

All relevant statutory planning instruments have been examined for the Proposal. It has been determined that assessment is permissible under Part 5 of the EP&A Act.

Key Environmental Issues

Soils

The Proposal would require a moderate amount of earthworks and stockpiling for replacing the Lemon Tree Creek Bridge. Construction works within the Proposal site have a moderate potential to cause soil erosion. Minor to moderate compaction of soils can also be expected as a result of movement of earthworks machinery and trucks. The Proposal would alter the existing landform by constructing cut and fill embankments along the new road alignment. The Proposal has a high potential to expose low risk Potential Acid Sulphate Soils (PASS) present at Lemon Tree Creek within the Proposal site during bridge construction works. These impacts are considered to be manageable and short term in duration.

Hydrology and Water Quality

Construction and operation of the Proposal has the potential to cause the water quality of the Lemon Tree Creek to decline due to the release of polluted water and generation of construction waste from cement works and accidental spills. Water quality protection measures would be implemented to minimise these potential impacts as far as practicable.

The improved road alignment would reduce the potential for spillages of fuels and/or chemicals to occur during the operation stage, which would reduce water quality impacts on Lemon Tree Creek.

Biodiversity

The Proposal requires the removal of approximately 0.5ha of bushland belonging to the Spotted Gum – Blue Gum – Blackbutt Open Forest vegetation community. Given the small amount of vegetation to be removed, and the much larger areas of the same vegetation type in the surrounding region, the impact of vegetation removal is considered to be minor. The proposed works have the potential to cause the growth and spread of the Class 4 noxious Fireweed along the highway within and beyond the Proposal site.

Socio-Economic Considerations

Construction related traffic delays are anticipated. These impacts would be short-term and manageable. Land acquisition from NSW State Forest would be required. The Proposal would retain access for all land uses surrounding the Proposal site. The proposed works are not expected to cause induced traffic, and road safety would be greatly improved.

Licenses and Approvals

The following licenses and approvals would apply:

- Permits under the *Fisheries Management Act 1994* would be required for reclamation works and for dredging works (eg. associated with culvert works).
- Should water for the Proposal need to be drawn from any waterways and used, a licence under Section 10, or a permit under Section 18F of the Water Act, 1912 may be required from the Department of Water and Energy (DWE).

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Appendices

1 Introduction and Methodology

1.1 Name of the Proposed Activity

Lemon Tree Creek Bridge replacement.

1.2 Local Government Area

Shoalhaven City Council.

1.3 RTA Region

Southern Region.

1.4 Introduction

The NSW Roads and Traffic Authority (RTA) propose to replace the Lemon Tree Creek Bridge on the Princes Highway, 12km south of Ulladulla (the Proposal).

This Proforma 2 Review of Environmental Factors (REF) has been prepared by RTA Environmental Planning and Assessment on behalf of RTA Regional Operations & Engineering Services, Southern Region. For the purposes of these works, the RTA is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment (EP&A) Act 1979*.

The purpose of the REF is to describe the Proposal, to document the likely impacts of the Proposal on the environment, and to detail protective measures to be implemented.

The description of the proposed works and associated environmental impacts have been undertaken in the context of Clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation (TSC) Act 1995*, the *Fisheries Management (FM) Act 1994*, and the (Commonwealth) *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. In doing so, the REF helps to fulfil the requirements of Section 111 of the EP&A Act, that the RTA examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

This REF has been prepared in accordance with the RTA's Proforma 2 REF as presented in the RTA's *Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4* (RTA 2001a).

The findings of the REF would be considered when assessing:

- Whether the Proposal is likely to have a significant impact on the environment and therefore the necessity for an assessment under Part 3A of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act, in Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS).

- The potential for the Proposal to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Commonwealth Environment and Heritage Minister in accordance with the EPBC Act.

1.5 Methodology

The method in which this document has been prepared is as follows:

1. A discussion was held with the Project Manager to consider the Proposal.

2. A Preliminary Environmental Investigation (PEI) completed in June 2005 for the proposed works has been utilised to prepare this REF.

3. An RTA Environmental Planning and Assessment representative undertook a site visit on 2 December 2005 with the RTA Project Manager to attain an overview of the Proposal and to identify any issues relevant to the completion of the REF.

4. The following agencies and RTA personnel were notified and/or consulted:
   - Department of Primary Industries (DPI);
   - The then Department of Environment and Conservation;
   - Shoalhaven City Council;
   - RTA's Senior Environmental Officer, Southern Region;
   - RTA's Aboriginal Cultural and Heritage Advisor (ACHA), Southern Region; and
   - Department of Natural Resources (DNR)

5. A desktop search was conducted on the following databases to identify any potential issues:
   - Australian Heritage Database;
   - NSW Heritage Office State Heritage Register and Inventory;
   - (the then) DEC Aboriginal Heritage Information Management System (AHIMS);
   - National Native Title Claims Search;
   - (the then) DEC Atlas of NSW Wildlife - Threatened Flora and Fauna Records;
   - DEH Protected Matters (EPBC Act) Database;
   - BioNet Database and NSW Fisheries Threatened Species List;
   - (the then) DEC Contaminated Land Records;
   - (the then) DNR Acid Sulphate Soils Risk Map; and
   - (the then) DPI Noxious Weeds List.

6. As part of the environmental assessment undertaken for this REF, a series of specialist studies were undertaken to identify Proposal constraints and to provide environmental safeguards. Specialist investigation regarding the following, was undertaken during the preparation of the REF:
   - Terrestrial and aquatic ecology (which included the Lemon Tree Creek and Termeil Creek areas); and
   - Aboriginal heritage.

7. A literature review and review of documentation was undertaken with regards to the following:

- Landform, geology, and soils;
- Potential acid sulphate soils;
- Groundwater;
- Local Environment Plans;
- Regional Environmental Plans;
- South Coast Regional Strategy; and
- State Environmental Planning Policies.

2 Proposal Description

2.1 Location

The Proposal is located on the South Coast of NSW approximately 12km south of Ulladulla and 30km north of Bateman's Bay. The Proposal would be undertaken on the Princes Highway, at Lemon Tree Creek Bridge, approximately 1km south of Lake Tabourie.

The Proposal site is defined as Lemon Tree Creek Bridge, the approaches of the Princes Highway (ranging from 170m to 360m either side of the bridge) and the land extending 30m beyond the pavement of the Princes Highway. The nearest residence to the Proposal site is located approximately 570m northeast of the Proposal site and is not considered to be impacted by the noise and vibration due to construction activities and thus is not considered further in the REF.

For the purposes of this REF, the Proposal site is defined as the 'footprint' of the proposed works including the proposed location of stockpile and compound site. In addition, the study area is defined as the Proposal site with an additional buffer of approximately 2km to cover the potential environmental impacts (eg. water quality) resulting from the proposed works. Figure 2.1 shows the location of the Proposal site.

The Meroo National Park (NP) is located east of and adjacent to the Proposal site. However, as the proposed bridge would be constructed away from the NP, it is not expected to have an impact on the NP and hence is not considered further in the REF. The forestry area including roadside remnant native vegetation, is located adjacent to the Proposal site (to its north) (see Figure 2.2). The Princes Highway is the only arterial road present within the Proposal site.

A detailed description of the existing environment is provided in Chapter 8 of this REF and Appendix A provides photographs of the Proposal site.

2.2 Proposed works

The Proposal would involve the construction of a new bridge and approaches partly within the Princes Highway road corridor, south of Ulladulla. The new bridge and approaches would have a design speed of 100km/h and a posted speed limit of 100km/h. The proposed works are summarised below:

- Construct a new single carriageway bridge on the upstream (western) side of the existing bridge;
- Modify the existing bridge approaches (530m total) to cater for the new bridge alignment from approximately 170m south to approximately 360m north of the bridge;
- The demolition and removal of the existing bridge structure; and
- To minimise the environmental impacts as far as practicable.

Chapter 7 provides a detailed description of the Proposal, including design parameters and construction activities and Appendix B provides diagrams of the Proposal.

(Scale: grids = 1 x 1 km)

Figure 2.1: Location of Proposal site
(Map extract courtesy of: Land and Property Information NSW)

Figure 2.2: Location of Meroo National Park
(Map extract courtesy of Land and Property Information NSW, Not to scale)

2.3 Cost and Source of Funds

The Proposal is anticipated to cost approximately $2.5 million and funding would be sourced from the State funded Infrastructure Maintenance Program.

2.4 Timing

The works for the Proposal are tentatively programmed to commence during early to mid 2008 and would be completed before the end of 2009.

3 Statutory Position

3.1 Local Environmental Plans

The Proposal is located within the Shoalhaven LGA. Shoalhaven City Council governs land use in the Shoalhaven LGA through the *Shoalhaven Local Environmental Plan (LEP) 1985*. The Proposal occurs within Unzoned land and land zoned Zone No. 1(f) [Rural 'F' (Forest) Zone].

Table 3.1: Land zonings within the Proposal site.

Zoning	Lemon Tree Creek Bridge
Unzoned	Within road reserve of Princes Highway
Zone 1(f)	Both east and west of the Highway within the Proposal site.

Road works are not prohibited within Zone 1(f) or Unzoned land. Consent from Shoalhaven City Council for the Proposal occurring within Zones 1(f) or Unzoned land of the LEP would be required.

Clause 54G 'Classified roads and toll works' of the LEP is applicable to the Proposal. Clause 54G of the LEP states:

> *'If, in the absence of this clause, development for the purpose of a classified road or tollway, or a proposed classified road or tollway, may be carried out with development consent, the development may be carried out without that consent'.*

Clause 54G of the LEP defines 'classified road' as: *'classified road means a classified road within the meaning of the Roads Act 1993'.*

The Proposal is for the purpose of a classified road. Under Clause 54G of the LEP, the proposed works within Unzoned land and 1(f) Forest zone may be carried out without development consent.

Clause 27, 'Development on acid sulfate soils' of the LEP states:

> *(1) This clause applies to land identified as having high probability to be affected by acid sulfate soils on the map prepared by the Department of Land and Water Conservation entitled "Acid Sulfate Soil Risk Map" dated December 1997 and available for public inspection at the office of the Council.*
> *(2) Despite any other provision of this plan, the consent of the Council is required for any development which involves or is likely to involve, through drainage, earthworks, or any other means, the exposure to the atmosphere of any part of soil which contains iron pyrites within land to which this clause applies.*

The Proposal site has a low probability of Acid Sulphate Soils and thus consent from the Council is not required for the Proposal.

3.2 Regional Environmental Plans

Illawarra Regional Environmental Plan No 1 (REP 1)
This plan applies to all land within the Cities of Shoalhaven and Wollongong, the Municipalities of Kiama and Shellharbour and the Shire of Wingecarribee. REP 1 provides a framework for

coordinated action to ensure best use of land resources, improvement in the quality of life, protection of regional needs and interests and the establishment of a stable and attractive climate for public and private investment.

Several items of environmental heritage within the Shoalhaven subregion are listed in Schedule 1 of REP 1. None of the listed items occur within the near vicinity of the Proposal site. The nearest site "Ulladulla Lighthouse at Warden Head" is located in Ulladulla, approximately 15km north of the Proposal site.

Lemon Tree Creek Bridge is located adjacent to land indicated in the Illawarra REP as "*Land with Landscape or Environmental Attributes*". The REP states that land within this zone shall have the recommendations of the REP taken into consideration, when an REP is being written or prepared. While this does not directly apply to the Proposal, the concept design would take the landscape quality of the area into consideration. The Proposal would also meet the objectives of this plan by improving road safety of the Princes Highway by providing safer bridge crossing over Lemon Tree Creek. The Proposal would also be consistent with the aims of the South Coast Regional Strategy (ie. protection of environment and heritage).

3.3 State Environmental Planning Policies

State Environmental Planning Policy 14 (SEPP 14) - Coastal Wetlands
The aim of this policy is to ensure that coastal wetlands are preserved and protected in the environmental and economic interests of the State.

Lemon Tree Creek, and the creek it drains into, Tabourie Creek, are both not listed as SEPP 14 wetlands.

Consent from Shoalhaven City Council and the preparation of an Environmental Impact Statement/concurrence of the Director of Department of Planning would not be required, as the Proposal is not expected to clear, drain or fill SEPP 14 land, and/or construct a levee on SEPP 14 land.

State Environmental Planning Policy 44 (SEPP 44) - Koala Habitat Protection
Shoalhaven City Council is identified within Schedule 1 of SEPP 44 (Koala Habitat Protection) as a LGA in which Koalas are known to occur. While the requirements of the SEPP do not technically apply to this Proposal, as it is not subject to Council consent, it is the RTA's practice to consider SEPP 44 criteria in its EIA process. These criteria relate to the percentages of feed tree cover, particularly trees listed under Schedule 2 - Known Feed Trees. The assessment criteria consider the percentage cover of known feed trees, and whether these are greater or less than 15% of the total tree canopy.

Seven Eucalypts were recorded within the study area surveyed for the ecological assessment. None of those species recorded are listed as known Koala feed trees under Schedule 2 of SEPP 44, therefore the study area is not considered to provide either potential or core Koala habitat. During field investigations, no individuals of this animal were observed, heard calling or located using spot-lights, and no characteristic scratching or scats were found. Therefore, the Proposal site does not support 'potential koala habitat', and SEPP 44 would not be applied to the Proposal (refer to **Appendix E**).

State Environmental Planning Policy 71 (SEPP 71) – Coastal Protection
SEPP 71 does not require development consent for the Proposal, but it is the RTA's practice to consider the aims of SEPP 71 in its EIA process. The Policy has been made to ensure that development in the NSW coastal zone is appropriate and suitably located, to ensure that there is a consistent and strategic approach to coastal planning and management, and to ensure there

is a clear development assessment framework for the coastal zone. The Proposal site along the Princes Highway is located within SEPP 71 lands. The Proposal is consistent with the relevant aims of the SEPP, as it would be appropriately located in close proximity to the existing Highway alignment.

3.4 Confirmation of Part 5 Position

All relevant statutory planning instruments have been examined for the Proposal. It is concluded that Clause 54G of the Shoalhaven LEP operates to remove the development consent requirements, thereby permitting assessment of the Proposal under Part 5 of the EP&A Act.

4 Consultation

4.1 Government Agency and Stakeholder Consultation

Relevant State government agencies and stakeholders were contacted in December 2005 and were invited to comment on the Proposal. Table 4.1 summarises the responses received from stakeholders and identifies the section in the REF where the issue is addressed. Copies of all correspondence are provided **Appendix C**.

Table 4.1: Summary of issues raised by government agencies and stakeholders.

Summarised Issues	Section in REF Where Addressed
Department of Primary Industries (DPI) - Forests	
A response to the consultation letter dated 12 December 2005 was received in December 2005. Forests NSW had the following comments to make with regard to the Proposal.	
• They have no problems with the proposed road realignment and new bridge constructions at Lemon Tree Creek Bridge.	Noted
• Because this is only a bridge replacement, there appears to be little impact on State Forest tenure. The Lemon Tree Creek Bridge may have limited impact on State Forest. However, the impact would only be on the realignment encroaching on the Powerline easement on the western side of the Princes Highway. If State Forest is affected by clearing we would have to implement the salvage rights to any timber removed. In addition, once we know the exact amount of State Forest that would be impacted upon, then our resources section would have to authorise the work by letter, and then RTA Surveyors would document the road corridor adjustment after the reconstruction is completed.	Noted
(The then) DPI - Fisheries	
A response to the consultation letter dated 12 December 2005 was received in December 2005. Fisheries had the following comments to make with regard to the Proposal.	
• The Department is concerned about any potential impacts that the proposed works may have on aquatic species and habitats in the vicinity of the proposed works. We note that as a public authority, the RTA is required under section 199 of the *Fisheries Management Act 1994* to consult with the Department and take into account any issues raised prior to approving dredging and reclamation works.	Section 8.6
• Roads and bridge must be designed and constructed to minimise habitat loss, changes in sediment transport and stream siltation, and to maintain natural tidal exchange or river flow. Address potential impacts that the proposed road works may have on the water quality and hydrology of waterways within the vicinity of the proposed works. To minimise these impacts an appropriate sediment and erosion control regime and water quality management provisions should be designed in accordance with current industry best management practices and implemented to safeguard the aquatic environment across the entire works area.	Section 8.6
• The design and construction of road waterway crossings, should be undertaken in accordance with the Department's Policy and Guidelines for Fish Friendly Waterway Crossings (2004) and Why Do Fish Need to	Section 8.6

Cross the Road? Fish Passage Requirements for Waterway Crossings (2004).	
• The following information should be provided to the Department so that an assessment of the proposed works can be undertaken: ➢ Location of works (including topographic map and photos). ➢ Name of adjacent watercourse(s). ➢ Description of works to be undertaken. ➢ Method/s of construction. ➢ Timing and duration of works. ➢ Volume and type of sediment to be excavated from the site, if appropriate. ➢ Aquatic habitat conditions at the site/s - particularly riparian and aquatic vegetation, water depth, and permanence of water flow and snags in the vicinity of the proposed works. ➢ Potential impacts upon aquatic and riparian habitats (both temporary and permanent). ➢ Proposals to mitigate impacts upon riparian and aquatic vegetation and aquatic habitats. ➢ Potential impacts upon water quality of the proposed works. ➢ Proposals to mitigate impacts upon water quality. ➢ Potential impediments to fish passage as a result of the works (both temporary e.g. coffer dams, and permanent) and possible mitigation measures to be employed to negate these impacts. ➢ An assessment of the potential impact that proposed works may have on aquatic threatened species, populations and ecological communities. • Once the REF has been prepared for the project, please forward a copy to this office for our review and further comment.	Noted
Shoalhaven City Council	
A response to the consultation letter dated 12 December 2005 was received in January 2006. Council had the following comments to make with regard to the Proposal.	
• Council's vegetation mapping indicates that an endangered ecological community (Swamp Sclerophyll Forest) listed under the NSW *Threatened Species Conservation Act 1995* is likely to be found immediately to the east of Lemon Tree Creek Bridge, though this has not been confirmed via ground truthing.	Section 6.2 and Appendix E
(The then) Department of Environment and Conservation	
(The then) DEC were invited to review and comment on the Draft REF and ecology report (refer to **Appendix E**) for the Proposal in early 2007. Comments received from the DEC on the ecology report on 13 April 2007 include the following:	
• DEC concurs with the proposed northern alignment of the Lemon Tree Creek upgrade	Noted
• The report should correct errors on page 5 regarding the mouth of Lemon Tree Creek (Tabourie Lake, not Willinga Lake)	Noted. Appendix E
• DEC suggests that the existing bridge pylons located in the creek line should be left in place when the existing bridge structures are decommissioned.	Section 7.5.1

• The habitat trees identified by Lesryk in Figure 5 of the report (page 15) should be marked on-site prior to the commencement of work. Appropriate management of root zones and drip lines of trees to be retained adjacent to work areas, and native vegetation, on the edge of work areas, should be enunciated in work method statements prepared for the Proposal and delivered to workers via site induction programs.	Section 8.6
A response to the consultation letter dated 22 February 2006 was received in March 2006. DEC had the following comments to make with regard to the Proposal.	
• While the DEC appreciates the opportunity to comment on this matter, in this instance the Proposal does not trigger any statutory provisions of environmental legislation administered by the DEC. As such, the DEC does not have a formal role in this matter. Notwithstanding this, the following comments are made.	Noted
• It is important to note that should the REF indicate that the Proposal is going to have a significant or adverse impact upon the environment, the DEC should be further consulted to ascertain any statutory obligations this may place on the Proposal. In addition, the DEC would also emphasise that all construction activities associated with the Proposal must be carried out with due diligence and best management practices.	Noted
• The following environmental impacts of the project need to be assessed, quantified and reported on: Control of water pollution, Waste management, Dust management, Contaminated land, Threatened species and Aboriginal cultural heritage.	Chapter 8
• Details are required on the location of the proposed development, including the affected environment, to place the proposal in its local and regional environmental context including surrounding land uses, planning zonings and potential sensitive receptors.	Sections 2.1, 3.1 and Chapter 8
• Describe mitigation and management options that will be used to prevent, control, abate or mitigate identified environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	Chapter 8
• Based on the information provided to the DEC to date, the applicant will not require an Environment Protection Licence because the activity is not scheduled under the *Protection of the Environment Operations Act 1997.*	Noted
• The level of potential pollution from these types of projects is difficult to assess. The DEC considers that through appropriate environmental assessment and the implementation of best management sediment and erosion control practices, maximum protection of water quality can be achieved.	Noted
• A pollution control plan associated with the bridge construction works, including a location diagram of the intended works, should be prepared prior to commencing work. Such a plan should include consideration of the following issues: ➢ An assessment of each site should be made giving consideration to site specific issues; ➢ In-channel works should only be undertaken during periods of low flows; ➢ External materials (eg. Concrete or rocks) that will be used to construct the bridge, stabilise the side track or the stream banks, which are to be placed in waters, should be cleaned of any contaminants such as soil, where practicable;	Section 8.4

➢ Machinery required to perform the construction and stabilisation works should remain out of the stream flow where possible. Where it is unavoidable for machinery to enter the stream flow, the plant should be degreased in an appropriate place prior to entering the water; ➢ Removal of in-channel deposits such as point bars or flood debris, should be undertaken within a small bund of the deposit or a buffer left in place, protecting the stream flow from the area of disturbance; ➢ Depending on the level of disturbance proposed within a section of channel it is suggested that consideration be given to placing sediment filters across the flow downstream of the area. These structures might take the form of sand barriers and/or geotextile fabric, if velocities permit; ➢ Retardation of the upstream flow onto works areas may also assist with short term works.	
• All wastes generated during the project must be managed in a manner that prevents the pollution of waters and air. Disposal of waste materials must be in accordance with legislative requirements of the *Protection of the Environment Operations Act 1997.*	Section 8.12
• The management of dust around the construction site is required to reduce the potential for the pollution of waters or impact on amenity of adjacent residents.	Section 8.5
• The REF must document the assessment and management of any land contamination to ensure that the land is not allowed to be put to a use that is inappropriate because of the presence of contamination. Under the *Contaminated Land Management Act* there is a responsibility to notify the DEC of site that pose a significant risk of harm to human health or the environment.	Section 8.2
• A threatened species impact abatement and where appropriate, management planning will form an important part of the REF for the proposal.	Appendix E
• A field survey of the site should be conducted and documented in accordance with the "draft Guideline for Threatened Species Assessment" (July, 2005).	Appendix E
• Likely impacts on regionally significant protected and threatened species and their habitat need to be assessed, evaluated and reported on. The assessment should specifically report on the considerations listed in Step 3 of the draft guideline.	Appendix E
• The REF should clearly state whether it meets each of the key thresholds set out in Step 5 of the draft guideline and describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	Appendix E
• In addition, the REF must address the provisions of Section 5A of the *Environmental Planning and Assessment Act 1979* and clearly identify if a species impact statement is required to be prepared.	Appendix E
• The REF should address and document the information requirements set out in the "draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation" (July, 2005) involving surveys and consultation with the Aboriginal community.	RTA 2005b
• The REF must identify the nature and extent of impacts on Aboriginal cultural heritage values across the project area. Should the site be found	RTA 2005b

	to have significant Aboriginal cultural heritage values, the REF must describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.	
•	The REF should clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations.	RTA 2005b

5 Strategic Stage

5.1 Background

Within NSW, the Princes Highway commences in the City of Sydney at the junction of City Road and Broadway, then continues through southern Sydney, Wollongong, Kiama, Nowra, Bateman's Bay, Bega, Eden, and then continues into Victoria. The Princes Highway is an important transport corridor in south-east New South Wales, serving local communities and a number of regional industries, particularly tourism, dairy and timber. The Princes Highway is the only interregional road serving the south coast of New South Wales and East Gippsland (Department of Transport and Regional Services 2005).

For the five year period, 1 April 2000 to 31 March 2005, there were a total of three reported vehicle crashes in the vicinity of the Proposal site. The crashes did not result in any fatalities, but resulted in injuries to people. All three crashes involved single vehicles on a dry road surface, with two of the crashes occurring during daylight. Speed was considered a contributing factor in two of the crashes and fatigue in other (RTA 2005a).

5.1.1 RTA's Corporate Plan Journey Ahead 2003-2008

The RTA's *Corporate Plan Journey Ahead 2003-2008* states that improving road safety is a number one priority. The Proposal would improve road safety in accordance with RTA's *Corporate Plan, The Journey Ahead 2003-2008.*

The Proposal would also be undertaken in accordance with the RTA's mission: "Delivery of the best transport outcomes balancing the needs of public transport passengers, cyclists, pedestrians, motorists and commercial operators by:

- Maintaining a strong customer focus;
- Working with innovation, openness and integrity;
- Achieving value for money; and
- Being environmentally responsible." (RTA 2001b)

5.1.2 Road Safety 2010

The Proposal is part of an ongoing commitment by the RTA to address road safety in accordance with the RTA's responsibilities for ensuring a maximum level of service to road users and to maintain appropriate services for adjacent landholders.

Road Safety 2010 is a strategy developed to help NSW move towards having the safest roads in the world and sets out how the road toll can be halved through change in a number of areas. The proposed road safety improvement works on the Princes Highway would provide a safer road and therefore help the RTA achieve the objectives of *Road Safety 2010.*

The Proposal has been designed in accordance with the RTA's *Road Environment Safety Guidelines 1991.* The guidelines identify road safety principles and techniques that need to be applied to achieve a safe road environment. The guidelines also focus on safety aspects of planning, design, construction and maintenance of roads.

5.1.3 Action for Air, 2006 Update

The Proposal complies with the NSW Government's *Action for Air*, and would comply with the following objectives from *Action for Air*:

- Integrate air quality goals and urban transport planning (ie. less traffic delay and improved travel time would result from the Proposal); and

- Provide more and better transport choices (ie. cycling space would be provided as part of the Proposal).

5.2 Need for the Proposal

The Proposal is needed for the following reasons:

- The existing bridge is a reinforced concrete structure that is past its economical life and fails to meet current road-safety standards;
- Road safety on the Princes Highway in the vicinity of the Proposal site is deficient due to the following:
  - The bridge is narrow at 6.7m between kerbs, with lane widths marked at a maximum of 3.0m. This contrasts unfavourably with approach lane widths of 3.5m;
  - Horizontal road alignments are deficient;
  - Shoulder widths are substandard; and
- Traffic delays are evident on the Princes Highway in the vicinity of the Proposal site following road accidents.

6 Concept Stage

6.1 Proposal Objectives

The primary objectives of the Proposal are to:

- Replace the existing structurally deficient concrete bridge;
- Improve road user safety on this section of the Princes Highway by replacing the current 80km/h radius alignments with a 100km/h radius alignment; and
- Provide wider traffic lanes and shoulders to provide for safer pedestrian/cycle usage.

Secondary objectives of the Proposal are to:

- Minimise impacts on the environment;
- Upgrade bridge approach pavements to provide for a 20 year design life;
- Reduce travel delays for all road users; and
- Reduce risk of flooding on bridge approaches.

6.2 Options Considered

Four options including the "Do nothing" option were considered for the Proposal. The four options are presented below.

6.2.1 Do Nothing

The Do Nothing option would not achieve any of the project objectives, and was accordingly discounted.

6.2.2 Option 1 - Bridge widening

This option would involve widening the existing bridge. This option was not adopted due to bridge load limitations, and the existing bridge is at the end of its design life.

6.2.3 Option 2 - Demolish bridge and rebuild in the existing location

This option would involve demolition of the existing bridge and construction of a new bridge (including side tracks) in the same location. This option was not adopted, as road users would have to use side tracks (speed limit reduced to 40kph) which would reduce road safety during construction.

6.2.4 Option 3 - Bridge replacement east of the Princes Highway

This option would involve construction of a new bridge and approaches to the east of the existing highway. This option was not adopted as it would require extensive clearing of Meroo National Park land.

6.2.5 Option 4 - Bridge replacement west of the Princes Highway

This option would involve construction of a new bridge and approaches to the west of the existing highway. This option would be constructed mostly within cleared/disturbed land impacted by utility operations. This option is expected to achieve all Proposal objectives and has accordingly been selected.

Preferred Option

The preferred Option 4 "Bridge replacement west of the Princes Highway" for Lemon Tree Creek is expected to achieve all Proposal objectives and has accordingly been selected.

7 Design Considerations

7.1 Existing Road

Features of the existing roads are outlined below:

- The alignment of the Princes Highway at the Proposal site is generally east-west;
- The posted speed limit is 80km/h;
- Two lane single carriageways;
- Pavement condition is good;
- Lane widths of approximately 3.5m and variable shoulder widths up to 2.0m;
- Bridge width between kerbs of 6.7m, with lane widths marked at a maximum of 3.0m;
- The bridge has two spans x 9.14m supported on a concrete pier and abutment walls with a total length of 18.59 m;
- There are no medians or concrete kerb/guttering present;
- Earth dish drains are present along the edges of both sides of the Princes Highway;
- One pipe culvert is present within the Proposal site, where it crosses under the Princes Highway;
- W-beam safety barriers are present at the location of the Lemon Tree Creek bridge and approaches;
- No provisions for pedestrians or cyclists on the bridge;
- Limited provision for pedestrians and cyclists on bridge approaches (ie. road shoulder only); and
- No roadside landscaping works are evident.

7.2 Existing and Forecast Traffic

The Average Annual Daily Traffic (AADT) volume for 2003 was 5,064 vehicles per day within the Proposal site with heavy vehicles making up 12 per cent of AADT. This section of the Princes Highway experiences higher AADT on Fridays and Saturdays. During the week of Christmas 2003, the AADT for the busier Friday and Saturday reached 6271 and 7775 respectively (RTA 2003).

The Princes Highway carries a major proportion of heavy vehicles (Department of Transport and Regional Services 2005), and is a current (and future) B-double truck route.

The forecast traffic for the Princes Highway within the Proposal site is 5789 (AADT) for the year 2007, and 8087 (AADT) for the year 2017. The AADT (axle pairs) recorded between 1997 and 2003 at station 07.691 (Termeil, 1km north of Bawley Point Road) on the Princes Highway in the vicinity of the Proposal site gives a calculated linear traffic growth of 3.4 per cent, which has been projected to give the following AADT:

Year	AADT (Axle Pairs)
1997	4178
2000	4603
2003	5064
2007	5789
2017	8087

7.3 Urban and Regional Design

The Proposal would be designed to blend in as far as practicable with the surrounding rural/bushland landscape. The design would aim to minimise the need for vegetation clearing as far as practicable, and the Proposal site would be subject to comprehensive revegetation to reduce the visual impact of the road works. Revegetation works would complement the surrounding environment through the use of local native plant species. Exposed batters and disturbed areas would be hydromulched with local native plant species.

A planting palette would be developed during the detailed design phase based on the ecology assessment (refer to **Appendix E**), advice obtained from Shoalhaven City Council, and from local native plant species lists. Species would be chosen for their demonstrated ability to grow robustly in an environment where water may be limited and occasional weed competition may also exist.

7.4 Design Parameters

The project would involve the construction of new bridge and approaches within the Princes Highway road corridor, south of Ulladulla. The following design parameters would apply to the Proposal:

- Design and posted speed of 100 km/h;
- Two-lane carriageway (northbound and southbound) with 3.5m traffic lane widths, 2.5m shoulders and no median;
- New 'wider' bridge over Lemon Tree Creek, 12m wide (two x 3.5m lanes with two x 2.5m shoulders);
- New bridge over Lemon Tree Creek 30m in length (three x 10m plank spans) with spill-through abutments.
- Provision for cyclists within 2.5m shoulders;
- Flexible and select zone pavement (550mm depth) with a design life of 20 years;
- 10m clear zones within the road reserve have been determined based on criteria outlined in Section 3.7 of the RTA's *Road Design Guide*. Road safety barriers would be provided where it is not possible to establish desired clear zones. No vegetation removal on National Park land would be required;
- Changes to existing vertical and horizontal alignment;
- Safe Intersection Sight Distances would be provided;
- Cut batter slopes 2:1 minimum up to 1.5m high;
- Fill batter slopes 4:1 minimum up to 2m high; and
- Batter slopes adjacent to barriers 2:1 minimum up to 2m high.

The Proposal is intended to assist in the reduction in the incidence of road traffic accidents.

Refer to **Appendix B** for more details.

7.4.1 Design Considerations

The design has been undertaken in accordance with the *RTA Road Design Guide* and *RTA Bridge Design Guide*, and has considered the following guidelines:

- *RTA Road Safety Audit Manual and Checklist;*
- *Austroads Guides;*
- *Australian Rainfall and Runoff 1987;* and
- *Austroads Waterways Design 1994.*

The following considerations have been used to formulate the design for the proposed works:

- Topography and layout of the site to minimise the requirement for cut and fill earthworks;
- Proximity of utilities such as telecommunications, electricity and water;
- Minimise environmental impacts as far as practicable by selecting an alignment with minimum requirements for vegetation removal, that would also complement the road design;
- Maximise the use of existing pavement;
- Minimise land acquisition and disruption to residents as far as practicable; and
- Take into account all relevant design guidelines such as sight distances, access requirements and drainage considerations.

Note: The proposed 100km/h speed limit meets the Safe Intersection Sight Distance design requirements in accordance with the *RTA Road Design Guide*.

7.4.2 Design outcomes

The Proposal would improve travel safety and efficiency for Princes Highway traffic by:

- Replacing the existing structurally deficient concrete bridge;
- Replacing the current 80km/h radius alignment with a 100km/h alignment;
- The risk of flooding on bridge approaches would be reduced, as bridge approaches have been designed to accommodate a 1:100 year storm event;
- Improving ride qualities; and
- Providing wider traffic lanes and shoulders to provide for safer pedestrian/cycle usage.

7.4.3 Constraints

The Proposal has the following constraints:

- Currently approved funds to be used by the end of 2007;
- Statutory environmental obligations (eg. water and ecology protection);
- Flood implications at the creek;
- The road and bridge design must comply with the RTA's *Road Design Guide*;
- Location of utility services; and
- Geotechnical conditions.

7.4.4 Traffic Management

Temporary lane closures would be required to construct the roadworks. Lane closures would be planned to minimise disruption to local services and road users. All signage and road markers to be introduced would be in accordance with current RTA "Traffic control at Work Sites" manual.

7.4.5 Drainage works

Runoff would be collected via a 'SF' dyke under guardrail and the bridge barrier kerb and be directed and deposited in off-line stormwater basins located nearby the new bridge on the northern and southern side of Lemon Tree Creek (two basins, 58m^3 capacity each). The stormwater basins would be designed to capture litter, coarse sediment and oil spills. Refer to Appendix B for more details.

At Lemon Tree Creek a new 450mm diameter pipe would be installed north of the creek. Where runoff is concentrated (eg. cut-off drains, V-drains), scour protection (OFM or Reno mattress) and concrete lining would be implemented to minimise erosion and sedimentation impacts as far as practicable. On the uphill slope above the top of cut batters, cutoff drainage channels would be constructed to minimise erosion and sedimentation impacts as far as practicable.

7.5 Construction Activities

7.5.1 Work Methodology

The Proposal would be constructed in three stages. Stage one would comprise the roadworks construction up to subgrade level, Stage two would consist of bridge construction (including establishment of site compound on the new road formation), and Stage three would involve construction of the new road pavement and demolition of the existing bridge. It is envisaged that blasting would not be required as part of the Proposal.

The works would be undertaken by either in-house service providers or Contractor(s) selected after a competitive tendering process, and would include the following activities:

- Installation of temporary erosion, sedimentation and drainage controls;
- Adjustment of utilities as required;
- Construction of permanent and temporary stormwater basins adjacent to Lemon Tree Creek;
- Establishment of stockpile and compound site;
- Bridge construction;
- Removal of vegetation and grubbing (0.5ha);
- Establishment of a clear zone within cut and fill sections;
- Surface preparation by graders, dozers, excavators and other equipment;
- Lime stabilisation of residual/alluvial soil or provision of a bridging layer;
- Compaction of the resultant surface using compaction equipment;
- Recycling of suitable excavated material and incorporation of unsuitable material in earthworks;
- Cut earthworks to be transported and placed as compacted fill;
- Importation of gravel materials;
- Installation of roadside drainage structures (All drainage structures would be pre-fabricated off-site);
- Construction of roadside batters;
- Construction of roadside gutters and berms;
- Application of flexible pavement by pavers and rollers;
- Ripping of obsolete sections of the existing Princes Highway road pavement/fill and rehabilitation with local native plants;
- Landscaping and revegetation of Proposal site;
- Installation of line marking, signs and guide posts; and
- Site clean up and disposal of all surplus waste materials.

Bridge construction

Construction of the bridge over Lemon Tree Creek, west of the existing bridge would consist of the following activities:

- Driving of piles;
- Establishment of pile caps and footings;
- Placement of steel reinforcement;
- Construction of pier columns (four piers with 10m spacings) and headstocks;
- Construction of two abutments;
- Construction off-site of prestressed concrete planks, transport to and placement at site and
- Construction of, parapets, deck and safety barriers.

The following would also be applicable to the bridge construction:

- No piers would be constructed within the creek;
- The abutments would be located approximately 9m away from the creek bank, and batter slopes adjacent to the abutments would be 1.5 to 1;

- Each pier would consist of five concrete piles;
- The piles for the abutments and piers would be driven using a rig (refer to Section 7.5.3 for access); and
- The bridge design would permit fauna movement under the bridge (ie. abutments are set back from the waterways).

Note: An on-site concrete batching plant would not be required, taking into account the estimated quantities required and the proximity to local concrete supplies in either Bateman's Bay or Ulladulla.

Refer to **Appendix B** for more details.

Bridge demolition

To maximise the waterway areas along the creek, the existing bridge would be removed following opening of the new bridge. Recycling and/or reuse of bridge concrete and steel parts would be undertaken where possible. If the bridge concrete and steel parts cannot be recycled and/or reused they would be disposed of at a licensed waste management facility.

The bridge would be dismantled from top down, including removal of the deck, headstocks, abutments, piers and piles. The piles would be cut off just below the surface of the creek bed. The original timber piers would also be removed as part of the works.

Timber footings of a previous bridge present in the creek channels beneath the bridge would be removed as part of the bridge demolition works.

In accordance with Section 139(4) of the *Heritage Act 1977* approval and/or exemption notification for removal of the bridge would not be required (Refer to Section9.2).

7.5.2 Construction Equipment

Plant and equipment required for the bridge and road construction works would include the following:

- Front end loaders;
- Rollers/vibrating compactors;
- Excavation plant;
- Cement supply agitator trucks;
- Cement pump trucks;
- Back hoes;
- Spray sealing equipment;
- Jack hammers;
- Concrete vibrators;
- Rock breakers;
- Pile drivers;
- Cranes;
- Dump trucks;
- Road sweepers;
- Bulldozers;
- Trucks delivering construction materials;
- Water tankers;
- Low loader transporters;
- Graders;
- Light commercial and passenger vehicles;
- Trenching machines;
- Chain saws;

- Stump grinder;
- Line marking vehicles;
- Milling machine; and
- Trucks transporting excavated material from and/or within the site and to deliver material onto the site.

7.5.3 Access

Adjacent to the Proposal site, there are also four-wheel drive access tracks and two gravel roads, leading off the Highway into Termeil State Forest. These roads and tracks are used for recreation, and as access trails for emergency services. There are no formalised pedestrian or cyclist facilities located within the Proposal site.

All existing accesses would be retained and provision would be made to maintain access during construction. Construction vehicles would enter and exit the Proposal site directly via the Princes Highway.

Bridge construction work would be carried out from either side of the creek banks. A trafficable surface would be established on either side of the creek. Water flow and fish passage would be maintained, and water quality protection measures would be implemented.

No sidetrack would be required to implement the works.

7.5.4 Source of Material

Construction of the Proposal would require the following materials from local suppliers:

- General fill;
- Pipe bedding;
- Select fill;
- Sub-base;
- Base course; and
- Sealing aggregate.

7.5.5 Additional Truck Movements

At Lemon Tree Creek it is anticipated that at the height of the construction period up to 85 additional heavy vehicle movements would be experienced per day, although typically an average of 70 extra movements per day would be expected.

The Princes Highway (northbound and southbound lanes) and junction roads would be utilised by the Proposal to transport materials and equipment within the Proposal site. It is likely that the cartage of cut and fill material within the Proposal site would require the highest number of truck movements.

The additional contribution to heavy vehicle traffic would be up to 14 per cent, on top of existing heavy vehicles (12 per cent estimate) on the Princes Highway. Truck movements associated with the construction of the Proposal would be expected to have a minor impact on the local and regional road system and the existing good pavement condition.

7.5.6 Workforce and Working Hours

The workforce would comprise a combination of RTA personnel and sub-contracting crews (up to twelve people). It is not anticipated that works would be undertaken outside the standard working hours of:

Monday – Friday:	7.00am to 6.00pm
Saturday:	8.00am to 1.00pm
Sunday and Public Holidays:	No work.

Any work undertaken outside of the standard working hours, would follow the procedure contained in the RTA's *Environmental Noise Management Manual 2001*, "*Practice Note vii – Roadworks Outside of Normal Working Hours*".

7.6 Stockpile and Compound Site

Compound and stockpile site, including a site office, portaloos, machinery storage areas, staff parking areas and vehicle washdown bays are expected to be established within the Proposal site.

A site compound/stockpile site would be located north of the existing bridge.

The location of the site compound/stockpile site would meet the following criteria in accordance with RTA's *Stockpile Site Management Procedures* (RTA 2001c):

- Be within areas which are already disturbed and do not require clearing of native vegetation.

Refer to **Appendix B** for more details.

7.7 Additional Fill Material

General earthworks have been designed to minimise the need to import fill material. Import of select material for earthworks is not expected to be required. Earthworks would consist of the following:

- A total cut volume of 6250m^3 (total fill volume of 5500m^3 and spoil volume of 1500m^3);
- There would be minimal excess earth material generated by the Proposal;
- Fill material would be sourced from within the Proposal site (ie. cut/fill works);
- A total of 2400m^3 of pavement material (including select material) would be required by the Proposal. Pavement material would be sourced from local quarries; and
- Spray sealing (6600m^2) would be sourced from an existing supplier at Mogo (approximately 50km south of the Proposal site).

The extraction or quarrying of materials does not form part of this REF.

7.8 Utilities

Relocation of underground telecommunications cables (Telstra) and overhead electricity cables (Country Power) on the western side of the highway at Lemon Tree Creek would be required.

Prior to the commencement of works, the need and extent for relocation of utilities would be determined following consultation with the affected utility owners.

7.9 Property Acquisition

Minor permanent strip land acquisition (0.72ha of State Forest land) would be required on the western side of the Princes Highway at Lemon Tree Creek. No Crown land acquisitions would be required.

8 Environmental Assessment

8.1 General

This section of the REF describes the existing environment and provides a detailed description of the potential environmental impacts associated with the Proposal during both construction and operation, and provides site-specific safeguards to ameliorate the identified potential impacts.

The environmental safeguards predominantly outline additional site-specific requirements, which are not covered by *RTA QA Specification G36 – Environmental Protection (Management System), RTA QA Specification G38 – Soil and Water Management (Soil and Water Plan)* and *RTA QA Specification G40 – Clearing and Grubbing* and *QA R178 – Vegetation* for inclusion into the Contractors Environmental Management Plan (CEMP). These safeguards would be implemented prior to construction, during construction and post construction. The RTA's Senior Environmental Officer, Southern Region prior to the commencement of work would review the CEMP.

8.2 Landform, Geology and Soils

Existing Environment

The geology of the Shoalhaven area is dominated by Permian age sandstones and siltstones. Older Ordovician age slates and shales make up the basement in the Clyde Valley with volcanic intrusions evident at Milton and Bawley Point. The area is predominantly hilly or mountainous country to the west with a narrow flat coastal strip to the east. In the northern section of the study area, the major surface geology is Permian sandstone, siltstone and conglomerates of the Shoalhaven Group. In the southern section, the Ordovician siltstone, claystone, sandstone, quartzite and chert are present. The Permian sediments are all relatively weak, easily eroded rocks, which have formed the rolling landform of the northern area. The Ordovician low-grade metamorphosed sediments are more resistant to weathering and have formed the steeper landform in the East Lynne area (Forestry Commission NSW 1983).

Lemon Tree Creek is situated on the lower slopes of hills and mountains that gently slope from west to east towards to the Pacific Ocean. To the west of Lemon Tree Creek is the hilly land of Termeil State Forest, where the land consists of undulating hills and mountains to approximately 100m in height, dissected by narrow valleys and drainage lines. To the east of Lemon Tree Creek Bridge, the land consists of low-lying areas of shrubs and heath that slope gently eastwards to the coast. The creek itself is a shallow depression, with pools of water along the creek line at the time of inspection. The banks of the creek are relatively flat and steeper, adjacent to the existing bridge structure (Forestry Commission NSW 1983).

The soils in the study area are gravelly brown and grey-brown soils that tend to be generally poor in nutrients and have good drainage characteristics. These soils have a moderate susceptibility to erosion by concentrated water flow (Forestry Commission NSW 1983). The pH of soil, from the nearest (the then) DNR Soil and Land Information System (SALIS) site is 5.7 (SALIS soil profile No. 15). A soil with pH of 5.7 is defined by the NSW DEC as slightly acid (5.5 – 6.5). This site is located approximately 2km northwest from the Lemon Tree Creek Bridge and is indicative of soil acidity at the proposal site. The Natural Resource Atlas was searched for the two study areas, and no land within or around the study areas are listed as having saline soils (Natural Resource Atlas, website).

The Proposal site is an isolated location on the Princes Highway adjoined by areas of bushland. There is one contaminated land site registered on the DEC Contaminated Land Sites Register for Shoalhaven LGA in Nowra, 65km north of the proposed works (refer to **Appendix D**). No evidence of any contaminated land was identified during site inspections. Agricultural land that has been used for cattle and sheep dips can be a source of soil contamination, however no evidence or records of cattle and sheep dips have been identified near Lemon Tree Creek Bridge. There are no travelling stock routes within either study area (Shoalhaven City Council 2005). There have been no accidents involving spills of chemicals or spills in the last five years at the Proposal site.

A geotechnical drilling investigation was undertaken at study area, 12km south of Ulladulla on the Princes Highway in July 2006 by the Technology and Technical Services, Southern Region. The aim of the drilling investigation was to provide details on foundation conditions and appropriate foundation systems for the new bridge and approach embankments. The report did not indicate potential contaminated site in the study area (RTA 2006).

Searches of the (the then) DNR Acid Sulphate Soil Risk maps have revealed that the land at Lemon Tree Creek Bridge is a risk area of Acid Sulphate Soils (ASS), though at varying degrees. The land on either side of Lemon Tree Creek is considered a low-risk area for ASS (refer to **Appendix D**).

Potential Impacts

The Proposal would require earthworks including cutting, filling, vegetation removal, culvert extension/drainage pipe installation and bridge construction. Construction works within the Proposal site have a moderate potential to cause soil erosion. Minor to moderate compaction of soils within the Proposal site can also be expected as a result of movement of earthworks machinery and trucks. Following completion of construction and establishment of revegetation works, the potential for erosion is expected to be no greater than the current condition of the Proposal site.

The Proposal would alter the existing landform by constructing cut and fill embankments along the new road alignment. Along the proposed carriageway, fill embankments would be up to approximately 3m in height, and cut embankments would be up to approximately 4m in height (ie. similar to current cut and fill heights).

The Proposal is not expected to encounter any contaminated land. The Proposal has a high potential to expose low risk Potential Acid Sulphate Soils (PASS) present at Lemon Tree Creek within the Proposal site during bridge construction works. PASS contain iron pyrite in an unoxidised state, and when air comes into contact with these soils, they form ASS. When water passes through ASS, sulphuric acid is leached out and transported into surrounding waterways. ASS has the potential to cause the following impacts:

- Many aquatic organisms are extremely sensitive to acidic drainage. Under certain combinations of weather and tidal flow, acidic leachates in the water can kill large numbers of fish and crustacean.
- Dissolved aluminium and iron in the acidic leachates generated from acidic sediments can be poisonous to both aquatic and terrestrial life forms.
- Water from ASS may form precipitates which coat surfaces in the aquatic environment, interfere with feeding and breeding of aquatic fauna, and suffocate gilled organisms.
- Sulphate salts released from the oxidation of pyrite can increase the salinity of fresh water.
- Acidic drainage can cause tissue damage to people and other life forms.

- Metal and concrete structures corrode when exposed to acid sulphate leachates unless highly corrosion resistant materials are used" (RTA Acid Sulphate Soil, Policy and Procedures, 1995)

Potential impacts caused by the Proposal would be avoided or minimised as far as practicable by implementing the following safeguards.

Site Specific Safeguards

- An erosion and sedimentation control plan would be developed and incorporated into the CEMP. The plan would incorporate specifications outlined in Landcom's *Managing Urban Stormwater: Soils and Construction ("Blue Book")*, identifying areas requiring management controls, include inspections and checklist sheets and be reviewed by the RTA's Senior Environmental Officer, Southern Region prior to the commencement of works.
- All stockpiles site/s would be designed, established, operated and decommissioned in accordance with the RTA's *Stockpile Management Procedures 2001*.
- Any material transported onto pavement surfaces would be swept and removed at the end of each working day.
- Hardstand material or rumble grids would be implemented at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces.
- Any imported fill required for the Proposal would be sourced from licensed/registered suppliers within the local area.
- Where trees are positioned under the proposed new bridge and require removal, tree stumps would be retained insitu where possible, and treated with a herbicide to kill the tree. Herbicide product label directions would be followed to minimise environmental impacts. This measure would reduce the potential for creek bank erosion.
- An aquatic approved herbicide (eg. Roundup bioactive) would be used within and immediately adjacent to waterways.
- Site rehabilitation of disturbed areas would be undertaken progressively as stages are completed. Batters would be stabilised with local native grasses (and/or sterile exotic grasses) and/or local native shrubs, and geotextile fabrics would be applied when needed.
- Where possible, disturbed areas would be restored to their pre-works shape at the completion of works.
- Prior to excavation the soils would be tested for ASS and if found to contain ASS or PASS an Acid Sulphate Soil Management Plan would be developed and incorporated into the CEMP. The plan would include but not be limited to:
  - Capping of exposed surfaces with clean fill to prevent oxidation;
  - Place excavated ASS separately in a lined, bunded and covered area;
  - Neutralise ASS by using soil additives such as aglime; and
  - Dispose of ASS in accordance with Part 2 of the *Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze 2005.*
- If unidentified sites of contaminated land are discovered within the Proposal site, works would cease at that location, contaminants would be immediately contained and the RTA's Senior Environmental Officer, Southern Region would be notified immediately. The Senior Environmental Officer would advise what action would need to be taken in regard to contamination assessment, containment, treatment, disposal and licences and approvals needed.

8.3 Climate

Existing Situation

The study area is situated in the Shoalhaven region and experiences warm to hot summers and cool to mild winters. Details from Jervis Bay meteorological station (approximately 30km to the north) are considered to be indicative of the study area. The study area has an annual average rainfall of approximately 1241mm, with the autumn and early winter months experiencing more rainfall than the other months of the year. The temperatures range from a mean daily maximum temperature of 23.9°C in February to a mean daily minimum temperature of 9.2°C in July (BOM 2007). Wind data is collected at Nowra NSW, approximately 80km north of the Proposal site. Due to the separation distance, this data cannot be applied to the study area.

Potential Impacts

The Proposal is not expected to impact on the local and/or regional climate. There would be the potential that during autumn and early winter months, heavy rainfall may impede earthworks required for the Proposal and could cause soil erosion and sedimentation.

Site Specific Safeguards

- The Commonwealth Bureau of Meteorology website/records would be checked at least on Monday and Thursday of each week, to allow sufficient time to vacate and clean up the site prior to the commencement of heavy rainfalls or anticipated rise in creek water levels.
- Where practicable, the works would be undertaken so they correspond with a period of dry weather, thereby reducing the risk of sediments entering Lemon Tree Creek.

8.4 Water Quality and Hydrology

Existing Situation

Surface water

Hydrology

Lemon Tree Creek (3.56km^2) catchment is a relatively small, east draining valley, up to seven kilometres in length that drains into estuarine lakes, which have formed behind coastal sand barriers.

Lemon Tree Creek is the southernmost of four catchments that drain into Tabourie Lake, which has formed behind an extensive sand barrier. At Lemon Tree Creek Bridge, the creek consists of a pool of standing water approximately 20m long by 4m wide with a maximum depth of approximately 0.5m. Concrete bridge piers from the existing bridge and timber piers from where the previous bridge stood in this pool are also present in the bare earth channel and banks of the creek beneath Lemon Tree Creek Bridge. The channel of the creek upstream of the bridge supports a number of increasingly smaller, shallower and infrequent pools. Downstream of the existing bridge, pools are more frequent.

No known flood events have overtopped the existing Lemon Tree Creek bridge.

Water Quality

Water quality sampling of Lemon Tree Creek was undertaken by the Ecology Lab in October 2004 and compared against the DEH *Australian Guidelines for Fresh and Marine Water Quality, Volume 1* (ANZECC 2000). Mean pH values were close to neutral for all three sampling sites and well within the range recommended by ANZECC (2000) guidelines for lowland rivers in south-eastern Australia. Lemon Tree Creek is a fresh water stream in the study area, as the estuarine influence is 1km further downstream from the bridge. Dissolved oxygen levels for all

three sampling sites within the creek were well below the recommended range of 85-110%. This was likely to be occurring from the decomposition of a substantial amount of organic material washed into the creek. Turbidity was within the recommended range at sampling sites upstream and downstream of the existing bridge structure, and slightly higher than the recommended levels at the existing bridge. This may have been due to the reduced amount of bank stabilising vegetation under the bridge causing higher amounts of sediment in this standing pool. The pH levels within the three sampling sites ranged from 7.0 to 7.4, which is within the ANZECC guidelines. The recommended range for conductivity of water is between 125 and 2200 mS/cm. At Lemon Tree Creek, sites 1 and 3 were within the guidelines, however site 2, downstream of the bridge the conductivity was below, with a reading of 110 mS/cm. The temperature of the water ranged between 14.1°C upstream of the bridge to 15.3°C at the existing bridge.

Council water quality monitoring in Lake Tabourie (downstream from Lemon Tree Creek Bridge) since 2000 has shown little variation in water quality ratings, with a medium water quality rating for most of the reporting period between 2000 and 2003. High levels of faecal contamination enter the lake from the small tributaries, Brandaree and Saltwater Creek (Lemon Tree Creek).

Groundwater
Several groundwater bores are present 1100m and beyond the Lemon Tree Creek Proposal site (CANRI 2005), and the elevation in the vicinity of the Proposal site ranges from 10-50m above sea level. The groundwater level in the vicinity of the Proposal site can therefore be expected to be in close proximity to the ground surface, particularly near Lemon Tree Creek.

Potential Impacts

Surface water

Hydrology
Stormwater flow from the Proposal site would continue to enter Lemon Tree Creek. Alteration of the existing landform by introducing cut and fill embankments along the new road alignment would only cause minor localised hydrology impacts within the Proposal site, and is not expected to cause any flooding or backwater impacts within or beyond the Proposal site. The Proposal would not cause any changes in impacts on adjoining properties from road runoff. Ripping and revegetation of obsolete sections of existing Princes Highway would assist to minimise as far as practicable the areas of impervious roadway.

Water quality
The Proposal would be limited to construction of bridge, extension/installation of drainage structures, cut and fill earthworks, rehabilitation of the existing roadway and removal of the existing bridge.

As the majority of bridge works are expected to be constructed outside of the low flow river channel, the potential impacts on water quality of the creeks are likely to be minor. During extension/installation of drainage structures, the Proposal is likely to have minor short-term sedimentation impacts on ephemeral unnamed drainage channels. Removal of the existing bridge is likely to cause minor disturbance to the banks and bed of the creek (Refer to Section 8.12 which deals with disposal of bridge timbers which may contain lead/other contaminants).

In summary, construction and operation of the Proposal has the potential to cause the water quality of the Lemon Tree Creek to decline due to the release of polluted water and generation of construction waste from cement works, vehicle washdowns, welding and accidental spills (eg. chemicals, fuels, oils, hydraulic fluid and pavement materials). Potential water quality impacts could include changes in chemical (pH, nutrients, dissolved oxygen, and inorganic and organic

matter) and physical (light penetration, salinity and temperature) water parameters. Water quality protection measures would be implemented to minimise these potential impacts as far as practicable.

The improved road alignment would reduce the potential for spillages of fuels and/or chemicals to occur during the operation stage, which would reduce water quality impacts on Lemon Tree Creek.

Operational vehicle pollutants including hydrocarbons and combustion derivatives, lubricating oil, petroleum, rubber, and heavy metals have the potential to enter Lemon Tree Creek. Pollution generated from operation of the Proposal can be expected to be less than pollution from the existing road runoff. This would be due to the improved road alignment, and deposition of bridge runoff to off-line stormwater basins nearby the bridge, as opposed to direct discharge to the creeks via scuppers as currently occurs. Deposition of bridge runoff to off-line stormwater basins would capture litter, coarse sediment and oil spills, causing less impact on the creek.

Pollution of Lemon Tree Creek caused by the Proposal is not expected to occur providing the safeguards below are implemented.

Groundwater

The proposed works are likely to make contact with the groundwater table at Lemon Tree Creek during bridge construction works. Groundwater quality has the potential to decline through the release of polluted water and wastes associated with bridge construction works, including accidental spills of fuels, hydraulic fluid, and chemicals. Potential impacts on groundwater during bridge construction works could include increased levels of turbidity, sedimentation, and potential changes in the chemical (pH, nutrients, dissolved oxygen, and inorganic and organic matter) and physical (salinity and temperature) water parameters. Groundwater pollution caused by the Proposal is not expected to occur providing the safeguards below are implemented.

Site Specific Safeguards

- The Proposal would be undertaken in accordance with RTA's *Water Policy* and *Code of Practice for Water Management (1999).*
- Access tracks to the Lemon Tree Creek bridge construction site would be constructed within the proposed road formation footprint, and to the north (approximately 6m wide track) of the proposed road formation footprint.
- Areas for access tracks and working platforms needed to construct piles/piers for the bridge would be restricted in size to minimise impacts on Lemon Tree Creek.
- Water flow in Lemon Tree Creek would be maintained during construction and operation of the Proposal.
- All access tracks and working platforms components would be suitably secured so they would not be dislodged into Lemon Tree Creek during dry and/or wet weather.
- To prevent pollution of Lemon Tree Creek, no loose rock or fill would be permitted to be placed on the working platforms within or in close proximity to the creek.
- Within Lemon Tree Creek, and north and south of Lemon Tree Creek, access by vehicles and workers beyond access tracks and working platforms would not be permitted.
- Sediment fencing would be placed to surround all access tracks and working platforms.
- Following completion of bridge construction works, all introduced materials (eg. sediment fencing) would be removed from the Proposal site.
- Should any spillage occur during construction the RTA's Senior Environmental Officer, Southern Region, would be contacted immediately, and contaminants would be

immediately contained, removed, treated (if necessary) and disposed of in accordance with DEC requirements.

- An incident emergency spill plan would be developed and incorporated in the CEMP. This would include measures to avoid spillages of fuels, chemicals, and fluids onto the floodplain and/or into any waterways. All personnel would be made aware of these measures. An emergency spill kit would be kept onsite at all times.
- All fuels, chemicals, and liquids would be stored at least 50m away from any waterways or drainage lines and would be stored within an impervious bunded area within the compound site.
- Culvert extensions would be positioned to ensure that water discharges do not cause backwaters and/or erosion and sedimentation problems.
- Any wastewater generated from construction processes would be contained onsite and/or treated using a DECC certified process prior to its disposal. The release of dirty water into waterways would be prohibited.
- All concrete works would be undertaken in accordance with the DEC *Environmental Best Management Practice Guideline for Concreting Contractors (2002).*
- The maintenance of machinery would be undertaken within impervious bunded areas within the compound site.
- Vehicle washdowns and/or cement washouts would be undertaken within compound site(s) in a designated bunded area with an impervious surface, or undertaken off site in an appropriately controlled area.
- To minimise the downstream disturbance of the proposed bridge works on riparian communities, erosion and sediment barriers would be erected on the downslope boundaries of all construction zones.
- Creek bed and bank stabilisation works would be completed immediately after completion of bridge works.
- To minimise construction impacts and operational road runoff on Lemon Tree Creek, stormwater basins (58m^3 capacity) would be installed nearby the new bridge on the northern and southern side of the creek.
- No on-line or in-stream water quality structures (eg. stormwater basins) would be utilised, as they would affect the continuity and corridor function of streams and result in the loss of riparian vegetation and habitat.
- All stormwater runoff would be directed off the new bridge, then enter the stormwater basins before being released into Lemon Tree Creek.
- Stormwater basins would be regularly emptied and maintained as per design specifications. Material collected would be disposed of at a licensed waste facility.
- During construction, visual monitoring of water quality (ie. turbidity, hydrocarbon spills/slicks) in Lemon Tree Creek would be undertaken on a regular basis and records kept and provided at anytime upon request.

8.5 Air Quality

Existing Environment

Air quality in the Shoalhaven LGA is considered to be good (Shoalhaven State of the Environment Report (SoER). As a result of comparatively little heavy industry and the fact that the study area is far enough south of Sydney and Wollongong, adverse air quality impacts from these sources do not occur.

According to the National Pollution Inventory there has been a slight decrease in carbon monoxide, oxides of nitrogen, particulate matter and sulphur dioxide emissions. The main sources of air pollutants in the LGA are food manufacturing, paper and paper product manufacturing, smoke from bush fires in summer, hazard reduction burns, motor vehicle emissions and smoke emissions from solid fuel heaters during winter months (NPI Database emission report). The number of passenger vehicle registrations in Shoalhaven increased by 877 vehicles. There was also a slight increase in the percentage of vehicles using LPG and Petrol/LPG as fuels. With the phase out of the older leaded petrol vehicles, emissions from passenger vehicle use have shown a gradual decline (Shoalhaven State of the Environment Report (SoER) 2005/2006).

Potential Impacts

During, and immediately after the construction phase, there is potential for a localised deterioration in air quality due to dust generated from exposed surfaces. Moderate dust would be generated during earthworks and construction of the road base and roadside batters, and ripping of redundant sections of the existing Princes Highway. Operation of construction machinery can also be expected to contribute minor pollutants to the local air quality. The nearest residential property to Lemon Tree Creek Bridge is located approximately 570m to its northeast and is unlikely to be affected by exhaust fumes and/or dust. Safeguards described below would minimise impacts as far as practicable on the residence.

The Proposal is expected to have a minimal long-term impact on air quality following the establishment of the proposed revegetation activities. The Proposal is not expected to encourage increased traffic levels, and accordingly would not cause an increase in vehicle emissions.

Site Specific Safeguards

- On-site construction truck movements would be controlled by being restricted to designated routes.
- Any stockpile with the capacity to cause dust would be dampened or covered to suppress dust emissions.
- Long-term stockpile would be sprayed with a sterile grass mix to suppress dust generation.
- When dust is visually detected, the frequency of watering would be increased. Dust generating activities would be reprogrammed to avoid periods of high wind velocity.
- If works are creating high levels of dust that are likely to cause discomfort to local residents or a safety hazard to traffic or work personnel, the works would be modified or stopped until the dust hazard is eliminated or has been reduced to an acceptable level.
- Truck loads would be wet down or covered as necessary to suppress dust generation.
- Tailgates would be secured during operation of trucks and utes.
- There would be no burning of timber or wastes.
- Machinery would be turned off, rather then left idling for long periods.

8.6 Biodiversity

A terrestrial ecological assessment for the Proposal was undertaken for the RTA by Lesryk Environmental Consultants in November 2006, which included Lemon Tree Creek and Termeil Creek areas (refer to **Appendix E**). An ecological constraints analysis for the Proposal was undertaken for the RTA by Lesryk Environmental Consultants (terrestrial ecology) and The Ecology Lab (aquatic ecology) in December 2004 (refer to **Appendix E**).

Existing Environment

The Proposal site has been impacted by past road works, the establishment of pastures, and transmission easements. A network of conservation reserves (Meroo, Budawang and Morton National Parks) and State Forests (Termeil, Clyde, Kiola, Flat Rock, Yadboro, North Brooman and South Broomanis) are the dominant land uses that surround the Proposal site. In regards to the farming properties present to the south west of Lemon Tree Creek, the dominant agricultural practice is livestock grazing (including horses and cattle).

Terrestrial Flora

Some portions of the Proposal site have been cleared of all native vegetation. A total of 158 native plants were recorded in the Proposal site, including a vegetation community within and adjacent to the Proposal site, being Spotted Gum – Blue Gum – Blackbutt Open Forest.

Spotted Gum – Blue Gum – Blackbutt Open Forest

Spotted Gum – Blue Gum – Blackbutt Open Forest occurs throughout the Proposal site.

Trees are up to 30m in height with a medium density canopy. Spotted Gum (*Corymbia maculata*), Blackbutt (*Eucalyptus pilularis*) and Sydney Blue Gum/Bangalay hybrid (*E. saligna/E. botryoides*) are common. White Stringybark (*Eucalyptus globoidea*) and Red Bloodwood (*Corymbia gummifera*) occur in association with the drier soils that are present away from the creek lines. Black She-oak (*Allocasuarina littoralis*), Cheese Tree (*Glochidion ferdinandii*) and Blueberry Ash (*Elaeocarpus reticulatus*) are common small trees, with Black Wattle (*Callicoma serratifolia*) common closer to the creeks.

The shrub layer varies in density and height, depending on species composition. The height of the shrubs ranges between 0.5m and 4m. Heath-myrtle (*Babingtonia pluriflora*), Lance Beard-heath (*Leucopogon lanceolatus*), Sydney Golden Wattle (*Acacia longifolia var. longifolia*), Black Wattle (*Acacia mearnsii*), Sweet-scented Wattle (*Acacia suaveolens*), Tick Bush (*Kunzea ambigua*), Lemon-scented Tea-tree (*Leptospermum polygalifolium ssp. Polygalifolium*), Gorse Bitter Pea (*Daviesia ulicifolia*), Hairpin Banksia (*Banksia spinulosa var. spinulosa*), Bush Pea (*Pultenaea flexilis*), Narrow-leaf Geebung (*Persoonia linearis*) and Blackthorn (*Bursaria spinosa*) are present.

The groundcover is generally sparse except near Lemon Tree Creek where vines and climbers cover the ground. White Root (*Pratia purpurascens*), Grey Guinea Flower (*Hibbertia obtusifolia*), Bracken Fern (*Pteridium esculentum*), Raspwort (*Gonocarpus teucrioides*), Common Maidenhair Fern (*Adiantum aethiopicum*), the grass (*Entolasia stricta*), Lilac Lily (*Schelhammera undulata*), Flax Lily (*Dianella revoluta var. revolute*), Bladey Grass (*Imperata cylindrica*), Native Violet (*Viola hederacea*) and Saw-sedge (*Gahnia clarkei*) are present.

The climbers, Water Vine (*Cissus hypoglauca*), Snake Vine (*Stephania japonica*), Golden Guinea Flower (*Hibbertia scandens*), Twining Guinea Flower (*Hibbertia dentata*) and Old Man's Beard (*Clematis aristata*) are present.

Terrestrial Fauna

A variety of native fauna species were recorded during the field investigations. The majority of these animals are common to abundant throughout the surrounding region. The terrestrial habitats available for use by native species were observed within the Proposal site, these being:

- Disturbed environment ;and
- Eucalypt woodland.

The disturbed environment habitat includes the Princes Highway and its road verges, the cleared and regularly maintained power line easements and the grazing pastures. This habitat type is dominated by exotic grasses and weeds. Associated with this habitat type are strips of

remnant vegetation, the width of which varies from 5 to 10m. Trees that are between 6 and 25m in height are present within these strips, none of which were noted to support hollows suitable for native species. The understorey is comprised of a medium to high density layer of native shrubs up to 5m in height. The groundcover within the remnant strips is composed of a high density layer of grasses, ferns, saplings and forbs up to 1m in height. Leaf litter, logs, some exposed rock and wind blown refuse are present.

The eucalypt woodland is the dominant habitat type of those vegetated parts of the Proposal site. The habitat type is common throughout the surrounding region, extending beyond the limits of each Proposal site. The eucalypt woodland supports trees that are up to 30m in height, several of which provide hollows (up to 150mm in diameter). Several dead stags, and a small amount of dead wood and dead trees are present within the Proposal site. Throughout the woodlands, the tree canopy is continuous, with few barriers to fauna movement. The middle storey supports a medium density layer of native saplings and tall shrubs up to 10m in height. The understorey is composed of a medium to high density layer of native shrubs and saplings up to 4m in height. The ground cover consists of a high density layer of native grasses, ferns, vines and forbs up to 1m in height. Due to the presence of hollow bearing trees and flowering plants, the eucalypt woodland offers a range of foraging, sheltering and breeding sites.

No large caves, rocky crevices or suitable cave substitutes were observed within either Proposal site.

Aquatics

The aquatic environment present in the Proposal site is the freshwaters of Lemon Tree Creek.

Lemon Tree Creek is approximately 5m wide and 0.5m deep. It supports standing water with some sparse occurrences of reeds up to 1.5m in height, as well as leaf litter and logs submerged in the water. The creek banks are earthen, around 1m in height and are either cleared or support riparian vegetation that is characteristic of the adjacent woodlands. Lemon Tree Creek is ranked as Class 3 (Minimal Fish Habitat). Invertebrates observed in Lemon Tree Creek included the families *Gerridae* (water striders) and *Dytisidae* (water beetles).

Due to the ongoing maintenance of the existing power line corridor, the vegetation lining the creek crossing has been regularly pruned and cleared.

No Mosquito fish were captured or observed within the Proposal site, although they have been recorded in the south coast region, and it is likely that they are present at times in waterways nearby the Proposal site.

The existing creek crossing is a concrete structure of varying span widths. No obvious roosting site available for use by native fauna species were observed in association with the bridge structure. Whilst offering some resources for native species, those components of the aquatic environments that occur within the Proposal site are not unique to the region, more developed occurrences of this habitat type are present beyond the limits of the Proposal site.

Potential Impacts

Terrestrial Flora

Based on a worse case scenario, it is expected that 0.5ha of bushland would be removed from the Lemon Tree Creek Bridge Proposal site.

The Proposal would require removal of trees, shrubs, goundcovers and climbers within the 'Spotted Gum – Blue Gum – Blackbutt Open Forest' vegetation community.

The 'Spotted Gum – Blue Gum – Blackbutt Open Forest' vegetation that would be removed by the proposed road works is the same as that which is present in the surrounding region. Given the small amount of vegetation to be removed, and the much larger areas of the same vegetation type in the surrounding region, the impact of vegetation removal is considered to be minor.

The proposed works have the potential to cause the growth and spread of the Class 4 noxious Fireweed along the highway within and beyond the Proposal site.

Terrestrial Fauna

The scale of the Proposal is not considered to have an adverse impact on the diversity of native species present. No hollow bearing trees would be removed by the Proposal, and no native species would be solely reliant upon those habitats present within the Proposal site such that the removal or further disturbance of these would threaten the occurrence of these animals. The species recorded are all expected to be present within both the Proposal site and surrounding region post-construction. Due to their ability to adapt to, and be tolerant of, urban developments/infrastructure, none of the native species recorded would be adversely affected such that the viability of a local population of that animal would be placed at risk of extinction. The surrounding vegetated areas are expected to ensure the long-term presence of these animals.

The 'disturbed environment' habitat type is considered to be of little to no ecological value for native species and none would be adversely affected as a result of the Proposal. No native species would be dependant upon the resources present within the disturbed environment such that their removal or further disturbance would adversely affect the viability of a population of that species.

The removal of some edge affected eucalypt woodland vegetation adjacent to the disturbed environment is not considered to present a significant impact on the viability of any locally occurring populations of native fauna.

The bridge designs would permit fauna movement under the Lemon Tree Creek bridge. The Proposal would widen the existing barrier to fauna movements (ie. the Princes Highway) at the Lemon Tree Creek (up to an additional 20m) Proposal site, but would not introduce any new barriers to fauna movements within or across the Proposal site.

Aquatics

A small number of riparian trees and shrubs would be removed from the banks of the creek during the works. Giving consideration to the habitat requirements of those terrestrial animals recorded or potentially occurring, it is not expected that any would be reliant upon the portion of the aquatic environment that occurs within the Proposal site, such that the disturbance of these sections would threaten the local viability of any species.

Removal of fish habitat (in stream and riparian vegetation) by the works has the potential to cause deterioration in water quality which may provide conditions suitable for the proliferation of Mosquito fish. This may have a detrimental effect on small native fish which inhabit the Proposal site.

The Proposal is consistent with the NSW (the then) DPI *Fish Friendly Guidelines* by providing the bridge with piers outside the main flow channel to allow free passage of aquatic species. The construction and design measures of river crossing would be consistent with:

- NSW (the then) DPI Policy and Guidelines for Fish Friendly Roads and Waterway Crossings;
- RTA Code of Practice for Water Management; and
- RTA Water Policy.

During construction and operation of the Proposal the following can be expected to be maintained:

- Fish habitat and fish passage [particularly for Flathead gudgeon (known to migrate) and Dwarf flathead gudgeon (likely to migrate)] within waterways in the Proposal site; and
- Habitat for invertebrates within the Proposal site.

The potential spills of oil and other pollutants during construction and operation of the Proposal has the potential to degrade soil and water quality, and increased erosion and sedimentation could increase nutrient loadings within the waterway and within the riparian zones. Although, the proposed works within the Proposal site would not be expected to unfavourably impact aquatic habitats or species, providing safeguards below are implemented.

Conservation Significance - Terrestrial Flora, Terrestrial Fauna and Aquatics

Terrestrial Flora

No threatened flora species, populations or ecological communities (TSC or EPBC Act listed), are likely to be affected by the proposed works. Neither preparation of a Species Impact Statement (SIS), or referral to the Commonwealth Department of Environment and Water Resources would be required.

Terrestrial Fauna

It is not considered that the Proposal would significantly reduce the extent of foraging resources available to Rufous Fantail or Black-faced Monarch birds (EPBC Act listed), such that they would become locally displaced or extinct. As such, the Proposal is not considered to affect the local or regional viability of these two birds, or any major areas of their necessary habitat. Referral to the Commonwealth Department of Environment and Water Resources for further consideration or approval would not be required.

'Clearing of native vegetation' and 'removal of dead wood and dead trees' are Key Threatening Processes under the TSC Act. A total of 0.5ha of native vegetation would be removed by the Proposal. A small amount of dead wood and dead trees may be removed by the Proposal.

No other threatened fauna species, populations or other ecological communities (TSC or EPBC Act listed), are likely to be affected by the proposed works. Neither preparation of a SIS, or referral to the Commonwealth Department of Environment and Water Resources would be required.

Aquatics

No species or communities listed on State or Commonwealth schedules are likely to be impacted by the Proposal. Neither preparation of a SIS, or referral to the Commonwealth Department of Environment and Water Resources would be required.

The removal of riparian vegetation and large woody debris from waterways are listed as key threatening process under the FM Act 1994. To minimise impacts on fish, woody debris in Lemon Tree Creek are not expected to be removed by the works. A small amount of riparian vegetation would be removed by the Proposal.

'Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands' is a key threatening process under the FM Act 1994. It is expected that no alteration to the natural flow of Lemon Tree Creek would occur as a result of the Proposal.

Site Specific Safeguards

Flora

- Prior to the commencement of construction work, existing local provenance (ie. tubestock or viable seed supply) would be sourced.
- Alternatively, prior to the commencement of construction work, seed collection within a 10km area surrounding the Proposal site would be undertaken, so that revegetation of areas disturbed during construction activities can be undertaken using locally sourced native plant stock (Note: Seed collection would be undertaken in advance of construction commencing to enable seed to be collected during appropriate seasons. This would ensure the provision of appropriate plant species and provenance, and to minimise adverse impacts upon the local native flora within the Proposal site).
- Prior to any clearing of State Forest land, the NSW DPI (Forests) resources section would have to authorise the work by letter. RTA Surveyors would then document the road corridor adjustment after the reconstruction is completed.
- Topsoil in vegetated areas containing native seed would be stockpiled on geotech fabric and used in revegetation works.
- Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licensed landfill facility. Weed infested or contaminated topsoil would not be reused for the proposed works or for revegetation works and would not be stockpiled adjacent to any areas of native vegetation.
- Vegetation clearing limits would be clearly marked in the field prior to clearing and incorporated into site plans and flora and fauna management plan and/or the clearing and grubbing plan as per RTA *Specification G40 (Clearing and Grubbing).*
- Toolbox sessions would be provided to inform staff of clearing limits and exclusion zones.
- Cleared and disturbed areas would be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion. Subsequent to this, revegetation of roadside areas adjacent to the new alignment would use locally occurring native plant species typical of those vegetation communities affected by the Proposal.
- Construction compounds, stockpile site and the storage of materials would be established within existing cleared areas.
- All trimming of mature native trees would be undertaken by a qualified arborist.
- A weed management strategy would be implemented for the Proposal site, and any planted vegetation.
- The growth and spread of the class 4 noxious weed (Fireweed, *Senecio madagascariensis*) must be controlled according to the measures specified in a management plan published by the local control authority.
- Obsolete sections of the existing Princes Highway would be ripped and revegetated using locally indigenous plant species.
- Vegetation removed would be chipped/mulched on-site and used in revegetation works within the Proposal site.
- Landscaping of all areas disturbed by the Proposal (including cut and fill batters) with local native plants would be undertaken where appropriate to enhance native vegetation cover.
- A planting palette would be developed during the detailed design phase based on the ecology assessment (refer to **Appendix E**), advice obtained from Shoalhaven City Council, and from local native plant species lists. Species would be chosen for their demonstrated ability to grow robustly in an environment where water may be limited and occasional weed competition may also exist.
- Any private land (ie. land located outside the road corridor) inadvertently impacted by the Proposal would be restored to satisfy landowner requirements (ie. to appropriate land contours, soil condition and vegetation cover).

- Should additional vegetation removal be required, the proposed variation to the original scope would be referred to the RTA's Senior Environmental Officer, Southern Region to determine if any further environmental impact assessment is required.

Fauna

- Fauna passage under the Princes Highway along the creek would be maintained during construction and operation.
- Riparian vegetation cover for terrestrial fauna movement would be retained where possible.
- Rather than removing whole trees, lopping of tree branches would be undertaken where possible to retain fauna habitat.
- Relocation, rescue and/or rehabilitation of fauna species found inhabiting the areas to be disturbed would be undertaken by person(s) licensed under the *National Parks and Wildlife Act 1974*.

Aquatic

- The new bridge would be designed and constructed in accordance with (the then) DPI Fisheries guidelines (*Policy and Guidelines for bridges, Causeways, Culverts and Similar Structures; Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (2004) and Fishnote - Policy and Guidelines for Fish Friendly Waterway Crossings*).
- To prevent alteration of creek flow, the new bridge piles/piers would not be constructed within the creek channel.
- Fish passage in the creeks would be maintained during construction in accordance with (the then) DPI Fisheries *Policy and Guidelines for bridges, Causeways, Culverts and Similar Structures* (NSW Fisheries 1999).
- The road and bridge works would be constructed and operated in a manner that would prevent deterioration of water quality in waterways [as per NSW Fisheries *Policy and Guidelines for Bridges, Causeways, Culverts and Similar Structures* (NSW Fisheries 1999)].
- The Minister for Fisheries would be notified of any proposal to remove or relocate any woody debris in the waterways.
- A permit from NSW Fisheries would be obtained, should it be necessary to temporarily or permanently block any fish passages.

8.7 Non-Aboriginal Heritage

Existing Environment

A search of the State Heritage Register/Inventory for the suburb of Ulladulla in the Shoalhaven LGA was undertaken on 22 May 2007. Several sites are listed on the register/inventory for the Shoalhaven LGA. None of the listed items occur within the Proposal site, with the nearest item 'Ulladulla Lighthouse' at Wardeen Head approximately 15km north of the Proposal site (refer to Appendix D).

A search of the Australian Heritage Database was undertaken on 22 May 2007 for the Shoalhaven LGA. Several sites are listed on the database for the Shoalhaven LGA. None of the heritage items occur within the Proposal site. The nearest heritage item to the Proposal site is an Aboriginal heritage place at Termeil approximately 1.6km southwest of the Proposal site (refer to Appendix D).

A search of the RTA Heritage and Conservation Register was undertaken on 22 May 2007 for items in the Southern Region. Several items are listed for the Southern Region. The nearest

heritage item to the Proposal site is located approximately 19km south of the Proposal site (refer to **Appendix D**).

Relics (greater than 50 years old) as defined under the *NSW Heritage Act 1977* are present within the Proposal site. The relics include the concrete beam bridge at Lemon Tree Creek, and timber footings, piers and abutments from the temporary timber beam bridge at Lemon Tree Creek (pre 1939/1940).

The existing concrete beam bridge (1939/1940) at Lemon Tree Creek present in the Proposal site was assessed as having no significant heritage value, either locally or regionally in the *Study of Heritage Significance of pre-1948 RTA Controlled Concrete Beam Road Bridges (Sydney, South West and Southern Regions).*

The Lemon Tree Creek Bridge was constructed as part of the Princes Highway improvement program carried out by the Department of Main Roads in the 1930's-1950's and formed a minor component in the overall Princes Highway improvement program.

The Lemon Tree Creek Bridge is a simple, functional structure which does not demonstrate creative or technical innovation or achievement.

The temporary timber beam bridge was constructed as a temporary crossing over Lemon Tree Creek while the concrete beam bridge was built in 1939/1940. Timber footings, piers and abutments of the temporary timber beam bridge are present beneath the Lemon Tree Creek bridge. The timber relics (footings, piers and abutments) present in the Proposal site are considered to have no significant heritage value, either locally or regionally (pers. comm. Ian Berger, RTA). These timber remnants are only a small component of the original temporary bridge structure. Although only a small component of the temporary timber beam bridge was observed at the Proposal site, there is the potential for more extensive remains to be present.

Potential Impacts

There are no known listed non-Aboriginal heritage items or sites within the Proposal site that would be affected by the Proposal.

The Proposal would not impact on any heritage items listed on the State Heritage Register/Inventory, RTA Heritage and Conservation Register or Australian Heritage Database. The Proposal would result in the removal of Lemon Tree Creek Bridge relics with no significant heritage value. The Proposal may also require the removal of timber footings, piers and abutments of the temporary timber beam bridge relics with no significant heritage value.

In accordance with Section 139(4) of the *Heritage Act 1977* approval and/or exemption notification for removal of the bridge would not be required. This is the case, as an exception under Section 139(4) of the *Heritage Act 1977* is created for excavation or disturbance for the purpose of the demolition of bridge not listed on the State heritage register, where demolition would impact solely upon the bridge, its pilings, footings and abutments and upon no other relics.

Site Specific Safeguards

- In the event that any non-Aboriginal relics are located during the works, all work would cease in the vicinity of the find, and the RTA's Senior Environmental Officer, Southern Region would be contacted.

8.8 Aboriginal Heritage

Navin Officer Heritage Consultants undertook a Cultural Heritage Assessment for the Proposal, including a field survey on 5 November 2004 with the RTA's Aboriginal Programs Consultant (APC), Southern Region (RTA 2005b).

The Bateman's Bay Local Aboriginal Land Council (LALC) were unable to attend the site visit with Navin Officer and the APC due to unforseen circumstances. However, the Bateman's Bay LALC agreed that the site visit should be undertaken and a copy of the archaeological report be forwarded to the Bateman's Bay LALC for review. At a later date, after discussions between the RTA's APC, the Batemans Bay LALC and the Ulladulla LALC, it was agreed that the Proposal sites are actually within the Ulladulla LALC jurisdiction.

A representative from the Ulladulla LALC undertook a site visit with the RTA's APC on 3 February 2005. The ULALC then wrote a report to be included in the Cultural Heritage Assessment written by Navin Officer. The Ulladulla LALC concluded that they have no objections to the proposed works. As the Aboriginal Cultural Heritage Assessment commenced prior to 1 January 2005, the DEC Interim Community Consultation Requirements for Applicants do not need to be adhered to.

Existing Environment

A search of the DEC AHIMS database was undertaken on 2 September 2004 for items of Aboriginal heritage known to occur within 5km of the Proposal site. A total of 29 objects and Aboriginal places are known to occur within 5km of the Proposal site. None of the Aboriginal sites occur within the Proposal site, the nearest site is approximately 360m west of Lemon Tree Creek Bridge (refer to RTA 2005b).

A search of the National Native Title Tribunal was undertaken on 11 October 2004 for claims in the Shoalhaven LGA. There are no registered National Native Title Claims or Aboriginal Land Use Agreements in Shoalhaven LGA (refer to RTA 2005b).

Potential Impacts

The AHIMS Aboriginal site approximately 360m west of Lemon Tree Creek Bridge is located outside the Proposal site. The proposed works would be approximately 300m east of the AHIMS site and would not be affected by the Proposal.

Site Specific Safeguards

- **All personnel working on site would receive training (eg. toolbox talks) in their responsibilities under the *National Parks and Wildlife Act 1974*.**
- **No works would be permitted near the AHIMS Aboriginal site.**
- Should Aboriginal heritage items be uncovered during works, all works in the vicinity of the find would cease and the RTA's Aboriginal Cultural and Heritage Advisor, Senior Environmental Officer Southern Region, DEC representative and relevant LALC representative would be contacted. Works in the vicinity of the find would not re-commence until appropriate clearance has been received.

8.9 Visual Amenity and Landscape

Existing Situation

The visual amenity of the Proposal site has been determined in accordance with the RTA's *Environmental Impact Assessment Policy Guidelines Procedures (Version 4).*

Within the study area the Princes Highway is situated adjacent to large areas of dense Eucalypt Forest that dominates the slopes and foothills of Termeil State Forest, is included in the Illawarra REP as being land with landscape or environmental attributes and is adjacent to the Meroo National Park. Motorists travelling along the Princes Highway would have views of the adjacent forest and occasional glimpses of mountains to the west and the park to the east. The study area is considered to be of moderate visual amenity.

Potential Impacts

Visual impacts of the Proposal have been assessed in accordance with the RTA's *Environmental Impact Assessment Policy Guidelines Procedures (Version 4).*

Construction

Establishment and operation of compound/stockpile site, construction of the new roadways and bridge including removal of native vegetation (0.5ha) along the Princes Highway, and construction of cut and fill embankments would reduce the visual amenity of the Proposal site in the short-term. Construction of the new roadways and bridge would have a moderate impact on the visual amenity for road users.

Operational

The new bridge over Lemon Tree Creek would generally be similar in appearance to the existing bridge, and would be located adjacent to it. Only the surface deck of the new bridge would be visible by road users travelling on the Princes Highway.

Introduction of the new bridge is not expected to affect the visual amenity in the study area. The visual impact of vegetation removal would decline with time as the revegetation works mature. Ripping and revegetation of obsolete sections of the Princes Highway would also enhance the visual amenity of the Proposal site in the long-term. The existing visual amenity at the Proposal site can be expected to be maintained in the long-term following completion of the works.

Site Specific Safeguards

- Following completion of construction activities, the Proposal site would be subject to comprehensive revegetation with local native species which would be undertaken to reduce the visual impact of the new bridge and roadworks. Revegetation works would be concentrated at the following locations:
  - All vegetated areas disturbed by the construction works;
  - New road embankments/batters; and
  - Along obsolete sections of the Princes Highway.
- A revegetation plan would be prepared for the Proposal, and would be reviewed by the RTA's Senior Environmental Officer, Southern Region prior to commencement of revegetation works.
- All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.
- Stockpile and/or compound site would be screened (eg. with shade cloth) to reduce visual impacts as far as practicable.

8.10 Socio-economic Considerations

Existing Situation

The Proposal site occurs on the Princes Highway, which links Sydney and Victoria and is an important tourist and regional freight route. The Princes Highway is used by local residents as the access route to larger towns such as Ulladulla and Nowra to the north, and Batemans Bay

to the south. Within the study area, there are seven four-wheel drive access tracks and two gravel roads, leading off the highway into Termeil State Forest and Meroo National Park. These roads and tracks are used for recreation, and also as access trails for emergency services in the area.

Land use in the study area consists of Termeil State Forest and Meroo National Park. Tabourie Lake is used for recreational fishing by local residents and tourists, as it is in close proximity to the town of Tabourie Lake which is a small town with recreational caravan parks. On 17 September 2004, the Deputy Director-General of Agriculture and Fisheries announced in Government Gazette 147 (F99/174) that at Tabourie Lake, its creeks and tributaries upstream from its confluence with the South Pacific Ocean, any fishing by means of nets of every description except the dip or scoop net, push or scissors net, hand hauled prawn net, and the landing net is prohibited for a period up to five years. There are no oyster or aquaculture activities in Tabourie Lake (NSW Fisheries 2005).

The bridge site is located in a rural area, and the nearest residential property to Lemon Tree Creek Bridge is 570m northeast.

Potential Impacts

The Proposal would retain access for all land uses surrounding the Proposal site. Traffic on the existing Princes Highway and side roads would be maintained throughout construction. The Proposal would provide space for cyclists on northbound and southbound lanes of the Princes Highway. The proposed works are not expected to cause increased traffic.

Short-term disruption to traffic flows can be expected to occur during construction of the Proposal. For short durations, north and/or southbound traffic would be limited to one-lane only and reduced speed limits (60 and 40km/h) would apply. Princes Highway traffic would be expected to be impacted slightly to moderately by the short-term changes in traffic operations during the construction works.

The community is expected to benefit from the proposed works, due to improved road safety and traffic flow, and fewer delays as a result of accidents.

The proposed works would involve the acquisition of land at Lemon Tree Creek Bridge. The land that would be acquired is a 24m corridor, comprising approximately 7200m^2 at the Proposal site. This would involve land acquisition from NSW State forest, which is the land immediately to the west. All acquisition would be undertaken within the guidelines of the *Land Acquisition (Just Terms Compensation) Act 1991*.

This would result in a minor reduction of available forestry land. Taking into account the small area of land acquisition required, adverse economic impacts on forestry is not expected.

Water may be sourced from local water sources such as creeks, or dams located within 10km of the Proposal site. If water is sourced from the creeks or dams, this would reduce the amount of water available for other land uses from these water sources (particularly for local creeks or dams).

Site Specific Safeguards

- All property acquisitions would be negotiated in accordance with the RTA's Land Acquisition Policy, and compensation in accordance with the *Land Acquisition (Just Terms Compensation) Act, 1991*. Property acquisitions and/or leasing arrangements would be resolved between the RTA and property owners prior to the commencement of works.
- A pre-construction audit of the local network condition would be conducted. It would then be possible to determine if additional truck movements have caused deterioration of the

road surface. Repair of road surface deterioration caused by the Proposal would then be undertaken.

- A Traffic Management Plan would be prepared in accordance with the RTA's *Traffic Control at Work Sites Manual 2003*, and approved by the RTA prior to implementation. Traffic management controls would be implemented during the construction period and traffic would use the existing roadway during construction. All temporary traffic control measures would be undertaken in accordance with the RTA's *Traffic Control at Work Sites manual* and RTA's QA Specification G10 *Control Of Traffic*.
- Consultation would be undertaken with potentially affected residences prior to the commencement of works and would be undertaken in accordance with the RTA's *Community Involvement Practice Notes and Resource Manual, 1988*. In addition, consultation would include but not limited to door knocks, newsletters or letter box drops providing information on the proposed works, working hours adhered to and a contact name and number should any complaints wish to be registered.

8.11 Waste Minimisation and Management

Potential Impacts

Potential wastes generated from the Proposal would include:

- Bridge timbers which may contain lead/other contaminants;
- Asphalt from the obsolete and new roadway;
- Excess road base, steel and cement;
- Cleared vegetation;
- Waste oils and liquids from maintenance of construction plant and equipment;
- Water from vehicle washdowns; and
- Garbage and sewage from site compounds.

Site Specific Safeguards

- A Waste Management Plan would be prepared in accordance with RTA's QA Specifications and in accordance with RTA's *Waste Minimisation & Management Guidelines, 1998* and the principles of the WARR Act.
- Disposal of waste materials would be in accordance with the legislative requirements of the *Protection of the Environment Operations Act 1997*.
- Trees to be removed (ie. not reused/retained within the Proposal site) would be assessed for their value as millable timber.
- All noxious weeds and exotic plant species removed would be bagged and disposed of at a licensed landfill facility.
- The demolition of existing structures would be undertaken in accordance with RTA's QA *Specification B341 Demolition of Existing Structure*.
- Testing, storage and disposal of bridge timbers which may contain contaminants (eg. lead) would be undertaken to ensure there is no contamination of land or water.
- Disposal/recycling of bridge timbers would be undertaken in accordance with RTA's *Environmental Direction Disposal/recycling of replaced bridge timbers (No. 10)*. Timber that is in good condition would be recycled and reused, and would be used to maintain any existing timber bridge within the region. If the timber is not in good condition it would be taken to a licensed waste management facility.
- All construction materials, surplus soils and wastes generated from the Proposal would be stockpiled and stored at the compound site prior to reuse, recycling or disposal.
- Wastes would not be stored for long periods during construction of the Proposal. Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction.

- Materials or equipment that fall into or adjacent to Lemon Tree Creek would be recovered immediately.
- Waste material generated (ie. bitumen, concrete, cleared vegetation, hydrocarbons, water, garbage and sewage) would be reused or recycled where possible.

In addition, the Resource Management Hierarchy principles of the WARR Act would be adopted as follows:

1. Avoid unnecessary resource consumption as a priority;
2. Avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery; and
3. Disposal is undertaken as a last resort.

8.12 Associated Infrastructure and Activities

Existing Situation
Underground telecommunications cables (Telstra) and overhead electricity cables (Country Power) are present in the Proposal site on the western side of the Highway at Lemon Tree Creek.

Impacts
Relocation of underground telecommunications cables (Telstra) and overhead electricity cables (Country Power) on the western side of the Highway at Lemon Tree Creek would be required.

Site specific Safeguards
- The "dial before you dig" hotline will be contacted prior to commencement of works.
- Prior to the commencement of works, the need for relocation of utilities will be determined following consultation with the affected utility owners.

8.13 Operation Hazards and Risks

Potential Impacts
The Proposal would introduce off-line stormwater basins located nearby the new bridge on the northern and southern side of Lemon Tree Creek (two basins, 58m^3 capacity each). These basins would be designed to capture litter, coarse sediment and oil spills. Impacts on receiving waters surrounding the Proposal site can be expected to decline following the introduction of the permanent stormwater basins.

In the short-term (during establishment of revegetation works), the Proposal would reduce the potential for bushfire caused by inappropriate disposal of cigarette butts. In the long-term (following establishment of revegetation works), the Proposal would not increase the potential for bushfire caused by inappropriate disposal of cigarette butts.

8.14 Demand on Resources

The demand on resources (ie. pavement material, fill, cement, hydrocarbons and water) is expected to be minimal. Except for water, no materials currently in short supply would be required for the Proposal. Water is currently in short supply in the Lemon Tree Creek area. A total of 3000kL of water sourced from local water sources would be used for earthworks

compaction and dust suppression. Fill material (5500m^3) would be sourced from within the Proposal site (ie. cut/fill works). Spoil material (1500m^3) would be disposed off at an approved landfill area. Pavement material (2400m^3) would be sourced from local quarries, concrete would be batched off-site at an existing local batch plant, and delivered in agitator trucks. Spray sealing (6600m^2) would be sourced from an existing local supplier at Mogo (approximately 50km south of the Proposal site).

Recycling and re-use of material would be undertaken where possible to reduce the demand on resources.
If materials cannot be recycled and/or reused they would be disposed of at a licensed waste management facility.

Site specific Safeguards

- In the event that the DWE does not grant a permit to draw surface water from streams, water would be extracted from construction sediment basins in order to conserve water.
- Safeguards detailed in Section 9.1 of this REF would be implemented to mitigate the identified impacts of the Proposal.

8.15 Cumulative Environmental Effects

Potential Impacts
The proposed works are part of ongoing safety improvements for the Princes Highway. No other RTA works are proposed nearby Lemon Tree Creek. Cumulative impacts from other projects and this Proposal are therefore not expected to occur in the vicinity of the Proposal site.

8.16 Principles of Ecological Sustainable Development

The National Strategy for Ecologically Sustainable Development (NSESD) has been formulated to ensure ESD is accounted for in all Proposals. There are three core objectives:

- To enhance individuals' and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- To provide for equity within and between generations; and
- To protect biological diversity and maintain essential ecological processes and life-support systems.

These objectives are complemented with a number of guiding principles that are considered below in Table 8.6 in terms of the Proposal.

Table 8.1: Principles of ESD Applied to the Proposal

Principle	Application to the Proposal
Precautionary Principle	Design aspects of the Proposal have considered potential hazards and risks resulting from both construction and operation of the Proposal. Specialist studies have also been undertaken to gain a detailed understanding of the existing environment. No issues have been identified that would cause any serious or irreversible environmental damage as a result of the Proposal at this location. The introduction of site specific safeguards as outlined in Section 9 of this REF would ameliorate potential environmental impacts.

Intergenerational Equity	The Proposal would improve the level of supporting infrastructure required for the Princes Highway, and make provision for a more efficient and safer transport corridor for use by future generations. Concurrently, the Proposal considers and minimises impacts to the local environment through the introduction of site specific safeguards. To ensure the integrity of natural and social values of the environment are maintained for future generations.
Conservation of Biological Diversity & Ecological Integrity	Thorough assessment of the local environment has been undertaken to identify and manage any potential environmental hazards or risks associated with the Proposal. Site specific safeguards outlined in Section 9 of this REF would ensure that the Proposal does not compromise biological diversity or ecological integrity.
Improved Valuation & Pricing of Environmental Resources	It is often difficult to place a monetary value on environmental resources. An indirect indication of the value of such resources is the cost of the proposed site specific safeguards. The costs of the proposed site specific safeguards would be calculated once design of the road is finalised.

9 Environmental Management

9.1 Summary of Proposed Safeguards

Site specific safeguards outlined in this document would be incorporated into the detailed design phase of the Proposal and during construction and operation of the Proposal. These safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. All safeguards described in this REF and the Decision Report/Conditions of Approval would be incorporated into the Contractor's Environmental Management Plan (CEMP).

The CEMP would be developed in accordance with the specifications set out in the RTA's Environmental Protection (Management System) – QA Specification G36, G38, G40 and QA R178.

Table 9.1 Summary of Proposed Safeguards

Landform, Geology and Soils	• An erosion and sedimentation control plan would be developed and incorporated into the CEMP. The plan would incorporate specifications outlined in Landcom's *Managing Urban Stormwater: Soils and Construction ("Blue Book")*, identifying areas requiring management controls, include inspections and checklist sheets and be reviewed by the RTA's Senior Environmental Officer, Southern Region prior to the commencement of works. • All stockpiles site/s would be designed, established, operated and decommissioned in accordance with the RTA's *Stockpile Management Procedures 2001*. • Any material transported onto pavement surfaces would be swept and removed at the end of each working day. • Hardstand material or rumble grids would be implemented at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces. • Any imported fill required for the Proposal would be sourced from licensed/registered suppliers within the local area. • Where trees are positioned under the proposed new bridge and require removal, tree stumps would be retained insitu where possible, and treated with a herbicide to kill the tree. Herbicide product label directions would be followed to minimise environmental impacts. This measure would reduce the potential for creek bank erosion. • An aquatic approved herbicide (eg. Roundup bioactive) would be used within and immediately adjacent to waterways. • Site rehabilitation of disturbed areas would be undertaken progressively as stages are completed. Batters would be stabilised with local native grasses (and/or sterile exotic grasses) and/or local native shrubs, and geotextile fabrics would be applied when needed. • Where possible, disturbed areas would be restored to their pre-works shape at the completion of works. • Prior to excavation the soils would be tested for ASS and if found to contain ASS or PASS an Acid Sulphate Soil

	Management Plan would be developed and incorporated into the CEMP. The plan would include but not be limited to: ➢ Capping of exposed surfaces with clean fill to prevent oxidation; ➢ Place excavated ASS separately in a lined, bunded and covered area; ➢ Neutralise ASS by using soil additives such as aglime; and ➢ Dispose of ASS in accordance with Part 2 of the *Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze 2005.* • If unidentified sites of contaminated land are discovered within the Proposal site, works would cease at that location, contaminants would be immediately contained and the RTA's Senior Environmental Officer, Southern Region would be notified immediately. The Senior Environmental Officer would advise what action would need to be taken in regard to contamination assessment, containment, treatment, disposal and licences and approvals needed.
Climate	• The Commonwealth Bureau of Meteorology website/records would be checked at least on Monday and Thursday of each week, to allow sufficient time to vacate and clean up the site prior to the commencement of heavy rainfalls or anticipated rise in creek water levels. • Where practicable, the works would be undertaken so they correspond with a period of dry weather, thereby reducing the risk of sediments entering Lemon Tree Creek.
Water Quality and Hydrology	• The Proposal would be undertaken in accordance with RTA's *Water Policy* and *Code of Practice for Water Management (1999).* • Access tracks to the Lemon Tree Creek bridge construction site would be constructed within the proposed road formation footprint, and to the north (approximately 6m wide track) of the proposed road formation footprint. • Areas for access tracks and working platforms needed to construct piles/piers for the bridge would be restricted in size to minimise impacts on Lemon Tree Creek. • Water flow in Lemon Tree Creek would be maintained during construction and operation of the Proposal. • All access tracks and working platforms components would be suitably secured so they would not be dislodged into Lemon Tree Creek during dry and/or wet weather. • To prevent pollution of Lemon Tree Creek, no loose rock or fill would be permitted to be placed on the working platforms within or in close proximity to the creek. • Within Lemon Tree Creek, and north and south of Lemon Tree Creek, access by vehicles and workers beyond access tracks and working platforms would not be permitted. • Sediment fencing would be placed to surround all access tracks and working platforms.

	• Following completion of bridge construction works, all introduced materials (eg. sediment fencing) would be removed from the Proposal site. • Should any spillage occur during construction the RTA's Senior Environmental Officer, Southern Region, would be contacted immediately, and contaminants would be immediately contained, removed, treated (if necessary) and disposed of in accordance with DEC requirements. • An incident emergency spill plan would be developed and incorporated in the CEMP. This would include measures to avoid spillages of fuels, chemicals, and fluids onto the floodplain and/or into any waterways. All personnel would be made aware of these measures. An emergency spill kit would be kept onsite at all times. • All fuels, chemicals, and liquids would be stored at least 50m away from any waterways or drainage lines and would be stored within an impervious bunded area within the compound site. • Culvert extensions would be positioned to ensure that water discharges do not cause backwaters and/or erosion and sedimentation problems. • Any wastewater generated from construction processes would be contained onsite and/or treated using a DECC certified process prior to its disposal. The release of dirty water into waterways would be prohibited. • All concrete works would be undertaken in accordance with the DEC *Environmental Best Management Practice Guideline for Concreting Contractors (2002).* • The maintenance of machinery would be undertaken within impervious bunded areas within the compound site. • Vehicle washdowns and/or cement washouts would be undertaken within compound site(s) in a designated bunded area with an impervious surface, or undertaken off site in an appropriately controlled area. • To minimise the downstream disturbance of the proposed bridge works on riparian communities, erosion and sediment barriers would be erected on the downslope boundaries of all construction zones. • Creek bed and bank stabilisation works would be completed immediately after completion of bridge works. • To minimise construction impacts and operational road runoff on Lemon Tree Creek, stormwater basins (58m^3 capacity) would be installed nearby the new bridge on the northern and southern side of the creek. • No on-line or in-stream water quality structures (eg. stormwater basins) would be utilised, as they would affect the continuity and corridor function of streams and result in the loss of riparian vegetation and habitat.

	• All stormwater runoff would be directed off the new bridge, then enter the stormwater basins before being released into Lemon Tree Creek. • Stormwater basins would be regularly emptied and maintained as per design specifications. Material collected would be disposed of at a licensed waste facility. • During construction, visual monitoring of water quality (ie. turbidity, hydrocarbon spills/slicks) in Lemon Tree Creek would be undertaken on a regular basis and records kept and provided at anytime upon request.
Air Quality	• On-site construction truck movements would be controlled by being restricted to designated routes. • Any stockpile with the capacity to cause dust would be dampened or covered to suppress dust emissions. • Long-term stockpile would be sprayed with a sterile grass mix to suppress dust generation. • When dust is visually detected, the frequency of watering would be increased. Dust generating activities would be reprogrammed to avoid periods of high wind velocity. • If works are creating high levels of dust that are likely to cause discomfort to local residents or a safety hazard to traffic or work personnel, the works would be modified or stopped until the dust hazard is eliminated or has been reduced to an acceptable level. • Truck loads would be wet down or covered as necessary to suppress dust generation. • Tailgates would be secured during operation of trucks and utes. • There would be no burning of timber or wastes. • Machinery would be turned off, rather then left idling for long periods.
Biodiversity	*Flora* • Prior to the commencement of construction work, existing local provenance (ie. tubestock or viable seed supply) would be sourced. • Alternatively, prior to the commencement of construction work, seed collection within a 10km area surrounding the Proposal site would be undertaken, so that revegetation of areas disturbed during construction activities can be undertaken using locally sourced native plant stock (Note: Seed collection would be undertaken in advance of construction commencing to enable seed to be collected during appropriate seasons. This would ensure the provision of appropriate plant species and provenance, and to minimise adverse impacts upon the local native flora within the Proposal site). • Prior to any clearing of State Forest land, the NSW DPI (Forests) resources section would have to authorise the work by letter. RTA Surveyors would then document the road corridor adjustment after the reconstruction is completed.

	• Topsoil in vegetated areas containing native seed would be stockpiled on geotech fabric and used in revegetation works. • Topsoil potentially containing weed propagules would be removed from the Proposal site and disposed of at a licensed landfill facility. Weed infested or contaminated topsoil would not be reused for the proposed works or for revegetation works and would not be stockpiled adjacent to any areas of native vegetation. • Vegetation clearing limits would be clearly marked in the field prior to clearing and incorporated into site plans and flora and fauna management plan and/or the clearing and grubbing plan as per RTA *Specification G40 (Clearing and Grubbing)*. Areas protected are referred to as exclusion zones and would not to be impacted. • Toolbox sessions would be provided to inform staff of clearing limits and exclusion zones. • Cleared and disturbed areas would be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion. Subsequent to this, revegetation of roadside areas adjacent to the new alignment would use locally occurring native plant species typical of those vegetation communities affected by the Proposal. • Construction compounds, stockpile site and the storage of materials would be established within existing cleared areas. • All trimming of mature native trees would be undertaken by a qualified arborist. • A weed management strategy would be implemented for the Proposal site, and any planted vegetation. • The growth and spread of the class 4 noxious weed (Fireweed, *Senecio madagascariensis*) must be controlled according to the measures specified in a management plan published by the local control authority. • Obsolete sections of the existing Princes Highway would be ripped and revegetated using locally indigenous plant species. • Vegetation removed would be chipped/mulched on-site and used in revegetation works within the Proposal site. • Landscaping of all areas disturbed by the Proposal (including cut and fill batters) with local native plants would be undertaken where appropriate to enhance native vegetation cover. • A planting palette would be developed during the detailed design phase based on the ecology assessment (refer to Appendix E), advice obtained from Shoalhaven City Council, and from local native plant species lists. Species would be chosen for their demonstrated ability to grow robustly in an environment where water may be limited and occasional weed competition may also exist. • Any private land (ie. land located outside the road corridor) inadvertently impacted by the Proposal would be restored to satisfy landowner requirements (ie. to appropriate land contours, soil condition and vegetation cover). • Should additional vegetation removal be required, the proposed variation to the original scope would be referred to the RTA's

	Senior Environmental Officer, Southern Region to determine if any further environmental impact assessment is required. *Fauna* • Fauna passage under the Princes Highway along the creek would be maintained during construction and operation. • Riparian vegetation cover for terrestrial fauna movement would be retained where possible. • Rather than removing whole trees, lopping of tree branches would be undertaken where possible to retain fauna habitat. • Relocation, rescue and/or rehabilitation of fauna species found inhabiting the areas to be disturbed would be undertaken by person(s) licensed under the *National Parks and Wildlife Act 1974*. *Aquatic* • The new bridge would be designed and constructed in accordance with (the then) DPI Fisheries guidelines (*Policy and Guidelines for bridges, Causeways, Culverts and Similar Structures; Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings (2004) and Fishnote - Policy and Guidelines for Fish Friendly Waterway Crossings*). • To prevent alteration of creek flow, the new bridge piles/piers would not be constructed within the creek channel. • Fish passage in the creeks would be maintained during construction in accordance with (the then) DPI Fisheries *Policy and Guidelines for bridges, Causeways, Culverts and Similar Structures* (NSW Fisheries 1999). • The road and bridge works would be constructed and operated in a manner that would prevent deterioration of water quality in waterways [as per NSW Fisheries *Policy and Guidelines for Bridges, Causeways, Culverts and Similar Structures* (NSW Fisheries 1999)]. • The Minister for Fisheries would be notified of any proposal to remove or relocate any woody debris in the waterways. • A permit from NSW Fisheries would be obtained, should it be necessary to temporarily or permanently block any fish passages
Non-Aboriginal Heritage	• In the event that any non-Aboriginal relics are located during the works, all work would cease in the vicinity of the find, and the RTA's Senior Environmental Officer, Southern Region would be contacted.
Aboriginal Heritage	• **All personnel working on site would receive training (eg. toolbox talks) in their responsibilities under the *National Parks and Wildlife Act 1974*.** • **No works would be permitted near the AHIMS Aboriginal site.** • **Should Aboriginal heritage items be uncovered during works, all works in the vicinity of the find would cease and the RTA's Aboriginal Cultural and Heritage Advisor, Senior Environmental Officer Southern Region, DEC representative and relevant LALC representative would be contacted. Works in the vicinity of the find would not re-commence until appropriate clearance has been received.**

Visual Amenity and Landscape	• Following completion of construction activities, the Proposal site would be subject to comprehensive revegetation with local native species which would be undertaken to reduce the visual impact of the new bridge and roadworks. Revegetation works would be concentrated at the following locations: ➢ All vegetated areas disturbed by the construction works; ➢ New road embankments/batters; and ➢ Along obsolete sections of the Princes Highway. • A revegetation plan would be prepared for the Proposal, and would be reviewed by the RTA's Senior Environmental Officer, Southern Region prior to commencement of revegetation works. • All working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day. • Stockpile and/or compound site would be screened (eg. with shade cloth) to reduce visual impacts as far as practicable.
Socio-economic Considerations	• All property acquisitions would be negotiated in accordance with the RTA's Land Acquisition Policy, and compensation in accordance with the *Land Acquisition (Just Terms Compensation) Act, 1991*. Property acquisitions and/or leasing arrangements would be resolved between the RTA and property owners prior to the commencement of works. • A pre-construction audit of the local network condition would be conducted. It would then be possible to determine if additional truck movements have caused deterioration of the road surface. Repair of road surface deterioration caused by the Proposal would then be undertaken. • A Traffic Management Plan would be prepared in accordance with the RTA's *Traffic Control at Work Sites Manual 2003*, and approved by the RTA prior to implementation. Traffic management controls would be implemented during the construction period and traffic would use the existing roadway during construction. All temporary traffic control measures would be undertaken in accordance with the RTA's *Traffic Control at Work Sites manual* and RTA's QA Specification G10 *Control Of Traffic*. • Consultation would be undertaken with potentially affected residences prior to the commencement of works and would be undertaken in accordance with the RTA's *Community Involvement Practice Notes and Resource Manual, 1988*. In addition, consultation would include but not limited to door knocks, newsletters or letter box drops providing information on the proposed works, working hours adhered to and a contact name and number should any complaints wish to be registered.
Waste Minimisation and Management	• A Waste Management Plan would be prepared in accordance with RTA's QA Specifications and in accordance with RTA's *Waste Minimisation & Management Guidelines, 1998* and the principles of the WARR Act. • Disposal of waste materials would be in accordance with the legislative requirements of the *Protection of the Environment Operations Act 1997*.

	• Trees to be removed (ie. not reused/retained within the Proposal site) would be assessed for their value as millable timber. • All noxious weeds and exotic plant species removed would be bagged and disposed of at a licensed landfill facility. • The demolition of existing structures would be undertaken in accordance with RTA's QA *Specification B341 Demolition of Existing Structure*. • Testing, storage and disposal of bridge timbers which may contain contaminants (eg. lead) would be undertaken to ensure there is no contamination of land or water. • Disposal/recycling of bridge timbers would be undertaken in accordance with RTA's *Environmental Direction Disposal/recycling of replaced bridge timbers (No. 10)*. Timber that is in good condition would be recycled and reused, and would be used to maintain any existing timber bridge within the region. If the timber is not in good condition it would be taken to a licensed waste management facility. • All construction materials, surplus soils and wastes generated from the Proposal would be stockpiled and stored at the compound site prior to reuse, recycling or disposal. • Wastes would not be stored for long periods during construction of the Proposal. Empty drums of fuels, oils or chemicals and fluids would not be stored on site during construction. • Materials or equipment that fall into or adjacent to Lemon Tree Creek would be recovered immediately. • Waste material generated (ie. bitumen, concrete, cleared vegetation, hydrocarbons, water, garbage and sewage) would be In addition, the Resource Management Hierarchy principles of the WARR Act would be adopted as follows: 1. Avoid unnecessary resource consumption as a priority; 2. Avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery; and 3. Disposal is undertaken as a last resort, reused or recycled where possible.
Associated Infrastructure and Activities	• The "dial before you dig" hotline will be contacted prior to commencement of works. • Prior to the commencement of works, the need for relocation of utilities will be determined following consultation with the affected utility owners.
Demand on Resources	• In the event that the DWE does not grant a permit to draw surface water from streams, water would be extracted from construction sediment basins in order to conserve water. • Safeguards detailed in Section 9.1 of this REF would be implemented to mitigate the identified impacts of the Proposal.

9.2 Licences and Approvals

NSW *Fisheries Management Act, 1994*

Permits under the *Fisheries Management Act 1994* would be required for reclamation works (eg. associated with siting of bridge piles/piers for the new bridge over Lemon Tree Creek) and for dredging works (eg. associated with culvert works).

The Minister for Fisheries would be notified of any proposal to remove or relocate any woody debris in the waterways.

A permit would be required from NSW Fisheries to temporarily or permanently block fish passage under Section 219 of the FM Act. Such blockages may include silt fencing across waterways for sediment and erosion control and bunding and dewatering works during the construction of crossings.

NSW *Heritage Act, 1977*

In accordance with Section 139(4) of the *Heritage Act 1977* approval and/or exemption notification for removal of the bridge would not be required. This is the case, as an exception under Section 139(4) of the *Heritage Act 1977* is created for excavation or disturbance for the purpose of the demolition of a bridge not listed on the State heritage register, where demolition would impact solely upon the bridge, its pilings, footings and abutments and upon no other relics.

NSW *Protection of the Environment Operations Act, 1997*

Pollution incident

The Contractor and the RTA are obliged to notify DEC when a "pollution incident" occurs that causes or threatens "material harm" to the environment.

Concrete works

No on-site concrete batch plant would be used for the Proposal. Concrete would be batched off-site at an existing local batch plant and delivered in agitator trucks.

The Proposal would not produce any pre-mixed concrete or concrete products within the Proposal site, that have a production capacity of more than 30,000 tonnes per year of concrete or concrete products. Under Schedule 1 '*Schedule of EPA-licensed activities*' of the POEO Act, a licence from DEC would not be required.

Fill extraction

Under Schedule 1 '*Schedule of EPA-licensed activities*' of the POEO Act, extractive industries are defined as activities:

- that obtain extractive materials by methods including excavating, dredging, blasting, tunnelling or quarrying or that store, stockpile or process extractive materials, and
- that obtain, process or store for sale or re-use an intended quantity of more than 30,000 cubic metres per year of extractive material.

The RTA would not be required to obtain an Environmental Protection Licence (EPL) under the POEO Act, as the Proposal would involve the on-site excavation of materials that would be reused on-site, or stored/stockpiled pending on-site reuse (ie. balanced cut and fill).

NSW *Water Act, 1912*

As per Section 4 of the *Water (Part 8 General) Regulation 1995*, the RTA is exempted from the need to obtain a Part 8 water licence from Department of Water and Energy (DWE) to construct a bridge over Lemon Tree Creek.

Water may be sourced from local water sources such as creeks, or dams located within 10km of the Proposal site. A total of 3000kL of water sourced from local water sources would be used for earthworks compaction and dust suppression.

A water sharing plan under the *Water Management Act 2000* does not apply to the Proposal site. Should water for the Proposal need to be drawn from any waterways and used, a licence under Section 10, or a permit under Section 18F of the *Water Act, 1912* may be required from DWE. In addition, the RTA's Senior Environmental Officer, Southern Region, would be advised of the location and methodology in which water would be drawn.

It should be noted that at any time after the completion of writing this REF the above sections of the *Water Act 1912* will be superseded by the *Water Management Act 2000* in the event that a water sharing plan applies to the affected water source. In those circumstances, regard would be given to any new or additional requirements resulting from the applicability of the *Water Management Act 2000* (and any other legislation) to any water source that may be affected by the Proposal.

10 Summary of Environmental Effects

10.1 Beneficial Effects

The beneficial effects from the construction of the Proposal would include:

- Improvements in road safety on the Princes Highway, south of Ulladulla, which would reduce delays and road accident trauma;
- Improved efficiency of the Princes Highway through fewer closures due to traffic incidents as mentioned in Section 5.1; and
- A safer road environment with improved horizontal alignment, increased formation width (12.0m wide bridge), increased clearzones and improved access treatments.

10.2 Adverse Effects

The Proposal would result in some adverse effects, which would include:

- Temporary increases in dust emissions during construction;
- Short-term disruption to traffic flows during construction;
- Increased truck movements during construction;
- Loss of vegetation and fauna habitat;
- Potential for sedimentation of local waterways as a result of construction activities;
- Minor loss of rural and forestry land due to land acquisition; and
- Short-term socio-economic impacts (visual and dust).

The majority of adverse effects would be of temporary nature only, and the impacts would be managed during the construction period in accordance with a CEMP.

11 Consideration of Environmental Factors

11.1 Clause 228(2) Factors (NSW Legislation)

The factors which need to be taken into account when considering the environmental impact of an activity are listed in Clause 228(2) of the *Environmental Planning and Assessment Regulation, 2000*. Those factors have been addressed in Table 11.1 below to ensure that the likely impacts of the proposed activities on the natural and built environment are fully considered.

Table 11.1: Compliance with Clause 228(2) of the EP&A Regulation 2000.

Clause 228(2) Factors	Impact
a) Any environmental impact on a community?	
The Proposal is expected to have a positive impact on the community in the long-term through the provision of improved road safety and traffic flow. Acquisition of forestry land (0.72ha) would not be expected to cause adverse economic impacts.	Long-term positive
Short-term disruption to traffic flows can be expected to occur during construction of the Proposal. Impacts on a community from construction works (exhaust fumes and/or dust) are unlikely, as the closest residence is located 570m from the Proposal site (refer to Sections 8.5 and 8.9 of this REF).	Short-term negative
b) Any transformation of a locality?	
The Proposal would have short-term negative impacts on the locality as a result of construction of the new roadways and bridge, including removal of native vegetation (0.5ha), and construction of cut and fill embankments. Site specific safeguards detailed in Section 9, including revegetation, have been proposed to reduce the identified impacts of the Proposal on the locality (refer to Section 8.10 of this REF).	Short-term negative
c) Any environmental impact on the ecosystem of the locality?	
The proposed works would involve the loss of 0.5ha of bushland at Lemon Tree Creek Bridge. The Proposal would require removal of trees, shrubs, goundcovers and climbers within the 'Spotted Gum – Blue Gum – Blackbutt Open Forest' vegetation community.	Long-term negative
The proposed works have the potential to cause the growth and spread of the Class 4 noxious Fireweed along the highway within and beyond the Proposal site.	Long-term negative
Due to their ability to adapt to, and be tolerant of urban developments/infrastructure, the animal species recorded are all expected to be present within the Proposal site and surrounding region post-construction.	Short-term negative
The bridge design would permit fauna movement under the Lemon Tree Creek bridge. The Proposal would widen the existing barrier to fauna movements (ie. the Princes Highway) at the Lemon Tree Creek (up to an additional 20m) Proposal site, but would not introduce any new barriers to fauna movements within or across the Proposal site.	Nil

Clause 228(2) Factors	Impact
Removal of fish habitat (in stream and riparian vegetation) by the works has the potential to cause deterioration in water quality which may provide conditions suitable for the proliferation of Mosquito fish. Fish habitat and fish passage, and habitat for invertebrates can be expected to be maintained within waterways in the Proposal site. Site specific safeguards detailed in Section 9, including revegetation, have been proposed to reduce the identified impacts of the Proposal on the locality (refer to Section 8.6 of this REF).	Short-term negative
d) **Any reduction of the aesthetics, recreational, scientific or other environmental quality or value of a locality?** The Proposal would have short-term negative impacts on the aesthetics of the Proposal site as a result of vegetation clearing. The proposed revegetation works would reduce visual impacts in the long-term. In the long-term there would be no reduction of the aesthetic, scientific quality, environmental quality or value of a locality (refer to Section 8.10 of this REF).	Short-term negative Long-term neutral
e) **Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present generations?** No impacts on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations are expected providing the site specific safeguards specified in Section 9 are implemented (refer to Sections 8.7 of this REF).	Nil
f) **Any impact on habitat of any protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)?** Due to their ability to adapt to, and be tolerant of urban developments/infrastructure, the animal species recorded are all expected to be present within the Proposal site and surrounding region post-construction. The bridge design would permit fauna movement under the Lemon Tree Creek bridge. The Proposal would widen the existing barrier to fauna movements (ie. the Princes Highway) at the Lemon Tree Creek (up to an additional 20m) Proposal site, but would not introduce any new barriers to fauna movements within or across the Proposal site. Removal of fish habitat (in stream and riparian vegetation) by the works has the potential to cause deterioration in water quality which may provide conditions suitable for the proliferation of Mosquito fish. Fish habitat and fish passage, and habitat for invertebrates can be expected to be maintained within waterways in the Proposal site. Site specific safeguards detailed in Section 9, including revegetation, have been proposed to reduce the identified impacts of the Proposal on the locality (refer to Section 8.6 of this REF).	Short-term negative Nil Short-term negative

g) **Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?** There would be no endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air as a result of the Proposal (refer to Section 8.6 of this REF).	Nil
h) **Any long-term effects on the environment?** With the implementation of the site specific safeguards outlined in Section 9 (particularly revegetation works and water quality protection), no long-term effects on the environment are expected (refer to Section 8 of this REF).	Nil
i) **Any degradation of the quality of the environment?** During construction there is the potential for impacts on flora and fauna, waterways and air. However, the implementation of site specific safeguards would ensure that these impacts are minimised as far as practicable. These impacts would be minimised through the implementation of site specific safeguards outlined in Section 9 (refer to Sections 8.4, 8.5, 8.6 and 8.9 of this REF).	Short-term negative
j) **Any risk to the safety of the environment?** The Proposal is expected to have a positive impact on the safety of the environment through provision of improved road safety. The Proposal would improve safety and travel efficiency for Princes Highway traffic (refer to Section 8.11 of this REF).	Long-term positive
k) **Any reduction in the range of beneficial uses of the environment?** The Proposal would not result in any reduction in the range of beneficial uses of the environment (refer to Section 8.15 of this REF).	Nil
l) **Any pollution of the environment?** There would potentially be some pollution of the environment during the construction phase due to impacts from the following: dust, erosion, release of water and wastes associated with construction works, vehicle washdowns, cement washouts, and from accidental spills of fuels, hydraulic fluid, pavement materials and chemicals. Immediately following construction works there is potential for impacts on the water quality of Lemon Tree Creek during rainfall events which could cause sediment runoff. Pollution generated from operation of the Proposal can be expected to be less than pollution from the existing road runoff. The introduction of off-line stormwater basins located nearby the new bridge can be expected to result in a reduction in road runoff pollutants entering Lemon Tree Creek. These impacts would be minimised as far as practicable through the implementation of site specific safeguards outlined in Section 9 (refer to Sections 8.2 and 8.4 of this REF).	Short-term negative Short-term negative Long-term positive

m) **Any environmental problems associated with the disposal of waste?** The Proposal would generate the following waste: asphalt from the obsolete and new roadway; excess road base, steel and cement; cleared vegetation; excess cut material; waste oils and liquids from maintenance of construction plant and equipment; water from vehicle washdowns; and garbage and sewage from site compounds. All waste would be reused, recycled or disposed of at a licensed waste facility (refer to Section 8.12 of this REF).	Short-term negative
n) **Any increased demands on resources, natural or otherwise which are, or are likely to become, in short supply?** Water is currently in short supply in the Lemon Tree Creek area. A total of 3000kL of water sourced from local water sources would be used for earthworks compaction and dust suppression. There would be no increased demands on any other resources which are, or are likely to become, in short supply. Recycling would be undertaken wherever possible (refer to Section 8.15 of this REF).	Short-term negative
o) **Any cumulative environmental effect with other existing or likely future activities?** No other RTA works are proposed nearby Lemon Tree Creek. Cumulative impacts from other projects and this Proposal are therefore not expected to occur in the vicinity of the Proposal site.	Nil

11.2 EPBC Act 1999 Factors (Commonwealth Legislation)

The EPBC Act requires that the following matters of National Environmental Significance (NES) be considered.

Table 11.2: Compliance with Commonwealth EPBC Act requirements.

EPBC Act Factors	Impact
a) Any environmental impact on World Heritage property? There are no world heritage properties within the vicinity of the Proposal.	Nil
b) Any environmental impact on National Heritage places? The Proposal would not impact on any listed places.	Nil
c) Any environmental impact on wetlands of international importance? The Proposal would not impact on any wetlands of international importance.	Nil
d) Any environmental impact on Commonwealth listed threatened species or ecological communities? 44 listed threatened species have the potential to occur in the vicinity of the Proposal site. No Commonwealth listed ecological communities are present within the Proposal site. The Proposal is not expected to significantly impact on any Commonwealth listed threatened species or ecological communities.	Nil
e) Any environmental impact on Commonwealth listed migratory species? It is not considered that the Proposal would significantly reduce the extent of foraging resources available to Rufous Fantail or Black-faced Monarch birds. No significant impact on Commonwealth listed migratory species is anticipated as a result of the Proposal.	Nil
f) Does any part of the Proposal involve nuclear action? The Proposal would not involve a nuclear action.	Nil
g) Any environmental impact on a Commonwealth Marine area? The Proposal would not impact on a Commonwealth marine area.	Nil
In addition: Any impact on Commonwealth Land? Commonwealth land would not be affected, indirectly or directly by this Proposal.	Nil

12 Certification

This Review of Environmental Factors provides a true and fair review of the Proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the Proposal.

P. Ryan

Peter Ryan
Environmental Officer
Date: 06-08-2007

I have examined this Review of Environmental Factors and the certification by Peter Ryan and accept the Review of Environmental Factors on behalf of the RTA.

John Burns
Project Manager
Date:

13 References

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RTA 2005b. *Lemon Tree and Termeil Creeks, Princes Highway, Southern NSW Aboriginal Archaeological Assessment of Proposed Road and Bridge Works.* Navin Officer, February 2005

RTA 2003 *Traffic Volume Data for the Southern Region 2003.*

RTA 2001a. *Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4*

RTA 2001b. *The Journey Ahead, The RTA Strategic Plan 2001-2006.*

RTA 2001c. *Stockpile Site Management Procedures.*

RTA 1998. *Community Involvement Practice Notes and Resource Manual, 1998.*

Shoalhaven City Council 2005/2006. *Shoalhaven State of the Environment Report 2004/05. Shoalhaven City Council, Nowra.*

Appendix A

Photographs of Proposal site

Plate 1: Alignment of the bridge, view to North

Plate 2: Alignment of the bridge, view to South

Plate 3: Bridge, view to the south.

Plate 4: Compound site to the right of highway, view to the south-west.

Plate 5: Timber piers in background, view to the south.

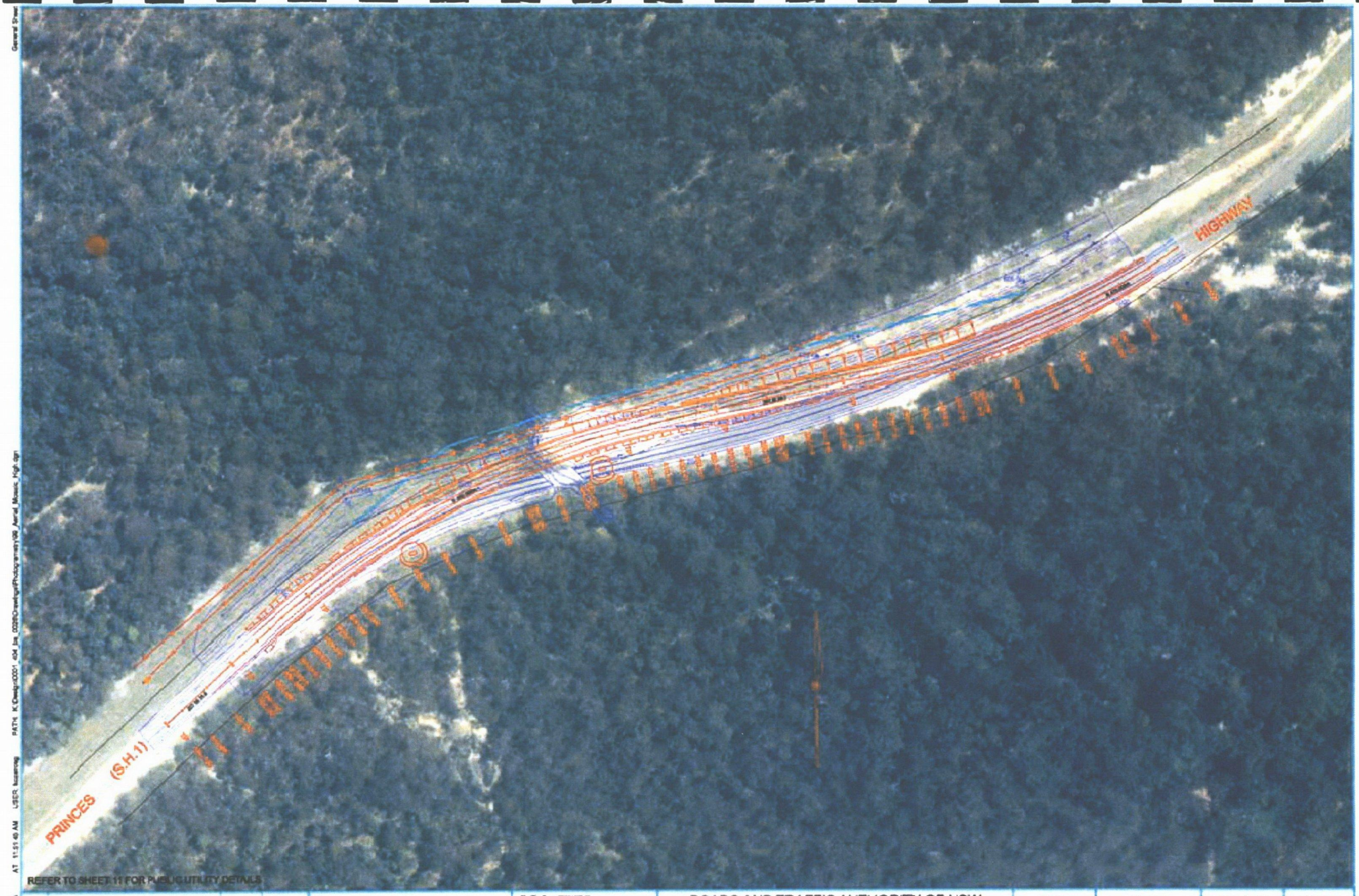
Plate 6: Upstream of creek, view to the west.

Plate 7: South of the creek, view to the north.

Plate 8: South of creek, view to the south.

Appendix B

Concept design



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SCALES

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SCALE 1:2000@A1

RTA PREPARED BY TECHNOLOGY AND TECHNICAL SERVICES SOUTHERN PROJECT DESIGN

DESIGNED G. KOZAROSKI

REVIEWED S. HARPER

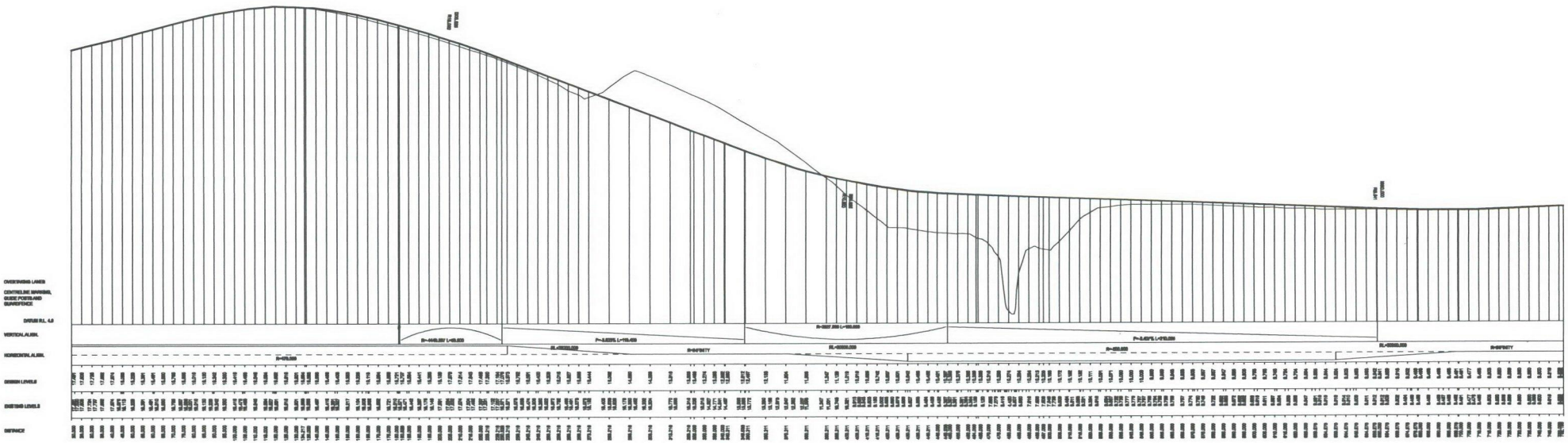
ROADS AND TRAFFIC AUTHORITY OF NSW

SHOALHAVEN CITY COUNCIL
SH1 - PRINCES HIGHWAY
APPROACHES TO PROPOSED BRIDGE OVER LEMON TREE CREEK
AERIAL MOSAIC

FILE No.	DRAWING:	PRINTED DATE	SHEET No.
XXX		20/12/2005	

REGISTRATION NUMBER

0001.404.BA.0026



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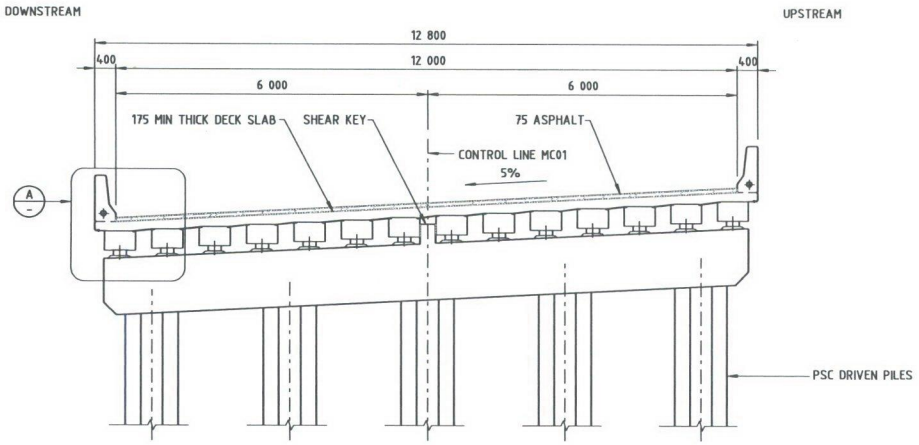

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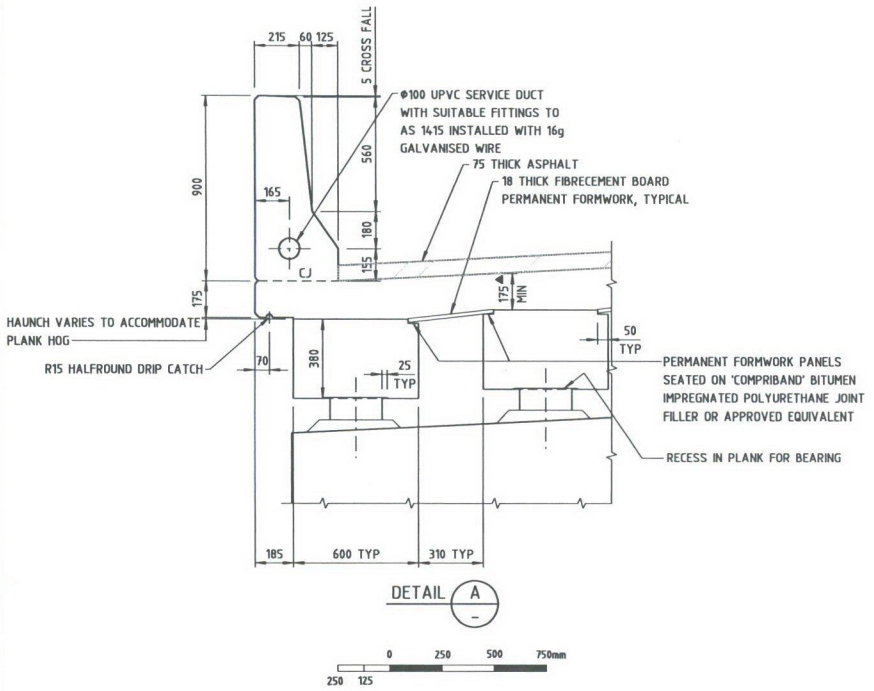
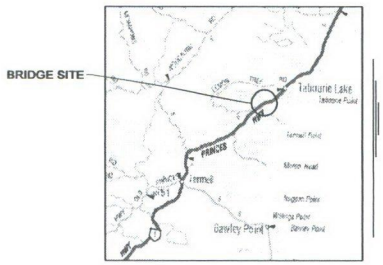


DETAIL A



LOCALITY PLAN

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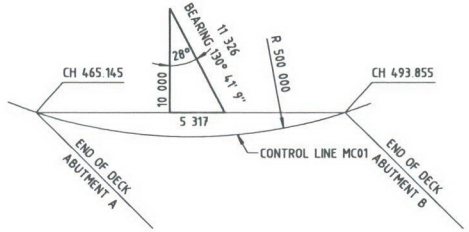

SKEW DIAGRAM

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GENERAL NOTES

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FOR OTHER GENERAL NOTES RELATING TO THIS SHEET, SEE SHEET No 1

▲DENOTES SLAB THICKNESS WILL VARY ALONG SPANS DUE TO HOG OF PLANKS.

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NOT TO BE USED
FOR CONSTRUCTION
16/03/2006

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

STATE HIGHWAY No 1 — CITY OF SHOALHAVEN

BRIDGE OVER LEMON TREE CREEK

AT 13 km SOUTH OF ULLADULLA

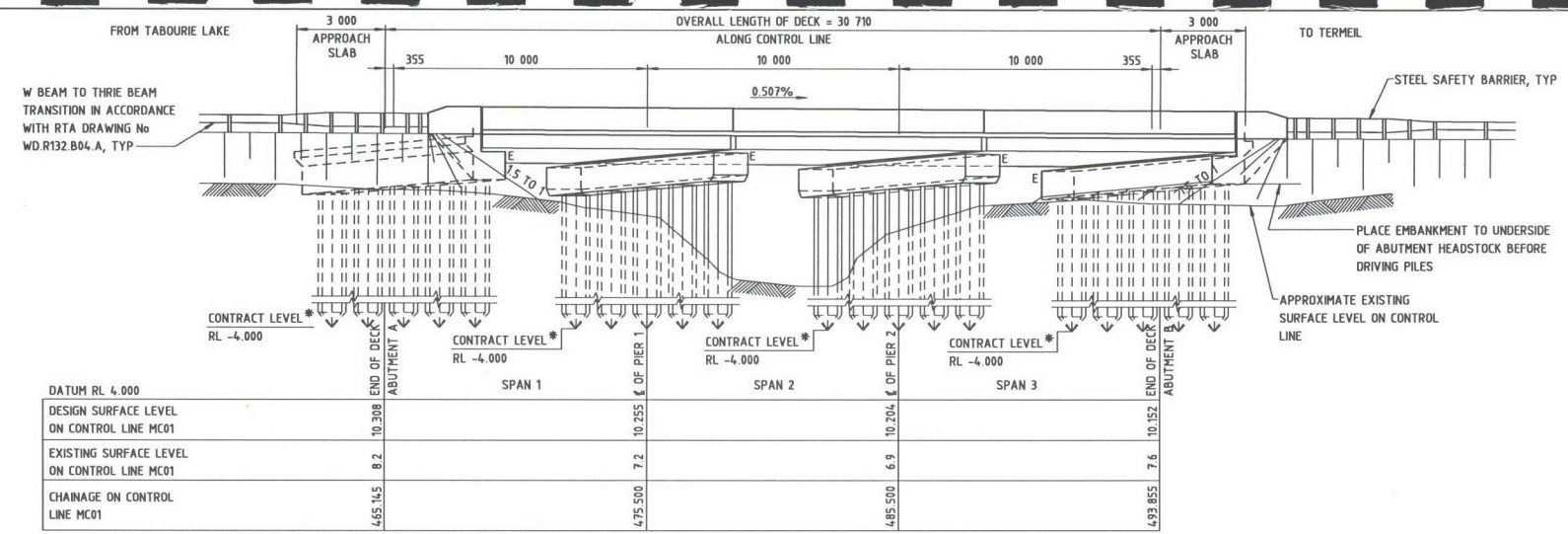
DESIGN PROPOSAL - SHEET B

PREPARED BY
BRIDGE ENGINEERING
110 GEORGE STREET
PARRAMATTA NSW 2150
PHONE: (02) 8837-0800
FACSIMILE (02) 8837-0095

CLIENT
SOUTHERN REGIONAL OFFICE
90 CROWN STREET WOLLONGONG
PO BOX 477 WOLLONGONG EAST NSW 2520
PHONE (02) 4221-2400
FACSIMILE (02) 4227-3705

PREPARED	CHECKED	SKETCH No
DESIGN		KD765DP
DRAWING CSL		
MANAGER, BRIDGE DESIGN (EXTERNAL)		SHEET No 2 / No OF SHEETS 2

CAD No KD765DPB.dgn



ELEVATION

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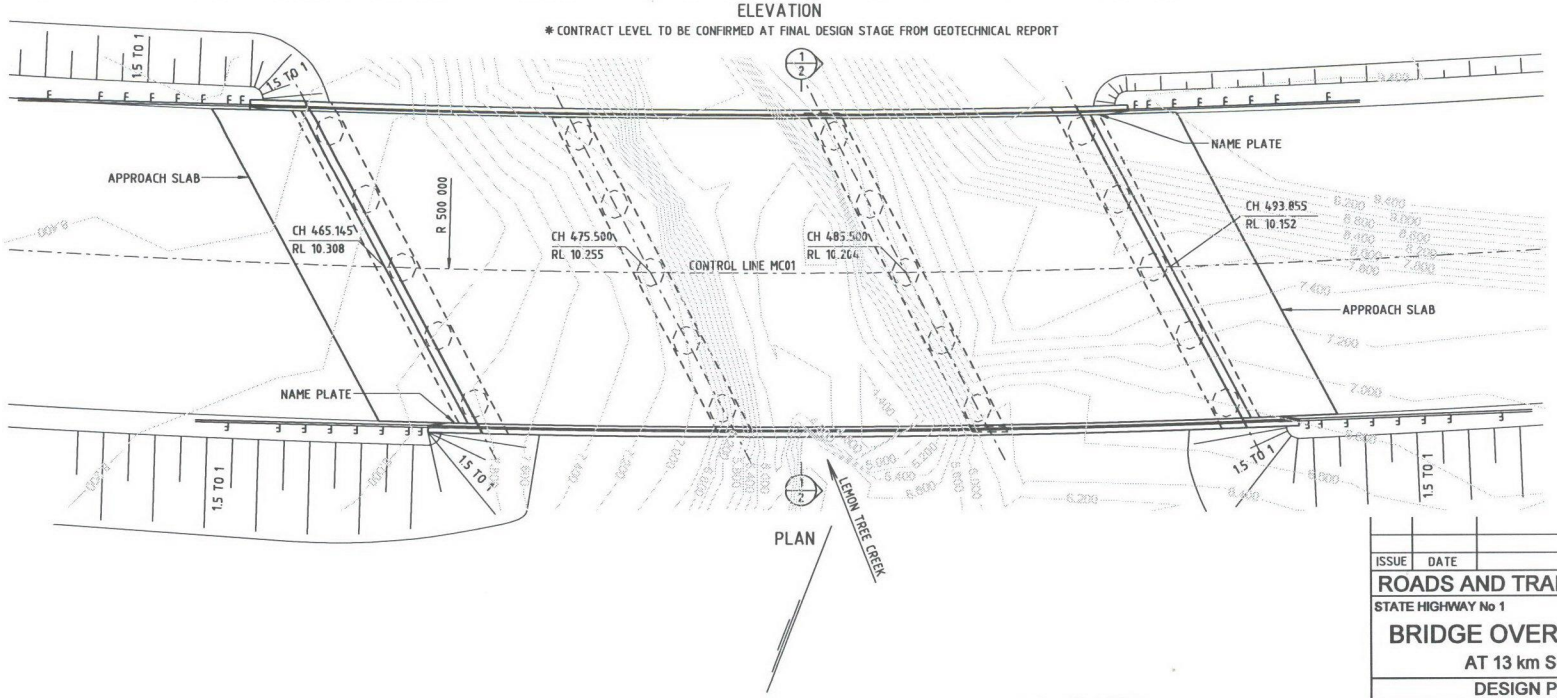

PLAN

GENERAL NOTES

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DIMENSIONS ARE IN MILLIMETRES.
CHAINAGES AND REDUCED LEVELS ARE IN METRES.
REDUCED LEVELS ARE RELATED TO AHD.
E DENOTES EXPANSION BEARING.

EXISTING BRIDGE - 1939
REGISTRATION No OF PLANS: 0001 404 BC 0169

ADVANCE COPY
NOT TO BE USED
FOR CONSTRUCTION
16/03/2006

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

STATE HIGHWAY No 1 — CITY OF SHOALHAVEN

BRIDGE OVER LEMON TREE CREEK

AT 13 km SOUTH OF ULLADULLA

DESIGN PROPOSAL - SHEET A

PREPARED BY
BRIDGE ENGINEERING
110 GEORGE STREET
PARRAMATTA NSW 2150
PHONE (02) 8837-0800
FACSIMILE (02) 8837-0095

CLIENT
SOUTHERN REGIONAL OFFICE
90 CROWN STREET WOLLONGONG
PO BOX 477 WOLLONGONG EAST NSW 2520
PHONE (02) 4221-3480
FACSIMILE (02) 4227-3706

PREPARED	CHECKED	SKETCH No
DESIGN		KD765DP
DRAWING CSL		
MANAGER, BRIDGE DESIGN (EXTERNAL)		SHEET No 1 / No OF SHEETS 2

CAD No KD765DPA.dgn

Appendix C

Consultation

Shoalhaven City Council

City Administrative Centre
Bridge Road, Nowra NSW Australia 2541
Phone: (02) 4429 3111 • Fax: (02) 4422 1816 • DX 5323 Nowra
Address all correspondence to
The General Manager, PO Box 42, Nowra NSW Australia 2541

COUNCIL REFERENCE:	2646 MS
COUNCIL FOLIO NO:	*
CONTACT PERSON:	Michael Smith
YOUR REF:	Lemon Tree and Termeil Creeks
REF	

11th January, 2006

Roads & Traffic Authority - Environmental Technology
RTA Operations Octagon Building
Level 5 Pod D
99 Phillip St
PARRAMATTA NSW 2150

Attention: Peter Ryan

Dear Peter

Comments - Replacement of Lemon Tree Creek and Termeil Creek Bridges Proposal

Thankyou for the opportunity to provide comment on the above proposal in relation to the Princes Highway approximately 15km south of Ulladulla.

As discussed during our telephone conversation on Wednesday 11 January 2006, council's vegetation mapping indicates that an endangered ecological community (Swamp Sclerophyll Forest) listed under the *NSW Threatened Species Conservation Act 1995* is likely to be found immediately to the east of Lemon Tree Creek Bridge, though the this has not been confirmed via "ground truthing" to the best of my knowledge.

If you need further information about this matter, please contact Michael Smith, Threatened Species Officer on (02) 4429 3209. Please quote Council's reference 2646.

Yours faithfully

Michael Smith
Threatened Species Officer

Map1

Environmental Layers

- **Sepp 14 Wetlands**
- **SCC THREATENED SPECIES POLYGONS**
  - Endangered Ecological Community
  - Fauna
  - Flora
  - All Others

Road Layers

Cadastre Layers

- **Cadastre**
- **Easements**

SCALE 1 : 10,081

200 0 200 400 600

METERS

N

Wednesday, 11 January 2006 5:06

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

12 December 2005

Peter Ryan
Environmental Officer
Roads and Traffic Authority
Level 5 Pod D, 99 Phillip St
PARRAMATTA NSW 2124

Ref: Lemon Tree and Termeil Creeks REF

Dear Peter

Re: Proposed replacement of Lemon Tree Creek and Termeil Creek Bridges on the Princes Highway south of Ulladulla

I refer to your letter of 12 December 2005 requesting Department of Primary Industries (DPI) initial comments on the above proposed works for the preparation of a Review of Environmental Factors (REF).

Issues Related to Fisheries

The responsibilities of the Department of Primary Industries include conserving fish stocks and fish habitat, marine vegetation, threatened fish species, and aquatic biodiversity. As such the Department is concerned about any potential impacts that the proposed works may have on aquatic species and habitats in the vicinity of the proposed works. We note that as a public authority, the RTA is required under section 199 of the *Fisheries Management Act 1994* to consult with the Department and take into account any issues raised prior to approving dredging and reclamation works.

In general, it is the Department's policy that roads and bridges must be designed and constructed to minimise habitat loss, changes in sediment transport and stream siltation, and to maintain natural tidal exchange or river flow. Of particular concern to the Department are the potential impacts that the proposed road works may have on the water quality and hydrology of waterways within the vicinity of the proposed works. To minimise these impacts an appropriate sediment and erosion control regime and water quality management provisions should be designed in accordance with current industry best management practices and implemented to safeguard the aquatic environment across the entire works area.

The design and construction of road waterway crossings, should be undertaken in accordance with the Department's *Policy and Guidelines for Fish Friendly Waterway Crossings* (2004) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (2004). Copies of these

Aquatic Habitat Protection, Fisheries Management Branch
NSW Department of Primary Industries
PO Box 17 Batemans Bay NSW 2536
1st Floor, Cnr Beach Road and Orient Street

ABN 51 734 124 190
www.dpi.nsw.gov.au
Tel: 02 4478 9103
Fax: 02 4472 7542

documents can be downloaded from the Department's website – www.fisheries.gov.au.

The following information should be provided to the Department when available in order that an assessment of the proposed works can be undertaken. The list should not be considered comprehensive but rather should act as a guide to the information that should be presented in the Review of Environmental Factors assessment document.

- Location of works (including topographic map and photos).
- Name of adjacent watercourse(s).
- Description of works to be undertaken.
- Method/s of construction.
- Timing and duration of works.
- Volume and type of sediment to be excavated from the site, if appropriate.
- Aquatic habitat conditions at the site/s – particularly riparian and aquatic vegetation, water depth, and permanence of water flow and snags in the vicinity of the proposed works.
- Potential impacts upon aquatic and riparian habitats (both temporary and permanent).
- Proposals to mitigate impacts upon riparian and aquatic vegetation and aquatic habitats.
- Potential impacts upon water quality of the proposed works.
- Proposals to mitigate impacts upon water quality.
- Potential impediments to fish passage as a result of the works (both temporary e.g. coffer dams, and permanent) and possible mitigation measures to be employed to negate these impacts.
- An assessment of the potential impact that proposed works may have on aquatic threatened species, populations and ecological communities.

Once the REF has been prepared for the project could you please forward a copy to this office for our review and further comment.

Issues Related to Agriculture, Mineral Resources and State Forests

None.

The Department of Primary Industries has been formed by the merger of NSW Fisheries, Mineral Resources NSW, State Forests NSW and NSW Agriculture. This is a coordinated Department of Primary Industries response and reflects the views of all these former agencies where relevant.

If you require any further information, please contact me on 02) 4478 9103.

Yours faithfully

Trevor Daly

Trevor Daly
A/Senior Conservation Manager, South

ATTN: ROWENA D'SOUZA
11 of 11 pages

Your reference : Lemon Tree and Termeil Creeks REF
Our reference : QU512/QUF7325
Contact Dimitri Young (02) 6298 9731

11 April 2007

RTA SOUTHERN RO
RECEIVED 13 APR 2007
CORRESPONDENCE No: 07/461
FILE No: 1/404.1312 -1

Mr John Burns
Technical Project Manager
Engineering Technology
Roads and Traffic Authority
Level 4, 90 Crown Street
WOLLONGONG NSW 2500

Cc: Mr Jay Stricker – Regional Manager

Dear Mr Burns,

Re: Review of flora and fauna assessment report for proposed replacement of bridges at Lemon Tree Creek and Termeil Creek, Princes Highway, City of Shoalhaven

Further to your request for comments from the Department of Environment and Conservation (DEC) in relation to a Review of Environmental factors (REF) for the proposal to replace bridges at Lemon Tree Creek and Termeil Creek on the Princes Highway south of Ulladulla, I wish to reiterate that the DEC does not have a formal statutory role in this matter.

Nevertheless, in the interests of improved environmental outcomes for threatened species, populations, ecological communities, or their habitats, the DEC has reviewed the flora and fauna assessment prepared by LesryK Environmental Consultants for the proposal. On the basis of this review and an inspection of the bridges, their approaches, and their immediate surrounds, undertaken by DEC officers on 3 April 2007, the following comments are provided.

General

The DEC concurs with the proposed northern alignment of the Lemon Tree Creek upgrade and the western alignment of the Termeil Creek upgrade. These routes traverse the areas of lowest conservation value at these locations and maintain the viability and integrity of areas of high conservation value in the south and east respectively.

PO Box 733, Queanbeyan, NSW 2620
6 Rutledge Street, Queanbeyan, NSW 2620
Tel: (02)6299 2929 Fax: (02) 6299 4281
ABN 30 841 387 271
www.environment.nsw.gov.au

J. BURNS

The report should correct errors on page 5 regarding the mouth of Lemon Tree Creek (Tabourie Lake, not Willinga Lake) and the responsibility for the management of the picnic area at Termeil Creek (DEC Parks and Wildlife Division, not Council/State Forests).

In order to sustain the integrity of the creek beds and minimise disturbances to the bed substrates, the DEC suggests that the existing bridge pylons located in each creek line should be left in place when the existing bridge structures are decommissioned. The DEC also concurs with the design of the proposal such that new pylons are placed outside of each creek line. In addition, the existing approaches should be rehabilitated and revegetated with species identified in adjacent native vegetation communities at each site to minimise habitat fragmentation arising from the proposal.

The habitat trees identified by LesryK in Figure 5 of the report (page 15) should be marked on-site prior to the commencement of work, as the markings do not appear to still be in place. Furthermore, other trees that may sustain habitat connectivity for gliding possums should also be marked on-site for retention, particularly on the northern approaches to the Termeil Creek bridge. Appropriate management of root zones and drip lines of trees to be retained adjacent to work areas, and native vegetation on the edge of work areas, should be enunciated in work method statements prepared for the proposal and delivered to workers via site induction programs.

Endangered Ecological Communities (EECs)

The DEC concurs with the general location and condition of the EECs at the Termeil Creek bridge site as presented in the LesryK report. However, the EECs appear to comprise a mosaic of *Swamp oak floodplain forest on coastal floodplains* and *Swamp sclerophyll forest on coastal floodplains*, due to the presence of Bangalay *Eucalyptus botryoides* and Woollybutt *Eucalyptus longifolia* in the canopy and Swamp Paperbark *Melaleuca ericifolia* and Snow in Summer *Melaleuca linariifolia* as dominants in the shrub layer. Furthermore, the EEC mapped by LesryK on the south-eastern bank of Termeil Creek is contiguous with EEC vegetation in the SEPP 14 Wetland immediately to the south-east.

DEC confirms the high conservation value of the EEC adjacent to the south-eastern side of the Termeil Creek bridge due to its maturity, integrity and high condition class, and the important role of the narrow band of Spotted Gum-Blackbutt forest between the EEC and the Princes Highway as an intact vegetated buffer for the long-term conservation of this EEC patch. This contrasts with the highly disturbed and fragmented nature of the native vegetation on the western side of the existing bridge where the ECC is confined to within a few metres of the creek banks as a result of clearing and pasture improvement for agricultural purposes. These observations strongly support the use of the western alignment for the new bridge at this location.

Green and Golden Bell Frog

The impacts of the proposal on the Green and Golden Bell Frog *Litoria aurea* do not appear to have been adequately assessed in the LesryK report. The species has been discounted from assessment on the basis that suitable habitat is absent, but the EEC associated with the SEPP 14 Wetland in the vicinity of Termeil Creek appears to provide important habitat resources for the species, which has been recorded in Meroo National Park. In addition, the species may potentially utilise the corridor of Termeil Creek for dispersal, as the corridor links wetland habitats in the east with a number of farm dams that could provide breeding habitat for the species west of the Princes Highway.

The LesryK report should provide an assessment of significance for the Green and Golden Bell Frog and the DEC recommends that the proposed works should be undertaken in winter when the species is likely to be inactive, so that potential impacts are minimised.

Hollow-dependent Bats

The impacts of the proposal on hollow-dependent fauna species such as microchiropteran bats do not appear to have been adequately assessed in the flora and fauna assessment report. The LesryK report states that a number of trees with hollows will be removed for the Termeil Creek upgrade (page 25), but the impacts of this action are not assessed. According to page 41 of the report, three threatened hollow-dependent microchiropteran bats (Large-footed Myotis, Greater Broad-nosed Bat, Eastern Freetail Bat), were recorded in the area by LesryK during surveys in 2004. However, this information is contradicted on page 50 of the report, which indicates that none of these species were recorded during the 2004 study despite targeted surveys. This apparent inconsistency requires clarification. If threatened hollow-dependent microchiropteran bats have been recorded in the vicinity of the areas to be affected, then the potential use by these threatened species of the trees with hollows to be removed may require further targeted field investigations. An assessment of significance for these threatened bat species should also be provided.

In any case, the bridge designs should be adjusted to accommodate alternative roosts in "bat boxes" incorporated into the bridge structures. Details for "bat-box" design and construction can be obtained from Mr. Jay Ng of Shoalhaven City Council (4429 3111).

Flora of Conservation Importance

Officers of the DEC recorded a population of the Christmas Orchid *Calanthe triplicata* in the road reserve on the north-western approaches to the Termeil Creek bridge. This species is at it southern limit of distribution in Meroo National Park with few known locations in the park. It is a flora species of regional conservation significance and appropriate impact amelioration for the species should be identified in the flora and fauna report and incorporated into the proposal. This

may involve translocation of the affected individuals into other parts of the road reserve to remain intact should the proposal be unable to avoid the population.

Summary

Whilst the preparation of a detailed flora and fauna assessment report for the proposal is commended, a number of matters require clarification and/or further analysis and assessment.

The DEC believes that when the flora and fauna matters raised in this correspondence regarding endangered ecological communities, the Green and Golden Bell Frog, hollow-dependent microchiropteran bats, the Christmas Orchid, and appropriate work practices have been addressed, the proposal should be able to proceed without having a significant impact on the flora and fauna values of the study area. This belief is based on the use of the northern alignment option at Lemon Tree Creek and the western alignment option at Termeil Creek, and the incorporation of the recommendations of the LesryK report (page 32) into the proposal.

Should you have any questions regarding the matters set out above, then please contact me on 6298 9731.

Yours sincerely,

Dimitri Young

DIMITRI YOUNG
Threatened Species Coordinator
South Branch

Department of
Environment and Conservation (NSW)

Your reference :Lemon Tree and Termeil Creeks REF
Our reference :QU512/ QUF7325

Mr Peter Ryan
Environmental Officer
Roads and Traffic Authority
Level 5, Pod D
99 Phillip Street
PARRAMATTA NSW 2124

RECEIVED
06 MAR 2006
BY

Dear Mr Ryan,

Re: Replacement of Lemon Tree Creek and Termeil Creek Bridges Proposal

I refer to your letter, dated 22 February 2006, seeking comments from the Department of Environment and Conservation (DEC) in relation to the preparation of a Review of Environmental Factors (REF) for the proposed replacement of the Lemon Tree Creek and Termeil Creek bridges on the Princess Highway, south of Ulladulla.

While the DEC appreciates the opportunity to comment on this matter, in this instance the proposal does not trigger any statutory provisions of environmental legislation administered by the DEC. As such, the DEC does not have a formal role in this matter. You may however wish to consider the relevant guidelines and references contained within Attachment A and Attachment B in the preparation and assessment of the REF.

Notwithstanding the above, it is important for you to note that should the REF indicate that the proposal is going to have a significant or adverse impact upon the environment, the DEC should be further consulted to ascertain any statutory obligations this may place on the proposal. In addition, the DEC would also emphasise that all construction activities associated with the proposal must be carried out with due diligence and best management practices.

Further, for your information and future reference, all matters (excluding those involving land constituting a gazetted National Park) that take place within the local government areas listed in Attachment C, should be forwarded to the DEC's regional office located in Queanbeyan via the below address:

PO Box 622
QUEANBEYAN NSW 2620

PO Box 622 Queanbeyan NSW 2620
Unit 4 Robert Lowe Building 39 Lowe Street Queanbeyan NSW 2620
Telephone (02) 6122 0100
Facsimile (02) 62995525
ABN 30 841 387 271
www.environment.nsw.gov.au

* Please note that, although the Environment Protection Authority (EPA) is now a part of the Department of Environment and Conservation, certain statutory functions and powers continue to be exercised in the name of the EPA.

If you would like to discuss this matter further, please do not hesitate to contact Stefan Press on 6122 3100.

Yours sincerely,

JUSTEN SIMPSON 2/3/06
Head of Operations Unit
South East Region

Attachment A – Department of Environment and Conservation's Environmental Assessment Guidance

Environmental impacts of the project

The following environmental impacts of the project need to be assessed, quantified and reported on:

- Control of water pollution
- Waste management
- Noise management
- Dust management
- Contaminated land
- Threatened species
- Aboriginal cultural heritage

These should be assessed in accordance with the relevant guidelines listed in Attachment B.

Details are required on the location of the proposed development, including the affected environment, to place the proposal in its local and regional environmental context including surrounding land uses, planning zonings and potential sensitive receptors.

Describe mitigation and management options that will be used to prevent, control, abate or mitigate identified environmental impacts associated with the project and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Based on the information provided to the DEC to date, the applicant will not require an Environment Protection Licence because the activity is not scheduled under the Protection of the Environment Operations Act 1997.

Control of water pollution

The level of potential pollution from these types of projects is difficult to assess. The DEC considers that through appropriate environmental assessment and the implementation of best management sediment and erosion control practices, maximum protection of water quality can be achieved.

A pollution control plan associated with the bridge construction works, including a location diagram of the intended works, should be prepared prior to commencing work. Such a plan should include consideration of the following issues:

- An assessment of each site should be made giving consideration to site specific issues;
- In-channel works should only be undertaken during periods of low flows;
- External materials (eg. Concrete or rocks) that will be used to construct the bridge, stabilise the side track or the stream banks, which are to be placed in waters, should be cleaned of any contaminants such as soil, where practicable;

- Machinery required to perform the construction and stabilisation works should remain out of the stream flow where possible. Where it is unavoidable for machinery to enter the stream flow, the plant should be degreased in an appropriate place prior to entering the water;
- Removal of in-channel deposits such as point bars or flood debris, should be undertaken within a small bund of the deposit or a buffer left in place, protecting the stream flow from the area of disturbance;
- Depending on the level of disturbance proposed within a section of channel it is suggested that consideration be given to placing sediment filters across the flow downstream of the area. These structures might take the form of sand barriers and/or geotextile fabric, if velocities permit;
- Retardation of the upstream flow onto works areas may also assist with short term works.

Waste management

All wastes generated during the project must be managed in a manner that prevents the pollution of waters and air. Disposal of waste materials must be in accordance with legislative requirements of the Protection of the Environment Operations Act 1997.

Noise management

Noise generated during the construction phase of the project must be managed in a manner consistent with the principles stated in the New South Wales Industrial Noise Policy. The amenity of residents adjacent to the site must be considered.

Dust management

The management of dust around the construction site is required to reduce the potential for the pollution of waters or impact on amenity of adjacent residents.

Contaminated land

The REF must document the assessment and management of any land contamination to ensure that the land is not allowed to be put to a use that is inappropriate because of the presence of contamination. Under the Contaminated Land Management Act there is a responsibility to notify the DEC of sites that pose a significant risk of harm to human health or the environment.

Impacts of the project on threatened species and their habitat

A threatened species impact abatement and where appropriate, management planning will form an important part of the REF for the proposal.

A field survey of the site should be conducted and documented in accordance with the "draft Guideline For Threatened Species Assessment" (July, 2005).

Likely impacts on regionally significant protected and threatened species and their habitat need to be assessed, evaluated and reported on. The assessment should specifically report on the considerations listed in Step 3 of the draft guideline.

The REF should clearly state whether it meets each of the key thresholds set out in Step 5 of the draft guideline and describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

In addition, the REF must address the provisions of Section 5A of the Environmental Planning and Assessment Act 1979 and clearly identify if a species impact statement is required to be prepared.

Impacts of the project on Aboriginal cultural heritage values

The REF should address and document the information requirements set out in the "draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation" (July, 2005) involving surveys and consultation with the Aboriginal community.

The REF must identify the nature and extent of impacts on Aboriginal cultural heritage values across the project area. Should the site be found to have significant Aboriginal cultural heritage values, the REF must describe the actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

The REF should clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations.

Attachment B - Guidance Material
Assessing Environmental Impacts

Water quality

- National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
- NWQMS Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000)
- NSW Government Interim Water Quality and River Flow Environmental Objectives.
- The relevant targets within the State Water Management Outcomes Plan
- *NSW Guidelines for Urban & Residential Use of Reclaimed Water* (NSW Water Recycling Coordination Committee, 1993).

Stormwater

- Managing Urban Stormwater: Soils and Construction (NSW Landcom, 2004)
- Managing Urban Stormwater: Source Control (EPA 1998)
- Managing Urban Stormwater: Treatment Techniques (EPA 1998).

(Note: some of these documents will be revised in 2006)

Contaminated Land

- Managing Land Contamination: Planning Guidelines - SEPP55 - Remediation of Land, Department of Urban Affairs and Planning and NSW EPA, 1998;
- Contaminated Sites – Guidelines for Consultants Reporting on Contaminated Sites (Environment Protection Authority (EPA) 1997);
- Contaminated Sites – Guidelines on Significant Risk of Harm and Duty to Report (EPA, 1999).

Noise and vibration

- NSW Industrial Noise Policy (EPA, 1999)
- NSW Environmental Criteria for Road Traffic Noise (EPA, 1999)
- Chapter 171 Noise Control Guideline, *Construction Site Noise, Environmental Noise Control Manual, 1994.*

Assessing threatened species impacts

- Draft Guidelines For Threatened Species Assessment (Department of Environment and Conservation and Department of Primary Industries, July, 2005) - Available from Department of Planning.

Assessing Aboriginal cultural heritage impacts

- Draft Guidelines For Aboriginal Cultural Heritage Impact Assessment and Community Consultation (Department of Environment and Conservation, July, 2005) - Available from Department of Planning
- Interim Community Consultation Requirements for Applicants
- http://www3.environment.nsw.gov.au/nows.nsf/Content/Protecting+Aboriginal+objects+and+places

Aboriginal Cultural Heritage Standards and Guidelines Kit - Available shortly on-line through DEC's webpage.

Attachment C – Local Government Areas Administered by DEC South East Region – Queanbeyan Office

- Bega Valley Shire
- Bombala
- Boorowa
- Cooma Monaro Shire
- Eurobodalla Shire
- Goulburn Mulwaree
- Harden Shire
- Palerang
- Queanbeyan City
- Shoalhaven City
- Snowy River Shire
- Upper Lachlan Shire
- Yass Valley
- Young Shire

Appendix D

Database searches

Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into two sections.

- Section 1. contains items listed by the **Heritage Council** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 130 of the NSW Heritage Act. This information is provided by the NSW Heritage Office.
- Section 2. contains items listed by **Local Councils & Shires and State Government Agencies**. This section may also contain additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

Click on an item name to view the full details.
The search results can be re-sorted by clicking on the **(sort)** option at the top of each column.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Listed Under Heritage Act
Berry Courthouse	58 Victoria Street	Berry	Shoalhaven	Yes
Berry Museum	135 Queen Street	Berry	Shoalhaven	Yes
Berry Railway Station group	Illawarra railway	Berry	Shoalhaven	Yes
Berry Railway Station group movable relics	Illawarra railway	Berry	Shoalhaven	Yes
Bomaderry Railway Station and yard group	Illawarra railway	Bomaderry	Shoalhaven	Yes
David Berry Hospital - Original Buildings & Gate House	Beach Road	Berry	Shoalhaven	Yes
Graham Lodge	Pleasant Way	Nowra	Shoalhaven	Yes
Lady Denman (M.V.)	Dent Street	Huskisson	Shoalhaven	Yes
Meroogal	35 West Street	Nowra	Shoalhaven	Yes

There were **9** records in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

Item Name (sort)	Address (sort)	Suburb (sort)	LGA (sort)	Information Source (sort)
A Row of Victorian Masonry Shops	93-99 Princes Highway	Milton	Shoalhaven	LGOV
Anglewood incl. Original garden, excl. mod. Additions	Yean Street	Burradoo	Shoalhaven	GAZ
Anglican Church of the Good Shepherd Rectory (former)	Rectory Park Way	Kangaroo Valley	Shoalhaven	LGOV
ANZ Bank (Former)	Queen Street	Berry	Shoalhaven	GAZ

Applegarth	Wilford's Road	Milton	Shoalhaven	GAZ
Applegarth	140 Wilford's Lane	Milton	Shoalhaven	LGOV
Archaeological Site	Bolong Road	Coolangatta	Shoalhaven	LGOV
Ayrton House (former C.B.C. Bank)	175 South Street	Terara	Shoalhaven	LGOV
Bank and Post Office Group incl. fmr ANZ Bank & CBC Bank	Queen Street	Berry	Shoalhaven	GAZ
Barrengarry House		Barrengarry	Shoalhaven	GAZ
Barrengarry Public School and Principal's Residence		Barrengarry	Shoalhaven	GAZ
Berry Estate Cottage	Pulman Street	Berry	Shoalhaven	GAZ
Berry Railway Station Group		Berry	Shoalhaven	SGOV
Berry Showground	Alexandra Street	Berry	Shoalhaven	LGOV
Berry-Hay Private Cemetery	Bolong Road	Coolangatta	Shoalhaven	LGOV
Bomaderry Railway Station And Yard Group		Bomaderry	Shoalhaven	SGOV
Bundanon and surrounding landscape	Shoalhaven River	Nowra	Shoalhaven	GAZ
Bundanon Homestead, Outbuildings & Landscape	533 Bundanon Road	Illaroo	Shoalhaven	LGOV
Carpenter Gothic style Weatherboard Church	80 Main Road	Cambewarra	Shoalhaven	LGOV
CBC Bank	Queen Street	Berry	Shoalhaven	GAZ
Church of the Good Shepherd Anglican & rectory		Kangaroo Valley	Shoalhaven	GAZ
Colonial Brick & Timber Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Brick Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Brick Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Brick Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Brick Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Brick Hall	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial style Weatherboard Store	1 Pulman Street	Berry	Shoalhaven	LGOV
Colonial Weatherboard Building	1335 Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Weatherboard Building	Bolong Road	Coolangatta	Shoalhaven	LGOV
Colonial Weatherboard Cottage	Pulman Street	Berry	Shoalhaven	LGOV
Colonial Weatherboard Cottage	11 Pulman Street	Berry	Shoalhaven	LGOV
Colonial Weatherboard Cottage	1335 Bolong Road	Coolangatta	Shoalhaven	LGOV

Colonial Weatherboard Cottage	Bolong Road	Coolangatta	Shoalhaven	LGOV
Coolangatta Estate	Shoalhaven Heads Road	Coolangatta	Shoalhaven	GAZ
Coolangatta Estate Gardens (remnants)	Bolong Road	Coolangatta	Shoalhaven	LGOV
Cottage	19 Pulman Street	Berry	Shoalhaven	GAZ
Courthouse	Princes Highway	Milton	Shoalhaven	GAZ
Courthouse (former)	Shoalhaven Road	Kangaroo Valley	Shoalhaven	GAZ
Creek Hospital	Pulman Street	Berry	Shoalhaven	GAZ
Danes Bank Cottage	Evans Lane	Milton	Shoalhaven	GAZ
Danesbank Two Storey Victorian Stone Farm House	121 Evan's Lane via Woodstock Road	Milton	Shoalhaven	LGOV
David Berry Hospital		Berry	Shoalhaven	GAZ
Dower House (former Coachman's House to Millbank)	27A Millbank Road	Terara	Shoalhaven	LGOV
Erowal Farm Homestead, Garden & Resort (former)	110 The Wool Road	Old Erowal Bay	Shoalhaven	LGOV
Federation Cottage	141 Moss Vale Road	Kangaroo Valley	Shoalhaven	LGOV
Federation Courthouse, Police Station & Stables	175 Moss Vale Road	Kangaroo Valley	Shoalhaven	LGOV
Federation Police Residence & Lockup (former)	Kinghorne Street	Nowra	Shoalhaven	LGOV
Federation Queen Anne style Residence	59 Bolong Road	Bomaderry	Shoalhaven	LGOV
Federation Rendered Courthouse & Police Station	64 Princes Highway	Milton	Shoalhaven	LGOV
Federation Two Storey Brick Residence & Garden	68 Princess Street	Berry	Shoalhaven	LGOV
Garrad House	PRINCES HIGHWAY	MILTON	Shoalhaven	SGOV
Gate House	SEE DAVID BERRY HOSPITAL ACT NO.53 1906	WAVERTON	Shoalhaven	SGOV
Hampden Bridge		Kangaroo Valley	Shoalhaven	GAZ
Hampden Bridge	Moss Vale Road	Kangaroo Valley	Shoalhaven	LGOV
Hampton Villa	Berry Street	Nowra	Shoalhaven	GAZ
Houshta (former Berry Estate Worker's Cottage)	93 Greenwell Point Road	Greenwell Point	Shoalhaven	LGOV
Inverness - two storey house	Southern Road	Terara	Shoalhaven	GAZ
Item	85 Tannery Road	Berry	Shoalhaven	LGOV
James Wilson Memorial Fountain	Prince Alfred Street	Berry	Shoalhaven	LGOV
James Wilson Store, Former	97 Queen Street	Berry	Shoalhaven	GAZ
K Valley School & former Schoolmasters Residence	140 Moss Vale Road	Kangaroo Valley	Shoalhaven	LGOV

Kendall Dale	Princes Highway	Milton	Shoalhaven	GAZ
Kendall Dale Dairy Farm Complex & Garden	E379A Princes Highway	Conjola	Shoalhaven	LGOV
Kirmington	Princes Highway (west of)	Milton	Shoalhaven	GAZ
Kirmington Dairy Farm Complex & Henry Kendall Monolith	West of Princes Highway near Kendall Dale	Yatte Yattah	Shoalhaven	LGOV
Lynburn Timber Federation Residence	501 Princes Highway	Bomaderry	Shoalhaven	LGOV
Main Building	SEE DAVID BERRY HOSPITAL ACT NO.53 1906	WAVERTON	Shoalhaven	SGOV
Mechanics Institute and School of Arts	Berry Street	Nowra	Shoalhaven	GAZ
Mechanics Institute and School of Arts	25 Berry Street	Nowra	Shoalhaven	LGOV
Meroogal House, Servant's wing and stables	35 West Street	Nowra	Shoalhaven	GAZ
Methodist Church, Former	Croobyar Road	Milton	Shoalhaven	GAZ
Millbank Cottage & Outbuildings	31 Millbank Road	Terara	Shoalhaven	LGOV
Minto House	102 PRINCES HIGHWAY	MILTON	Shoalhaven	SGOV
Moss Cottage	3 Ferry Lane	Nowra	Shoalhaven	LGOV
Mount Airlie	Woodstock Road	Milton	Shoalhaven	GAZ
Mount Airlie Two Storey Vict. Italianate Estate Residence	34A Woodstock Road	Ulladulla (R)	Shoalhaven	LGOV
National Australia Bank	Princes Highway	Milton	Shoalhaven	GAZ
Nowra Courthouse	Kinghorne Street	Nowra	Shoalhaven	LGOV
Old Nowra Road Bridge - across Shoalhaven River	Princes Highway	Nowra	Shoalhaven	GAZ
Pickering's Old Store Group incl. Pickering's Old Store Residence	Princes Highway	Milton	Shoalhaven	GAZ
Plunket Street Conservation Area	Plunket Street	Nowra	Shoalhaven	GAZ
Plunkett Street Conservation Area	Plunkett Street	Nowra	Shoalhaven	LGOV
Point Perpendicular Lighthouse	Currarong Road	Beecroft (R)	Shoalhaven	LGOV
Point Perpendicular Lighthouse Group		Point Perpendicular	Shoalhaven	GAZ
Police Sergeant's Residence (Former Courthouse)	Plunkett Street	Nowra	Shoalhaven	LGOV
Principal's Residence	Greenwell Point Road	Pyree	Shoalhaven	GAZ
Principal's Residence		Cambewarra	Shoalhaven	GAZ
Public School	Victoria Street	Berry	Shoalhaven	GAZ

Public School		Terara	Shoalhaven	GAZ
Public School		Kangaroo Valley	Shoalhaven	GAZ
Pulman Street Group		Berry	Shoalhaven	GAZ
Pyree Public School, Former	Greenwell Point Road	Pyree	Shoalhaven	LGOV
Rectory		Kangaroo Valley	Shoalhaven	GAZ
Residence	Pulman Street	Berry	Shoalhaven	GAZ
Residence (former Barrengarry School and Residence)	Bunkers Hill Road	Barrengary	Shoalhaven	LGOV
Residence (former Victorian Gothic Style Church) & Graveyard	Croobyar Road	Milton	Shoalhaven	LGOV
Shoalhaven Bridge	Princes Highway	Nowra	Shoalhaven	LGOV
SHOALHAVEN DISTRICT MEMORIAL HOSPITAL	SHOALHAVEN STREET	NOWRA	Shoalhaven	SGOV
St Andrew's Presbyterian Church		Nowra	Shoalhaven	GAZ
St Lukes Anglican Church	Princes Street	Berry	Shoalhaven	GAZ
St Lukes Anglican Rectory	Princes Street	Berry	Shoalhaven	GAZ
Tapalla Point Rock Platforms		Huskisson	Shoalhaven	GAZ
Terara House		Terara	Shoalhaven	GAZ
Terara House, Chapel, Grounds & Tree Lined Drive	77 Millbank Road	Terara	Shoalhaven	LGOV
Terara School Grounds and Trees	20 Millbank Road	Terara	Shoalhaven	LGOV
Town Hall		Milton	Shoalhaven	GAZ
Two Storey Colonial Sandstone Homestead	154 Wogamia Road	Longreach	Shoalhaven	LGOV
Two Storey Victorian Free Classical style Bank	122 Queen Street	Berry	Shoalhaven	LGOV
Two Storey Victorian Rendered Brick Shop	Queen Street	Berry	Shoalhaven	LGOV
Two Storey Victorian Weatherboard Cottage	Princes Highway (inside Settlement Courtyard)	Milton	Shoalhaven	LGOV
Two Storey Victorian Weatherboard Residence	1 Kalinga Street	Cambewarra	Shoalhaven	LGOV
Ulladulla Lighthouse	Warden Head	Ulladulla	Shoalhaven	GAZ
Ulmus parvifolia	Princes Highway	Milton	Shoalhaven	LGOV
Uniting Church		Milton	Shoalhaven	GAZ
Victorian Academic Gothic style Church	3 & 5 Kinghorne Street	Nowra	Shoalhaven	LGOV
Victorian Anglican Church & Memorial Gates	68A Princess Street	Berry	Shoalhaven	LGOV
Victorian Brick School	75 Greenwell Point Road	Greenwell Point	Shoalhaven	LGOV

Victorian Classical Academic style Court Building	58 Victoria Street	Berry	Shoalhaven	LGOV
Victorian Classical style Rendered Masonry Hall	71 Princes Highway	Milton	Shoalhaven	LGOV
Victorian Free Classical style Post Office	137 Queen Street	Berry	Shoalhaven	LGOV
Victorian Free Gothic Style Church & Graveyard	143 Moss Vale Road	Kangaroo Valley	Shoalhaven	LGOV
Victorian Georgian style Police Residence & Lock up	56 Victoria Street	Berry	Shoalhaven	LGOV
Victorian Gothic Revival Rubblestone Uniting Church	38 Croobyar Road	Milton	Shoalhaven	LGOV
Victorian Italianate style Brick Residence	Tanney Road	Cambewarra	Shoalhaven	LGOV
Victorian Italinate style Bank Building	107 Princes Highway	Milton	Shoalhaven	LGOV
Victorian Rendered Brick Residence	Plunkett Street	Nowra	Shoalhaven	LGOV
Victorian Rendered Brick School & Grounds	Plunkett Street	Nowra	Shoalhaven	LGOV
Victorian Sandstone School & attached Residence	20 Millbank Road	Terara	Shoalhaven	LGOV
Victorian School & School Master's Residence	Victoria Street & 40 Victoria Street	Berry	Shoalhaven	LGOV
Victorian Scottish Baronial style Bank	135 Queen Street	Berry	Shoalhaven	LGOV
Victorian Timber Residence & Outbuildings	35 West Street	Nowra	Shoalhaven	LGOV
Victorian Two Storey Residence	171 Upper Kangaroo River Road	Burrawang	Shoalhaven	LGOV
Victorian Weatherboard Residence & Stables	110 Berry Street	Nowra	Shoalhaven	LGOV
Warden Head Wrought & Cast Iron Lighthouse	Deering Street	Ulladulla	Shoalhaven	LGOV
Weatherboard Cottage (former Greenwell Point School House)	91 Greenwell Point Road	Greenwell Point	Shoalhaven	LGOV
Weatherboard Farmhouse & Broughton Ck Grist	13 Pulman Street	Berry	Shoalhaven	LGOV
Whoppidally	Princes Highway	Milton	Shoalhaven	GAZ
Wilson Memorial Drinking Fountain	Alexandra Street	Berry	Shoalhaven	GAZ
Wilson Memorial Drinking Fountain	Victoria Street	Berry	Shoalhaven	GAZ
Wintersloe	45 Links Road	Bowral	Shoalhaven	GAZ
Wogamia House	Yalwal Road (via)	Wogamia	Shoalhaven	GAZ
Woppindally Dairy Farm Complex	E 280 Princes Highway	Conjola (R)	Shoalhaven	LGOV

There were **143** records in this section matching your search criteria.

There was a total of **152** records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

Note: The Heritage Office seeks to keep the State Heritage Inventory (SHI) up to date, however the latest listings in Local and Regional Environmental Plans (LEPs and REPs) may not yet be included. Always check with the relevant Local Council or Shire for the most recent listings.

Australian Heritage Database

Search Results

edit search | new search | about the Australian Heritage Database | Heritage home | Australian Heritage Council home

105 results found.

Anglican Church of the Good Shepherd 143 Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Badgerys Lookout View	Tallong, NSW, Australia	(Indicative Place) Register of the National Estate
Barren Grounds Nature Reserve Jamberoo Mountain Rd	Jamberoo, NSW, Australia	(Registered) Register of the National Estate
Beecroft Peninsula Currarong Rd	Currarong, NSW, Australia	(Listed place) Commonwealth Heritage List
Beecroft Peninsula (Commonwealth) Currarong Rd	Currarong, NSW, Australia	(Registered) Register of the National Estate
Beecroft Peninsula / Lake Wollumboola Currarong Rd	Currarong, NSW, Australia	(Registered) Register of the National Estate
Belowla Island Nature Res	Kioloa, NSW, Australia	(Registered) Register of the National Estate
Benandarah Area Princes Hwy	Benandarah, NSW, Australia	(Registered) Register of the National Estate
Berry Bank and Post Office Group Queen St	Berry, NSW, Australia	(Registered) Register of the National Estate
Berry Courthouse 58 Victoria St	Berry, NSW, Australia	(Registered) Register of the National Estate
Berry District Princes Hwy	Berry, NSW, Australia	(Indicative Place) Register of the National Estate
Berry Local History Museum 135 Queen St	Berry, NSW, Australia	(Registered) Register of the National Estate
Berry Post Office Queen St	Berry, NSW, Australia	(Registered) Register of the National Estate
Berry Soldiers Memorial & Memorial Avenue Alexandra St	Berry, NSW, Australia	(Indicative Place) Register of the National Estate
Birrell & Davis Dam & Quarries	Nerriga, NSW, Australia	(Indicative Place) Register of the National Estate
Black Ash Nature Reserve Berry Mountain Rd	Berry, NSW, Australia	(Registered) Register of the

Bomaderry Creek Gorge West Cambewarra Rd	Bomaderry, NSW, Australia	National Estate (Registered) Register of the National Estate
Bomaderry Creek Zieria Baeuerlenii Site West Cambewarra Rd	Bomaderry, NSW, Australia	(Registered) Register of the National Estate
Bomaderry Creek Zieria Baeuerlenii Site 2 West Cambewarra Rd	Bomaderry, NSW, Australia	(Registered) Register of the National Estate
Bomaderry Public School (1893 building) 5 Birrilley St	Bomaderry, NSW, Australia	(Indicative Place) Register of the National Estate
Boolgatta Farm Group Princes Hwy	Yatteyyattah via Milton, NSW, Australia	(Indicative Place) Register of the National Estate
Brush Island Nature Reserve	Bawley Point, NSW, Australia	(Registered) Register of the National Estate
Budawang National Park Budawang Rd	Monga, NSW, Australia	(Registered) Register of the National Estate
Bundanon Commonwealth Land Area Illaroo Rd	Nowra, NSW, Australia	(Indicative Place) Register of the National Estate
Bundanon Including Landscape Illaroo Rd	Nowra, NSW, Australia	(Registered) Register of the National Estate
Bundanon Including Landscape Illaroo Rd	Nowra, NSW, Australia	(Indicative Place) Commonwealth Heritage List
Cambewarra Mountain Area Cambewarra Rd	Cambewarra, NSW, Australia	(Registered) Register of the National Estate
Church of the Good Shepherd Rectory (former) Rectory Park Way	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Clyde River Kings Hwy	Batemans Bay, NSW, Australia	(Indicative Place) Register of the National Estate
Coolangatta Estate Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Billiards Room (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Blacksmiths Shop (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Coach House (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Coach House (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Community Hall (former) Bolong Rd	Shoalhaven Heads, NSW,	(Registered) Register of the

	Australia	National Estate
Coolangatta Estate Convict Cottage (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Office (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Stables & Coachmans Residence (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate The Cottage Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coolangatta Estate Tinsmiths Shop & Residence (former) Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Coomonderry Swamp Nature Reserve Proposal Gerroa Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Crocodile Head Area Lighthouse Rd	Currarong, NSW, Australia	(Within Listed Place) Commonwealth Heritage List
Cudmirrah Nature Reserve (1980 boundary)	Berrara, NSW, Australia	(Registered) Register of the National Estate
Cudmirrah Ornithological Area Berrara Rd	Berrara, NSW, Australia	(Indicative Place) Register of the National Estate
Currarong Rockshelters Area Currarong Rd	Currarong, NSW, Australia	(Within Listed Place) Commonwealth Heritage List
Devils Glen Nature Reserve Berry Mountain Rd	Berry, NSW, Australia	(Registered) Register of the National Estate
Ettrema / Bundundah Wilderness	Nerriga, NSW, Australia	(Indicative Place) Register of the National Estate
Fitzroy Falls Geological Area Moss Vale Kangaroo Valley Rd	Fitzroy Falls, NSW, Australia	(Indicative Place) Register of the National Estate
Gurumbi Nature Reserve Jervis Bay Rd	Erowal Bay, NSW, Australia	(Registered) Register of the National Estate
Hampden Bridge Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Bawley Point, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Burrill Lake, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Currarong, NSW, Australia	(Registered) Register of the National Estate

Indigenous Place	Currarong, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Durras North, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Kangaroo Valley, NSW, Australia	(Indicative Place) Register of the National Estate
Indigenous Place	Kioloa, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Nowra, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Orient Point, NSW, Australia	(Indicative Place) Register of the National Estate
Indigenous Place	Pebbly Beach via Durras North, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Sassafras via Nerriga, NSW, Australia	(Registered) Register of the National Estate
Indigenous Place	Termeil, NSW, Australia	(Indicative Place) Register of the National Estate
Indigenous Place	Wandandian, NSW, Australia	(Registered) Register of the National Estate
Jervis Bay and Surrounds	Jervis Bay, NSW, Australia	(Registered) Register of the National Estate
Kangaroo Valley Kangaroo Valley Rd	Kangaroo Valley, NSW, Australia	(Indicative Place) Register of the National Estate
Kangaroo Valley Pioneer Settlement Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Rejected Place) Register of the National Estate
Kangaroo Valley Police Station & Courthouse (former) Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Kangaroo Valley Soldiers Memorial Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Indicative Place) Register of the National Estate
Kangaroo and Lower Shoalhaven Rivers Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Rejected Place) Register of the National Estate
Kirmington Princes Hwy	Yatteyattah via Milton, NSW, Australia	(Registered) Register of the National Estate
Meroogal 35 West St	Nowra, NSW, Australia	(Registered) Register of the National Estate
Mill Bank House and associated buildings Millbank Rd	Terara, NSW, Australia	(Indicative Place) Register of the National Estate

Milton Courthouse 64 Princes Hwy	Milton, NSW, Australia	(Registered) Register of the National Estate
Morton National Park (1980 boundary)	Bundanoon, NSW, Australia	(Registered) Register of the National Estate
Murramarang Area Princes Hwy	Benandarah, NSW, Australia	(Registered) Register of the National Estate
Murramarang National Park (1980 boundary) Durras Rd	Durras, NSW, Australia	(Registered) Register of the National Estate
Narrawallee Inlet Matron Porter Dr	Narrawallee via Mollymook, NSW, Australia	(Registered) Register of the National Estate
Narrawallee Inlet and Nature Reserve Lake Conjola Entrance Rd	Lake Conjola, NSW, Australia	(Registered) Register of the National Estate
Narrawilly Princes Hwy	Milton, NSW, Australia	(Indicative Place) Register of the National Estate
National Bank Queen St	Berry, NSW, Australia	(Registered) Register of the National Estate
Nowra Post Office (former) 72 Junction St	Nowra, NSW, Australia	(Registered) Register of the National Estate
Nowra Road Bridge Princes Hwy	Nowra, NSW, Australia	(Registered) Register of the National Estate
Nowra Soldiers Memorial Junction St	Nowra, NSW, Australia	(Indicative Place) Register of the National Estate
Nowra South African War Memorial Junction St	Nowra, NSW, Australia	(Indicative Place) Register of the National Estate
Parma Farm and outbuildings Parma Rd	Falls Creek, NSW, Australia	(Indicative Place) Register of the National Estate
Penguin Head Geological Site Penguin Head Rd	Culburra, NSW, Australia	(Indicative Place) Register of the National Estate
Pigeon House Mountain and Surrounding Area Pigeon House Rd	Milton, NSW, Australia	(Registered) Register of the National Estate
Plantation Point Rock Platform Plantation Point Pde	Vincentia, NSW, Australia	(Registered) Register of the National Estate
Plunket Street Precinct Plunket St	Nowra, NSW, Australia	(Registered) Register of the National Estate
Point Perpendicular Lightstation Lighthouse Rd	Currarong, NSW, Australia	(Registered) Register of the National Estate
Point Perpendicular Lightstation Lighthouse Rd	Currarong, NSW, Australia	(Listed place) Commonwealth Heritage List

Public School 140 Moss Vale Rd	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Red Rocks Nature Reserve Nugents Creek Rd	Kangaroo Valley, NSW, Australia	(Registered) Register of the National Estate
Remains of Original Coolangatta Estate Homestead Bolong Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Rock Platform Pacific Cr	Ulladulla, NSW, Australia	(Rejected Place) Register of the National Estate
Rodway Nature Reserve Wattamolla Rd	Berry, NSW, Australia	(Registered) Register of the National Estate
School of Arts (former) 71 Princes Hwy	Milton, NSW, Australia	(Registered) Register of the National Estate
Seven Mile Beach National Park Gerroa Rd	Shoalhaven Heads, NSW, Australia	(Registered) Register of the National Estate
Shoalhaven Historical Society Museum Plunket St	Nowra, NSW, Australia	(Registered) Register of the National Estate
Snapper Point Nursery Beds	Kioloa, NSW, Australia	(Registered) Register of the National Estate
Swan Lake / Cudmirrah Area Sussex Inlet Rd	Sussex Inlet, NSW, Australia	(Indicative Place) Register of the National Estate
Tapalla Point Rock Platforms Nowra St	Huskisson, NSW, Australia	(Registered) Register of the National Estate
Union Church Jervis St	Greenwell Point, NSW, Australia	(Indicative Place) Register of the National Estate
Warden Head Geological Site Deering St	Ulladulla, NSW, Australia	(Registered) Register of the National Estate
Warden Head Lighthouse Deering St	Ulladulla, NSW, Australia	(Registered) Register of the National Estate

Report Produced: Wed Jun 13 14:28:21 2007

Southern region

In This Section

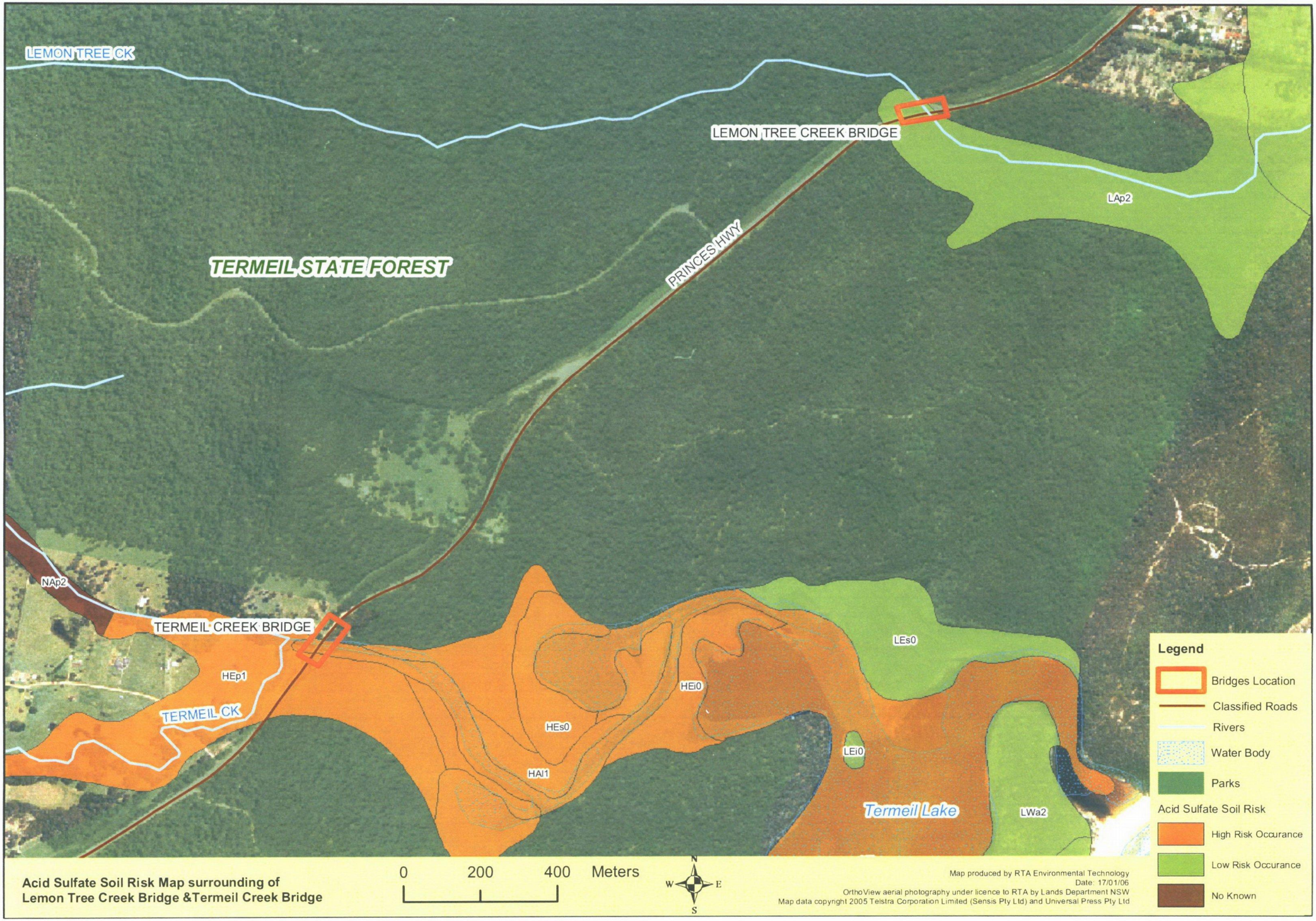
- Hunter region
- Northern region
- South West region
- Southern region
- Sydney region
- Western region

Southern Region

Abernethys Creek Bridge	4309517
Alsops Creek Bridge	4309632
Ball Bank Inclinometer, Bega Registry Office	4305420
Bellbird Creek Bridge	4309550
Boxers Creek Bridge	4309637
Bridge over Wologorong Creek	4301637
Broughton Creek Bridge	4309596
Charleyong Bridge over Mongarlowe River	4300172
Cockwhy Creek Bridge	4309604
Couria Creek Bridge	4309629
Crankies Plain Bridge, Bombala	4300006
Crookwell River Bridge	4309559
Dalgety Bridge over Snowy River	4301689
Diggers Creek Bridge	4309636
Dignams Creek Bridge	4309630
Drafting Equipment, Bega Registry Office	4301432
Drafting Equipment, Mittagong	4305407
Drafting Equipment, Wollongong	4301455
Duck Creek Bridge	4309595
Fairy Creek Bridge	4309514
Gundaroo Bridge over Yass River at Gundaroo	4300157
Guthries Creek Bridge	4309555
Hampden Bridge, Kangaroo Valley	4301059
Higgins Creek Bridge	4309518
Kangaloolah Creek Bridge	4309638
Kings Falls Bridge	4309611
Lansdowne Bridge over Mulwaree Ponds	4300186
Mummel Bridge	4309648
Narooma Bridge	4300639
Native Dog Creek Bridge	4309635
New Buildings Bridge over Towamba River	4300139
Nowra Bridge over the Shoalhaven River	4301658
Office Equipment, Bega Registry Office	4305422
Office Equipment, Mittagong	4305408
Old Marulan Town (Lots 1, 7 & 14)	4300302
Road Construction and Maintenance Equipment, Mittagong	4305409
Road Grader, Cooma Depot	4301437
Rossis Bridge 4.5Km NW of Goulburn	4300156
Signage, Cooma	4301438
Spencers Creek Bridge	4309556
Stapletons Bridge	4309612
Stone lined channel outlet from Murray Lagoon, Federal Highway	4301028

Survey Equipment, Bega Registry Office	4301431
Survey Equipment, Bega Works Depot	4305421
Survey Equipment, Goulburn	4301444
Survey Equipment, Mittagong	4301452
Survey Equipment, Wollongong	4301458
Thornes Bridge over Mulwaree River	4300163
Tractor Road Grader, Bega Works Depot	4301434
Truss Bridge over Crookwell River	4300130
Victoria Bridge over Stonequarry Creek, Picton	4301089
Victoria Creek Bridge	4309628
Wandandian Creek Bridge	4309598
Wonboyn River Bridge	4309633
Yowaka Bridge near Eden	4300515

↑ Back to top



Acid Sulfate Soil Risk Map surrounding of Lemon Tree Creek Bridge &Termeil Creek Bridge

Map produced by RTA Environmental Technology
Date: 17/01/06
OrthoView aerial photography under licence to RTA by Lands Department NSW

Print Close page

Search results

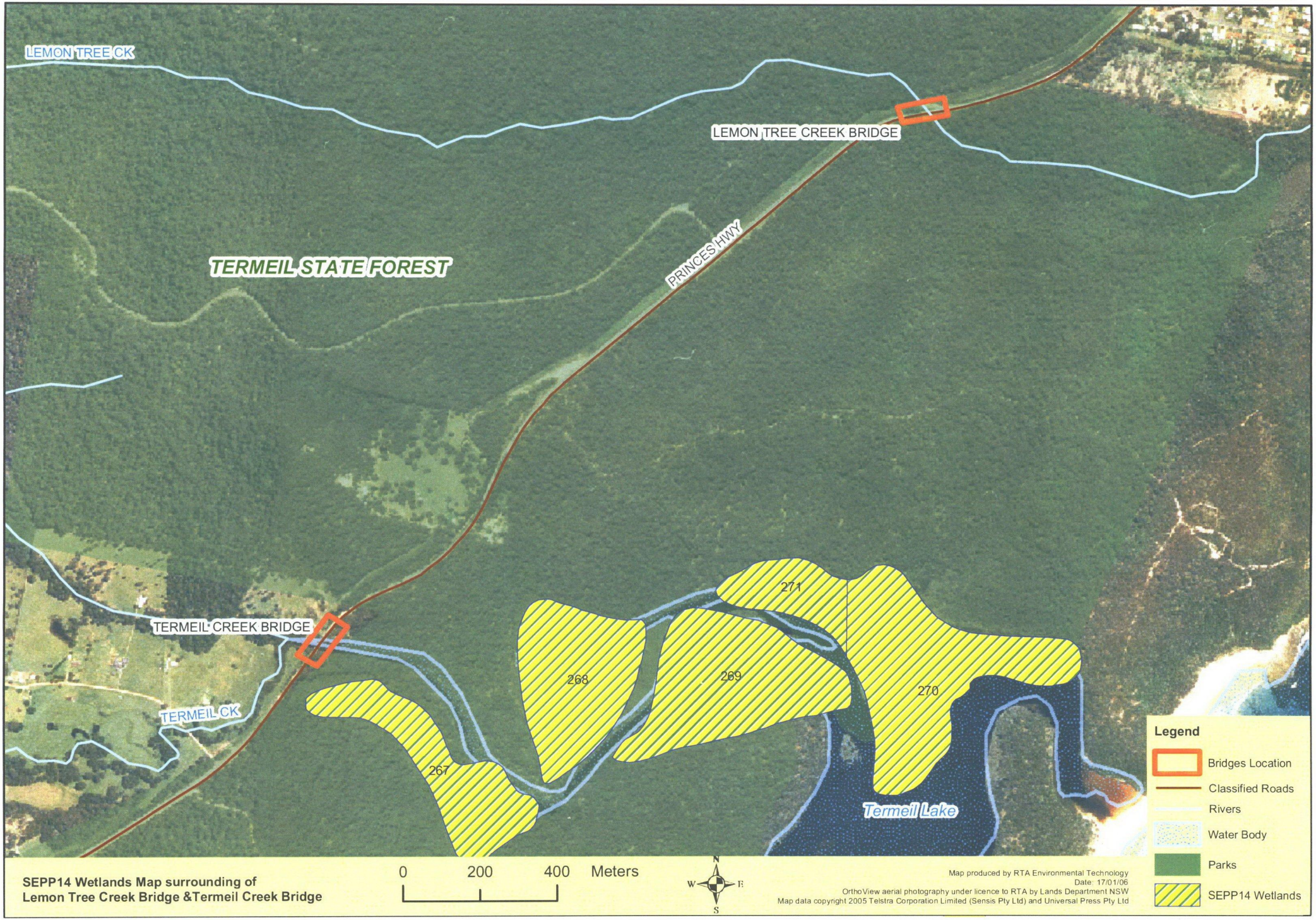
Your search for: LGA: Shoalhaven City Council

Matched 2 notices relating to 1 site.

Suburb	Address	Site Name	Notices related to this site
Nowra	Lamonds Lane	Nowra Gasworks	2 current

Page 1 of 1

2 July 2007



SEPP14 Wetlands Map surrounding of
Lemon Tree Creek Bridge &Termeil Creek Bridge

Map produced by RTA Environmental Technology
Date: 17/01/06
OrthoView aerial photography under licence to RTA by Lands Department NSW

What is currently listed?

The overall list of threatened species, populations, communities and key threatening processes includes the following:

Endangered species

The species is likely to become extinct in nature if threats continue, or its numbers and/or habitat are reduced to such a critical level that it's in immediate danger of extinction. It may already be extinct, but isn't presumed extinct.

The endangered species already listed are:

- Eastern freshwater cod **(Maccullochella ikei)**
- Recovery plan for eastern cod **1.1 Mb**
- Green sawfish **(Pristis zijsron)**
- Grey nurse shark (Carcharias taurus)
- Murray hardyhead **(Craterocephalus fluviatilis)**
- Oxleyan pygmy perch **(Nannoperca oxleyana)**
- River snail **(Notopala sublineata)**
- Southern Bluefin Tuna **(*Thunnus maccoyii*)**
- Trout cod **(Maccullochella macquariensis)**
- Protecting Trout cod - A guide for fishers **651 Kb**
- Sydney Hawk dragonfly **(Austrocordulia leonardi)**

Endangered populations

The population has been reduced to such a critical level, or its habitat has been so drastically reduced, that it's in immediate danger of extinction. It must be a listed vulnerable species, or be geographically isolated, near the limit of its natural range, and genetically distinct.

- Western population of purple spotted gudgeon **(Mogurnda adspersa)**
- Western population of olive perchlet **(Ambassis agassizii)**

Endangered ecological communities

The ecological community (a group of different species living in a particular area) is likely to become extinct in NSW if threats continue.

- Aquatic ecological community in the natural drainage system of the lower Murray River catchment
- Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River
- Aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River.

Species presumed extinct

The species hasn't been definitely located in nature during the preceding 50 years despite searching of known and likely habitats during that period.

- Bennetts seaweed **(Vanvoorstia bennettiana)**

Vulnerable species

The species is likely to become endangered if threats continue.

- Adams emerald dragonfly **(Archaeophya adamsi)**
- Black cod **(Epinephelus daemelii)**
- Buchanans fairy shrimp **(Branchinella buchananensis)**
- Great white shark **(Carcharodon carcharias)**
- Macquarie perch **(Macquaria australasica)**
- Southern pygmy perch **(Nannoperca australis)**
- Silver perch **(Bidyanus bidyanus)**
- **Marine brown alga (Nereia lophocladia)**

Key threatening processes

The process adversely affects at least two listed threatened species, populations or communities or could make others become threatened.

- Current shark meshing program in NSW waters
- Hook and line fishing in areas important for the survival of threatened fish species
- The introduction of fish to fresh waters within a river catchment outside their natural range
- The removal of large woody debris from NSW rivers and streams
- The degradation of native riparian vegetation along New South Wales water courses
- Instream structures and other mechanisms that alter natural flow **see also:** cold water pollution
- **Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales.**

Last Updated: June 26, 2007, 9:18 am

Australian Government
Department of the Environment and Water Resources

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

13 June 2007 17:43

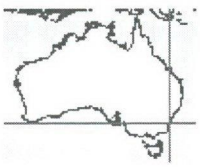
EPBC Act Protected Matters Report

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.

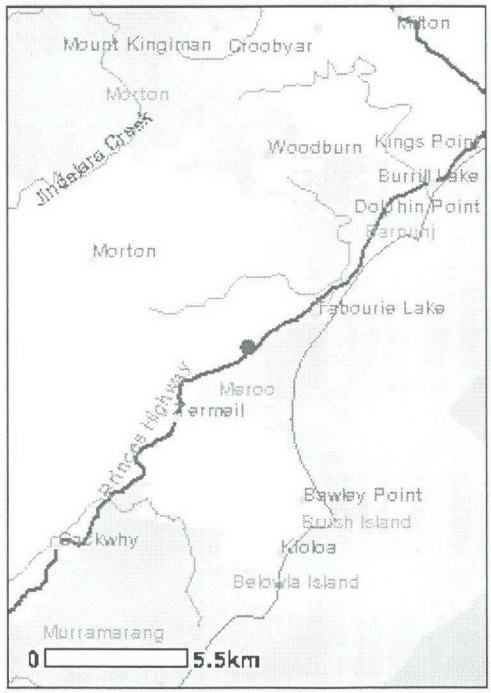
You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Search Type: Point
Buffer: 10 km
Coordinates: -35.4572,150.36997



Report Contents:



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 - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	40
Migratory Species:	43

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

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. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Places on the RNE:	5
Listed Marine Species:	58
Whales and Other Cetaceans:	12
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.

State and Territory Reserves:	4
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Diomedea amsterdamensis * Amsterdam Albatross	Endangered	Species or species habitat may occur within area
Diomedea antipodensis * Antipodean Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea dabbenena * Tristan Albatross	Endangered	Foraging may occur within area
Diomedea exulans * Wandering Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni * Gibson's Albatross	Vulnerable	Species or species habitat may occur within area
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Macronectes giganteus * Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Macronectes halli * Northern Giant-Petrel	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster * Orange-bellied Parrot	Critically Endangered	Species or species habitat may occur within area
*Pterodroma neglecta neglecta** Kermadec Petrel (western)	Vulnerable	Species or species habitat may occur within area
Rostratula australis * Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri * Buller's Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta * Shy Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche chrysostoma * Grey-headed Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida * Campbell Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris * Black-browed Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini * Salvin's Albatross	Vulnerable	Species or species habitat may occur within area

Thalassarche steadi * White-capped Albatross	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia * Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus * Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea * Green and Golden Bell Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus * Stuttering Frog, Southern Barred Frog (in Victoria)	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus * Blue Whale	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	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)	Endangered	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Endangered	Species or species habitat known to occur within area
*Isoodon obesulus obesulus** Southern Brown Bandicoot	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Vulnerable	Species or species habitat known to occur within area
*Potorous tridactylus tridactylus** Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Roosting known to occur within area
Ray-finned fishes		
Prototroctes maraena * Australian Grayling	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Vulnerable	Species or species habitat may occur within area
Sharks		
*Carcharias taurus (east coast population)** Grey Nurse Shark (east coast population)	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias * Great White Shark	Vulnerable	Species or species habitat may occur within area
Rhincodon typus * Whale Shark	Vulnerable	Species or species habitat may occur within area
Plants		

Caladenia tessellata * Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana * Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Genoplesium vernale * East Lynne Midge-orchid	Vulnerable	Species or species habitat may occur within area
Thesium australe * Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Migratory	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross	Migratory	Species or species habitat may occur within area

Diomedea antipodensis Antipodean Albatross	Migratory	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Migratory	Foraging may occur within area
Diomedea exulans Wandering Albatross	Migratory	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Migratory	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Migratory	Species or species habitat may occur within area
Puffinus pacificus Wedge-tailed Shearwater	Migratory	Breeding known to occur within area
Puffinus tenuirostris Short-tailed Shearwater	Migratory	Breeding known to occur within area
Sterna albifrons Little Tern	Migratory	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Migratory	Species or species habitat may occur within area
Thalassarche chlororhynchos Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche chrysostoma Grey-headed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Migratory	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Migratory	Species or species habitat may occur within area

Migratory Marine Species

Mammals

Balaenoptera edeni Bryde's Whale	Migratory	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Migratory	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Migratory	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Migratory	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin	Migratory	Species or species habitat may occur within area

Megaptera novaeangliae * Humpback Whale	Migratory	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Migratory	Species or species habitat may occur within area
Reptiles		
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Migratory	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias Great White Shark	Migratory	Species or species habitat may occur within area
Rhincodon typus Whale Shark	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Catharacta skua Great Skua	Listed	Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross	Listed	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross	Listed	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Listed	Foraging may occur within area
Diomedea exulans Wandering Albatross	Listed	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Listed	Species or species habitat may occur within area
Eudyptula minor Little Penguin	Listed	Breeding known to occur within area
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus	Listed -	Species or species habitat may occur

White-throated Needletail	overfly marine area	within area
Lathamus discolor * Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Listed	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Listed	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Pelagodroma marina White-faced Storm-Petrel	Listed	Breeding known to occur within area
Puffinus pacificus Wedge-tailed Shearwater	Listed	Breeding known to occur within area
Puffinus tenuirostris Short-tailed Shearwater	Listed	Breeding known to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Sterna albifrons Little Tern	Listed	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Listed	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Listed	Species or species habitat may occur within area
Thalassarche chlororhynchos Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Listed	Species or species habitat may occur within area

Thalassarche chrysostoma Grey-headed Albatross	Listed	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Listed	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Listed	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross	Listed	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Listed	Species or species habitat may occur within area
*Thinornis rubricollis rubricollis** Hooded Plover (eastern)	Listed - overfly marine area	Species or species habitat likely to occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal	Listed	Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal	Listed	Species or species habitat may occur within area
Ray-finned fishes		
Acentronura tentaculata Hairy Pygmy Pipehorse	Listed	Species or species habitat may occur within area
Cosmocampus howensis Lord Howe Pipefish	Listed	Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish	Listed	Species or species habitat may occur within area
Hippocampus abdominalis Eastern Potbelly Seahorse, New Zealand Potbelly, Seahorse, Bigbelly Seahorse	Listed	Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse	Listed	Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse	Listed	Species or species habitat may occur within area
Histiogamphelus briggsii Briggs' Crested Pipefish, Briggs' Pipefish	Listed	Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Kimbla Pipefish	Listed	Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish	Listed	Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish	Listed	Species or species habitat may occur within area
Notiocampus ruber Red Pipefish	Listed	Species or species habitat may occur within area
Phyllopteryx taeniolatus Weedy Seadragon, Common Seadragon	Listed	Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse	Listed	Species or species habitat may occur within area

Solenostomus cyanopterus Blue-finned Ghost Pipefish, Robust Ghost Pipefish	Listed	Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish	Listed	Species or species habitat may occur within area
Stigmatopora nigra Wide-bodied Pipefish, Black Pipefish	Listed	Species or species habitat may occur within area
Syngnathoides biaculeatus Double-ended Pipehorse, Alligator Pipefish	Listed	Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish	Listed	Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish	Listed	Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish	Listed	Species or species habitat may occur within area
Reptiles		
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Listed	Species or species habitat may occur within area
Whales and Other Cetaceans [Dataset Information]	Status	Type of Presence
Balaenoptera acutorostrata Minke Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Cetacean	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Cetacean	Species or species habitat may occur within area
Delphinus delphis Common Dolphin	Cetacean	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Cetacean	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus	Cetacean	Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin	Cetacean	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Cetacean	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Cetacean	Species or species habitat may occur within area
Tursiops aduncus Spotted Bottlenose Dolphin	Cetacean	Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin	Cetacean	Species or species habitat may occur within area
Commonwealth Lands [Dataset Information]		
Australian National University		
Commonwealth Trading Bank of Australia		

Places on the RNE [Dataset Information]
Note that not all Indigenous sites may be listed.

Indigenous

Murramarang Aboriginal Area NSW

Pigeon House Mountain and Surrounding Area NSW

Natural

Benandarah Area NSW

Brush Island Nature Reserve NSW

Murramarang Area NSW

Extra Information

State and Territory Reserves [Dataset Information]

Brush Island Nature Reserve, NSW

Meroo National Park, NSW

Morton National Park, NSW

Murramarang National Park, NSW

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Southern RFA, New South Wales

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 migratory and marine provisions of the Act have been mapped.

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.

Acknowledgments

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

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- 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
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution.

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

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Noxious weed declarations

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Noxious weed declarations for Shoalhaven City Council

The following weeds are declared noxious in the control area of Shoalhaven City Council:

Weed	Class	Legal requirements
African boxthorn [Lycium ferocissimum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
African feathergrass [Pennisetum macrourum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African lovegrass [Eragrostis curvula]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
African turnipweed [Sisymbrium runcinatum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnipweed [Sisymbrium thellungii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Alligator weed [Alternanthera philoxeroides]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Anchored water hyacinth [Eichhornia azurea]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Annual ragweed [Ambrosia artemisiifolia]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Arrowhead [Sagittaria montevidensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Artichoke thistle [Cynara cardunculus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Athel tree [Tamarix aphylla]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bathurst/Noogoora/Californian/cockle burrs [Xanthium species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Bear-skin fescue [Festuca gautieri]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bitou bush [Chrysanthemoides monilifera subspecies rotundata]	4	The growth and spread of the plant must be controlled according to the measures specified in a management

		plan published by the local control authority
Black knapweed [Centaurea nigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Blackberry [Rubus fruticosus aggregate species] except cultivars Black satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smoothstem, Thornfree	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Boneseed [Chrysanthemoides monilifera subspecies monilifera]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Bridal creeper [Asparagus asparagoides]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Broomrapes [Orobanche species] Includes all Orobanche species except the native O. cernua variety australiana and O. minor	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Burr ragweed [Ambrosia confertiflora]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cabomba [Cabomba caroliniana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cayenne snakeweed [Stachytarpheta cayennensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Chilean needle grass [Nassella neesiana]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Chinese violet [Asystasia gangetica subspecies micrantha]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Clockweed [Gaura lindheimeri]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Clockweed [Gaura parviflora]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cockle burrs [Xanthium species]		See Bathurst/Noogoora/Californian/cockle burrs
Corn sowthistle [Sonchus arvensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Crofton weed [Ageratina adenophora]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Dodder [Cuscuta species]	5	The requirements in the Noxious Weeds Act 1993 for a

Includes All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana		notifiable weed must be complied with This is an All of NSW declaration
East Indian hygrophila [Hygrophila polysperma]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
English broom [Cytisus scoparius]		See Scotch broom
Espartillo [Achnatherum brachychaetum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Eurasian water milfoil [Myriophyllum spicatum]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Fine-bristled burr grass [Cenchrus brownii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Fireweed [Senecio madagascariensis]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Fountain grass [Pennisetum setaceum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gallon's curse [Cenchrus biflorus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Giant Parramatta grass [Sporobolus fertilis]	3	The plant must be fully and continuously suppressed and destroyed
Glaucous starthistle [Carthamus glaucus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Golden dodder [Cuscuta campestris]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Golden thistle [Scolymus hispanicus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gorse [Ulex europaeus]	3	The plant must be fully and continuously suppressed and destroyed
Green cestrum [Cestrum parqui]	3	The plant must be fully and continuously suppressed and destroyed
Groundsel bush [Baccharis halimifolia]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [Harrisia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Hawkweed [Hieracium species]	1	The plant must be eradicated from the land and the land must be kept free of the plant

		This is an All of NSW declaration
Horsetail [Equisetum species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Hymenachne [Hymenachne amplexicaulis]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Karoo thorn [Acacia karroo]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Kochia [Bassia scoparia] except Bassia scoparia subspecies trichophylla	1	except B.scoparia subspecies trichophylla The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Lagarosiphon [Lagarosiphon major]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Lantana [Lantana species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Lantana [Lantana species]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Leafy elodea [Egeria densa] Declaration commences 1 July 2007	5	Commences 1 July 2007 The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Long-leaf willow primrose [Ludwigia longifolia]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Mexican feather grass [Nassella tenuissima]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mexican poppy [Argemone mexicana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Miconia [Miconia species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mimosa [Mimosa pigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mistflower [Ageratina riparia]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Mossman River grass [Cenchrus echinatus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration

Nodding thistle [Carduus nutans]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Onion grass [Romulea species] Includes all Romulea species and varieties except R. rosea var. australis	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Oxalis [Oxalis species and varieties] Includes all Oxalis species and varieties except the native species O. chnoodes, O. exilis, O. perennans, O. radicosa, O. rubens, and O. thompsoniae	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Pampas grass [Cortaderia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Parthenium weed [Parthenium hysterophorus]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Pond apple [Annona glabra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly acacia [Acacia nilotica]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly pear [Cylindropuntia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Prickly pear [Opuntia species except O. ficus-indica]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Privet (Broad-leaf) [Ligustrum lucidum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Privet (Narrow-leaf/Chinese) [Ligustrum sinense]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Red rice [Oryza rufipogon]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Rhus tree [Toxicodendron succedaneum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority This is an All of NSW declaration
Rubbervine [Cryptostegia grandiflora]	1	The plant must be eradicated from the land and the land must be kept free of the plant

		This is an All of NSW declaration
Sagittaria [Sagittaria platyphylla]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Salvinia [Salvinia molesta]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Sand oat [Avena strigosa]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Scotch broom [Cytisus scoparius]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Senegal tea plant [Gymnocoronis spilanthoides]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Serrated tussock [Nassella trichotoma]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Siam weed [Chromolaena odorata]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Smooth-stemmed turnip [Brassica barrelieri subspecies oxyrrhina]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Soldier thistle [Picnomon acarna]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Spotted knapweed [Centaurea maculosa]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
St. John's wort [Hypericum perforatum]	3	The plant must be fully and continuously suppressed and destroyed
Texas blueweed [Helianthus ciliaris]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Water caltrop [Trapa species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water hyacinth [Eichhornia crassipes]	3	The plant must be fully and continuously suppressed and destroyed
Water lettuce [Pistia stratiotes]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water soldier [Stratiotes aloides]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Willows [Salix species]	5	The requirements in the Noxious Weeds Act 1993 for a

Includes all Salix species except S. babylonica, S. x reichardtii, S. x calodendron		notifiable weed must be complied with This is an All of NSW declaration
Witchweed [Striga species] Includes all Striga species except native species and Striga parviflora	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow burrhead [Limnocharis flava]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow nutgrass [Cyperus esculentus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration

Appendix E

Ecology Assessment

Flora and fauna assessment proposed relocation of the Termeil and Lemon Tree Creek Bridges

Princes Highway,
Lake Tabourie

July 2007

lesryk
ENVIRONMENTAL
CONSULTANTS

Report prepared on behalf of:

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Please note that, given the dynamic nature of the relevant pieces of environmental legislation considered in this report, the authors consider that this report only has a 'shelf life' of six months. If a development application, review of environmental factors or statement of environmental effect is not submitted to a determining authority for consideration within this time frame, it is recommended that this report be reviewed and revised where required in light of any relevant legislative listings or changes.

EXECUTIVE SUMMARY

At the request of the New South Wales Roads and Traffic Authority, a vascular flora and vertebrate fauna study of the lands that occur within, and in close proximity to, two sections of the Princes Highway, south of Lake Tabourie, NSW has been undertaken. The study has been conducted as part of an investigation to provide information on the ecology of these areas, the RTA proposing to realign the Princes Highway at these locations. The sections of the Princes Highway surveyed are located adjacent to Lemon Tree and Termeil Creek Bridges.

By the completion of the study two birds, the Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*), listed as Migratory under the Commonwealth *EPBC Act* were identified within the study area. There is also the possibility that the Green and Golden Bell Frog (*Litoria aurea*) may also be present. Giving consideration to the Administrative Guidelines on Significance provided in association with the Commonwealth *EPBC Act*, it is not considered that the matter would require referral to the Federal Minister for the Environment and Water Resources for further consideration or approval.

By the completion of the field investigations, two state listed Endangered Ecological Communities, Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest, and one regionally significant plant Christmas Orchid (*Calanthe triplicata*) had been recorded. In addition to this, one threatened fauna species the Yellow-bellied Glider (*Petaurus australis*) was also considered to be present.

A mosaic of Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest occurs in narrow strips lining Termeil Creek. Both communities are listed as Endangered Ecological Communities under Schedule 1, Part 3 of the NSW *TSC Act*. It is considered that the amount of clearing associated with the Proposal (approximately 150m^2) would not have a significant effect on these communities, or their habitats. Therefore, the preparation of a Species Impact Statement which further considered the impact of the Proposal on these communities was not recommended.

The Christmas Orchid (*Calanthe triplicata*) was recorded on the shoulder of the highway on the north-western approach to Termeil Creek Bridge. Given its proximity to the proposed works, it is likely to be removed during construction. Recommendations for relocation of this plant have been presented.

The proposed western alignment for the Termeil Creek crossing would also avoid any indirect impacts on the viability of sensitive vegetation downstream, this being a wetland listed under State Environmental Planning Policy Number 14 [Coastal Wetlands] and an area mapped as Swamp Sclerophyll Forest.

Having been previously detected traversing through and feeding within the woodlands that occur to the east of Termeil Creek Bridge, it was considered appropriate that a precautionary approach be adopted in relation to the presence of the Yellow-bellied Glider. The proposed western alignment for the Termeil Creek crossing would avoid any indirect impacts on the viability of any Yellow-bellied Glider individuals and their habitats. Giving consideration to the structure and quality of the habitat present within the study area, and the presence of large conservation reserves/protected areas adjacent to and beyond the limits of the study area, it was not considered that any individuals or populations of this species would be significantly affected as a result of the Proposal. As such, the expected impacts associated with the Proposal on the Yellow-bellied Glider are considered to be minimal, and therefore, based on a consideration of the seven part test, the preparation of a Species Impact Statement was not recommended.

Similarly, it was not considered necessary that a Species Impact Statement would need to be prepared to further consider the impacts of the Proposal on the potentially occurring Green and Golden Bell Frog or hollow dependant microchiropterans. The possible presence of these threatened animals was considered due to the occurrence of habitats suitable for these species and the adoption of the precautionary approach.

With reference to the definitions provided under State Environmental Planning Policy Number 44 – Koala habitat protection, the study area is not considered to provide either Potential or Core Koala habitat. As such, a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of either bridge Proposal.

Recommendations have been presented to ensure that the activities associated with the Proposal are undertaken in an ecologically sustainable manner, thereby minimising the impact of the works on any features of state conservation value.

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Photographic record of the study area.

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1. Introduction.

At the request of the New South Wales (NSW) Roads and Traffic Authority (RTA), a vascular flora and vertebrate fauna study of the lands that occur within, and in close proximity to, those sections of the Princes Highway that are located at both Lemon Tree and Termeil Creek Bridges, south of Lake Tabourie, NSW, has been undertaken. The survey has been conducted as the RTA is proposing to replace these two bridges as they are considered to be too narrow, poorly aligned and at the end of their design life. In addition both bridges exhibit major spalling, cracking and erosion. Termeil Creek Bridge is also subject to severe alkali aggregate reaction attack on all concrete piers. The proposed construction is part of the RTA's commitment to improving safety on NSW roads.

It is noted the works associated with the Proposal are to include:

- The establishment of a site compound/stockpile at both Lemon Tree and Termeil Creeks;
- The realignment of the bridge approaches;
- The replacement of the existing bridges;
- The establishment of the bridge piers outside of the creek channels;
- The removal of vegetation and the undertaking of cut/fill works;
- The establishment of spill/retention basins within the road reserve;
- The restoration of the existing creeks post-construction; and
- The relocation of utilities as required.

For the purposes of this investigation, unless a specific portion of the survey site is referred to, the lands that occur within and adjacent to (for a distance of 20 metres [m]) the Proposal will be referred to as the study area, whilst the study region will include the surrounding lands for a distance of up to 10 kilometres (km). When referring to the Proposal, this is considered to include all works associated with the projects' construction and operation.

Based on a worse case scenario, at Termeil Creek, it is likely that the Proposal would result in the removal and disturbance (including edge effects and changed microhabitats) of around 0.42 hectares (ha) of bushland. At Lemon Tree Creek, given the extent of clearing that has already been undertaken at this location, the works would only require the removal of a linear strip of vegetation that occurs immediately north of the highway. Where present, this vegetation strip is approximately 100m long and 2m wide.

For reference, the two study areas surveyed are identified in Figure 1, whilst Figures 2 and 3 provide and indication of the extent of works proposed at each creek crossing.

The assessment of possible impacts associated with the undertaking of the Proposal is based on a field survey of the study areas, a literature review of previous studies undertaken in both the region and the Shoalhaven City LGA, the consultation of standard databases and the consideration of the objectives of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*), the New South Wales *Environmental Planning and Assessment Act 1979*, NSW *National Parks and Wildlife Act 1974*, NSW *Threatened Species Conservation Act 1995* (*TSC Act*), and any relevant State Environmental Planning Policies (SEPP) (e.g. SEPP 44 – Koala habitat protection).

It is noted that the current investigation builds on the findings of a previous study undertaken at the two bridge sites by LesryK Environmental Consultants during December 2004. During the investigations conducted at this time, a range of species-specific survey methods were employed including:

- The direct observation of any fauna species within, or adjacent to, each of the proposed works sites;
- The identification of all plants within the area of likely disturbance, including both direct and indirect impacts;
- The identification of the structure of those vegetation communities and fauna habitats present;
- Diurnal and nocturnal call identification of fauna species with all calls being identified in the field;

- Spotlighting for nocturnal fauna species;
- Echolocation detection targeting insectivorous bats (microchiropterans);
- Call playbacks targeting threatened owls and mammals;
- The identification of any indirect evidence such as tracks/scratchings that would suggest the presence of any fauna species; and
- Targeted searches for those species of state and national conservation concern, or their likely habitat areas, that were identified during the literature review stage of the project.

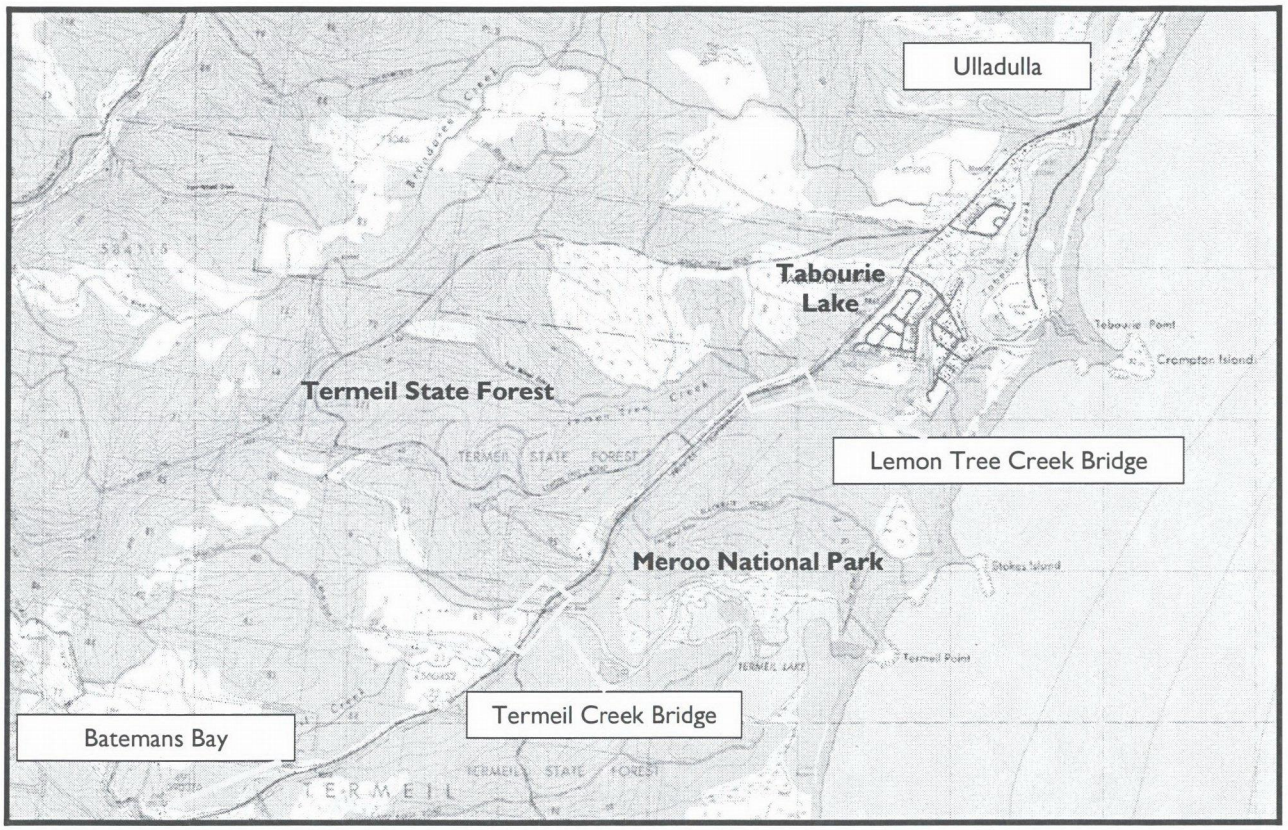


Figure 1. Study areas and location.

Source:
Tabourie 1:25,000 topographic map
(Not to scale)

⇧
NORTH

Through use of these survey methods, a total of 158 native plants and 59 animals had been recorded, of which the Yellow-bellied Glider (*Petaurus australis*) is listed under the *TSC Act*.

It is also noted that, during the previous study, the following vegetation communities were identified:

- Moist Tall Open Forest; and
- Swamp Forest (Sydney Coastal Estuary Swamp Forest Complex) (this being an Endangered Ecological Community [EEC]).

Given the results of the previous field investigations combined with the lack of any modification to those habitats detected at that time, it was not considered necessary to conduct any additional nocturnal work or employ any other species specific methods to identify those native animals present. The results obtained during the previous field investigation were considered comprehensive, the species recorded at that time considered to still be present within, or in the vicinity of, the study areas.

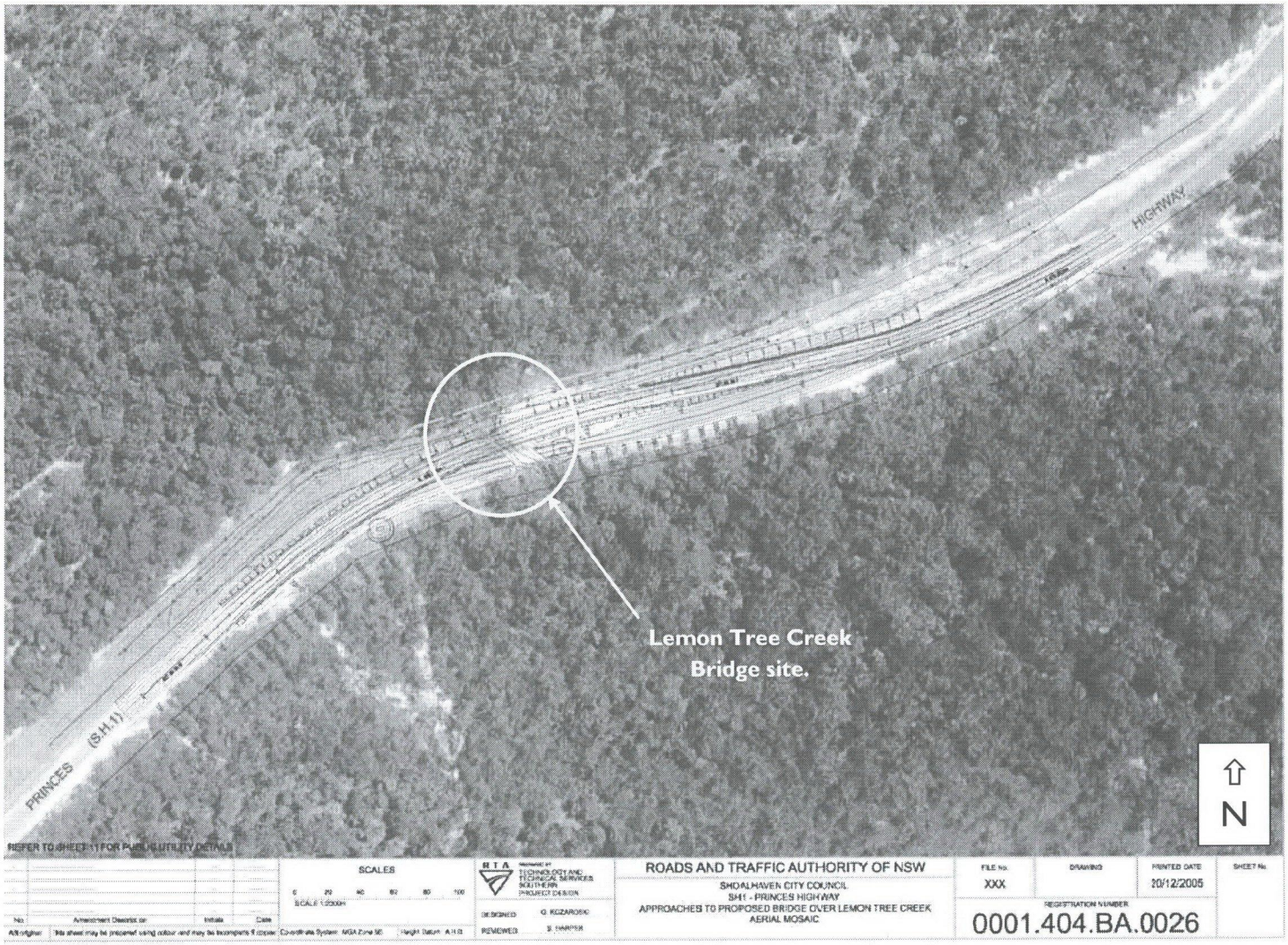


Figure 2. Extent of works proposed at Lemon Tree Creek.

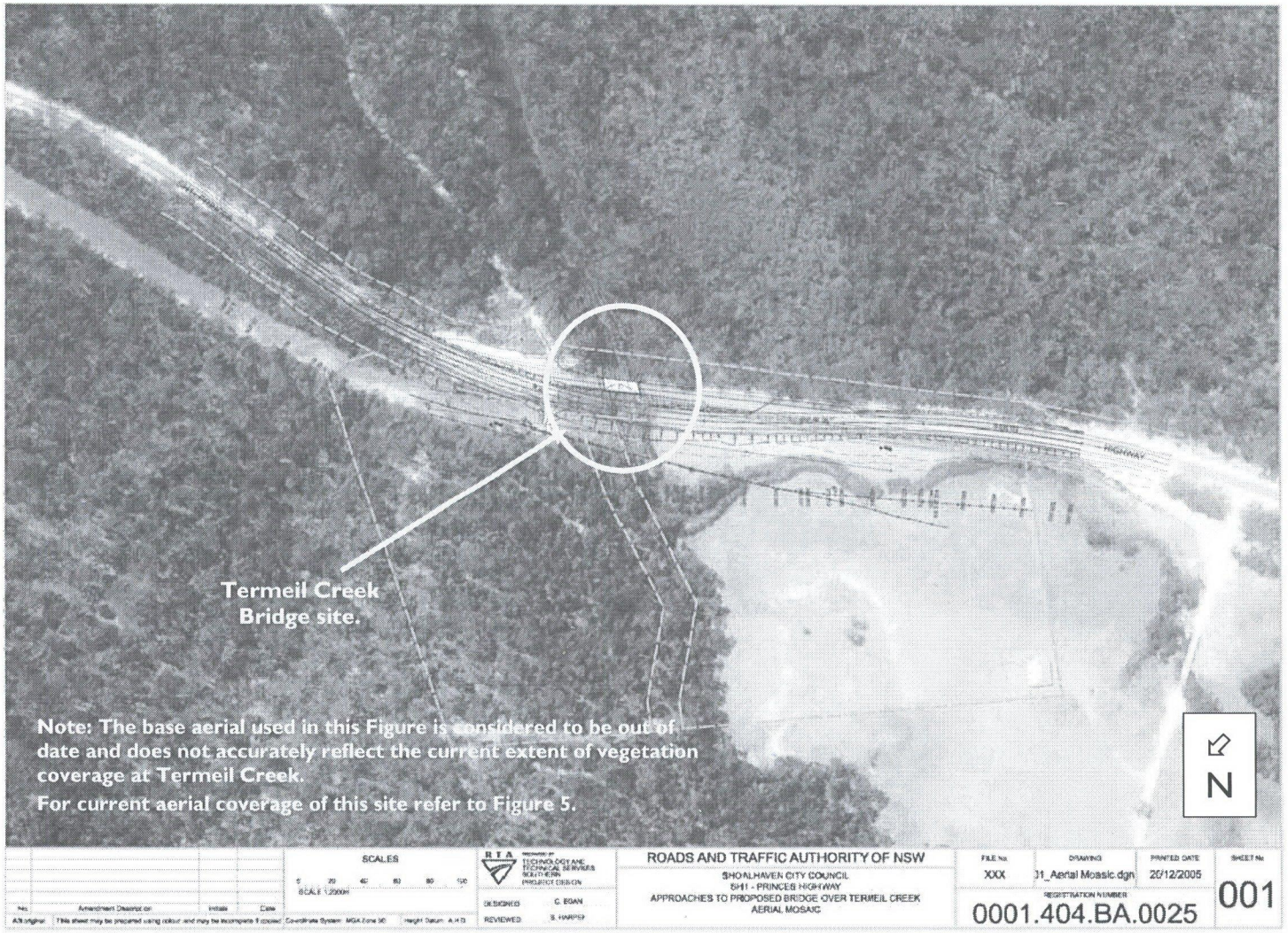


Figure 3. Extent of works proposed at Termeil Creek.

As such, giving consideration to the scope of each of the bridge proposals, these being developed with reference made to the recommendations presented in the ecological constraints report, it was not considered that the undertaking of any additional species specific fauna survey methods was necessary.

Given the ephemeral and cryptic nature of some flora species known to occur in the vicinity of the study areas, and in light of changes to listings of EEC's on the *TSC Act*, it was considered prudent to conduct a flora survey that would encompass these aspects.

As the current study draws on a large percentage of information presented in the initial constraints analysis report, it is recommended that the reader familiarise themselves with this initial document. For the purpose of the current study, unless necessary for reference, it was not considered necessary to repeat a percentage of information provided in the initial document.

2. Environmental setting.

The areas surveyed during the current investigation are located within the Shoalhaven City Local Government Area, these two sites occurring approximately 10km south of the township of Ulladulla, NSW.

The study areas both form part of the Princes Highway, Lemon Tree and Termeil Creek Bridges being around 1 and 3 km's south of the township of Lake Tabourie, respectively. As noted, the proposed works would include the replacement of both bridges, as well as minor alterations to their approaches.

A network of conservation reserves is the dominant land use that occurs within the vicinity of the study area, though some farming properties are also present particularly north west of Termeil Creek. In regards to those farms present, the dominant agricultural activity is livestock grazing (including horses and cattle). As a result of past road works, the establishment of pastures and transmission easements and the creation of a Department of Environment and Climate Change maintained rest stop, some portions of each of the study areas have been cleared of all native vegetation.

The study areas occur within a region that is characterised by gently rolling coastal foothills and restricted coastal plains. Generally, elevations within the areas surveyed range from 10 to 50m above sea level, whilst slopes are less than 10%.

Both Lemon Tree and Termeil Creeks drain in an easterly direction, eventually discharging into Tabourie and Termeil Lakes respectively. In regards to these drainage lines, at the time of the field investigation, Termeil Creek was flowing and appeared to be tidally influenced. The Termeil Lake Wetlands occur downstream of Termeil Creek Bridge, these wetlands being listed under State Environmental Planning Policy (SEPP) Number 14 [Coastal Wetlands]. Whilst most of the SEPP 14 Wetlands occur around 500m downstream of Termeil Creek Bridge, one, No. 267, is located approximately 150m south to south east of this site.

During the field investigation Lemon Tree Creek was dry and only consisted of several small pools.

The major surface geologies of the northern section of the study area are Permian sandstone, siltstone and conglomerates of the Shoalhaven Group, and in the southern section, Ordovician siltstone, claystone, sandstone, quartzite and chert. The Permian sediments are all relatively weak, easily eroded rocks that have formed the characteristic rolling countryside of the northern area, while the more resistant low-grade metamorphosed Ordovician sediments form the steeper countryside in the East Lynne area (Forestry Commission NSW 1983).

All of the soils in the study area consist of gravely brown and grey-brown soils and massive earths derived from the Permian and Ordovician sediments. These soils tend to be generally poor in nutrients with good drainage characteristics, and support tall forest when present in sufficient depth. Susceptibility of these soils to erosion by concentrated water flow is moderate (Forestry Commission NSW 1983).

Yearly average rainfall and temperature information is taken from the Tabourie 1:25,000 map sheet (8927-II-S). The district has a summer temperature range between 15°C and 25°C, and winter temperature range of 7°C to 18°C. Average annual rainfall is 1266 millimetres (mm). Rainfall distribution is concentrated in the winter months.

Conservation reserves that occur in the vicinity of the study area include Meroo, Budawang and Morton National Parks. These national parks cover areas of 3644, 23787 and 191260ha respectively. A network of State Forests is also present, these including Termeil, Clyde, Kiola, Flat Rock, Yadboro, North Brooman and South Brooman State Forests. These cover areas of 703, 3604, 175, 4888, 10768, 3643 and 5941ha respectively.

3. Literature review and field guides.

Prior to undertaking any fieldwork, previous studies conducted in the region and known databases were consulted to identify the diversity of flora and fauna species known for, or potentially occurring in, the study region. The identification of these native species within this part of the Shoalhaven City LGA, particularly those listed under the Schedules to the *EPBC* and *TSC Acts*, thereby permits the tailoring of the field survey to the detection of these animals and plants, or their necessary vegetation communities and habitat types. By identifying likely species, the most appropriate species-specific survey techniques may be selected should their associated vegetation communities/fauna habitats be present. The undertaking of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any plants and animals that are of regional, state or national conservation concern.

The studies and reports referred to include:

- NSW State Forest's Management Plan for the Batemans Bay Management Area (Forestry Commission of NSW 1983);
- A flora and fauna constraints analysis prepared for the two study areas (LesryK Environmental Consultants 2004);
- A fauna assessment undertaken of the Princes Highway between Lemon Tree Creek and East Lynne (LesryK Environmental Consultants 1996);
- A botanical survey of the Princes Highway south of Lake Tabourie (Landscope Environmental Consultants 1996);
- Shoalhaven City Council's State of the Environment Report (Shoalhaven City Council 2003);
- The Register of the National Estate (Australian Heritage Commission 2007);
- The Department of Environment and Water Resources (DEW) Online Database (DEW 2007);
- The Department of Environment and Climate Change's (DECC) Atlas of NSW Wildlife (DECC 2007);
- The Australian Museum database (Australian Museum 2007);
- The Southern Comprehensive Resource Assessment (CRA) vegetation report (Thomas *et al.* 2000);
- A report on the vegetation of south-eastern NSW (Tindall *et al.* 2005); and
- A state-wide classification of vegetation in NSW (Keith 2004).

Other reports and documents referred to are provided within the bibliography section of this report.

When accessing the Register of the National Estate, the search area specified was the Shoalhaven City LGA. For the DEW and DECC databases the search area specified was 10km^2 centred on the study areas. The search area specified when consulting the Australian Museum database was Termeil State Forest.

All these databases and reports were reviewed and drawn upon where relevant. Particular attention was paid to identifying records of species listed (or currently being considered for listing) under the Schedules of the *EPBC* and *TSC Acts*, animals, plants and vegetation communities that have been recorded in the region and may occur within, or in the vicinity of, the study areas.

Field guides and standard texts used were:

- Harden (1992, 1993, 2000 and 2002) – for the identification of plants;
- Cogger (2000) – reptiles and frogs;
- Simpson and Day (1999) – birds;
- Churchill (1999) – bats;
- Strahan (1995) – mammals; and
- Triggs (1996) – identification of scats, tracks and markings.

The naming of those species recorded or known for the region follows the nomenclature presented in these texts or as described on the Schedules to the *EPBC* and *TSC Acts*.

The classification of vegetation communities found in the study area is described according to Specht (1981).

The conservation significance of those plants, animals and vegetation communities recorded is made with reference to:

- The *EPBC* and *TSC Acts*;
- Shoalhaven City Council's State of the Environment Report (2003);
- The publication of *Rare Or Threatened Australian Plants (ROTAP)* (Briggs and Leigh 1996); and
- The NSW State Forest's Management Plan for the Batemans Bay Management Area (Forestry Commission of NSW 1983).

Through consultation of both the Australian Heritage Commission's Australian Heritage Database and NSW Heritage Office Online Heritage Databases, it was identified that there are no items listed as having national or state heritage significance within the study areas (Australian Heritage Commission 2007, NSW Heritage Office 2007).

4. Results of the literature review.

Through the consultation of the DEW and DECC databases, and Shoalhaven City Council's State of the Environment Report, it was identified that three plants of conservation significance have been previously recorded within the study region, these being the:

- Leafless Tongue Orchid (*Cryptostylis hunteriana*);
- East Lynne Orchid (*Genoplesium vernale*); and
- Tangled Bedstraw (*Gallium australe*).

The Leafless Tongue Orchid is a saprophyte that occurs sporadically in swamp-heath on sandy soils, chiefly in coastal districts (DECC 2007b). This species is listed as vulnerable under the Schedules of the *EPBC* and *TSC Acts*. It has been recorded at three locations in Meroo National Park (Termeil State Forest) during 2001 and 2003 (DECC 2007a).

The East Lynne Orchid is restricted to the Batemans Bay to Jervis Bay area where it occurs in sclerophyll woodlands and forest on shallow, well-drained soils with low fertility (National Parks and Wildlife Service [NPWS] 2002). This species is also listed as vulnerable under the Schedules of the *EPBC* and *TSC Acts*. It has been recorded near the Princes Highway at East Lynne to the south of the two study areas in 1998 and Yadboro State Forest during 2005 (DECC 2007b).

Tangled Bedstraw is an inconspicuous herb that until recently was thought to be extinct in NSW. Whilst this is the case, a number of records of this species have been made in recent years south of Port Macquarie. It has been recorded in a range of habitats in NSW including a valley floor, alluvial soil beside a creek, heathland in a rocky gully, and the top of an escarpment above a creek (DECC 2007b).

This species is listed as vulnerable under the *TSC Act*. Tangled Bedstraw has been recorded within Meroo National Park near Termeil Lake in 2003 (DECC 2007a).

Twenty seven (27) other threatened flora species are known from the Shoalhaven City LGA. The following species are those considered to have suitable habitat in the study region though they have not been recorded within this area as yet:

- The Thick-lip Spider Orchid (*Caladenia tessealatis*). This species is generally found in grassy, sclerophyll woodland on clay loam or sandy soils. It has been recorded at nearby Burrill Lake and Jervis Bay (DECC 2007) and is listed as vulnerable under the Schedules of the *EPBC* and *TSC Acts*; and
- The Underground Orchid (*Rhizanthella slateri*). This orchid is a rarely encountered, subterranean saprophyte that flowers between October and November. It has been recorded near Nowra (DECC 2007) and is listed as vulnerable under the *TSC Act*.

Targeted surveys for each of the above mentioned threatened plants, or their necessary habitats, were undertaken during the field investigations.

Thirteen EECs that are listed by the *EPBC* and/or *TSC Acts* are known to occur within, or in the vicinity of, the Shoalhaven City LGA, these being:

- Robertson Basalt Tall Open Forest;
- Robertson Rainforest;
- Littoral Rainforest;
- River-flat eucalypt forest on coastal floodplains;
- Swamp Oak Floodplain Forest;
- Swamp Sclerophyll Forest;
- Coastal Saltmarsh;
- Freshwater wetlands;
- Milton-Ulladulla Subtropical Rainforest;
- Illawarra Lowlands Grassy Woodlands;
- Illawarra Subtropical Rainforest;
- Montane Peatlands and Swamps; and
- Natural Temperate Grassland.

Of these EEC's, Littoral Rainforest, River-flat eucalypt forest, Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest, Coastal Saltmarsh, Freshwater wetlands and Milton-Ulladulla Subtropical Rainforest are known to occur in the Jervis CMA sub-region, in which the subject site is located (DECC 2007).

Fauna surveys and compilation lists prepared for the region have identified 27 native mammals, 132 native birds, 5 reptiles and 13 frogs (Appendix 2). In addition to these, a number of introduced animals have also been recorded (Appendix 2).

Of those native species previously recorded, 26 are listed, or nominated for listing under the Schedules to the *EPBC* and/or *TSC Acts* (Appendix 3). Whilst it is acknowledged that these species have been previously recorded within the study region, given the lack of their necessary habitat requirements (e.g. caves, ocean beaches and estuarine environments) a number of these animals are not considered to be present within the study area. Based on the author's knowledge of the diversity of fauna habitats present within the study area, combined with a review of standard geological texts, there is the potential that 17 of those state and /or nationally listed threatened species previously recorded in the study region may be present within, or in the vicinity of, the study area (Table 1). As such, targeted surveys for these species, or their necessary habitats, were undertaken during the field investigations.

For reference, the main habitat requirements of the 26 threatened species previously recorded in either the study area or surrounding region, and a consideration of the likely impacts of the Proposal on the local viability of these species, has been provided in Appendix 3. When assessing the extent of likely impact of the Proposal on the local and regional presence of those species listed in Appendix 3, including their movement patterns and interbreeding needs, the assessment criteria provided under

Section 5A of the NSW *Environmental Planning and Assessment Act 1979* have been referred to and drawn upon.

In relation to a number of the threatened species listed in Appendix 3, though previously recorded within the study region, it is noted that these animals have specific habitat requirement (e.g. caves, ocean beaches and estuarine environments) no components of which are present within the study area. As such, no locally viable populations of these species would be present within, or in close proximity to, the limits of the study area. Therefore, as no locally viable populations of these animals would be present, it is not considered that the undertaking of the Proposal would have an adverse impact on any of these species, their populations or habitats.

Table 1. Threatened fauna species previously recorded in either the study are or surrounding region.

Key
EPBC Act M – Listed as migratory under the *EPBC Act.*
* - Detected by the author's in the study area.

Common Name	Scientific Name	Legislation
MAMMALS		
Yellow-bellied Glider *	*Petaurus australis*	*TSC Act*
Grey-headed Flying Fox	*Pteropus poliocephalus*	*EPBC* and *TSC Acts*
Large-footed Myotis	*Myotis adversus*	*TSC Act*
Greater Broad-nosed Bat	*Scoteanax rueppellii*	*TSC Act*
Eastern Cave Bat	*Vespadelus troughtoni*	*TSC Act*
Eastern Freetail Bat	*Mormopterus norfolkensis*	*TSC Act*
BIRDS		
Great Egret	*Ardea alba*	*EPBC Act*
Osprey	*Pandion haliaetus*	*EPBC* and *TSC Acts*
White-bellied Sea-eagle	*Haliaeetus leucogaster*	*EPBC Act*
Gang-Gang Cockatoo	*Callocephalon fimbriatum*	*TSC Act*
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	*TSC Act*
Powerful Owl	*Ninox strenua*	*TSC Act*
Barking Owl	*Ninox connivens*	*TSC Act*
Sooty Owl	*Tyto tenebricosa*	*TSC Act*
Masked Owl	*Tyto novaehollandiae*	*TSC Act*
Rufous Fantail *	*Rhipidura rufifrons*	*EPBC Act* M
Black-faced Monarch *	*Monarcha melanopsis*	*EPBC Act* M

4.1. Recovery Plans.

The NPWS has prepared, or is in the process of preparing, recovery plans for the Yellow-bellied Glider (*Petaurus australis*), Little Tern (*Sterna albifrons*), Barking Owl (*Ninox connivens*) and Large forest owls, these species having been previously recorded within the Shoalhaven City LGA (Appendix 2). As part of these recovery plans certain objectives have been established. Given the minimal extent, and type, of habitat to be modified as part of the Proposal, it is not considered that the further development of the study area would breach any of these objectives such that there would be a significant impact on these species or their necessary habitat.

5. Field survey methods.

A survey of the study areas was undertaken by Deryk Engel $_{(B.Env.Sc.HONS)}$, Paul Burcher $_{(B.App.\ Sc.)}$ and Stephen Bloomfield $_{(B.App.\ Sc.)}$ on the 13th of January 2006. The weather conditions experienced during the investigation were overcast skies (full cloud cover), mild temperatures (21^{0}C) and still conditions with intermittent showers.

As noted, the current study follows on / builds upon a previous investigation at the study area conducted by LesryK Environmental Consultants during which time a total of fourteen (14) person hours of active investigation had been accumulated.

Generally, given the limited size of each of the study areas, and the structure of those vegetation communities and fauna habitats present, no survey limitations were encountered during the field surveys. The field investigation involved undertaking foot traverses across all portions of each study area, during which time the diversity of plants and animals present were recorded. When conducting the foot surveys, the 'Random Meander Method' (as per Cropper 1993) was employed. This method is suitable for covering large areas and for locating any rare species (and their associated vegetation communities/habitat types) that may occur within a survey site. The method involves walking randomly across a particular survey area while sampling all of the various habitat types and vegetation communities present until no new species have been recorded for at least thirty minutes.

The survey methods employed during the current field survey were:

- The direct observation of any fauna species within, or adjacent to, each of the proposed works sites;
- The identification of all plants within the area of likely disturbance, including both direct and indirect impacts;
- The identification of the structure of those vegetation communities and fauna habitats present;
- The identification and marking of any habitat trees thought to be used by native fauna;
- Diurnal call identification of fauna species with all calls being identified in the field;
- The identification of any indirect evidence such as tracks/scratchings that would suggest the presence of any fauna species; and
- Targeted searches for those species of state and national conservation concern, or their likely habitat areas, that were identified during the literature review stage of the project.

For the purposes of this investigation, terrestrial animals are taken to mean all native vertebrate species. As such, terrestrial animals would include birds (including some migratory species), ground traversing, arboreal and flying mammals, reptiles and frogs. As such, this report does not consider the impact that any new bridge proposal would have on fish species.

The purpose of the field surveys was to locate within the areas surveyed any plants, animals or vegetation communities that are of state and/or national conservation significance.

By the completion of the field surveys, approximately six (6) person hours of active investigation had been accumulated. Given the size and structure of the study area, this length of time is considered more than adequate when endeavouring to identify the dominant vegetation communities, fauna habitats, plant and animal species present within, and adjacent to, both of the survey areas.

6. Flora results.

6.1. Vegetation Communities.

Two vegetation communities were identified within or adjacent to the subject sites, these being:

- Spotted Gum – Blue Gum – Blackbutt Open Forest; and
- Swamp Oak – Paperbark Open Scrub.

The structure and major species occurring in the communities recorded are described below. The areas of construction for the new bridges and approaches have been degraded by clearing for a power transmission easement, weed invasion and rubbish dumping. Adjacent habitats, beyond the transmission easement and on the eastern side of the highway are in near pristine condition. Weed species are generally more common close to the existing highway and in cleared or disturbed areas.

The tree species occurring in the Spotted Gum – Blue Gum – Blackbutt Open Forest community vary according to several factors, including variation in soil type as a result of localised exposures of

geology, slope, aspect and soil moisture conditions. The species composition of the understorey vegetation of this community also varies, with fire history the most likely predominant influence.

The Swamp Oak – Paperbark Open Scrub occurs as a result of the tidal nature of Termeil Creek.

6.1.1. Spotted Gum – Blue Gum – Blackbutt Open Forest.

Occurrence:
Throughout each of the study areas except in the band along Termeil Creek (refer to Figures 4 and 5).

Structure:
Trees to 30m in height with a medium density canopy. The shrub layer varies in density and height, depending on the species composition. The height of these shrubs ranges between 0.5m and 2m. The groundcover is generally sparse except near Lemon Tree Creek where vines and climbers cover the ground.

Common Species:
Trees:
Spotted Gum (*Corymbia maculata*), Blackbutt (*Eucalyptus pilularis*) and Sydney Blue Gum/Bangalay hybrid (*E. saligna*/*E. botryoides*) are common. White Stringybark (*Eucalyptus globoidea*) and Red Bloodwood (*Corymbia gummifera*) occur in association with the drier soils that occur further from the creek lines. Black She-oak (*Allocasuarina littoralis*), Cheese Tree (*Glochidion ferdinandii*) and Blueberry Ash (*Elaeocarpus reticulatus*) are common small trees, with Black Wattle (*Callicoma serratifolia*) common closer to the creeks.

Shrubs:
Heath-myrtle (*Babingtonia pluriflora*), Lance Beard-heath (*Leucopogon lanceolatus*), Sydney Golden Wattle (*Acacia longifolia* var. *longifolia*), Black Wattle (*Acacia mearnsii*), Sweet-scented Wattle (*Acacia suaveolens*), Tick Bush (*Kunzea ambigua*), Lemon-scented Tea-tree (*Leptospermum polygalifolium* ssp. *Polygalifolium*), Gorse Bitter Pea (*Daviesia ulicifolia*), Hairpin Banksia (*Banksia spinulosa* var. *spinulosa*), Bush Pea (*Pultenaea flexilis*), Narrow-leaf Geebung (*Persoonia linearis*) and Blackthorn (*Bursaria spinosa*).

Groundcovers:
White Root (*Pratia purpurascens*), Grey Guinea Flower (*Hibbertia obtusifolia*), Bracken Fern (*Pteridium esculentum*), Raspwort (*Gonocarpus teucrioides*), Common Maidenhair Fern (*Adiantum aethiopicum*), the grass (*Entolasia stricta*), Lilac Lily (*Schelhammera undulata*), Flax Lily (*Dianella revoluta* var. *revolute*), Bladey Grass (*Imperata cylindrica*), Native Violet (*Viola hederacea*) and Saw-sedge (*Gahnia clarkei*).

Climbers:
Water Vine (*Cissus hypoglauca*), Snake Vine (*Stephania japonica*), Golden Guinea Flower (*Hibbertia scandens*), Twining Guinea Flower (*Hibbertia dentata*) and Old Man's Beard (*Clematis aristata*).

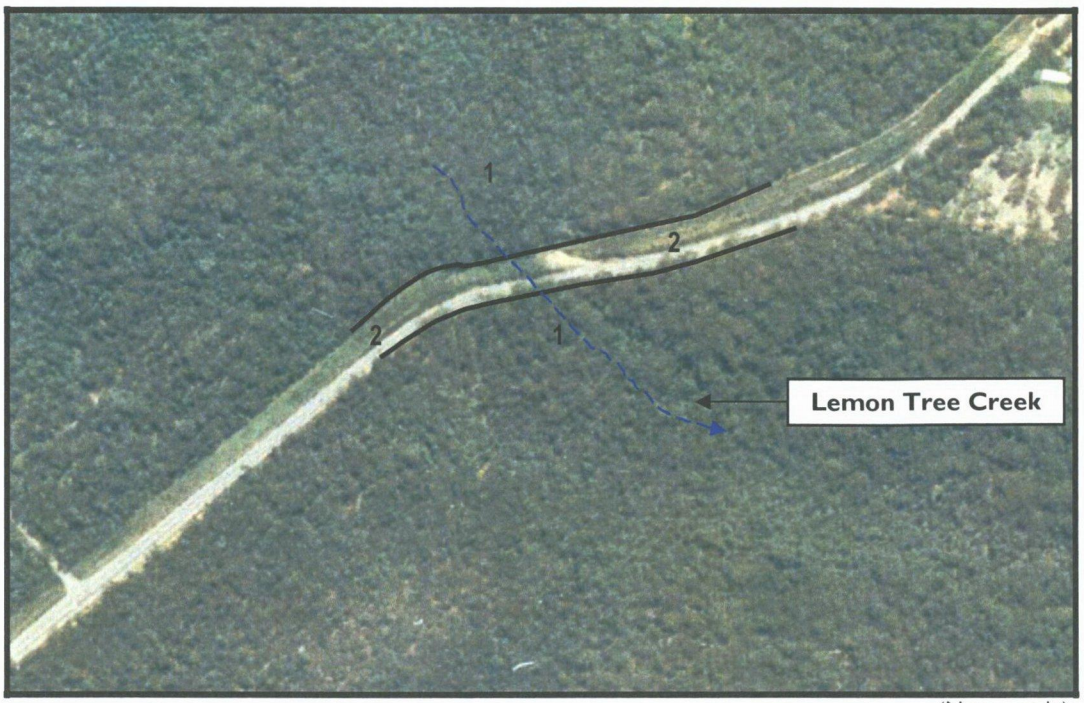
6.1.2. Swamp Oak – Paperbark Open Scrub.

Occurrence:
In a very narrow band on moderately saline-influenced soils along Termeil Creek (refer to Figure 5).

Structure:
Trees and shrubs to 10m high with a moderately dense canopy. Sparse to dense groundcover to 1m.

Common Species:
Trees:
Swamp She-oak (*Casuarina glauca*) and Paperbark (*Melaleuca ericifolia*).

Groundcovers:
Saw Sedge (*Gahnia clarkei*), Couch (*Cynodon dactylon*), Common Maidenhair Fern (*Adiantum aethiopicum*) and introduced grasses and herbs.

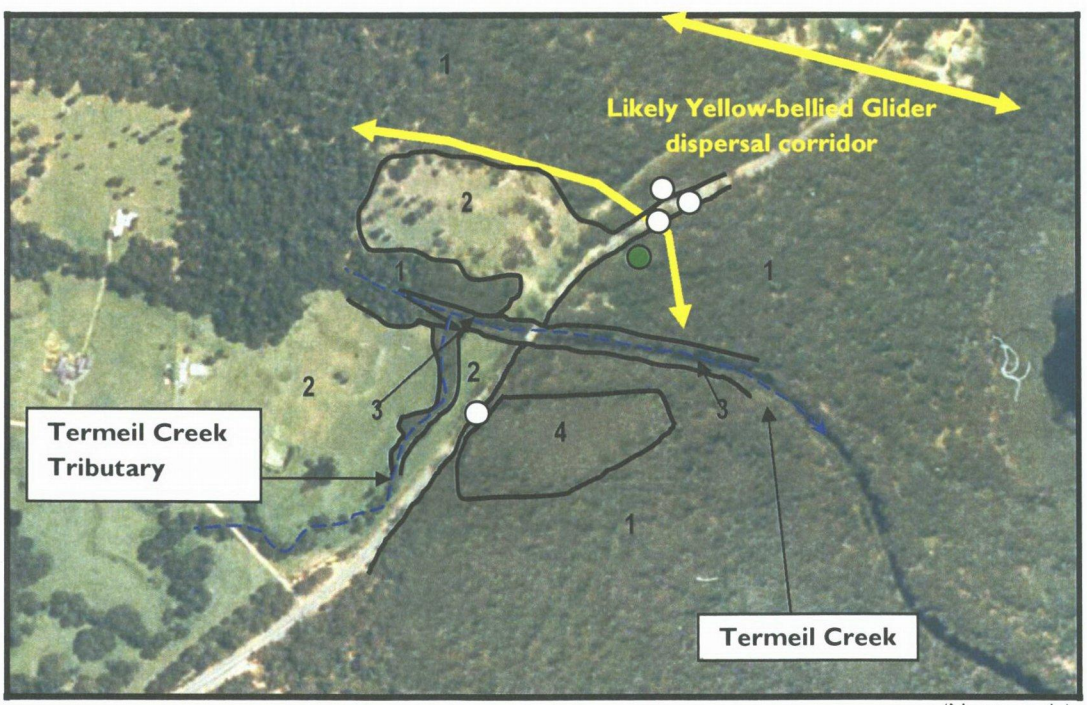


(Not to scale)

Figure 4. Lemon Tree Creek sampling sites.

Key				
	1	Spotted Gum – Blue Gum – Blackbutt Open Forest (Eucalypt woodland).	3	Swamp Oak – Paperbark Open Scrub (Melaleuca woodland).
	2	Disturbed environment.	4	SEPP 14 Wetland.
	●	Location of previously identified Yellow-bellied Glider feed tree.	○	Location of habitat trees.

North



(Not to scale)

Figure 5. Termeil Creek sampling sites.

6.2. Significance of the vegetation in the study area.

Mapping prepared by Shoalhaven City Council (http://gis.shoalhaven.nsw.gov.au/soemaps) indicates that the vegetation present along Lemon Tree Creek is "Blue Gum Forest", whilst that upslope is mapped as "Blackbutt Forest". At Termeil Creek, the riparian area is mapped as Blue Gum Forest, while further upslope it is mapped as "Spotted Gum Forest".

Downstream along the edges of the Termeil Creek, "Paperbark Forest/Shrubland" is mapped as occurring. "Paperbark Forest/Shrubland" conforms to an intergrade of the *TSC Act* endangered ecological communities "*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*" and "*Swamp Sclerophyll Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*". To the south of this, more Swamp Sclerophyll Forest is considered to be present, though this has not been confirmed by ground truthing. Several SEPP 14 Wetlands occur in the Termeil Creek estuary and surrounding catchments just downstream from the existing bridge site. One of these (No. 267) is a sedge swamp located about 150m south to south east of the highway. Given the scale of works, the distances between the two bridges and the stands of vegetation, and the use of standard erosion and sediment control measures, it is considered unlikely that the Proposal would affect either of these communities.

At a regional scale, vegetation mapping and classification has been undertaken for the Southern Comprehensive Resource Assessment [Southern CRA] area (Thomas *et al.* 2000) as part of the regional forests agreements process and an area covering the Greater Sydney, Illawarra and Southern Highland regions (Tindall *et al.* 2005) on behalf of the NSW Departments of Planning and Environment & Conservation. The Southern CRA study area extends from Oberon Shire in the north to the Victorian border in the south, and west from the coast to Holbrook Shire, excluding the Eden CRA Region and the ACT. The Greater Sydney, Illawarra and Southern Highlands study area extends from the Penrith and Sydney 1:100 000 map sheets in the north, to the Batemans Bay and Araluen 1:100 000 map sheets in the south.

At a state scale, a detailed overview of the vegetation of NSW has recently been completed by Keith (2004). This document brought together information regarding the vegetation of NSW collected over the recent past (such as the regional surveys cited above), as well as historical information.

At a regional scale, the Spotted Gum - Blue Gum – Blackbutt Open Forest at Lemon Tree Creek is mapped as "South Coast Swamp Forest Complex - *Casuarina glauca*" near the creek and "Northern Foothills Moist Shrub Forest" upslope to the north (Thomas *et al.* 2000). At Termeil Creek Thomas *et al.* mapped the open forest as Lowland Dry Shrub Forest near the creek with Northern Foothills Moist Shrub Forest upslope (Thomas *et al.* 2000). It is considered that the Spotted Gum – Blue Gum – Blackbutt Open Forest at both sites conforms to Northern Foothills Moist Shrub Forest as described by Thomas *et al.* (Thomas *et al.* 2000).

At both sites all vegetation was mapped as "Clyde Gull Open Forest" by Tindall *et al.* (Tindall *et al.* 2005), though it conforms more closely to their "Southern Lowland Wet Forest" classification.

At a state scale the Spotted Gum – Blue Gum – Blackbutt Open Forest is part of the "Southern Lowland Wet Sclerophyll Forests" vegetation class (Keith 2004). Most of its original distribution in the region is currently included within state forests and conservation reserves (Tindall *et al.* 2005). It does not conform to any EEC listed, or currently being considered for listing, on the *EPBC* or *TSC Acts*.

Thomas *et al.* (Thomas *et al.* 2000) mapped the Swamp Oak – Paperbark Open Scrub at Termeil Creek as "South Coast Swamp Forest Complex - *Casuarina glauca*", though it better conforms to their "Ecotonal Coastal Swamp Forest" classification. Following Tindall *et al.* (Tindall *et. al.* 2005) it conforms to "Estuarine Creekflat Scrub". Estuarine Creekflat Scrub has a naturally restricted distribution, which has been reduced by coastal development (Tindall *et al.* 2005). At a state scale, it belongs to the "Coastal Floodplain Wetlands" vegetation class (Keith 2004). It also conforms to an intergrade of "*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*" (hereafter referred to as "Swamp Oak Floodplain Forest") and "*Swamp Sclerophyll Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*" (hereafter referred to as "Swamp Sclerophyll Forest") listed as an EEC under the *TSC Act*.

Table 2 summarises the relationship of the subject site's vegetation to local, regional and state studies and the *TSC Act*.

Table 2. Site vegetation communities and local, regional and state equivalents.

Site Vegetation Community	Local (Shoalhaven City Council)	Regional (Thomas et *al.* 2000)	Regional (Tindall et *al.* 2005)	State (Keith 2004)	*TSC Act* EEC
Swamp Oak – Paperbark Scrub (Termeil Creek)	Paperbark Forest/Shrubland	Ecotonal Coastal Swamp Forest	Estuarine Creekflat Scrub	Coastal Floodplain Wetlands	Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest
Spotted Gum – Blue Gum – Blackbutt Open Forest (Termeil and Lemon Tree Creeks)	Blue Gum Forest Blackbutt Forest Spotted Gum Forest	Northern Foothills Moist Shrub Forest	Southern Lowland Wet Forest	Southern Lowland Wet Sclerophyll Forests	-

It is noted that, by the completion of the field survey, no species listed as threatened under the Schedules to the *EPBC* or *TSC Acts* were recorded within, or in close proximity to, the study area.

The Christmas Orchid (*Calanthe triplicata*) occurs on the shoulder of the road on the north-western approach to Termeil Creek Bridge. This species is regarded as regionally significant as it reaches its southern limit in the locality (NPWS 2005). Given its proximity to the proposed works, it is likely to be removed during construction. Therefore, the species should be translocated to another well-shaded, well-drained location within the road reserve away from the works. The species is readily grown in cultivation and can be propagated by division of its pseudobulbs (Wrigley and Fagg 1996). This orchid also has a shallow root system. Therefore, translocation is likely to be successful provided a suitable location is chosen.

6.3 Noxious weeds.

The only plant species listed on the *Noxious Weeds Act 1993* found in the study areas was Fireweed *Senecio madagascariensis*. The Act requires that "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."

A management plan for Fireweed has been developed by the Southern Tablelands and South Coast Noxious Weeds Committee (2003). It notes that a major method of spread of the seed of the species is the wind-tunnel effect created along high-speed roads such as the Princes Highway. The plan requires roadside easement and corridor managers [such as the RTA] to ensure adequate plant and equipment hygiene; that works operation are conduced in such a way to reduce Fireweed spread and the participation in cooperative management plans.

7. Fauna results.

7.1. Species recorded.

By the completion of the field surveys twenty-two (22) native birds had been recorded within the study area (Appendix 2). It is noted that no mammals, reptiles or frogs were observed during the current field investigation.

In regards to the detection of those native birds recorded:

- All were observed within, adjacent to, or flying over the study area, or identified from their distinct calls; and

- Two, the Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*), are listed as Migratory under the Schedules to the *EPBC Act*. For reference, habitat and life cycle descriptions of each of these birds are provided below.

Having been previously detected traversing through and feeding within the woodlands that occur to the east of Termeil Creek Bridge (LesryK Environmental Consultants 2004), it was considered appropriate that a precautionary approach be adopted for the Yellow-bellied Glider (*Petaurus australis*). For reference, the habitat and life cycle needs of this species has also been provided

7.1.1. Rufous Fantail (*Rhipidura rufifrons*).

The Rufous Fantail migrates south from north-eastern Queensland and New Guinea to breed within the southern states during the summer months (October to February) (Frith 1997). Generally this species inhabits rainforests, moist sclerophyll forests and vegetated riparian corridors along the east coast and ranges (Frith 1997, Chafer *et al.* 1999). This bird forages on a variety of insects that occur within the shrub layers of its preferred habitat type (Frith 1997).

The Rufous Fantail was observed within the Princes highway road corridor, north west of the existing Termeil Creek bridge. Given the suitable resources available within the surrounding environment and the extent of the works proposed, it is not considered that the Proposal would significantly reduce the extent of foraging habitat available to this species such that it would become locally displaced or extinct. As such, the Proposal is not considered to affect the local or regional viability of the Rufous Fantail, or any major areas of its necessary habitat. Whilst this is the case, to further consider the potential for the Proposal to have an adverse impact on the Rufous Fantail an assessment giving consideration to the Administrative Guidelines on Significance provided in association with the Commonwealth *EPBC Act* has been undertaken below (refer to Section 8.2.1).

7.1.2. Black-faced Monarch (*Monarcha melanopsis*).

The Black-faced Monarch prefers wet eucalypt forests and rainforest (Frith 1997). They nest in sheltered gullies or within rainforests, foraging within the middle storey layers (Frith 1997). This species migrates in March/April as far as New Guinea and returns during September (Frith 1997).

The Black-faced Monarch was identified from its distinct call, this being heard on the northern side of Lemon Tree Creek Bridge (west of the highway). Given the extent of suitable resources available to this species within the surrounding environment and the minimal extent of the works proposed, it is not considered that the Proposal would significantly reduce the extent of foraging habitat available to this species such that it would become locally displaced or extinct. As such, the Proposal is not considered to affect the local or regional viability of the Black-faced Monarch, or any major areas of its necessary habitat. Whilst this is the case, to further consider the potential for the Proposal to have an adverse impact on the Rufous Fantail an assessment giving consideration to the Administrative Guidelines on Significance provided in association with the Commonwealth *EPBC Act* has been undertaken below (refer to Section 8.2.1).

7.1.3. Yellow-bellied Glider (*Petaurus australis*).

The Yellow-bellied Glider is distributed from eastern Victoria through to central Queensland, with an isolated population occurring in northern Queensland (Russell 1980, Strahan 1983). Throughout these areas, this animal's distribution is patchy, the Yellow-bellied Glider being restricted to areas of tall mature eucalypts where suitable feed trees are available (Strahan 1983). A nocturnal species, the Yellow-bellied Glider sleeps during the day in large mature trees (Strahan 1992). This species is an exudivorous feeder, feeding predominantly on the sap that is obtained from incisions gnawed into the

trunks of eucalyptus trees (Goldingay 1989, Strahan 1992). Preferred feed trees include *Eucalyptus gummifera*, *E. maculata* and *E. piperita* with *E. saligna*, *E. viminalis* and *E. fastigata* also being utilised (Goldingay 1989, Goldingay and Kavanagh 1991, Goldingay and Kavanagh 1993). These food resources undergo seasonal variations in abundance, therefore the Yellow-bellied Glider will modify its home range to utilise other food resources including nectar, pollen and insect honeydew (Goldingay 1989, Van Dyck 1992).

The Yellow-bellied Glider is a highly mobile species, gliding or climbing through the forest canopy (Braithwaite 1983, Goldingay and Kavanagh 1991). Where the tree cover is of sufficient height and density to provide for unobstructed movement, glide distances can be quite considerable (in the order of 70 - 100m) (author's field notes, Engel and Fanning 1995, Goldingay 1989, Goldingay and Kavanagh 1991).

Based on the findings of the previous investigation conducted at the study area (LesryK Environmental Consultants 2004), due to the relatively close proximity of the tree canopy, a likely Yellow-bellied Glider fauna corridor was identified (Figure 5). Due to the canopy widths across the highway, this corridor is expected to provide for the dispersal and foraging needs of this species. No other corridors were identified within the areas surveyed, due to:

a) The extent of clearing and habitat fragmentation as a result of previous road works, clearing for the powerlines and/or farming practices; and
b) The low heights of those plants present (e.g. the Melaleuca woodland along Termeil Creek).

Glider groups are usually comprised of three to four individuals, often consisting of an adult breeding pair and several subadults (Goldingay and Kavanagh 1993). This group will inhabit an exclusive home range, the size of which is variable, with estimates from 20 to 85ha (Henry and Craig 1984, Craig 1985, Goldingay 1992, Goldingay and Kavanagh 1993, Goldingay *et al.* 2001, Lindenmayer 2002).

The Yellow-bellied Glider is threatened by habitat clearing and fragmentation, including the removal of hollow-bearing trees utilized for nesting, certain fire regimes which may isolate populations or affect food resources, and predation by feral animals such as foxes and cats (NPWS 1999).

The potential impacts associated with the undertaking of the Proposal at Termeil Creek on the viability of this species are considered in Section 8.2.2, this consideration drawing on the assessment criteria provided within Section 5A of the NSW *Environmental Planning and Assessment Act 1979*. Based on the outcomes of this assessment, it is considered that the undertaking of the proposed road works to the west of the existing creek crossing, within an area that is predominantly cleared of native vegetation, will not have a significant impact on the Yellow-bellied Glider, its population or habitat. Given the establishment of the highway at this site, it is not considered that any habitats important to the local occurrence of this species would be removed, and none of its likely fauna corridors or dispersal routes (as identified on Figure 5) would be fragmented or impacted upon. Even though the Yellow-bellied Glider is listed under the *TSC Act*, individuals that may be present within, and adjacent to, the study area are not considered to be adversely affected as a result of the Proposal proceeding as planned.

7.2. Habitat Trees.

Four eucalypts that would meet the life cycle requirements of native species were observed within the Termeil Creek survey area. These trees occur to the north (3 trees) and south (1 tree) of the existing bridge. The trees have been identified as "habitat trees" as they:

a) Are situated within an identified fauna corridor; or
b) Are over 20m in height and therefore provide gliders with suitable take off and landing perches; or
c) Provide east – west connectivity across the highway; or
d) Support hollows.

For reference, the approximate locations of these trees are provided on Figure 5, their exact locations being given below.

During the field investigation any trees identified that were thought to be utilised as habitat by native fauna were marked with flagging tape or spray-painted. Four trees potentially used as habitat were identified and marked, their locations being:

- Habitat tree 1 - Easting (E) - 261541, Northing (N) - 6073068;
- Habitat tree 2 - E - 261557, N - 6073073;
- Habitat tree 3 - E - 261551, N - 6073064; and
- Habitat tree 4 - E - 261337, N – 6072829.

Given the identified locations of these four trees, and through reference to those plans provided by the RTA (refer to Figure 3), it is not considered that any of these plants would be removed due to the undertaking of the Proposal. As such, the resources provided by these trees, particularly in relation to canopy and corridor connectivity, would not be adversely affected. As such, with the retention of these four trees, particularly the three that are located to the north of Termeil Creek in association with the expected Yellow-bellied Glider corridor, no habitat isolation or fragmentation would arise.

7.3. Habitat types available for native fauna species.

Four habitats types available for use by native species were observed within the study area, these being:

- A disturbed environment;
- Aquatic environment and riparian vegetation;
- Melaleuca woodland; and
- Eucalypt woodland.

Descriptions of the structure and therefore value of these habitat types for native species are provided below, along with an indication of their locations. For reference, the location of each of the habitat types recorded is also provided on Figures 4 and 5, it being recommended that the following descriptions be read in conjunction with a review of these figures and the photographic record provided. As mentioned, each of these habitats were detected during the initial investigation, no major alteration occurring to any of these subsequent to that study

7.3.1. Disturbed environment.

The disturbed environment incorporates those portions of each study area that have been previously cleared or disturbed. This habitat type includes the Princes Highway and its road verges, the cleared and regularly maintained power line easements, the grazing pastures and the DECC rest stop that occur in the vicinity of Termeil Creek. This habitat type is dominated by exotic grasses and weeds, the density of which is dependant upon the maintenance regimes imposed. Associated with this habitat type are strips of remnant vegetation, the width of which varies from 5 to 10m. Trees that are between 6 and 25m in height are present within these strips, none of which were noted to support hollows suitable for native species. In addition, an understorey is present, this being comprised of a medium to high density layer of native shrubs that are up to 5m in height. The groundcover within the remnant strips is composed of a high density layer of grasses, ferns, saplings and forbs that are to 1m in height, leaf litter, logs, some exposed rock and wind blown refuse being evident.

This habitat type is considered to be of little to no ecological value for native species and none would be adversely affected as a result of the Proposal. No native species would be dependant upon the resources present within the disturbed environment such that their removal or further disturbance would adversely affect the viability of a population of that species. As such, the further disturbance of this habitat type as part of the Proposal can proceed as planned without adversely affecting the overall biodiversity of either the study area or surrounding region.

PHOTOGRAPHIC RECORD OF STUDY AREA

Photo 1: Princes Highway at Lemon Tree Creek Bridge facing north.

Photo 2: Power line transmission easement on the north-western side of the Princes Highway at Lemon Tree Creek, facing north. Note cleared grassland and regenerating eucalypts.

Photo 3: Structure of eucalypt woodland present beyond the limits of Lemon Tree Creek.

Photo 4: Princes Highway at Termeil Bridge, looking south.

Photo 5: Cleared paddocks on western side of Princes Highway facing north, Termeil Creek and eucalypt woodland in the background.

Photo 6: Termeil Creek with riparian vegetation.

7.3.2. Aquatic environments.

Two aquatic environments were recorded during the field investigations, these being the brackish waters of Termeil Creek and the freshwaters of Lemon Tree Creek.

Termeil Creek is approximately 10m wide and supports flowing water that was up to 2m deep at the time of field investigations. Within this creek, numerous snags were observed, these being both emergent and submerged. The creek banks are earthen and in places up to 1m in height (particularly west of the existing creek crossing). West of the existing Termeil Creek crossing there is a 3m wide strip of riparian vegetation, this supporting eucalypt saplings and melaleuca shrubs that are between 3 and 5m in height.

None of the eucalypt saplings that are present on this side of the bridge support any obvious hollows. The groundcover at this location is composed of a medium to high density layer of native grasses and weeds, these being to 0.2m in height.

At the time of the field investigations, numerous fish were observed within Termeil Creek.

East of Termeil Creek Bridge, the riparian vegetation is characteristic of the surrounding eucalypt woodland (as described below).

Lemon Tree Creek is approximately 5m wide and 0.5m deep. It supports standing water with some sparse occurrences of reeds that are up to 1.5m in height, as well as obvious leaf litter and logs submerged in the water. The creek banks are earthen, around 1m in height and are either cleared or support riparian vegetation that is characteristic of the adjacent woodlands (as described below).

Due to the ongoing maintenance of the existing power line corridor, the vegetation lining both creek crossings has been regularly pruned and cleared.

In relation to the existing creek crossings, both are concrete structures of varying span widths. During the field investigation, no obvious roosting sites available for use by native fauna species were observed in association with either bridge structure.

Whilst offering some resources for native species, those components of the aquatic environments that occur within each study area are not unique to the study region, more pristine occurrences of this habitat type being present beyond the limits of each site. Giving consideration to the habitat requirements of those terrestrial animals recorded or potentially occurring, it is not expected that any would be reliant upon the portion of the aquatic environment that occurs within the study area, such that the disturbance of these sections would threaten the local viability of any species. In relation to this habitat type, it is noted that portions have been disturbed as a result of past land use practices, and the ongoing maintenance of the transmission line easement.

7.3.3. Melaleuca woodland.

This habitat type was only recorded at Termeil Creek, the Melaleuca woodland lining the banks of this drainage line. This fauna habitat type corresponds to that described within the botanical section of this report as Swamp Oak – Paperbark Open Scrub. The Melaleuca woodland is more developed to the east of the existing creek crossing, the stands to the west being impacted upon as a result of past farming practices. Within this woodland there is a medium density layer of native shrubs that are up to 5m in height, the density of which varies throughout the study area. The ground cover is dominated by ferns, native and exotic grasses and forbs that are to 1m in height, leaf litter and ground debris also being present. Portions of this habitat type have been previously burnt. Isolated trees are also present, particularly at the ecotone with the adjacent eucalypt woodland. Where present the trees are up to 30m in height, one or two of which support hollows that have a diameter of around 150mm.

Those portions of the Melaleuca woodland that are present within the study area are not considered to be of any major ecological value for any of the native species recorded or potentially occurring. Due to its structure this woodland is considered to offer little in the way of sheltering and/or foraging opportunities. The loss of one or two isolated hollow bearing trees, compared to the number present in the adjacent woodland, is not considered to present a significant impact on any native fauna populations.

7.3.4. Eucalypt woodland.

The eucalypt woodland is the dominant habitat type of those vegetated portions of the study area. This habitat type is common throughout the surrounding region, extending beyond the limits of each study area. The eucalypt woodland supports trees that are up to 30m in height, several of which provide hollows (up to 150mm in diameter) suitable for the life cycle needs of native species. In addition to the hollow bearing trees, several dead stags are also present. Throughout the woodlands, the tree canopy is continuous, with few barriers to the movement patterns of native species being evident. The middle storey supports a medium density layer of native saplings and tall shrubs, these plants being to 10m in height whilst the understorey is composed of a medium to high density layer of native shrubs and saplings that are from 2 to 5m in height. The ground cover consists of a high density layer of native grasses, ferns, vines and forbs, these being up to 1m in height depending on the amount of light penetration.

It is noted that, no large caves, rocky crevices or suitable cave substitutes were observed within either study area.

Due to the presence of hollow bearing trees and flowering plants, the eucalypt woodland offers a range of foraging, sheltering and breeding sites. The removal of some edge affected vegetation, this being those stands that occur adjacent to the disturbed environment, is not considered to present a significant impact on the viability of any locally occurring populations of native fauna. Edge effects observed during the field investigation include infestations of weeds along the woodland/disturbed environment ecotone due to altered regimes of light penetration into the woodland and modified soil moisture contents. The extent of the edge effect disturbance varies throughout the study area ranging from one to several metres depending on the extent of light penetration. The presence of weeds has reduced the diversity of native plants within the ecotone area, thereby reducing the value of this habitat for native animals. Therefore, some disturbance of this habitat type may be possible without having an adverse impact on the presence of any native fauna populations. As such, the disturbance of these parts of the eucalypt woodland is not considered to threaten any native fauna.

Whilst hollow bearing trees were observed in association with those woodlands that occur at, and beyond the limits of , each development site, it is noted that, at Lemon Tree Creek, none of these plants would be removed. No hollow bearing trees would be removed by the undertaking of the proposed road works at Lemon Tree Creek.

8. Ecological assessments.

8.1. Flora.

8.1.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999.*

By the completion of the field investigations, no plants listed under the Schedules to the *EPBC Act* had been recorded within, or in the vicinity of, the area affected by the Proposal. Similarly, no EEC's or endangered flora populations had been detected. The Proposal would not have a detrimental impact on any flora species of national conservation significance and therefore it is not considered that the matter requires referral to the Federal Minister for the Environment and Water Resources for further consideration or approval.

8.1.2. State - *Environmental Planning and Assessment Act 1979.*

Though targeted, no plant species listed under the Schedules to the *TSC Act* were recorded or indicated as occurring within the study area.

Adjacent to Termeil Creek, a mosaic of two endangered ecological communities is present, these being Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest. As such, a seven part test as provided under Section 5A of the *Environmental Planning and Assessment Act 1979* has been undertaken to assess any adverse impacts that may be incurred on these communities as a result of the undertaking of the Proposal. As a mosaic of these two communities is present they are considered together.

8.1.2. (a) Swamp Oak Floodplain Forest/ Swamp Sclerophyll Forest - Seven Part Test.

(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,

Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest are EEC's, not threatened species.

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

Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest are EEC's, not endangered populations.

(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,

The proposed realignment of the Princes Highway will remove approximately 150m^2 of a mosaic of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest at Termeil Creek. At this location the communities are intermixed and represented by narrow strips of disturbed habitat either side of the creek in which weed invasion is apparent. The communities also extend and broaden eastwards of the existing bridge, whilst westwards they attenuate. The Proposal will have an adverse effect on these communities in that it will directly remove habitat. However, given the extent of the communities beyond the study area, it is considered that this loss would not place the local occurrence of the Swamp Oak Floodplain Forest or Swamp Sclerophyll Forest at risk of extinction. Furthermore, vegetation would be re-established following removal of the existing bridge.

(ii) or 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,

Upstream of the existing bridge, the communities only occur as a very narrow band that has been modified by clearing and weed invasion. It is considered that the Proposal would not adversely modify the communities such that these remnants are placed at risk of extinction.

(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 would result in the loss of approximately 150m^2 of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest. Given that the communities are far more extensive and intact downstream of the site, it is considered that the extent of removal is not significant. Given the already modified

nature of habitat in the vicinity of the existing bridge, it is considered that the Proposal would not exacerbate those long-term impacts that already affect the community. i.e. weed invasion, increased solar exposure, wind shear, and so forth.

(ii) and whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

Riparian vegetation is already fragmented in the study area by the presence of the existing bridge and associated clearing. The Proposal will further increase the distance between remnants of the communities either side of the Princes Highway. However, this exacerbation of fragmentation is not considered significant as those remnants upstream are already degraded and the Proposal would have no effect on the ability of genetic material to move between remnants.

(iii) and 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,

Given the small amount of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest to be affected, the already modified nature of riparian vegetation in the area affected and the fact that it peters out upstream of the site, it is considered that the habitat represented in the study site is not of particular importance in the locality. It is considered unlikely that the Proposal will affect the reproductive ability of those plants remaining either side of the new bridge.

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

Critical habitat of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest has not yet been defined.

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

No recovery plan or threat abatement plan has been prepared for either community. However, the following recovery strategies have been identified by the DECC (DECC 2007c) in relation to both communities:

- *Habitat management: Ongoing EIA (Environmental Impact Assessment)- Advice to consent and planning authorities. Prepare identification and impact assessment guidelines and distribute to consent and determining authorities.*
- *Habitat management: Site Protection (e.g. Fencing/Signage). Identify and prioritise other specific threats and undertake appropriate on-ground site management strategies where required.*

It is recommended that the interface of the works area and retained native vegetation be temporarily fenced to prevent the incursion of vehicles, machinery and materials.

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

The Proposal involves "clearing of native vegetation" and "removal of dead wood and trees", which are both listed as a Key Threatening Processes. Whilst the Proposal would exacerbate both of these threatening processes, it is considered that the scale of impact is not significant.

8.1.2. (b) Expected impact on Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest.

The Proposal would result in the loss of approximately 150m^2 of a mosaic of Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest. Given the small amount of habitat affected, its disturbed state and the extent of the community further east along Termeil Creek, it is considered that the loss of this area of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest is unlikely to have a significant effect on the community, or its habitat.

8.2. Fauna.

8.2.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999.*

During the field survey, two species, the Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*), listed as migratory birds under Part 13, Division 2, Subdivision 3 of the *EPBC Act*, were observed/indicated as being present within the study area.

Based on the observations made during the field investigations, combined with the findings of past studies on these species and the consultation of known literature sources, it is not considered that the Rufous Fantail or Black-faced Monarch would significantly rely upon the study area for any of their necessary life cycle requirements. Therefore, giving consideration to the Administrative Guidelines on Significance provided in association with the *EPBC Act* (DEW 2007) for a migratory species, these guidelines being used to determine whether an action has, will have, or is likely to have a significant impact on a matter of national environmental significance, it is not considered that the Proposal would:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for the Rufous Fantail or Black-faced Monarch, or
- result in an invasive species that is harmful to the Rufous Fantail or Black-faced Monarch becoming established in an area of important habitat of either of these species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the Rufous Fantail or Black-faced Monarch.

Due to the proximity of the SEPP 14 wetlands, south to south-east of the existing Termeil Creek bridge, and the detection of Green and Golden Bell Frogs (*Litoria aurea*) in the nearby Meroo National Park within similar wetland environments (NPWS 2005), there is the potential that this species may be present in association with this aquatic environment. As such, if present, there is the potential that this frog may traverse along Termeil Creek during its foraging/dispersal periods. Based on a precautionary approach, the following assessment, drawing on the Administrative Guidelines on Significance provided in association with the *EPBC Act* (DEW 2007) for a Vulnerable species, has been undertaken.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of an important population of a species.*

The proposed realignment of the Princes Highway at Termeil Creek will not result in the removal of any habitats important to the Green and Golden Bell Frog. Similarly, it will not erect any barriers to the movement patterns of this species beyond those that currently exist. As the works would not have a direct impact on the nearby SEPP 14 wetland (nor its buffer vegetation), if this species is present at this location, it is not considered that the works would cause a long-term decrease in the size of the Green and Golden Bell Frog population.

- *reduce the area of occupancy of an important population.*

The works would not reduce the area of occupancy available to this species.

- *fragment an existing important population into two or more populations.*

The bridge traversing Termeil Creek will be a three span structure. The bridge would be approximately 4m above the existing ground level and would include opportunities for the unrestricted movement of ground traversing species under the deck. As such, any species traversing along Termeil Creek and its associated riparian vegetation would still be able to move east – west along this drainage line. As such, no fragmentation of any habitats currently available east and west of the Princes Highway, for any potentially occurring Green and Golden Bell Frog individuals, would occur.

- *adversely affect habitat critical to the survival of a species.*

No habitat critical to the survival of this species would be affected.

- *disrupt the breeding cycle of an important population.*

The works would not adversely affect the breeding cycle of this species. Undertaking the construction activities for the Termeil Creek crossing during the winter months (when Green and Golden Bell Frogs are in hibernation) will ensure that no individuals of this species would be traversing along Termeil Creek if present at this locality. As such, the undertaking of the works during the winter months would ensure that no breeding individuals are affected if present.

- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*

No habitat available to this species would be affected to the extent that the species would decline.

- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*

Beyond those that currently exist (including those originating upstream in association with the nearby farming properties), the works would not result in any additional invasive species establishing within the study area. Implementation of a weed management plan will treat those infestations that currently occur.

- *introduce disease that may cause the species to decline.*

The works will not introduce any diseases that will cause this species to decline.

- *interfere substantially with the recovery of the species.*

The works will not substantially interfere with the recovery of this species.

Based on a consideration of the Administrative Guidelines on Significance provided in association with the *EPBC Act*, it is considered that the proposed realignment of the Princes Highway at Lemon Tree and Termeil Creeks can proceed as planned without requiring referral of the matter to the Federal Minister for the Environment and Water Resources for further consideration or approval.

8.2.2. State - *Environmental Planning and Assessment Act 1979.*

Having been previously detected traversing through and feeding within the woodlands that occur to the east of Termeil Creek Bridge (LesryK Environmental Consultants 2004), it was considered appropriate that an assessment of any likely impacts associated with the Proposal on the Yellow-

bellied Glider be considered using the seven part test as provided under Section 5A of the *Environmental Planning and Assessment Act 1979*. These criteria are used to determine "whether there is likely to be a significant effect on the Yellow-bellied Glider, its population, ecological communities, or habitats", and consequently whether a Species Impact Statement is required.

Whilst only recorded in the vicinity of Termeil Creek (LesryK Environmental Consultants 2004), it is likely that the Yellow-bellied Glider would also be present in those woodlands that surround Lemon Tree Creek.

In addition, based on a precautionary approach, seven part tests have also been undertaken for the Green and Golden Bell Frog and hollow dependant threatened microchiropterans. These assessments have been undertaken as:

A) a SEPP 14 wetland is present to the south / south-east of the Termeil Creek bridge site, this having a habitat structure that is suitable for the presence of the Green and Golden Bell Frog; and

B) one or two hollow bearing trees, that may be utilised by microchiropterans, would be removed as part of the road works.

In undertaking the seven part test on those threatened hollow dependant microchiropterans that could potentially be present, these have been "grouped" together and assessed accordingly due to the similarity of their habitat needs.

8.2.2. (a) The Yellow-bellied Glider - Seven Part Test.

(a) *"...in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction..."*

No trees suitable for the breeding needs of the Yellow-bellied Glider would be removed as a result of the Proposal. The resources present within the study area are not considered to constitute any significant component of the Yellow-bellied Glider's sheltering, breeding or foraging requirements. At Termeil Creek, with both the retention of the four habitat trees identified and the preservation of the main glider dispersal corridor, it is not considered that any fragmentation of this species' habitat areas would arise. Given the limited extent and scale of the Proposal, and the lack of habitat fragmentation, it is not considered that there would be any significant impact on the life cycle requirements of the Yellow-bellied Glider such that a locally viable population of this species would be placed at risk of extinction.

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

An 'endangered population' is defined as a "population specified in Part 2 of Schedule 1" of the *TSC Act*. Therefore the Yellow-bellied Glider is not an endangered population.

(c) *"...in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, 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..."

The Yellow-bellied Glider is not listed as an EEC.

(d) *"...in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed...", and

Within the study area, no significant Yellow-bellied Glider breeding, roosting or foraging sites were observed. It is noted that the one feed tree was found adjacent to the study area, however this tree is outside of the boundaries of the proposed work and would therefore not be affected by the Proposal. The study area may meet a small portion of this species foraging resources however, given the small scale and extent of the proposed works, and similar resources provided in surrounding conservation reserves, it is not considered that a significant area of known regional habitat will be adversely affected. No regionally significant habitat would therefore be affected by the proposed road works.

(ii) "... whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action...", and

The proposed road works would not isolate any currently interconnecting or proximate areas of habitat suitable for use by the Yellow-bellied Glider. Due to the existing highway, cleared transmission easements and farming pastures the eucalypt woodlands that are present within and adjacent to the study area are already fragmented, the proposed works not considered to further isolate any areas of importance to the foraging or dispersal needs of this species.

With reference to Figures 3 and 5, it is expected that, at Termeil Creek, the proposed road works would be completed in the vicinity of the three "northern" habitat trees. Maintenance of the cross highway canopy widths north of the proposed road works would provide suitable opportunities for the dispersal needs of this species. As noted, the Yellow-bellied Glider has been recorded traversing open space areas that are in the order of 70 – 100m, the current and likely cross highway canopy widths not expected to negate the movement patterns of this species (maximum cross canopy widths post construction are expected to be no greater than 20m to 30m).

Given this, as well as the extent of proposed works, the maintained connectivity of those corridors that occur beyond the limits of the works, and the retention of the habitat trees identified, the Proposal would not present any new barriers to the movement patterns of this species. Therefore, no areas of habitat known to be used by this species would be isolated or further fragmented.

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

The proposed road works are not considered to remove, modify, fragment or isolate a significant amount of vegetation such that the long-term survival of the Yellow-bellied Glider would be jeopardised. The proposed western alignment for the Termeil Creek crossing would avoid any indirect impacts on the viability of any Yellow-bellied Glider populations. In addition, with the retention of the likely Yellow-bellied Glider fauna corridor identified in Figure 5, the long-term survival of the Yellow-bellied Glider within, and in close proximity to, the study area is ensured.

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

No critical habitat will be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

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

A recovery plan has been prepared for the Yellow-bellied Glider. However, given the minimal extent, and type, of habitat to be modified as part of the Proposal, it is not considered that the further development of the study area would breach any of these objectives such that there would be a significant impact on this species or its necessary habitat.

(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..."*

Currently 27 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act*. Of these, "the clearing of native vegetation" and the "removal of dead wood and dead trees" are applicable to the Proposal. Whilst it is acknowledged that, at Termeil creek, the Proposal would result in the clearing of a maximum of 0.42ha of vegetation potentially available for the foraging needs of the Yellow-bellied Glider, taking into account over 248413ha of similar resources in the surrounding conservation reserves, it is not considered that this clearance would result in a significant loss of any habitat for this species from the region. In relation to the amount of vegetation proposed for removal, it is noted that this includes the Melaleuca woodland and a strip of vegetation that occurs on the rock cutting immediately north of Termeil Creek, bushland that, due to its structure and limited height, would not be utilised by the Yellow-bellied Glider for either foraging or dispersal purposes. As such, it is not considered that the Proposal would constitute a significant Key Threatening Process such that the life cycle requirements of this species would be compromised.

8.2.2. (b) Expected impact on the Yellow-bellied Glider.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Yellow-bellied Glider. Due to the small scale of the Proposal, and the presence of similar conserved bushland areas (including State Forests and National Parks) in close proximity to the study area (these covering an area of approximately 248413ha), no Yellow-bellied Glider dispersal or movement corridors would be disturbed, and no significant areas of local or regional habitat would be removed or isolated. Therefore, the expected impacts associated with the Proposal on the Yellow-bellied Glider are considered to be minimal, and the preparation of a Species Impact Statement is not necessary.

8.2.2. (c) The Green and Golden Bell Frog - Seven Part Test.

(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 works would not have a direct impact on any habitats important to the local presence of this species. Whilst habitats suitable for the Green and Golden Bell Frog occur in the vicinity of Termeil Creek, no components of these habitats would be disturbed as a result of the undertaking of the proposed road works. As such, the works would not affect the local viability of this species (if present) such that it is placed at risk of extinction.

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

An 'endangered population' is defined as a "population specified in Part 2 of Schedule 1" of the *TSC Act*. Therefore the Green and Golden Bell Frog is not an endangered population.

(c) *"...in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, 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..."*

The Green and Golden Bell Frog is not listed as an EEC.

(d) *"...in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed...", and

The works would not remove any habitat available to this species. The works would modify a small percentage of riparian vegetation that lines Termeil Creek, the impact of which would be off set through the rehabilitation of the existing pavement/approaches after their removal.

(ii) "... whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action...", and

The inclusion of an underpass into the bridge design would ensure that no areas of habitat available for the Green and Golden Bell Frog are further fragmented or isolated.

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

The importance of the riparian habitat that lines Termeil Creek (and which would be cleared as a result of the Proposal), incomparison with the remainder of the aquatic environments being retained in this locality, is considered to be minimal.

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

No critical habitat will be adversely affected by the proposed development. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act.*

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

A recovery plan has been prepared for the Green and Golden Bell Frog. However, given the minimal extent, and type, of habitat to be modified as part of the Proposal, it is not considered that the further development of the study area would breach any of the objectives outlined in this document such that there would be a significant impact on this species or its necessary habitat.

(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..."*

Currently 27 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act.* Of these, "the clearing of native vegetation" would be applicable to the Proposal. Whilst it is acknowledged that, at Termeil Creek, the Proposal would result in the clearing of a maximum of 0.42ha of vegetation potentially available for the foraging needs of the Green and Golden Bell Frog, taking into account the extent of similar resources in the surrounding network of conservation reserves and nearby bushland/wetland areas, it is not considered that this clearance would result in a significant loss of any habitat for this species from the region. In relation to the amount of vegetation proposed for removal, it is noted that, with the rehabilitation of the realigned sections of the highway, the overall net loss of foraging sites available for this species would be minimal. As such, it is not considered that the Proposal would constitute a significant Key Threatening Process such that the life cycle requirements of this species would be compromised.

8.2.2. (d) Expected impact on the Green and Golden Bell Frog.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of the Green and Golden Bell Frog. Due to the small scale of the Proposal, the presence of similar bushland and aquatic areas in close proximity to the study area and the inclusion of underpasses suitable for the movement needs of this species into the bridge design, no Green and Golden Bell Frog dispersal corridors would be disturbed, and no significant areas of local or regional habitat available to this species would be removed or isolated. Therefore, the expected impacts associated with the Proposal on the Green and Golden Bell Frog are considered to be minimal, and the preparation of a Species Impact Statement is therefore not necessary.

8.2.2. (e) Hollow dependant microchiropterans - Seven Part Test.

(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 removal of one or two isolated hollow bearing trees is not considered to adversely affect the life cycle of any hollow dependant microchiropterans, such that the populations of these species are placed at risk of extinction. It is acknowledged that, if present, some microchiropteran individuals may be lost due to the felling of those trees present, though the overall impact of this on the local viability of any populations of these animals is not considered significant. The possible loss of several individuals would not cause the extinction of any local populations of those threatened microchiropterans previously recorded in the study region.

(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..."*

An 'endangered population' is defined as a "population specified in Part 2 of Schedule 1" of the *TSC Act*. No hollow dependant microchiropterans are listed as an endangered population.

(c) *"...in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, 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 hollow dependant microchiropterans are listed as an EEC.

(d) *"...in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed...", and

The works would only result in the removal of one or two hollow bearing trees. The extent of this, compared to the surrounding, nearby habitat, is considered to be minimal.

(ii) "... whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action...", and

The ability of microchiropterans to traverse open space areas, and the maintenance of wooded connectivity north of the proposed Termeil Creek crossing, will ensure that no habitats currently available for the foraging, sheltering or breeding needs of hollow dependant microchiropterans would be further fragmented or isolated.

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

The importance of the hollow bearing trees that would be removed as a result of the road works, in comparison with the remainder of the habitat being retained in this locality, is considered to be minimal.

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

No critical habitat will be adversely affected by the Proposal. The study area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act.*

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

No recovery or threat abatement plans have been prepared for any hollow dependant microchiropterans.

(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..."*

Currently 27 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act.* Of these, "the clearing of native vegetation" and the "removal of dead wood and dead trees " would be applicable to the Proposal. It is also noted that a Preliminary Determination has been made to list the "Loss of hollow-bearing trees" as a Key Threatening Process due to the number of native species, including threatened animals, that are dependant upon this resource. Whilst it is acknowledged that, at Termeil creek, the Proposal would result in the clearing of one or two isolated hollow bearing trees, taking into account the extent of similar resources in the surrounding nearby bushland, the impact of this is considered to be minimal. As such, it is not considered that the Proposal would constitute a significant Key Threatening Process such that the life cycle requirements of any hollow dependant threatened microchiropterans would be compromised.

8.2.2. (f) Expected impact on hollow dependant threatened microchiropterans.

The undertaking of the Proposal would not disturb, remove, modify or fragment any habitats critical to the life cycle requirements of any hollow dependant threatened microchiropterans. Due to the limited number of hollow bearing trees being removed, and the presence of similar resources in the surrounding bushland, no significant microchiropteran roosting or breeding sites would be cleared. Similarly, the works would not isolate any habitat areas currently available for these flying animals. As such, the expected impacts associated with the Proposal on the hollow dependant threatened microchiropterans are considered to be minimal, and the preparation of a Species Impact Statement for this group of animals is therefore not necessary.

8.3. State - *State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection.*

The Shoalhaven Local Government Area is identified under Schedule 1 – Local Government Areas of SEPP 44 – Koala Habitat Protection. This Policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas.

Seven eucalypts were recorded within the areas surveyed, none of which are listed as Koala feed trees under Schedule 2 of SEPP 44. Therefore, based on the criteria provided under SEPP 44, the study area is not considered to provide either Potential or Core Koala habitat. During the current and previous field surveys no individuals of this animal were observed, spot lit or heard calling and no

characteristic scratching or scats were found. Therefore it is not considered that this species is present in the vicinity of either study area. As such, a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of either bridge Proposal.

8.4. Expected impact on non-threatened fauna.

Excluding the Rufous Fantail and Black-faced Monarch, the remainder of the native species recorded within the study area are protected, as defined by the NSW *National Parks and Wildlife Act 1974*, but considered to be common to abundant throughout the surrounding region. The animals observed would be regularly recorded in the surrounding region in association with their documented habitat types. These species would not be solely reliant upon those habitats present within the study area such that the removal or further disturbance of these would threaten the occurrence of these animals. The species recorded are all expected to be present within both the study area and surrounding region post-construction. Due to their ability to adapt to, and be tolerant of, urban infrastructure, none of the native species recorded would be adversely affected such that the viability of a local population of that animal would be placed at risk of extinction.

The scale of the Proposal is not considered to have any adverse impacts on the diversity of native species present. The surrounding vegetated areas are expected to ensure the long-term presence of these animals. The works would not reduce or have a negative impact on the current diversity of species present within, and beyond the limits of, each of the bridge sites.

9. Conclusions.

As a result of the undertaking of the fauna survey, two species, the Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*), listed as Migratory under the *EPBC Act*, had been recorded. Whilst recorded in association with the eucalypt woodlands, giving consideration to the Administrative Guidelines on Significance provided in association with the *EPBC Act*, it was not considered that the realignment of the Princes Highway at Lemon Tree or Termeil Creek Bridges would have a significant effect on these two species, their populations or habitats. Similarly, at Termeil Creek,, based on a precautionary approach, the works were not considered to have an adverse impact on the Green and Golden Bell Grog (*Litoria aurea*) if it was present in the nearby wetland. Based on the results of the flora and fauna survey combined with a review of known literature and database sources, the proposed works at either road works site are not considered to affect, threaten or have an adverse impact on any of those plants, animals or ecological communities listed under the *EPBC Act*. Therefore, it is not considered that the matter would require referral to the Federal Minister for the Environment and Water Resources for further consideration or approval.

Results from the flora survey showed that a mosaic of two Endangered Ecological Communities, Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest, listed under Schedule 1, Part 3 of the *TSC Act* occur in a narrow band along Termeil Creek. An assessment of the likely impacts of the Proposal on these communities was undertaken using the criteria listed under Section 5A of the *Environmental Planning and Assessment Act*. The assessment found that, given the small amount of Swamp Oak Floodplain Forest / Swamp Sclerophyll Forest likely to be affected, the Proposal would not have a significant effect on either of these Endangered Ecological Communities, or their habitats.

Based on the literature review and an assessment of the habitats present within the study area during the current investigation, the adoption of a precautionary approach in relation to the state listed Yellow-bellied Glider (*Petaurus australis*), Green and Golden Bell Grog (*Litoria aurea*) and hollow dependant microchiropterans was deemed necessary. However, based on a consideration of the assessment criteria provided under Section 5A of the NSW *Environmental Planning and Assessment Act* 1979 it was concluded that the Proposal would not have a significant impact on these species, their populations or habitats. As such, it was not considered that the matter would require the preparation of a Species Impact Statement.

With reference to the criteria provided under SEPP 44, the study area is not considered to be of either Potential or Core Koala habitat. Therefore, it is not considered that the proposed crossing of Termeil and Lemon Tree Creeks would require the preparation of a Plan of Management for Koalas, or the adoption of any other appropriate mitigative measures.

10. Recommendations.

Implementation of the following measures would ensure the Proposal is undertaken in an ecologically sustainable manner:

- The area of vegetation to be cleared should be minimised. Native vegetation outside the works area should be temporarily fenced to prevent incursion of vehicles, machinery or materials.

- Prior to commencement of works, individuals of the Christmas Orchid that occur north-west of the existing Termeil Creek Bridge should be translocated to an area of similar habitat (i.e. a well-shaded forest) outside the works area. The works should be undertaken by a qualified bush regeneration firm in consultation with a botanist.

- It the cross highway canopy width are greater than 30m, a re-assessment of the proposed road works should be undertaken.

- Habitat trees identified and tagged should be retained and construction activity kept well clear of these plants. If necessary, these trees should be again clearly identified/highlighted on site prior to the undertaking of the construction works. Temporary fencing should be erected around these plants, these being placed at the outer limits of the trees canopy (thereby negating any possible soil compaction and disturbance of the root ball).

- At Termeil Creek, additional large trees that occur near the proposed works site, and which provide movement opportunities for gliders, should also be clearly identified to prevent any indirect disturbance of these habitat features.

- To replace the loss of the hollow bearing trees that maybe occupied by hollow dependant microchiropterans, it is recommended that features be included into the design of the Termeil Creek Bridge that would provide sheltering resources for these animals. Without compromising the integrity of the bridge, consideration should be given to the provision of deeper expansion joints, bolt holes and suitable cavities.

- Prior to the clearing of the hollow bearing trees these should be first inspected by a qualified ecologist to ensure that no roosting animals are present. The ecologist should also check the trees once they have been felled to ensure that no species present were injured by the fall.

- To negate any adverse impact on any potentially occurring Green and Golden Bell Frog individuals, works undertaken at Termeil Creek should be carried out during the winter months. If this is not feasible, consultation with a qualified ecologist should be entered into to determine an appropriate strategy for the protection of any Green and Golden Bell Frogs that maybe traversing along Termeil Creek.

- Rocks, natural debris and ground cover plants should be established under the bridge deck at Termeil Creek to provide shelter from predators for any ground traversing species that may be moving along this drainage line. The location, character and placement of this material should be based on discussions held with a qualified ecologist.

- Construction vehicles should restrict their movements to the existing road network or areas previously disturbed by past land use practices.

- No vehicles, machinery, equipment or stockpiles should be parked/stored in those areas of native bushland that occur beyond the limits of the works.

- To prevent the spread of weeds, truck wheels should be cleaned prior to entering the construction sites.

- Control of the noxious weed Fireweed should be conducted within the study area as part of a wider control programme for the Princes Highway. In this regard the RTA should have regard to the management plan prepared for the species and liaise with the Southern Tablelands and South Coast Noxious Weeds Committee.

- Cleared and disturbed areas, and the existing portions of the highway formation that are realigned, should be stabilised with suitable native grasses and ground cover plants as soon as possible to prevent soil erosion. Subsequent to this, revegetation of roadside areas adjacent to the new alignment should use locally occurring native plant species typical of those vegetation communities affected by the Proposal.

- A bushland plan of management should be prepared by a qualified restoration firm that addresses the issues relating to the rehabilitation of the site.

- An Erosion and Sediment Control Plan should be prepared. This plan should include the stabilisation of exposed surfaces as soon as possible to reduce the potential for any erosion.

- The Erosion and Sedimentation Control Plan should ensure that no sediments leave the Proposal area and that the works do not adversely affect either Lemon Tree or Termeil Creeks. The quality of these drainage lines should not be reduced as a result of the proposed works.

- No sediment-laden water should be permitted to enter into either Lemon Tree or Termeil Creeks without first being filtered.

- The works should be undertaken so they correspond with a period of dry weather, thereby reducing the risk of sediments entering both Lemon Tree and Termeil Creeks, and the Termeil Lake Wetlands.

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Appendix 1: Plant species recorded during the surveys of vegetation at Lemon Tree and Termeil Creeks.

Key
* = Introduced (weed) species

FAMILY	SPECIES
LYCOPSIDA	
Lycopodiaceae	*Lycopodium deuterodensum*
CYCADOPSIA	
Zamiaceae	*Macrozamia communis*
Filicopsida	
Adiantaceae	*Adiantum aethiopicum*
Blechnaceae	*Blechnum cartilagineum*
Cyatheaceae	*Cyathea australis*
Dicksoniaceae	*Calochlaena dubia*
Dennstaedtiaeae	*Pteridium esculentum*
Gleicheniaceae	*Gleichenia microphylla*
	Sticherus flabellatus
Magnoliopsida - Dicotyledons	
Acanthaceae	*Pseuderanthemum variabile*
Apiaceae	*Centella asiatica*
	Foeniculum vulgare *
	Hydrocotle bonariensis
	Hydrocotle geraniaceae
	Xanthosia tridentata
Apocynaceae	*Parsonsia straminea*
Araliaceae	*Polyscias sambucifolia*
Asclepiadaceae	*Tylophora barbata*
Asteraceae	*Aster subulatus*
	Bidens pilosa *
	Bracteantha bracteanthum
	Chrysocephalum apiculatum
	Cirsium vulgare *
	Conyza bonariensis *
	Coreopsis lanceolata *
	Gnaphalium gymnocephalum
	Hypochoeris radicata *
	Olearia viscidula
	Ozothamnus diosmifolium
	Pseudognaphalium luteoalbum
	Senecio linearifolius
	Senecio madascariensis *
	Sonchus oleraceus *
	Tagetes minuta *

FAMILY	SPECIES
Bignoniaceae	*Pandorea pandorana*
Campanulaceae	*Wahlenbergia gracilis*
Carophyllaceae	*Stellaria flaccidus*
Casuarinaceae	*Allocasuarina littoralis*
	Allocasuarina torulosa
	Casuarina glauca
Caesalpiniaceae	*Senna clavigera* *
Cassythaceae	*Cassytha glabella*
Convolvulaceae	*Dichondra repens*
Cunoniaceae	*Callicoma serratafolia*
	Ceratopetalum gummiferum
Dilleniaceae	*Hibbertia aspera*
	Hibbertia bracteata
	Hibbertia dentata
	Hibbertia obtusifolia
	Hibbertia scandens
Droseraceae	*Drosera peltata*
Eleocarpaceae	*Eleocarpus reticulatus*
Epacridaceae	*Astroloma humifusum*
	Leucopogon juniperinus
	Leucopogon lanceolatus var. lanceolatus
Euphorbiaceae	*Breynia oblongifolia*
	Glochidion ferdinandi var. ferdinandi
	Micrantheum ericoides
	Omalanthus populifolius
Fabaceae: Faboideae	*Aotus ericoides*
	Brachypodum rhytidophyllum
	Daviesia ulicifolia
	Desmodium varians
	Glycine clandestina species complex
	Glycine tabacina species complex
	Gompholobium grandiflorum
	Hardenbergia violacea
	Indigofera australis
	Kennedia rubicunda
	Oxylobium ilicifolium
	Platylobium formosum
	Pultenaea daphnoides
	Pultenaea flexilis
	Pultenaea retusa
	Pultenaea villosa
	Trifolium repens *

FAMILY	SPECIES
	Trifolium subterraneum *
Fabaceae: Mimosoideae	*Acacia binervata*
	Acacia elata
	Acacia implexa
	Acacia irrorata subsp. irrorata
	Acacia longifolia
	Acacia mearnsii
	Acacia suaveolens
	Acacia terminalis
Goodeniaceae	*Goodenia heterophylla*
	Goodenia ovata
	Scaevola albida
Haloragaceae	*Gonocarpus micranthus*
	Gonocarpus teucrioides
Lamiaceae	*Prostanthera lasianthos*
Lobeliaceae	*Pratia purpurascens*
Malvaceae	*Sida rhombifolia* *
Meliaceae	*Synoum glandulosum*
Menispermiaceae	*Stephania japonica*
	Sarcopetalum harveyanum
Myrtaceae	*Angophora floribunda*
	Backhousia myrtifolia
	Babingtonia pluriflora
	Corymbia gummifera
	Corymbia maculata
	Eucalyptus amplifolia
	Eucalyptus botryoides/E. saligna hybrid
	Eucalyptus elata
	Eucalyptus globoidea
	Eucalyptus longifolia
	Eucalyptus paniculata
	Eucalyptus pilularis
	Eucalyptus scias subsp. callimastha
	Kunzea ambigua
	Leptospermum juniperinum
	Leptospermum polygalifolium
	Leptospermum trinervium
	Melaleuca linariifolia
	Melaleuca ericifolia
	Syncarpia glomulifera
Oleaceae	*Notelaea longifolia*
Oxalidaceae	*Oxalis corniculata*
Passifloraceae	*Passiflora edulis*

FAMILY	SPECIES
Plantaginaceae	*Plantago lanceolata* *
Pittosporaceae	*Bursaria spinosa*
	Billardiera scandens
	Pittosporum revolutum
	Pittosporum undulatum
Polygonaceae	*Persicaria lapathifolia*
Proteaceae	*Banksia serratta*
	Banksia spinulosa var. spinulosa
	Hakea dactyloides
	Lomatia ilicifolia
	Persoonia levis
	Persoonia linearis
	Persoonia mollis
Ranunculaceae	*Clematis aristata*
	Ranunculus plebieus
Rhamnaceae	*Pomaderris cinerea*
Rosaceae	*Rubus fruticosus species aggregate*
	Rubus parvifolius
Rubiaceae	*Opercularia aspera*
	Pomax umbellata
Santalaceae	*Leptomeria acida*
	Exocarpus cupressiformis
Sapindaceae	*Dodonaea triquetra*
Solanaceae	*Solanum nigrum* *
Thymeliaceae	*Pimelea linifolia subsp. linifolia*
Verbenaceae	*Verbena bonariensis* *
Violaceae	*Viola hederacea*
Vitaceae	*Cissus hypoglauca*
Magnoliopsida - Monocotyledons	
Araceae	*Livistona australis*
	Zantedeschia aethiopica *
Commelinaceae	*Commelina cyanea*
Cyperaceae	*Carex appressa*
	Chorizandra sphaerocephalum
	Cyperus brevifolius
	Cyathochaeta diandra
	Eleocharis sphacelata
	Gahnia clarkei

FAMILY	SPECIES
	Gymnoschoenus sphaerocephala
	Ptilothrix deusta
	Schoenus imberbis
	Schoenus melanostachys
Juncaceae	*Juncus articulatus* *
	Juncus cortinuus
	Juncus subsecundus
	Juncus usitatus *
	Lepidosperma filiforme
Liliaceae	*Lilium formosanum* *
Lomandraceae	*Lomandra confertifolia*
	Lomandra multiflora
	Lomandra longifolia
Orchidaceae	*Cryptostylis subulata*
	Cymbidium suave
	Calanthe triplicata
	Dipodium punctatum
Philesciaceae	*Eustrephus latifolius*
Phormiaceae	*Dianella revoluta var. revoluta*
Poaceae	*Andropogon virginicus* *
	Briza minor *
	Cynodon dactylon
	Cymbopogon refractus
	Danthonia tenuior
	Dichelachne micrantha
	Echinopogon ovatus
	Entolasia stricta
	Eragrostis brownii
	Imperata cylindrica var. major
	Microlaena stipoides var. stipoides
	Oplismenus aemulus
	Panicum simile
	Paspalum dilatatum *
	Paspalum distichum
	Paspalum urvillei *
	Pennisetum clandestinum *
	Poa affinis *
	Phragmites australis
	*Setaria secundatum**
	Stenotaphrum secundatum *
	Themeda australis
	Vulpes sp. *
Smilacaceae	*Smilax glyciphylla*

Appendix 2: Fauna species recorded or known to occur in the vicinity of the study area.

Source of Records

1 = Species recorded during present study.
2 = DECC (2004).
3 = Lesryk Environmental Consultants (2004).
4 = Lesryk Environmental Consultants (1996).

Key

A - indicates species listed under the *EPBC Act.*
F - migratory Family listed under the *EPBC Act.*
M - Species listed as migratory listed under the *EPBC Act.*
B - indicates species listed under the *TSC Act.*
E - Species is Endangered.
V - Species is Vulnerable.
* - indicated introduced species.

A	B	Common Name	Family and Scientific Name	1	2	3	4
		MAMMALS					
			Tachyglossidae				
		Short-beaked Echidna	*Tachyglossus aculeatus*		x		
			Dasyuridae				
		Brown Antechinus	*Antechinus stuartii*		x		
			Peramelidae				
		Long-nosed Bandicoot	*Perameles nasuta*		x	x	x
			Petauridae				
	V	Yellow-bellied Glider	*Petaurus australis*		x	x	x
		Sugar Glider	*Petaurus breviceps*		x	x	
			Pseudocheiridae				
		Greater Glider	*Petauroides volans*		x	x	x
			Acrobatidae				
		Feathertail Glider	*Acrobates pygmaeus*		x		
			Phalangeridae				
		Common Brushtail Possum	*Trichosurus vulpecula*		x		x
			Macropodidae				
		Eastern Grey Kangaroo	*Macropus giganteus*		x	x	
		Red-necked Wallaby	*Macropus rufogriseus*			x	
		Swamp Wallaby	*Wallabia bicolor*		x		x
			Pteropodidae				
V	V	Grey-headed Flying Fox	*Pteropus poliocephalus*		x		
			Vespertilioidae				
		Gould's Wattled Bat	*Chalinolobus gouldii*		x		
		Chocolate Wattled Bat	*Chalinolobus morio*		x		
	V	Large-footed Myotis	*Myotis adversus*		x		
		Gould's Long-eared Bat	*Nyctophilus gouldi*		x		
	V	Greater Broad-nosed Bat	*Scoteanax rueppellii*		x		
		Eastern Broad-nosed Bat	*Scotorepens orion*		x		
		Large Forest Bat	*Vespadelus darlingtoni*		x		
		Southern Forest Bat	*Vespadelus regulus*		x		
	V	Eastern Cave Bat	*Vespadelus troughtoni*		x		
		Little Forest Bat	*Vespadelus vulturnus*		x	x	
			Molossidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
	V	Eastern Freetail Bat	*Mormopterus norfolkensis*		x		
		White-striped Freetail Bat	*Nyctinomus australis*		x	x	
			Muridae				
		Water Rat	*Hydromys chrysogaster*		x		
		Bush Rat	*Rattus fuscipes*		x		
		Swamp Rat	*Rattus lutreolus*		x		
		* Black Rat	*Rattus rattus*		x		
			Canidae				
		* Fox	*Vulpes vulpes*		x	x	x
			Leporidae				
		* Rabbit	*Oryctolagus cuniculus*			x	
		BIRDS					
			Procellariidae				
M		Short-tailed Shearwater	*Puffinus tenuiorstris*		x		
		Fluttering Shearwater	*Puffinus gavia*		x		
		White-faced Storm Petrel	*Pelagodroma marina*		x		
			Pelecanidae				
		Australian Pelican	*Pelecanus conspicillatus*		x		
			Sulidae				
		Australasian Gannet	*Morus serrator*		x		
			Phalacrocoracidae				
		Pied Cormorant	*Phalacrocorax varius*		x		
		Little Pied Cormorant	*Phalacrocorax melanoleucos*		x		
		Great Cormorant	*Phalacrocorax carbo*		x		
		Little Black Cormorant	*Phalacrocorax sulcirostris*		x		
			Podicipedidae				
		Great Crested Grebe	*Podiceps cristatus*		x		
		Australasian Grebe	*Tachybaptus novaehollandiae*				x
			Spheniscidae				
		Little Penguin	*Eudyptula minor*		x		
F			**Anatidae**				
		Black Swan	*Cygnus atratus*		x		
		Australian Shelduck	*Tadorna tadornoides*		x		
		Pacific Black Duck	*Anas superciliosa*		x		x
		Chestnut Teal	*Anas castanea*		x		
		Australian Wood (Maned) Duck	*Chenonetta jubata*		x	x	
			Rallidae				
		Dusky Moorhen	*Gallinula tenebrosa*		x		
		Purple Swamphen	*Porphyrio porphyrio*		x		x
		Eurasian Coot	*Fulica atra*		x		
			Ardeidae				
		White-faced Heron	*Egretta novaehollandiae*		x		
M		Great Egret	*Ardea alba*		x		
		Intermediate Egret	*Egretta intermedia*		x		
		Nankeen (Rufous) Night Heron	*Nycticorax caledonicus*			x	
			Threskiornidae				
		Australian White Ibis	*Threskiornis molluca*	x	x		
		Royal Spoonbill	*Platalea regia*		x		

A	B	Common Name	Family and Scientific Name	1	2	3	4
			Haematopodidae				
	V	Pied Oystercatcher	*Haematopus longirostris*		x		
	V	Sooty Oystercatcher	*Haematopus fuliginosus*		x		
F			**Charadriidae**				
		Masked Lapwing	*Vanellus miles*		x	x	x
	E	Hooded Plover	*Thinornis rubricollis*		x		
		Double-banded Plover	*Charadrius bicinctus*		x		
		Red-capped Plover	*Charadrius ruficapillus*		x		
			Laridae				
		Silver Gull	*Larus novaehollandiae*		x		
		Pacific Gull	*Larus pacificus*		x		
M		Caspian Tern	*Sterna caspia*		x		
M	E	Little Tern	*Sterna albifrons*		x		
		Crested Tern	*Sterna bergii*		x		
F			**Accipitridae**				
M	V	Osprey	*Pandion haliaetus*		x		
		Whistling Kite	*Haliastur sphenurus*		x	x	
M		White-bellied Sea-eagle	*Haliaeetus leucogaster*		x		
		Little Eagle	*Hieraaetus morphnoides*		x		
		Brown Goshawk	*Accipiter fasciatus*			x	
		Collared Sparrowhawk	*Accipiter cirrhocephalus*		x		
		Grey Goshawk	*Accipiter novaehollandiae*		x		
		Swamp Harrier	*Circus approximans*		x		
F			**Falconidae**				
		Peregrine Falcon	*Falco peregrinus*		x		
		Australian Hobby	*Falco longipennis*		x		
		Brown Falcon	*Falco berigora*			x	
		Nankeen Kestrel	*Falco cenchroides*		x		
			Columbidae				
		* Rock Dove	*Columba livia*		x		
		Brown Cuckoo-dove	*Macropygia amboinensis*			x	
		Crested Pigeon	*Ocyphaps lophotes*		x		
			Cacatuidae				
	V	Glossy Black-Cockatoo	*Calyptorhynchus lathami*		x		
		Yellow-tailed Black Cockatoo	*Calyptorhynchus funereus*		x		
	V	Gang-Gang Cockatoo	*Callocephalon fimbriatum*		x	x	x
		Galah	*Eolophus roseicpilla*		x	x	
		Sulphur-crested Cockatoo	*Cacatua galerita*	x	x	x	
			Psittacidae				
		Rainbow Lorikeet	*Trichoglossus haematodus*	x	x	x	x
		Musk Lorikeet	*Glossopsitta concinna*	x	x		
		Australian King Parrot	*Alisterus scapularis*		x		
		Crimson Rosella	*Platycercus elegans*		x	x	x
		Eastern Rosella	*Platycercus eximius*	x			
			Cuculidae				
		Fan-tailed Cuckoo	*Cuculus flabelliformis*		x	x	
		Channel-billed Cuckoo	*Scthrops novaehollandiae*		x		
			Strigidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
	V	Powerful Owl	*Ninox strenua*		x		
		Southern Boobook	*Ninox novaeseelandiae*		x	x	
	V	Barking Owl	*Ninox connivens*		x		
			Tytonidae				
	V	Sooty Owl	*Tyto tenebricosa*		x		
	V	Masked Owl	*Tyto novaehollandiae*		x		
			Podargidae				
		Tawny Frogmouth	*Podargus strigoides*		x		
			Apodidae				
M		White-throated Needletail	*Hirundapus caudacutus*		x		
M		Fork-tailed Swift	*Apus pacificus*		x		
			Alcedinidae				
		Azure Kingfisher	*Alcedo azurea*		x		
		Laughing Kookaburra	*Dacelo naxaeguineae*		x	x	x
		Sacred Kingfisher	*Todiramphus sanctus*	x	x	x	
			Coraciidae				
		Dollarbird	*Eurystomus orientalis*		x		
			Menuridae				
		Superb Lyrebird	*Menura novaehollandiae*				x
			Neosittidae				
		Varied Sittella	*Daphoenositta chrysoptera*	x	x		
			Climacteridae				
		White-throated Treecreeper	*Cormobates leucophaeus*	x	x	x	x
		Red-browed Treecreeper	*Climacteris erythrops*		x		
			Maluridae				
		Superb Fairy-wren	*Malurus cyaneus*	x	x	x	x
		Variegated Fairy-wren	*Malurus lamberti*		x		
		Southern Emu-wren	*Stipiturus malachurus*		x		
			Pardalotidae				
		Spotted Pardalote	*Pardalotus punctatus*		x	x	x
		White-browed Scrubwren	*Sericornis frontalis*		x	x	x
		Brown Gerygone	*Gerygone mouki*		x		
		Brown Thornbill	*Acanthiza pusilla*		x	x	x
		Yellow Thornbill	*Acanthiza nana*		x		x
		Striated Thornbill	*Acanthiza lineata*	x	x	x	
			Meliphagidae				
		Red Wattlebird	*Anthochaera carunculata*	x	x	x	
		Little (Brush) Wattlebird	*Anthochaera chrysoptera*		x		x
		Noisy Friarbird	*Philemon corniculatus*	x	x	x	x
		Lewin's Honeyeater	*Meliphaga lewinii*	x	x	x	
		Yellow-faced Honeyeater	*Lichenostomus chrysops*	x	x	x	
		White-plumed Honeyeater	*Lichenostomus pencillatus*			x	
		Brown-headed Honeyeater	*Melithreptus brevirostris*		x	x	
		White-naped Honeyeater	*Melithreptus lunatus*		x		
		New Holland Honeyeater	*Phylidonryis novaehollandiae*		x	x	
		Eastern Spinebill	*Acanthorhynchus tenuirostris*		x	x	x
		Scarlet Honeyeater	*Myzomela sanguinolenta*		x		
			Orthonychidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Eastern Whipbird	*Psophodes olivaceus*	x	x	x	
			Petroicidae				
		Rose Robin	*Petroica rosea*			x	
		Flame Robin	*Petroica phoenicea*		x		
		Eastern Yellow Robin	*Eopsaltria australis*	x	x		
		Jacky Winter	*Microeca fascinans*		x		
			Pachycephalidae				
		Grey Shrike-thrush	*Colluricincla harmonica*		x	x	x
		Golden Whistler	*Pachycephala pectoralis*		x	x	
		Rufous Whistler	*Pachycephala rufiventris*		x		
			Dicruridae				
		Grey Fantail	*Rhipidura fuliginosa*	x	x	x	x
M		Rufous Fantail	*Rhipidura rufifrons*	x	x		
		Willie Wagtail	*Rhipidura leucophrys*	x	x	x	
		Leaden Flycatcher	*Myiagra rubecula*	x	x	x	
M		Black-faced Monarch	*Monarcha melanopsis*	x	x		
		Magpie Lark	*Grallina cyanoleuca*			x	x
			Oriolidae				
		Olive-backed Oriole	*Oriolus sagittatus*		x	x	
			Ptilonorhynchidae				
		Green Catbird	*Ailuroedus crassirostris*		x		
		Satin Bowerbird	*Ptilonorhychus violaceus*		x		
			Campephagidae				
		Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		x	x	x
			Artamidae				
		Dusky Woodswallow	*Artamus cyanopterus*		x	x	
		Grey Butcherbird	*Cracticus torquatus*		x	x	x
		Australian Magpie	*Gymnorhina tibicen*		x	x	x
		Pied Currawong	*Strepera graculina*		x		x
		Grey Currawong	*Strepera versicolor*		x		
			Corvidae				
		Australian Raven	*Corvus coronoides*		x	x	x
			Corcoracidae				
		White-winged Chough	*Corcorax melanorhamphos*		x		
			Hirundinidae				
		Welcome Swallow	*Hirundo neoxena*		x	x	x
		Fairy Martin	*Hirundo ariel*	x		x	
F			**Sylviidae**				
		Golden-headed Cisticola	*Cisticola exilis*		x		
			Ploceidae				
		Red-browed Finch	*Neochmia temporalis*		x		x
		Beautiful Firetail	*Stagonopleura bella*		x		
			Zosteropidae				
		Silvereye	*Zosterops lateralis*		x		
F			**Muscicapidae**				
		Bassian (Ground) Thrush	*Zoothera lunulata*		x		
		REPTILES					
			Agamidae				

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Jacky Lizard	*Amphibolurus muricatus*		x		
			Varanidae				
		Lace Monitor	*Varanus varius*		x		
			Scincidae				
		Eastern Water Skink	*Eulamprus quoyii*			x	
		Grass Skink	*Lampropholis delicata*			x	
			Elapidae				
		Red-bellied Black Snake	*Pseudechis porphyriacus*		x		
		AMPHIBIANS					
			Myobatrachidae				
		Common Eastern Froglet	*Crinia signifera*		x	x	x
		Eastern Banjo Frog	*Limnodynastes dumerilii*		x		
		Striped Marsh Frog	*Limnodynastes peronii*		x		
		Haswell's Frog	*Paracrinia haswelli*		x		
		Brown Toadlet	*Pseudophryne bibronii*		x		
			Hylidae				
V	E	Green and Golden Bell Frog	*Litoria aurea*		x		
		Bleating Tree Frog	*Litoria dentata*		x		
		Eastern Dwarf Tree Frog	*Litoria fallax*				x
		Jervis Bay Tree Frog	*Litoria jervisiensis*		x		x
		Peron's Tree Frog	*Litoria peronii*		x	x	
		Leaf Green Tree Frog	*Litoria phyllochroa*		x		
		Tyler's Tree Frog	*Litoria tyleri*		x	x	
		Verreaux's Tree Frog	*Litoria verreauxii*		x		

Appendix 3. Fauna species of conservation significance previously recorded in the district.

* - habitat requirements were generally extracted from Frith (1997), Cogger (2000), Strahan (1995), NPWS (1999) and the NSW Scientific Committee (2007), with other references used being identified in the bibliography.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
BIRDS			
Short-tailed Shearwater *Puffinus tenuiorstris*	*EPBC Act*	Pelagic species. Coastal, oceanic. Breeds on offshore islands. Mostly absent from May to September in Australia.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Great Egret *Ardea alba*	*EPBC Act*	Utilises lakes, swamps and dams. Forages on frogs, fish and crustaceans. Nests in colonies within vegetation associated with waterways.	During the field survey, no egret roosting colonies were identified within either study area. If present this species would only be recorded foraging in association with the drainage lines and adjacent pastures.
Pied Oystercatcher *Haematopus longirostris*	*TSC Act*	Found along beaches and estuaries of Australia feeding on molluscs. Nests on sandy beaches well above the high water mark. Found throughout Australian waters.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Sooty Oystercatcher *Haematopus fuliginosus*	*TSC Act*	Commonly found along exposed rocky shores, wave cut platforms, reefs and stony beaches. Feeds mainly on limpets, periwinkles and mussels picked off rocks. They usually fly to offshore islands to breed. Found throughout Australian waters.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Hooded Plover *Thinornis rubricollis*	*TSC Act*	Ocean beaches, sandy dunes, reefs, Occasionally coastal lakes.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Caspian Tern *Sterna caspia*	*TSC Act*	Coastal and inland watercourses and saline and brackish lakes. Breeds colonially and hunts over the ocean, lagoons and saltpans, often seen hunting in fields and grasslands near these water bodies.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Little Tern *Sterna albifrons*	*EPBC Act* *TSC Act*	The Little Tern is distributed along the entire coast of New South Wales. Little Terns are migratory and arrive in NSW during September to November and then leave March to May. It is strictly a coastal species, nesting in estuaries or on coastal beaches, and feeding in nearby waters. Most of the nesting sites in NSW are sand-spits, sand islands or beaches within or adjacent to the estuaries of rivers, creeks and coastal lakes.	Unlikely to utilise the study area as no components of this species documented habitat requirements are present.
Osprey *Pandion haliaetus*	*EPBC Act* *TSC Act*	A fish eating raptor, the Osprey inhabits mainly coastline areas. Nests are usually constructed in a large, dead tree, though rocky outcrops and artificial structures are also known to be used. This bird is usually loyal to its nesting sites.	Potentially present in association with Termeil Creek, this being a larger estuarine drainage line, though more likely to be found further away from the study are in association with larger, more open water bodies.
White-bellied Sea-eagle *Haliaeetus leucogaster*	*EPBC Act*	The White-bellied Sea-eagle is associated with coastal areas and bays all around Australia, and inland areas of large rivers, lakes and swamps. It spends most of its time soaring above these water bodies hunting for fish, tortoises, sea snakes, waterfowl and sometimes rabbits on land.	Potentially present in association with Termeil Creek, this being a larger estuarine drainage line, though more likely to be found further away from the study are in association with larger, more open water bodies.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Gang-Gang Cockatoo *Callocephalon fimbriatum*	*TSC Act*	The Gang-gang Cockatoo is generally found during the summer months in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, this bird may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests. Favours old growth attributes for nesting and roosting.	Potential resources for the presence of this bird were observed within the eucalypt woodlands (i.e. hollow bearing trees and stands of casuarinas are present). Whilst this is the case, within the study areas themselves, little resources available to this species were observed. During the field survey, whilst specifically targeted, no individuals of this species were observed and none were heard calling.
Glossy Black-Cockatoo *Calyptorhynchus lathami*	*TSC Act*	The Glossy Black-Cockatoo nests and roosts within hollows of large eucalypt trees and can spend up to 88% of each day foraging. This species inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits. This species shows strong preference for individual trees with a high seed to cone ratio.	Potential resources for the presence of this bird were observed within the eucalypt woodlands (i.e. hollow bearing trees and stands of casuarinas are present). Whilst this is the case, within the study areas themselves, little resources available to this species were observed. During the field survey, whilst specifically targeted, no individuals of this species were observed and none were heard calling. Similarly, no monostands of Casuarinas and no crushed Casuarina cones were observed within the study areas.
Powerful Owl *Ninox strenua*	*TSC Act*	The Powerful Owl favours wet to dry eucalypt forests with a dense understorey. Nesting in large hollows, nearly always in the trunk or top of a mature eucalypt. When not breeding, this bird will roost during the day within the shelter provided by a dense understorey, such as a bushy eucalypt or vine forest.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded in the eucalypt woodlands as potential resources for this species are available (i.e. hollow bearing trees and prey species are present).
Barking Owl *Ninox connivens*	*TSC Act*	Inhabits the timbered hills, forests and savanna woodlands of coastal and subcoastal eastern and northern Australia, often in association with hydrological features such as rivers and swamps. This species often prefers the woodland edge. Prey species such as birds, rabbits, insects and arboreal mammals are taken from the air. Usually always found in pairs occupying a range of between 30 and 200ha year round. Nesting occurs in tree hollows. Within their territories, numerous roosts may be used during the day. This species is more active than other large woodland owls.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded in the eucalypt woodlands as potential resources for this species are available (i.e. hollow bearing trees and prey species are present).
Sooty Owl *Tyto tenebricosa*	*TSC Act*	Inhabits tall, wet, old-growth forests on fertile soils with a dense understorey. Has a home range area of between 200 to 800ha in which a permanently bonded pair occurs. Breeds in the trunks of mature Eucalypts and appears to be loyal to nest sites. Roosts apart by day on a number of set perches throughout their territory. Prey species include mainly arboreal mammals.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded in the eucalypt woodlands as potential resources for this species are available (i.e. hollow bearing trees and prey species are present).

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Masked Owl *Tyto novaehollandiae*	*TSC Act*	Heavily timbered forests, woodlands and watercourses, never more than 300km from the coast. Has a large home range area of 500 to 1000ha per pair. Roosts and breeds in big hollows in trees, these usually being 40-500cm deep and around 10-30m above the ground. Pairs are permanently bonded and hold the same territory all year round (and occasionally over successive years). Can also nest on bare sand, cliff crevices or in limestone caves. Preys on small to medium sized mammals and birds, as well as some insects.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded in the eucalypt woodlands as potential resources for this species are available (i.e. hollow bearing trees and prey species are present).
White-throated Needletail *Hirundapus caudacutus*	*EPBC Act*	The White-throated Needletail breeds in the northern hemisphere and arrives in Australia in October. Most commonly associated with the east coast highlands, coastal plains and the hinterlands of arid inland Australia. Within this are, becomes locally nomadic in response to local weather changes. Drinks and feeds on insects while on the wing. Roost during the night in trees in forests.	Unlikely to utilise the study area as no major components of this species documented habitat requirements are present.
Fork-tailed Swift *Apus pacificus*	*EPBC Act*	The Fork-tailed Swift flies across southeastern Australia several times a year following the eastward low pressure systems in the atmosphere. They spend the majority of the day and night on the wing. The Fork-tailed Swift preys on flying insects such as termites, ants, flies and bugs. This bird drinks from inland lakes, and rain water puddles, skimming over the surface.	Unlikely to utilise the study area as no major components of this species documented habitat requirements are present.
Rufous Fantail *Rhipidura rufifrons*	*EPBC Act* M	The Rufous Fantail occurs within mangroves, fringing vine scrubs, rainforests and wet sclerophyll forests. This species forages within scrubby understorey and take insects and spiders. This species migrates in March/April to northern Queensland and New Guinea and returns September/October.	Recorded. Further assessment undertaken in Section 8.2.1 of this report.
Black-faced Monarch *Monarcha melanopsis*	*EPBC Act* M	The Black-faced Monarch prefers wet eucalypt forest and rainforest. They nest in sheeted gullies or within rainforest foraging within the middle storey layers. This species migrates in March/April as far as New Guinea and returns September.	Recorded. Further assessment undertaken in Section 8.2.1 of this report.
MAMMALS			
Yellow-bellied Glider *Petaurus australis*	*TSC Act*	The Yellow-bellied Glider is restricted to areas of tall, mature eucalypts. This species occupies tree hollows during the day and feeds at night predominantly on the sap that is collected from incisions that are gnawed into the trucks of specific species of eucalypts. Preferred feed trees include *Eucalyptus gummifera*, *E. maculata* and *E. piperita* with *E. saligna*, *E. viminalis* and *E. fastigata* also being utilised. The Yellow-bellied Glider occupies a home range area that is between 30 and 64 hectares in size. This arboreal possum is a highly mobile species that is able to glide across open space areas that are in the order of 70 to 100m.	Recorded during the previous investigation. As such, a precautionary approach was adopted and an assessment undertaken in Section 8.2.2 of this report.

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Grey-headed Flying-fox *Pteropus poliocephalus*	*EPBC Act* *TSC Act*	A canopy-feeding frugivore, blossom-eater and nectarivore which inhabits a variety of habitats. Roosts and breeds communally in 'camps', with these camps containing between 500 and 5,000 individuals. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring. Foraging occurs opportunistically on both native and exotic plants, often at distances between 30 and 70 km from camps.	Specifically targeted during the previous field investigation but not observed or heard calling during the nocturnal session. If present would be recorded in association with the eucalypt woodlands where suitable foraging resources are present. During the field survey, no current or historic Flying-fox camps were observed.
Large-footed Myotis *Myotis adversus*	*TSC Act*	The Large-footed Myotis is generally found where there is permanent and/or flowing water. This species roosts in caves, disused tunnels, tree hollows and dense riparian foliage, nearly always in the vicinity of suitable water bodies. The Myotis emerges at dusk to feed on aquatic insects "raked" off the waters surface.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded utilising the aquatic components of Termeil Creek to forage over whilst roosting in the adjacent woodlands. As the works would require the removal of one or two hollow bearing trees, though not recorded, a precautionary approach has been adopted and a seven part test undertaken on this hollow dependant microchiropteran.
Greater Broad-nosed Bat *Scoteanax rueppellii*	*TSC Act*	Preferring habitats which range from rainforests through to woodlands, this species usually roosts in tree hollows, though some individuals have been found in the roof spaces of old buildings. Feeding on large insects such as beetles, and is also known to take small vertebrates such as mice and other small bats.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded within the eucalypt woodlands where suitable foraging and sheltering sites are present. As the works would require the removal of one or two hollow bearing trees, though not recorded, a precautionary approach has been adopted and a seven part test undertaken on this hollow dependant microchiropteran.
Eastern Cave Bat *Vespadelus troughtoni*	*TSC Act*	The Eastern Cave Bat is a cave dweller. This species is distributed along eastern Australia from Cape York through to Narooma in NSW and inland through to the semi-arid zone. Habitats in which it has been recorded include drier forests and tropical woodlands, sandstone overhangs, tunnels and occasionally buildings. This species has been recorded emerging prior to dark to feed on mosquitoes.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded within the eucalypt woodlands where suitable foraging sites are present. During the field survey, no potential sheltering sites were observed.
Eastern Freetail-Bat *Mormopterus norfolkensis*	*TSC Act*	This species is known to predominantly roost during the day in tree hollows. Emerging after dusk to feed on flying insects, the Eastern Freetail-bat hawks through the forest canopy, or in clearings at its edge.	Specifically targeted during the previous field investigation but not recorded. If present would be recorded within the eucalypt woodlands where suitable foraging and sheltering sites are present. As the works would require the removal of one or two hollow bearing trees, though not recorded, a precautionary approach has been adopted and a seven part test undertaken on this hollow dependant microchiropteran.
AMPHIBIANS			

Common and Scientific Name	Legislation	Habitat Requirements*	Presence Consideration
Green and Golden Bell Frog *Litoria aurea*	*EPBC Act* *TSC Act*	Water bodies which support a lack of well developed emergent vegetation, free of chemical contamination, presence of diurnal shelter, basking sites and refuge sites for hibernation over winter, feeding areas, aquatic breeding and spawning areas and an absence of exotic fish, such as Mosquito fish.	The SEPP 14 wetland that occurs to the south / south-east of Termeil Creek Bridge may provide resources suitable for the occurrence of this species. If present, there is the potential that individuals maybe traversing along Termeil Creek during their foraging periods. As such, based on a precautionary approach, the impact of the works on this species has been assessed using the relevant assessment criteria (refer to Section 8.2.).