Review of Environmental Factors

2000/2001 National Highway Major Works Programme - Packaged Widening Works

Northern Region

SH9 - New England Highway.
Sandy Creek Road to north of Bluff River Road.
62.69km to 68.04km north of Glen Innes



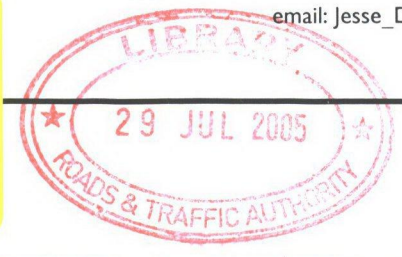
Prepared for
Client Services
Northern Region

Prepared by
RTA Operations
Environmental Technology
Level 5, 99 Phillips St
PARRAMATTA NSW 2124
Ph: 8837 0589
Fax: 8837 0053
email: Jesse_Death@rta.nsw.gov.au

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Person managing this document	**Person(s) writing this document**
Jesse Death	Jesse Death

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Prepared by RTA Operations – Environmental Technology Branch

Prepared for:	**Prepared by:**
John Watts RTA Operations Technical Services Northern Region	Environmental Technology Branch RTA Operations Directorate Level 5/99 Phillips St PARRAMATTA NSW 2124

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1 Proposal Identification

Name of Proposal: 2000/2001 National Highway Major Works Program – Packaged Widening Works for SH9 - New England Highway. Sandy Creek Rd to north of Bluff River Rd – 62.7km to 68.04km north of Glen Innes.

Region: Northern Region.

Local Government Area: Tenterfield

Construction Program: Pavement Rehabilitation and Formation Widening including Overtaking Lanes in Each Direction of Travel, 62.70 km to 68.04 km north of Glen Innes.

Plan Registration No.: 0009.430.RC.2005

2 Introduction and Background

2.1 Introduction

This Proforma 2 Review of Environmental Factors (REF) has been prepared by Environmental Technology Branch (RTA Operations Directorate) on behalf of the NSW Roads and Traffic Authority (RTA), Northern Region. For the purposes of the proposed 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 this REF is to describe the Proposal, 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 the associated environmental impacts has 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 Act* 1994 and the *Environment Protection and Biodiversity Conservation* (EPBC) *Act* 1999. In doing so, this REF helps fulfill the requirements of Section 111 of the EP&A Act that the RTA examine 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, (RTA, April 2001).

The findings of the REF would be considered when assessing:

- whether the Proposal is likely to have any significant impact on the environment and therefore the necessity for an Environmental Impact Statement (EIS) under Section 112 of the EP&A Act; and
- the significance of any impact on threatened species as defined by *the Threatened Species Conservation Act* 1995, in accordance with Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS).

2.2 Background

A preliminary environmental investigation was undertaken in late 2000, to determine the environmental constraints to the design of the Proposal and the necessity for specialist studies. That investigation revealed that the following potential issues and risks would be associated with the proposed works:

- The potential presence of threatened fauna and flora species;
- The integrity of habitat for protected species;
- The large number of native fauna observed as road kills indicates that the site may provide a "movement corridor";
- The abundance of amphibians within the study area, indicating integrity of aquatic habitat; and
- The potential for pollution of Little Llangothlin Nature Reserve and the habitat of the Eastern Freshwater Cod.

This REF examines those issues and risks in detail and also assesses other impacts identified during the course of the REF.

2.3 Methodology

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

- A site visit was held with the Project Manager's representative to discuss the proposal and assess the sites.
- Consultation was undertaken with the following authorities and RTA personnel:

  NSW Environment Protection Authority (EPA)

  NSW Department of Land and Water Conservation (DLWC)

  NSW Fisheries

  NSW State Forests

  Local Councils

  Scott Lawrence - Environmental Adviser, RTA Northern Region

  Mary-Lou Buck - Aboriginal Liaison Officer, RTA Northern Region

  Claire Everett, RTA Heritage and Archaeology Specialist
- A search was conducted on the following databases to identify any potential issues:

  Australian Heritage Commission Register of National Estate

  NSW Heritage Office State Heritage Register

  RTA Heritage and Conservation Register

  Council Heritage Listings

  NPWS Aboriginal Sites Register

  NPWS Wildlife Atlas flora records

  NPWS Wildlife Atlas fauna records

  Environment Australia EPBC Database

- A literature review and review of documentation was undertaken to determine issues relating to:

  Acid sulphate soils

  Local Environment Plan zoning

  State Environmental Planning Policies

  Known sensitive sites

  Regional Environmental Plans

- Specialist consultants were commissioned to undertake site specific studies of:

  Terrestrial Flora

  Terrestrial Fauna

  Aquatic Ecology

  Indigenous Archaeology / Cultural Heritage

Assessment was undertaken in line with the Environmental Impact Assessment Policy, Guidelines and Procedures (RTA, April, 2001) and current RTA policies.

3 Proposal Description

3.1 Location

The study area, known as McClifty's, extends from 62.7 to 68.04 kilometres north of Glen Innes on the New England Highway. Refer to **Appendix A** for site location map. The study area begins on the northern side of Sandy Creek and ends just to the north of the intersection of Bluff Creek Road and the New England Highway. Please refer to **Appendix B** for photographs of the study area.

3.2 Description of the site and Surroundings

The road reserve is flanked by agricultural land, varying from intensive sheep farming to low intensity cattle farming properties. The vegetation adjacent to the roadside, within the road reserve, is primarily an Open Eucalypt Woodland, with a substantial number of large trees with large tracts of clearings on both sides of the road. There is a lack of midstorey throughout the area, although pockets of dense scrub occur in some of the gullies adjacent to the road. The ground cover consists almost entirely of native grasses and there is a low percentage of introduced weed species.

Most waterways appear to drain away towards the southeast. Table drains of varying depths are located on both sides of the road.

The rehabilitation and pavement widening Proposal lies entirely within the road reserve, with widening of the existing formation generally being confined to one side. Clearing of vegetation would be limited to within a few metres of the existing formation.

3.3 General Description of the Proposed Works

The Proposal involves rehabilitation of the existing road pavement and would include widening of the shoulders where possible while avoiding or minimising major earthworks. Two overtaking lanes, one for each direction of travel would be included in the work. The northbound overtaking lane would be located at the start of the proposed work. The southbound overtaking lane would be located immediately south of the McClifty's Road intersection.

3.3.1 Design Parameters

The road design parameters outlined for this Proposal include the improved safety of this section of the Highway through improved pavement structure and shoulder widths, as well as improved design standards for width and travel speed. Further information on design parameters is located in **Section 8.3** of this REF.

3.3.2 Construction Activities

The proposal is to rehabilitate the existing road pavement, at the location described in **Appendix A**. Variations in the overlay thickness are proposed throughout the length of the Proposed works. Further information on construction activities is located in **Section 8.4** of this REF.

3.3.3 Additional Fill Material

General earthworks would require 7,500 cubic metres. In addition, 11,500 cubic metres of select fill and 22,000 cubic metres of pavement material would be imported. Removal and stockpiling of topsoil would total 4,500 cubic metres and spoil would total 3,500 cubic metres.

Select fill material would be sourced from a known supplier with a quarry north of Castlecrag Rd, roughly 5km from the New England Highway, a haul of approximately 20 kilometres. Pavement material (DGB20) would be sourced from an existing quarry near Glen Innes, worked by a known supplier. Suitable sealing aggregates would be sourced from a known supplier that has quarries and crushing plants at Glen Innes. Stabilising agents and bitumen would be purchased from suppliers out of the area and would be supplied by specialist road vehicles as required.

Materials are to be sourced from suppliers who have full environmental and development approval from Council.

3.3.4 Spoil

The Proposal would involve the handling of approximately 3,500 cubic metres of spoil.

3.3.5 Truck Movements

The supply of pavement materials and select fill would involve up to 4,000 additional truck movements spread over the 50-week contract period, that is 20 per day. This compares to a daily volume of approximately 3,500 vehicles including 770 trucks on the New England Highway. On quarry feeder roads, likely truck movements would have been considered in the Development Approval for the suppliers' operations rather than as a direct result of this Proposal.

3.3.6 Compound and Stockpile Sites

The compound site is proposed to be located in an area of previously cleared land with an existing access track. The site is approximately 30m east of the Highway in line with ch. 65500. This site has been chosen as it would require the least amount of vegetation removal and therefore minimise to the extent possible, the impact on the environment.

It is anticipated that the stockpile site would be located at ch. 65500, the same location as the compound site. There would be a need to stockpile quantities of topsoil, fill material and some pavement material during the course of the work. Possible locations for additional smaller stockpile sites include east of ch. 62900, east of ch. 63650, east of ch.64400 opposite McClifty's Rd, west of ch. 66900 and west of ch. 67700. These areas are significantly smaller in size than the ch. 65500 site, and would be suitable for the stockpiling of up to 2,000m^3 of material(s).

The contract would require that all stockpile sites be managed to ensure that run-off is contained and/or filtered before leaving the site.

3.3.7 Culverts

There are 19 transverse culverts within the study area, all of which require extensions. The minimum extension would be 1.22m, while the maximum extension would be 4.88m. Culvert extensions would be constructed prior to the fill being placed over them. Construction would involve removal of the old headwall, excavation or fill to support the pipe extension, placing of a bedding layer of sand, placing and jointing of the pipes, backfilling around and over the pipe with select material compacted in layers, installation of new headwalls and treatment of outlet areas with the appropriate scour prevention treatment for the location, for example seeding, jute mesh, rocks, concrete, wire mattress. Silt trap measures for such works would be part of the overall sedimentation control plan for the Proposal.

3.3.8 Cut Widening

The proposed work would involve narrow widening of some existing cuts. It is expected that the majority of the cut would be excavated using large excavators working from the road and loading into trucks. The existing topsoil and vegetation would be removed and stockpiled for future use. The completed cut would be surfaced with salvaged topsoil and treated according to the slope, for example through hydro-seeding, mulching or jute mesh.

3.3.9 Fill Widening

Fill widening would involve fairly narrow earthworks. The existing topsoil and vegetation would be removed from the batter and widening area and stockpiled for future use. The fill base would be established by reshaping and compacting. The existing fill would be benched to allow the new fill to tie in with the existing fill. New material would be imported by truck and dumped in the appropriate location for spreading and compaction in layers. When the fill is completed, it would be surfaced with salvaged topsoil and treated according to the slope, eg hydro seeding, mulching, jute mesh.

3.3.10 Shoulder Widening

Where the existing shoulders are not sufficiently wide to support the new pavement, the outer portion of unsuitable material would be excavated to 650 mm below the final surface level and replaced with a 300mm layer of select fill compacted in layers. The next 350mm would be DGB (pavement material).

3.3.11 Costs

The concept estimate for pavement rehabilitation and widening for the 5.34 km study area are listed as **Appendix C**. The Proposal would be expected to cost $7,914,977.00.

3.3.12 Timing

It is anticipated that the works would be completed in 50 weeks, given ideal working conditions. Construction is currently programmed to start in late 2003 / early 2004.

4 Statutory Requirements

4.1 Local Environmental Plan

The area surrounding the New England Highway in the vicinity of the proposed works is subject to the Tenterfield Shire Council Local Environment Plan (LEP). Land in the vicinity of the study area is zoned 1(a) – General Rural in the LEP dated 1996. The New England Highway road reserve is unzoned according to the LEP, therefore council consent would not be required prior to undertaking the works, with the RTA therefore being the proponent and determining authority for the Proposal.

4.2 Regional Environmental Plans

No relevant Regional Environmental Planning Policies apply to the Proposal.

4.3 State Environmental Planning Policies

SEPP 44 (Koala Habitat Protection) applies to this LGA. Although the RTA is not bound by the provisions of SEPP 44 for a Part 5 assessment, SEPP 44 is applicable to the LGAs and the provisions would be used in an ecological assessment for the study area. This area of works has potential to comprise koala habitat, however, feed tree species occurring on site are in abundance.

No other SEPPs have been identified as relevant for the study area.

4.4 *Protection of the Environment Operations Act, 1997*

The *Protection of the Environment Operations Act* (PoEO) 1997, has repealed the following five Acts: *Clean Air Act* 1961, *Clean Waters Act* 1970, *Pollution Control Act* 1970, *Noise Control Act* 1975, and the *Environmental Offences and Penalties Act* 1989.

Section 120 – Prohibition of pollution of waters, Clauses 1-4 state that waters must not be polluted. The penalty to a corporation for causing water pollution can be up to $250,000 and, in the case of a continuing offence, to a further penalty of $120,000 for each day the offence continues. In the case of an individual the penalty can be up to $120,000 and, in the case of a continuing offence, a further penalty of $60,000 for each day the offence continues may apply. All works undertaken would incorporate the RTA's Water Quality Code of Practice.

Under the act it is, however, a defence if the person establishes that:

(a) the pollution was regulated by an environment protection licence held by the person or another person, and

(b) the conditions to which that licence was subject relating to the pollution of waters were not contravened.

4.5 Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*

Matters of National Environmental Significance (NES) as identified within the *Environment Protection and Biodiversity Conservation Act, 1999* are not anticipated to be significantly affected as a result of the Proposal. No Commonwealth land would be affected, either directly or

indirectly as a result of this Proposal. These matters are fully explored under the checklist in **Section 8.22**.

4.6 Licences and Approvals

Should water for roadworks be required to be drawn from local sources, a permit would be required from the Department of Land and Water Conservation.

Where culvert widening works are proposed, NSW Fisheries would need to be consulted prior to works being undertaken.

A licence would need to be obtained should the removal of threatened species be required.

If any activities are likely to cause pollution of creeklines, a licence would need to be obtained for the works under the PoEO Act, 1997.

5 Specialist Studies and Community and Stakeholder Involvement

5.1 Specialist Studies

An indigenous heritage assessment was undertaken by Davies Heritage Consultants Pty Ltd in early 2001. A summary of that study is given at **Section 8.6.** The full archaeological report is included at **Appendix D**.

A flora assessment was undertaken by Idyll Spaces Pty Ltd in early 2001. A summary of that study is given at **Section 8.7.** The full flora report is included at **Appendix D**.

A fauna assessment was undertaken by Kendall and Kendall Pty Ltd in early 2001. A summary of that study is given at **Section 8.8**. The full fauna report is included at **Appendix D**.

5.2 Community and Stakeholder Involvement

Table 5.1, below lists public authorities and government agencies that were contacted for the purposes of the environmental assessment of the Proposal. Where a response was received, it is listed in column 2, while column 3 identifies the section in the REF where authority responses have been addressed.

Table 5.1: Authority Responses

Authority	Response	Section in REF where Addressed
NSW Fisheries	The following issues need to be addressed in the REF:	
	• Principles of NSW Fisheries Policy and Guidelines for bridges, roads, causeways, culverts and similar structures. (1999) and the Fisheries Management Act 1994.	8.15
	• Impacts on fish passage and water velocity. Fisheries must be informed if fish passage is to be blocked or altered.	N/A
	• Use of erosion and sediment controls as disposal of soil into a waterway is unacceptable.	8.10
	• Consultation with Fisheries is required for the construction of any culverts or bridges.	Noted
	• Consultation with Fisheries is required for any dredging or reclamation works.	N/A
	• Temporary sidetracks or crossings should be constructed of large, clean rock.	N/A
	• Site rehabilitation.	11.1
NSW National Parks and Wildlife Service	The following issues need to be addressed in the REF:	
	• Areas of significance for native vegetation, with particular reference to the value of habitat for threatened species, populations or ecological communities and their habitats, or regionally significant species and vegetation associations.	8.7
	• Areas of potential significance for native fauna with particular reference to the value of habitat for threatened species, populations or ecological communities, or regionally significant species.	8.8
	• Areas of archaeological potential and Aboriginal heritage value as identified by the Aboriginal community and sites registered on the NPWS Aboriginal sites register.	8.5, 8.6

• Areas of NPWS estate.	N/A
The NPWS letter also provides a list of threatened species which have been noted from the general area of the existing road alignment. Based upon that list, the following recommendations are made:	
• A search of the NPWS Wildlife Atlas should be undertaken for flora and fauna records.	8.7, 8.8
• Detailed surveys should be undertaken, to determine ecological values and potential impacts, if the study area possesses attributes for threatened species.	8.7, 8.8
• Attention should be given to mitigating impacts. Mitigation may include modification to the Proposal, compensatory habitat or native vegetation restoration.	8.7, 8.8, 11.1
• Several Aboriginal cultural heritage sites are located in the vicinity of the Proposal. It is recommended that a search be undertaken of the NPWS Aboriginal Sites Register, and an archaeological assessment be undertaken in consultation with the local Aboriginal community.	8.6
• If any areas or species requiring consideration under the EPBC Act 1999 may be affected, approval may be required from Environment Australia.	8.22

NSW Environment Protection Authority	Phone conversation with Mr Brian Hughes on 30/10/00. Mr Hughes indicated that the EPA requires the RTA to use Best Practice Guidelines.	Noted
NSW Department of Land and Water Conservation (DLWC)	The following issues need to be addressed in the REF:	
	• Proposed erosion and sediment control measures.	8.10
	• An erosion and sedimentation control plan should be prepared for each site. That plan should include a soil description and information on the erosion and sedimentation control structures.	8.10
	• Rehabilitation of the site, including final landforms, revegetation strategies and species to be used.	11.1
	• A description of vegetation at each site, including the presence of threatened species.	8.7
	• A statement of land title if works are not undertaken within the road reserve.	N/A
	• Details of timing and construction methods.	8.1 – 8.4
Northern New England Rural Lands Protection Board (RLPB)	The RLPB advises that their Director's raised no objections to the proposal. The normal RLPB concerns for such proposals include soil conservation and rehabilitation.	8.10
	Any repair of fencing when earthworks impinge on Travelling Stock Reserves.	N/A
	Request the opportunity to comment further as further details become available.	Noted
NSW State Forests	Mr Steve Rayson, north east region Regional Manager, was contacted by phone on the 13/11/01 regarding the Proposal. The position of the State Forests is such that as long as the works are within the road reserve then the State Forests would have "nil comment" to make on the proposal.	Noted
Tenterfield Shire Council	Consultation with Tenterfield Shire Council was undertaken by phone on the 5/11/01, with Mr Scott Riley. Council requires that section 79 (c) of the Environmental Planning and Assessment Act, 1979 be adhered to.	N/A

6 Strategic Stage

6.1 General

The New England Highway is a major inland route linking Sydney and Brisbane. It is the principal route for interstate road freight and provides B-Double access along its entire length. The Oxley, Bruxner and Gwydir Highways run east-west from the Highway, linking the New England Region to the coast. In addition to freight, the Highway has considerable traffic movement between towns, mines and farms. The upgrading and maintenance of the Federally funded New England Highway is a high priority for NSW. An improved route would encourage the continued use of the Highway by freight operators.

6.2 Justification and Need for the Proposal

This section of the highway is a two lane two-way single carriageway located in a 100 km/hr rural surrounding. The terrain is undulating and includes several crests and some steep grades. The horizontal alignment is of a high standard and suitable for the travel speed. The vertical alignment however is of a lesser standard and below a 100km/hr travel speed. Stopping sight distance at all the crests is below the travel speed, and is limited to 90 - 95km/hr.

The pavement is in very poor condition and requires immediate remedial works. The existing pavement has had extensive areas of failure, with subsequent heavy patching. As a consequence, the pavement shape has deteriorated, resulting in poor surface drainage and rideability, which puts road user safety at risk. Investigations indicate that there are a number of pavement structures within the Proposal length, therefore different overlay thicknesses may be required to achieve the required outcome.

This section of the Highway has been identified by Asset Management, Northern Region, as being in very poor condition and in urgent need of pavement rehabilitation. Construction is included in the 2001 / 2002 and 2002 / 2003 works program.

7 Concept Stage

7.1 Objectives of the Proposal

This proposal is necessary to:

1. Restore the pavement integrity consistent with the National Highway Maintenance Strategy,
2. Widen the formation to provide wider shoulders where possible without major earthworks, and
3. Provide overtaking lanes in both directions.

7.2 Constraints

The Proposal has the following constraints:

- Allocated funding for development, pre-construction and construction activities.
- Statutory environmental obligations.
- Development and pre-construction activities to be completed within the approved schedule.
- Maximum utilisation of existing pavement/width.
- Work under traffic.
- Need to retain access to a subdivision at ch. 66900.
- The potential presence of a threatened plant species.

7.3 Options Considered

In the planning phase of the Proposal, Asset Management identified a need for pavement rehabilitation as well as improvements in general shoulder width throughout the Proposal length. Some other minor deficiencies were also identified in this phase of the Proposal.

The Region's Road Safety, Traffic Management and Development Branch also targeted this section of the New England Highway for funding of overtaking lanes to fit in with the overtaking lane strategy for the Highway.

Combined funding is available to rehabilitate the pavement, widen the general road formation and also construct two overtaking lanes.

The horizontal alignment of the existing highway is above 100 km/hr standard and quite acceptable for the Proposed 20-year volume of traffic. The vertical alignment however does fall below 100kph stopping sight distance on several of the crests within the Proposal length.

The relocation of the highway on a new alignment was not considered an appropriate option as considerable native vegetation and habitat would need to be removed to accommodate a new alignment. A new road formation would require additional resources for construction and maintenance of the Highway, impacting substantially on the economic viability of the Proposal. The level of vegetation removal required, the presence of threatened plant species opposite Bluff River Road and overall cost would not make the re-alignment of the Highway at this location a viable option.

Consequently, the brief for this Proposal is limited to options based on the existing highway formation. The existing formation is to be treated as an asset and improvements are to be made to this asset.

Option 1 - Do nothing

Not only has this section of the Highway required extensive patching over the past few years but it is also deficient in formation width for most of the Proposal length.

This option does not address the RTA's responsibilities to maintain a National Highway in accordance with the Proposal's objectives. Prolonged delay of the Proposal could result in major failure and more accidents causing the Highway to be out of service and/or jeopardise the safety of road users.

Option 2 – Granular Overlay

This option involves the construction of a pavement built fully of unbound gravels, with additional overlay gravel mixed with the existing base to produce minimum layer depth of 150mm.

The Pavement Report has recommended that sections of the Proposal length be overlayed with differing depths of granular pavement;

62.66km to 63.90km	150mm
63.90km to 65.25km	200mm
65.25km to 66.60km	200mm
66.60km to 67.90km	150mm
67.90km to 68.04km	150mm (area of poor subgrade)

The granular overlay requires approximately 50% more gravel for the Proposal when compared with an overlay prior to deep lift (bound Pavement). Availability of large quantities of pavement material is becoming increasingly difficult.

Additional overlay would require additional widening on fills to support the increased final surface level. Because of the condition of the road, the existing pavement would require re-working prior to a granular overlay to form a sound uniform sub-base. A granular overlay would require a longer "working" time and greater exposure to weather conditions, leading to a higher risks factor. If this pavement treatment for some reason fails or results in a short pavement life, there would be no option but to deep lift stabilise the pavement.

Option 3 – Granular Overlay and In - Situ Stabilisation

This option would involve importing 100mm to 200mm of material to be bound and then in-situ stabilised to a depth of 350mm. The target strength would be >4MPa and the pavement would be a heavily bound pavement. Such a pavement has a design life > 20 years.

Pavement depths recommended for overlay before in-situ stabilisation are shown in **Table 7.1** below. It should be noted that these overlay depths may be subject to minor changes in the final pavement design.

Table 7.1: Pavement Depths

62.7km to 63.6km	175mm
63.6km to 64.4km	Nil
64.4km to 65.25km	200mm
65.25km to 65.6km	150mm
65.6km to 67.4km	100mm
67.4km to 68.04km	175mm

A granular overlay followed by deep lift stabilisation to a depth of 350mm would ensure long lasting performance of the pavement.

There would be a saving in the amount of granular pavement material required for this option and a shorter 'working' time and less exposure to weather conditions. Consequently, a lesser risk factor.

Allowing for bulking of the materials after stabilisation and construction tolerances a layer thickness of 350 mm is proposed.

Additive type and percentage: Testing of the base and sub-base materials has indicated that they react with lime and lime based blend additives. These results indicate that satisfactory UCS values of > 4 Mpa could be achieved with 4% of 70/30 or 60/40 slag lime blends, or 3% quicklime. The 70/30 slag / lime blend has performed well in similar works.

Preferred Option

The preferred option is Option 3 – Granular overlay and In-Situ Stabilisation

This option provides the benefits of strengthening the pavement and recycling existing resources. It also offers the most practical and affordable solution. The construction of a flexible overlay is not likely to have major construction problems due to the relatively lower traffic volumes on this area of the highway.

8 Design Considerations

8.1 Existing Road

This section of the highway comprises one northbound and one southbound lane located in a 100 km/hr rural surrounding. The terrain is undulating and includes several crests and some steep grades. The horizontal alignment is of a high standard and suitable for the travel speed. The vertical alignment however is of a lesser standard and below a 100km/hr travel speed. Stopping sight distance at all the crests is below the travel speed, and is limited to 90 - 95km/hr.

The Highway within this section has been identified by Asset Management Northern Region as being in very poor condition and in urgent need of pavement rehabilitation and is included in the 2001/2002 and 2002/2003 works program.

The pavement is in very poor condition in some areas and requires immediate remedial works. As a consequence of the failed road pavement and heavy patching, the pavement shape has deteriorated resulting in poor surface drainage and rideability, which puts the road user at risk. The works would improve the quality of road surface and reduce maintenance expenditure.

8.2 Existing and Forecast Traffic

The following statistics have been used as the basis for design considerations:

- AADT - 3500 (2000);
- AADT 20yr projected - 5600 (2020);
- % Heavy Vehicles - 22% (1997);
- Accidents - 2 (Serious Casualty), 9 (no injuries);
- Accidents Mvk - 0.29 (total) 0.03 (serious);
- Roughness c/km - 98 (Seg 2570);
  - 98 (Seg 2575);
  - 94 (Seg 2580);
  - 86 (Seg 2585);
- Rutting - 27% (Seg 2570);
  - 25 %(Seg 2575);
  - 19 %(Seg 2580);
  - 20 %(Seg 2585);

8.3 Design Parameters

The outcomes for this Proposal would be:

- Provide a smoother pavement to achieve a target Roughness of 40 counts / km;
- Improved safety from improved pavement and shoulder widths;
- Improved safety with the provision of overtaking lanes for both directions of travel
- Improved design standards for width and travel speed;

- Pavement designed for a 20 year life; and
- Reduction in maintenance costs.

The following assumptions have been made in evaluating the proposed options:

- Existing centreline to be modified, however there would be no major departures from the general horizontal and vertical alignments;
- Existing road reserve to be retained;
- Existing drainage structures are adequate;
- 50mm Topsoil On Batters;
- Area Volume Method Adequate;
- Volumes are from Design Surface to Existing Surface; and
- Advisory Speed Signs on curves are appropriate for the existing conditions.

The following design elements have been adopted:

- Travel Lane - 3.5 m;
- Shoulder - 2.0 m (general);
  - 3.0 m (adjacent to barrier line);
  - 1.0 m (adjacent to auxiliary lane);
- Fill Verge - 0.3 m (general);
  - 0.6 m (adjacent to guardfence);
- Cut Verge - 1.5 m with SK gutter (0.3m berm);
- Fill Batter - 2 to 1;
- Cut Batter - 1.5 to 1

8.4 Construction Activities

The proposal is to rehabilitate the existing road pavement, at the location described in **Appendix A**. Variations in the overlay thickness are proposed throughout the length of the Proposed works.

The proposal would involve the following activities:

- Prepare the existing shoulder plus areas of formation widening and the batter surface;
- Rework to 650 mm (minimum) below finished surface level where widening is required (in accordance with the drawings);
- Place and compact layers of general earthworks material to 650 mm below design surface level (in accordance with the drawings);
- Place and compact a layer of select material to 300 mm below design surface level;
- Place and compact a layer of imported granular pavement material* to design surface level across the new road formation;

- Deeplift stabilise the road formation full width, which would require the existing roadbase and imported overlay layer to be broken up to a depth of 350 mm;
- Reshaped to design surface levels and apply a 10 mm primer seal. The stabilisation of the roadbase would be carried out using an *in-situ* plant which blends the cementitious additive with the material to create a stronger base;

The proposal would also involve the following associated activities and controls:

- After a minimum period of approximately 6 months, to allow for general shrinkage cracking of the bound pavement, a full width 5 mm correction seal (if required), together with a full pavement width 14 mm scrap rubber seal would be applied as the final seal;
- Suitable traffic management controls would be implemented during the construction period and traffic would use the existing roadway;
- A site compound, including amenities for workplace Type 1 and a site office, would be required;
- Minimal vegetation is to be removed when locating the compound right of ch 64km250 in a relatively clear area;
- All trees within the clear zone are to be considered for removal;
- It is anticipated that utilities are not affected by the proposal however, a check would be required for clearances to overhead power lines;
- It is anticipated that works would be completed in 50 weeks, given ideal working conditions.

* *(The imported material may be finished up to 20 mm (assumed) below the design levels to allow for the bulking effect during the stabilisation process.)*

There are three intersections located within the Proposal:

- McClifty's Road/SH 9 junction would be improved to a minimum intersection treatment, which provides a right turn bay for traffic turning off the highway.
- The treatment for a subdivision access road left of chainage 66.0km needs to be further investigated at the Final Design stage. The concept design includes 3.0m widened shoulder adjacent to the intersection.
- Bluff River Road/SH 9 junction and Primrose Hill Road /SH 9 junctions would form a four way intersection with opposing minimum length right turn bays, to cater for traffic turning off the highway.

9 Environmental Assessment

9.1 Non-indigenous Heritage

Existing Situation

A Preliminary Environmental Investigation has been carried out for this Proposal as part of the 2000/2001 National Highway Major Works Programme – Packaged Widening Works. As part of this investigation searches were undertaken on a number of databases into the cultural heritage of the study area. No recorded sites were shown to exist within 5km of the study area for the NSW Heritage Office State Heritage Register, RTA s.170 Heritage and Conservation Register, or the Tenterfield Shire Council LEP Heritage Lists. The Australian Heritage Commission Register of the National Estate lists the Bluff River Rail Bridge as an item of National Heritage Significance. This rail bridge is approximately 4km north east of the study area and would not be impacted upon by the Proposal. No other heritage items on the register have been recorded within 5km of the study area.

Impacts

It is not anticipated that the proposed works would impact on cultural heritage in the vicinity of the study area. However, if there were any items of heritage significance within 75m of the study area, they may be structurally affected by vibration.

Proposed Safeguards

Works would cease immediately upon discovery of any non-indigenous relic. The RTA Northern Region Environmental Adviser and the State Heritage Commission would be contacted immediately. Works would only recommence following clearance from the appropriate authorities.

9.2 Indigenous Heritage

Existing Situation

Based on environmental and prior Archaeological research it was considered that the study area was of low to medium archaeological potential. The main significant material types predicted to be located by a field survey were stone artefact scatters (including isolated stone artefacts), quarries and scarred trees.

Two Scarred trees were located within the study area during the survey. Both trees are located on the western side of the New England Highway to the south of the junction with McClifty's Rd and the Highway.

Both the scarred trees located during the survey are of significance to the Moombahlene Local Aboriginal Land Council (LALC). The scars on these trees constitute physical evidence of prior occupation of the area, and as such may add to the value and significance assigned by members of the Aboriginal community. The significance of this site to the local Aboriginal community can also be illustrated through the comparison of the study area to other proximal Aboriginal sites. Aboriginal sites in the vicinity of the study area include two bora grounds, a stone artefact scatter, and an isolated stone artefact. As the known cultural heritage record for the broader study area does not include scarred trees, the two scarred trees located during the survey should be considered important as a site type to be retained for a representative sample.

Impacts

The scarred trees identified above are potentially under threat of impact by the Proposal. Given the topography within the study area it is considered that there is a possibility that other undetected archaeological material could also be present. However, because the potential for the existence of artefacts other than isolated stone artefacts or background scatter would be considered low, further archaeological work would not be considered warranted.

It is not anticipated that the proposed works would impact on indigenous heritage in the vicinity of the study area if the following safeguards were implemented.

Proposed Safeguards

- Prior to construction a buffer zone of no more than 5 meters would be established around the two identified scarred trees.
- The location of the two scarred trees would be noted on the contract documents and the protection of these trees would be incorporated in the Construction Environment Management Plan (CEMP) for the Proposal.
- All personnel working on the site would be briefed on the significance of the items (scarred trees) and the need to protect them during the construction phase.
- If the works uncover any item which may be interpreted as Aboriginal in origin, work should cease immediately. The NPWS and the RTA's Environmental Adviser should be contacted immediately and works should not re-commence in the subject area until the find has been examined and dealt with appropriately.
- Information about such finds should be passed onto both the NSW NPWS, Coffs Harbour, and the Moombahlene LALC as soon as possible for further discussion and negotiation.

9.3 Flora

Existing Situation

The forest communities of the study area are considered to be poorly preserved in the region. A small population of the Vulnerable species *Thesium australe,* and potential habitat for other threatened flora species, was found in the study area.

Roadside vegetation corridors in largely cleared landscapes such as the study area may be an important corridor connecting forest remnants for native birds and animals, thereby facilitating the dispersal of fruits and seeds of many native plants between remnants. For example the native mistletoe *Amyema miquelii* appears to be more common on the road reserve than elsewhere.

There were 7 vegetation communities identified in the immediate vicinity of the Proposal;

Community 1: - Cleared.

This community is characterised by an absence of woody vegetation and dominance of exotic grasses.

Community 2: - Ribbon gum – Fuzzy box Open Forest.

The overstorey consists of large mature trees around 25m tall. There is also a significant amount of regrowth and senescing trees, however the midstratum is absent. Ribbon gum is the dominant species within this community. This community is notable for the presence of hollows and the large size of the trees.

Community 3: - Blakey's red gum – apple box – stringybark – ribbon gum Open Forest.

The overstorey consists mainly of small to medium mature trees around 15m tall with few hollows. Blakey's red gum, apple box and stringybark are co-dominant. The midstratum consists of a sparse layer of white sally wattle over a scattering of dogwood and cherry ballart. The groundcover consists of a sparse cover of primarily native species.

Community 4: - Disturbed Blakey's red gum – apple box – stringybark – ribbon gum Open Forest.

This community is similar to community 3 but occurs in a landscape that is extensively cleared for pasture. The midstratum is generally absent, and a moderately dense cover of exotic grasses and herbs typically dominates the ground-layer.

Community 5: - Blakey's red gum – yellow box – stringybark – rough-barked apple Open Forest.

The overstorey consists mainly of small to medium trees around 15m tall. Blakey's red gum, stringybark and rough-barked apple are generally co-dominant throughout. The distribution of yellow box is patchy, being common above McCliftys but uncommon elsewhere in the community.

The midstratum consists of a sparse layer of dogwood and cherry ballart to 6m tall. The groundcover consists of a sparse cover of primarily native species.

Community 6: - Disturbed Blakey's red gum – yellow box – stringybark – rough-barked apple Open Forest.

This community is similar to community 5 but occurs in a landscape that is extensively cleared for pasture. The midstratum is generally absent, and a moderately dense cover of exotic grasses and herbs typically dominates the ground-layer.

Community 7: - Swamp foxtail – Swamp millet Closed Grassland

This community dominates the moist areas of Four Mile Creek, a shallow and poorly defined intermittent watercourse. Swamp foxtail and Swamp millet are the dominant species.

Refer to ***Appendix D*, Roadside Vegetation Study, figures 1a – 1d**, for vegetation community distribution within the study area.

The habitat values of the vegetation communities have been compromised by prior disturbance. This disturbance has resulted in the following impacts on the local vegetation:

- the thinning or clearing of tree cover;
- the preponderance (prevalence) of regrowth and the general absence of senescent trees;
- the general absence of native mid-stratum vegetation; and
- the invasion or replacement of ground layer vegetation by introduced weeds, pasture grasses and shrubs.

Of particular concern is the dominance of introduced pasture grasses on more fertile areas (such as moist areas, level areas, drains and fill batters), which because of their height and dense cover are likely to exclude the regeneration of native shrubs and trees in these areas for the foreseeable future. It should be noted however that the dominance of these species appears to be a result of soil disturbance associated with road construction and maintenance, and often declines markedly with distance from the road edge.

An additional flora assessment was undertaken in late February 2002, to assess the proposal in terms of Scientific Committee final determinations that have been gazetted since the original flora report was completed in late February of 2001. Specifically, the NPWS Wildlife Atlas Records were reviewed again for any threatened plant species included since the original assessment, and 8 part-tests have been undertaken on any species found in the study area that has been listed since the original assessment was undertaken in late February 2001.

Conservation Significance

No critical habitat, threatened vegetation communities or plant populations listed under the TSC Act or the EPBC Act occur in the study area.

The threatened plant species *Thesium australe*, listed as Vulnerable by the TSC Act and the EPBC Act, was detected in the study area. One small population occurs in the study area in Community 4 (Disturbed Blakey's red gum – apple box – stringybark – ribbon gum Open Forest), comprising 3 plants spread over 20 square metres.

Potential habitat for the threatened species *Acacia macnuttiana, Diuris pedunculata, Goodenia macbarronii, Grevillea beadleana, Haloragis exalata subsp. velutina, Pimelea venosa, Pultenaea stuartiana* and *Thesium australe* was detected in the study area. Whether or not potential habitat for *Lepidium peregrinum* and *Bertya pinifolia* also exists in the study area is not known, as habitat descriptions for these species are not available.

Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum and *Pultenaea stuartiana* are small and without distinctive vegetative features, are not readily detected except when flowering and may therefore occur in the study area. *Bertya pinifolia* is not reported from the locality and is known only from near the Queensland border. Populations of *Diuris pedunculata* are very rare in the locality, with only one population known from within 30 kilometres of the study area. *Lepidium peregrinum* is also very rare, known only from a location west of Tenterfield. Two populations of *Pultenaea stuartiana* are known from within the locality, occurring at least 20 kilometres to the east.

Community 2 and Community 3 may be of conservation significance for *Diuris pedunculata*, Communities 3 and 5 may be of significance for *Pultenaea stuartiana*, and Communities 2,3 and 5 may be of significance for *Pimelea venosa.*

The conservation status of vegetation communities 2, 3, 5, and 7 are regarded as poor, with communities dominated by *Eucalyptus viminalis, E bridgesiana , E blakelyi,* and *E melliodora* not reserved or poorly reserved both in northern NSW and NSW generally (Hager and Benson 1994). It is therefore important to preserve the existing vegetation communities as much as feasibly possible.

With regard to the additional assessment undertaken in February of 2002, two new scientific determinations are of relevance to the study area. These are:

1. The listing of clearing of native vegetation as a threatening process (Scientific Committee 21/09/01), and
2. The listing of the plant *Euphrasia ciliolata* as Vulnerable (Scientific Committee 18/01/02). This species was last recorded in 1961, over 20km south of the study area.

Impacts

The study found that the 3.7 hectares of native vegetation that would be removed by the Proposal, consisting of a narrow strip beside the existing road, and that flora habitat values of that vegetation have been compromised by prior clearing of tree cover, general absence of senescent trees and mid-stratum vegetation, and the replacement of native ground layer vegetation by introduced weeds. Therefore the vegetation that would be removed by the Proposal is considered unlikely to be of conservation significance for threatened flora species.

Due to one threatened plant species and potential habitat for other threatened plant species reported from the locality occuring in the study area, the proposal has the potential to impact on threatened plant species, populations or ecological communities and their habitats.

Up to 3.67 hectares of poorly conserved forest dominated by *Eucalyptus viminalis, E bridgesiana , E blakelyi,* and *E melliodora* may be removed by the proposal. This includes: up to 1.77 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Diuris pedunculata*, 1.77 hectares of habitat considered unlikely to be of conservation significance for the Vulnerable species *Pultenaea stuartiana*, 2.39 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Pimelea venosa,* and 3.67 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Lepidium peregrinum* and *Bertya pinifolia,* that may be removed by the proposal.

The TSC Act and the EP&BC Act each list eight factors to be considered in deciding whether the proposed activity is likely to have a significant effect on any threatened species, population or ecological community and their habitat, and therefore whether a Species Impact Statement or approval of the Environment Minister is required prior to approval. The Roadside Vegetation Study (**Appendix D**), through the application of an 8 point test, indicates that the Proposal would not have a significant impact on any threatened species, population or ecological community in the vicinity of the Proposal. A Species Impact Statement or approval of the Commonwealth Environment Minister would not be required if the following safeguards are implemented for the Proposed works.

With regard to the additional assessment undertaken in February of 2002, no new records of critical habitat, threatened vegetation communities or plant populations listed under the *Threatened Species Conservation Act*, 1995 (TSC Act) occur in the study area.

Potential habitat for the newly listed threatened plant *Euphrasia ciliolata*, which is found in grassy sites, near bogs or swamps or in subalpine woodland (Scientific Committee 2002) may occur in the moist areas of Communities 2, 8, 9, and 10 as outlined in the original report (Elks, GN 2001). Therefore, an additional 8-Part test has been undertaken to assess the potential impacts of the proposal on the threatened plant species *Euphrasia ciliolata*.

As a result of the 8-Part test assessment it was found that the threatened plant species *Euphrasia ciliolata* is not likely to occur in the study area. With the introduction of mitigative and conservation measures as proposed below (and outlined in the original report (Elks, GN 2001)), a Species Impact Statement would not be required.

Because the proposed activity constitutes a key threatening process (native vegetation removal) a threat abatement plan written by the National Parks and Wildlife Service (NPWS) would be adhered to. However, at the time of writing this report no threat abatement plan has as yet been written. Therefore, in accordance with the *Environmental Planning and Assessment Act*, 1979, the terms of the threat abatement plan cannot yet be "taken into account" by consent authorities and determining authorities (within the meaning of the Act) when they consider applications for approval for the carrying out of activities under Part 5 of the TSC Act.

Proposed Safeguards

Given the likelihood that the threatened species *Euphrasia ciliolata* does not occur in the study area or the locality, that the threatened species *Arthraxon hispidus* does not occur in the study area, and the measures of mitigation and conservation as proposed in the original report (Elks 2001), it is expected that a Species Impact Statement would not be required. A Vegetation Management Plan would be undertaken to manage rehabilitation of the site post construction in accordance with the following proposed safeguards.

- Introduced species should not be used for rehabilitation. Particularly harmful species include the grasses Phalaris aquatica, Festuca pratensis, Phleum pratense and Eragrostis curvula, which are already common in the study area. These species permanently displace native vegetation, invade native bushland, produce copious dry matter that is a fire hazard, and choke drains.
- Suitable species suitable for dry and less fertile areas (such as steeper slopes, rocky areas, cut batters) include:
  - Large Trees: Eucalyptus viminalis, Eucalyptus stellulata.
  - Shrubs/small trees: Acacia dealbata
  - Ground layer grasses and herbs: Themeda australis, Danthonia linkii , Bothriochloa decipiens, Poa labillardieri, Sorghum leiocladum and Scleranthus biflorus.
  - Trees and shrubs would be planted sparsely in these areas.
- Suitable species for moister and more fertile areas (such as gentle slopes, fill batters) include:
  - Large Trees: Eucalyptus viminalis, Eucalyptus stellulata, Eucalyptus pauciflora.
  - Shrubs/small trees: Acacia dealbata Acacia melanoxylon
  - Ground layer grasses and herbs: Poa labillardieri, Sorghum leiocladum, Bracteantha bracteata, Ammobium alatum, Acaena nova-zelandiae, Themeda australis, Psoralea tenax.
  - Trees and shrubs would be planted densely in these areas.
- Suitable species for wet areas:
  - Ground layer grasses and herbs: Pennisetum alopecuroides, Lythrum salicaria.
- A qualified botanist would mark out and fence off the areas containing rare or threatened plants prior to the commencement of any earth moving activities. The staff on site would be made aware of the areas. These measures would prevent vehicles and machinery from entering them.
- Vegetation disturbance would be generally kept to a minimum;
- If introduced species are present in abundance, removal by scraping away weeds and the topsoil layer may be beneficial immediately prior to regeneration with native species;
- Progressive rehabilitation of exposed areas using locally native plant species would be undertaken.
- Topsoil would be retained, if suitable (ie weed free where feasible), and used during re-vegetation of the site. Soil that may be contaminated with introduced grasses or weeds would be disposed of.
- Any plants that would be affected by clearing would be assessed as to their suitability for replanting.
- Trees to be retained within the worksite would be protected from damage by machinery or unnecessary removal by paraweb or other appropriate fencing.
- Stockpile materials would be placed a minimum of 5 metres away from trees to be retained.
- During construction there would be no parking of equipment in areas where vegetation is protected.

- Construction works would be restricted to the existing road corridor.
- Cleared and mulched vegetation would not be dumped into adjacent bushland or stockpiled in these sites.
- Noxious weed species in the area of the works would be controlled in accordance with the Noxious Weeds Act, 1993 particularly to prevent any further spread of weeds, and would be undertaken according to best practice principles, such as using alternative methods to herbicides where practical; where herbicides are needed, they would be used strictly in accordance with the manufacturer's instructions and would not be used within 10 metres of a watercourse; and washing down of vehicles in bunded areas of the site, especially tyres which can carry weed seeds.
- Revegetated areas would be adequately protected and a maintenance program adopted (watering, weeding, replanting) for 12 months.

9.4 Fauna

Existing Situation

No threatened fauna populations or critical habitat, as listed under the TSC Act or the EP&BC Act, were recorded or are considered to occur in the study area. No threatened fauna species listed in the Schedules of the TSC Act 1995 were recorded during the survey. The Forest Raven *Corvus tasmanicus* a species of conservation concern was recorded during the survey.

Sources for compilation of a list of target species included the schedules of the *Threatened Species Conservation Act* (TSC Act), *Fisheries Management Act* (FM Act) and the *Environment Protection & Biodiversity Conservation Act* (EP&BC Act). The NSW NPWS Wildlife Atlas database; NSW Fisheries and Environment Australia websites, and other relevant habitat requirement information was also used.

Threatened fauna species (TSC Act) known to occur within the locality are listed in Table 3a of the Roadside Fauna Study (Appendix D) and include *Ninox strenua* (Powerful Owl), *Calyptorhynchus lathami* (Glossy Black-Cockatoo), *Phascolarctos cinereus* (Koala), *Pseudomys oralis* (Hastings River Mouse) and *Litoria subglandulosa* (New England Tree Frog). Other threatened fauna species considered by the consultant as potentially occurring in or near the study area are listed in Table 3b of the Roadside Fauna Study (Appendix D). Threatened aquatic species (FM Act) possibly occurring downstream of the study area are listed in Table 3c of the Roadside Fauna Study (Appendix D).

Terrestrial and wetland fauna species covered by migratory provisions of the EP&BC Act (http//www.dest.gov.au/search/databases.html March 2001) and potentially occurring in the study area are listed in Table 4a and 4b respectively. Similarly, threatened fauna species are listed in Table 4c of the Roadside Fauna Study (Appendix D).

An additional fauna assessment was undertaken in late February 2002, to assess the proposal in terms of Scientific Committee final determinations that have been gazetted since the original fauna report was completed in June of 2001. Specifically, the NPWS Wildlife Atlas Records were reviewed again for any threatened fauna species included since the original assessment, and 8 part-tests have been undertaken on any species found in the study area that has been listed since the original assessment was undertaken.

Since 1st March 2001 the following species that are considered possible occurrences in the study area have been added to the schedules of the TSC Act 1995:

Black-chinned Honeyeater	Brown Treecreeper
Diamond Firetail	Grey-crowned Babbler

Grey-headed Flying-Fox	Eastern Pygmy Possum
Hooded Robin	Speckled Warbler

The Brown Treecreeper and Diamond Firetail were recorded in the study area during the survey.

Impacts

Due to the level of vegetation removal associated with the proposal, and the existence of potential habitats of threatened fauna species in the study area, there is a potential impact on threatened fauna species as a result of the proposal.

Part 5A of the EP&A Act, lists eight factors to be considered in deciding whether the proposed development is likely to have a significant effect on threatened species or their habitats, and therefore whether a Species Impact Statement or approval of the Federal Environment Minister is required for the Proposal. The "8 part test" for this Proposal has been applied to the important habitat features of the species listed in Tables 3a, 3b and 3c of the Roadside Fauna Study (Appendix D), rather than to each individual species.

The 8 part test indicates that:

- The Proposal would not be likely to disrupt the life cycle of threatened species such that a local population of that species would be placed at the risk of extinction;
- Endangered populations do not occur within or near the study area;
- The removal of 3.7ha of vegetation not containing key habitat features is considered an insignificant area in a regional context;
- There would be no isolation of potential habitat from current interconnecting or proximate areas of habitat as a result of the Proposal;
- Critical habitat does not occur in the study area;
- No threatened populations or ecological communities occur in the vicinity of the Proposed works;
- The Proposed development is not a threatening process; and
- Because of complicated influences from various zoogeographical regions, many fauna species would be at the edge of their distribution limit in this area of NSW. However the impact of the Proposed activity would not contribute to the retraction of the range of threatened species that occur in in the study area.

Therefore, under the EPBC Act the proposal is not a matter of national environmental significance and does not require referral to the Commonwealth Environment Minister.

State Environmental Planning Policy No. 44 Koala Habitat Protection

The study area is within the Tenterfield shire area. This shire is listed on Schedule 1 of SEPP 44 and therefore the SEPP is applicable to the shire.

In the study area four vegetation communities (communities 2, 3, 4, 5 & 6) contain a proportion of a Schedule 2 Feed Tree Species (*Eucalyptus viminalis*) that is greater than 15% of the total numbers of trees in a tree strata. Therefore these communities are potential koala habitat as defined by the SEPP.

Once an area has been defined as potential koala habitat further assessment is required to determine if the area is core koala habitat as defined in the SEPP. Core koala habitat is defined as "an area of land with a resident population of koalas, evidenced by attributes such as

breeding females (that is, females with young), and recent sightings of and historical records of a koala population.

The study area does not constitute core koala habitat as;

- no evidence of koalas was observed, i.e. no scats or koalas were observed during the field survey; and
- the NSW NPWS wildlife atlas records indicate that there is a sparse distribution of historical records of koalas within 20km of the study area, there only being 2 records one in 1975 and one in 1994 the closest being approximately 4 km from the study area.
- The loss of 3.7 ha of degraded and marginal habitat would not constitute a significant impact on any threatened, migratory or wetland species or their habitats.

According to the additional investigations undertaken in February of 2002, the loss of 3.7 ha of primarily degraded and marginal habitat would not constitute a significant impact on any threatened, migratory or wetland species or their habitats.

Proposed Safeguards

- If a tree containing hollows requires removal, an ecologist would be required to inspect the tree prior to removal.
- Vegetation communities 5 & 6 contain Yellow Box, *Eucalyptus melliodora*, a favoured food tree of the regent honeyeater. As far as practicably possible, road design would avoid vegetation community 5, which is located on the eastern side of the road between McCliftys Rd and Four Mile Creek (Refer to **Figures 1b and 1c** of the **Roadside Vegetation Study, Appendix D)**. Other stands of community 5 vegetation are intermittently located on the eastern side of the road approximately 100-600m south of McCliftys Rd.
- If a mature specimen of Yellow Box occurs in vegetation community 6 (located in areas on the opposite side of the road to community 5) where no similar specimen occurs across the road, the road design would avoid this tree.
- The Brown Treecreeper nests in tree hollows. An ameliorative measure recommended in the original report was the retention of trees with hollows, in addition to this, the new road alignment should be designed to avoid those areas of Veg. Community 2.
- It is recommended that trees and shrubs that provide nesting habitat for the Diamond Firetail should not be removed during the breeding season that occurs between October and January.

9.5 Aquatics

Existing Situation

The Eastern Freshwater Cod, an endangered species as listed on the Fisheries Management Act is restricted to the upper reaches of the Clarence River. The species does not occur west of the Great Dividing Range. However, it is considered that as described in the Eastern Freshwater Cod draft recovery plan there is a need to control sedimentation and prevent pollution. The draft plan does not provide specific measures to achieve these aims. No additional aquatic species relevant to this proposal have been listed on the TSC Act since undertaking the original report, therefore no further assessment of aquatic species has been undertaken.

Impacts

It is not anticipated that there would be any impact on the Eastern Freshwater Cod as a result of the proposed works.

Proposed Safeguards

There are no specific mitigation measures proposed for this species, however best practice procedures should be implemented in order to maintain water quality. Other mitigation measures outlined in ***Table 10.1*** of this REF would also help to ameliorate the impacts on aquatics in the vicinity of the Proposal.

9.6 Landforms, Geology & Soils

Existing Situation

The Tenterfield Shire lies along the crest of the Eastern Highlands. Generally the terrain is that of a moderately mature landscape. The country is steep to undulating and reflect the underlying lava flows. The valley is moderately broad with well-developed alluvial flats adjacent to the meandering creeks.

The New England Fold Belt (Korsch, 1977) that underlies the study area is made up of basal rocks, such as variably fractured shales, cherts, sandstones, siltstones and conglomerates. Apart from the granites and their often dramatic erosional landforms, the most dominant geological influence on the modern landscape is the widespread tertiary basalts that have flooded much of the shire.

The Grafton 1:250,000 Geological Series Sheet indicates that the study area lies within the Permian aged acid to intermediate volcanics. The southern end of the work is within adamellite porphyrite of the Bolivia Mass, and Sandy Flat adamellite. The northern end of the work is predominantly within Sandy Flat adamellite and a small proportion of undifferentiated granites.

The soils of the study area are largely derived from Tertiary basalts with some addition from Permian sedimentary and volcanic rocks. Individual hills comprise a number of near horizontal lava flows that are up to 10 metres thick. At some locations in the study area, at the interface of two lava flows, there is an aquifer that discharges as a spring. These locations are associated with ground instability.

Impacts

Erosion and sedimentation are the major impacts associated with the proposed works. An additional erosion threat associated with basalt-derived soils within the study area is mass wasting and slippage on steep slopes with minimum tree cover. Basalt country is therefore most in danger from high magnitude events such as floods or heavy rains.

Soil salinity and acid soils are rare within the New England area, with both of these phenomena known on a small scale in the region. No soil salinity or acid soils are known to exist within the study area, or within close proximity to the study area. In addition, the study area is too far inland and at too high an elevation to be prone to acid sulphate soils.

It is not anticipated that the proposed works would impact significantly on the landforms, geology and soils of the Proposal site with the introduction of appropriate safeguards.

Proposed Safeguards

An Erosion and Sedimentation Control Plan (ESCP) would be developed for the works in accordance with *RTA Road Design Guide* 1989, Section 8 - Erosion and Sedimentation, and the NSW Department of Housing's *Managing Urban Stormwater Soils and Construction* 1998. That plan would be approved by the Regional Environmental Adviser before works commence and would address requirements for the roadworks and drainage works separately, as well as any

requirements for the stripping, stockpiling and respreading of topsoil. The ESCP would detail the following:

- The provision of sediment and filter traps, in advance of and in conjunction with, earthworks operations in order to prevent contaminated run-off leaving the site.
- Appropriate scour protection and energy dissipation measures to be placed in drainage lines below drainage outlets.
- All drainage lines would be identified prior to works and bunded with sandbags at the perimeter of the site, to prevent accidental spills or sediment entering the easterly drainage system, in addition to normal erosion controls.
- All stockpiles would be located no less than 50 metres from drainage lines and covered when not in use.
- Erosion and sediment controls would be used as appropriate at culverts, to prevent sediment form entering waterways.
- No work would be undertaken within the creek bed at Sandy Creek during times of high flow, in order to minimise sedimentation impacts.
- All plant and equipment would be maintained (including washing out of machinery) in an appropriately protected area to prevent any polluting of streams or groundwater.
- An appropriate spill containment kit would be kept on site at all times.
- Exposed areas would be revegetated progressively and restored progressively as work is completed for each section. A cover crop of non-invasive sterile species and locally native vegetation species would be used.
- Disturbed areas would be kept to a minimum.
- Controls would be implemented on site prior to commencement of clearing or drainage works and would be inspected at a minimum of weekly intervals and within 24 hours of rainfall events until the works have been completed and the area stabilised. Any problems would be rectified without delay. Regular routine maintenance (and records to illustrate that maintenance) would be undertaken to replace damaged sediment control structures and maintain and improve other temporary measures as required.
- DLWC would be contacted, prior to earthworks on the failing embankments, to discuss methods of preventing future slope failure. Those methods would be incorporated into the Contractors Environmental Management Plan (CEMP).

9.7 Hydrology and Water Quality

Existing Situation

Two river systems have a significant part of their watershed located in Tenterfield Shire. The Great Dividing Range separates the Clarence system to the east, and the Border Rivers system to the west.

There are many minor drainage systems within these two systems, owing to a large extent to the highly dissected lands within the shire. The tributaries of the Clarence system generally maintain a permanent flow. However, the tributaries of the Border Rivers catchment are prone to unsustainable natural flows during long dry periods.

Potential Impact

- Naturally high phosphate levels in the basalt soils of the study area would potentially cause high nutrient levels should sediment make its way into streams in the vicinity of the Proposal.

- Runoff from the study area during works would potentially cause sedimentation of waterways.

Proposed Safeguards

- Consultation would be undertaken with NSW Fisheries prior to any works in Sandy Creek.
- The erosion and sediment control measures outlined in the ESCP would be sufficient for mitigating against the impacts of water pollution.
- A check of any drainage works would be undertaken promptly during and after the first few heavy rain events following completion of the works.
- Prior to the commencement of construction, an emergency procedure for chemical spills and other potential incidents would be developed.
- Consultation would be undertaken with DLWC prior to commencement of works, regarding the requirement for a permit to draw water for roadworks from local water sources, if necessary.
- Re-fuelling would not occur in the vicinity of waterways.
- The compound site would be bunded to confine any spills/ water loss.
- On-site chemicals would be stored in a bunded area with an impermeable floor.
- All construction plant, equipment, vehicles and machinery would be maintained in accordance with manufacturer's specification in order to meet the requirements of the POEO Act and associated regulations.
- Should there be any spillage it would be immediately contained, removed, treated (if necessary) and disposed of to the satisfaction of the EPA.
- If any activities are likely to cause pollution of nearby waterways, a licence would be obtained for the works under the POEO Act.
- If concrete was delivered to the site, cleaning out of concrete truck agitators would be limited to environmentally sound designated areas, such as existing stockpile site, to ensure runoff does not leave the site. These areas would be cleaned up on completion of works.
- All plant/equipment would be inspected daily for leakage of fuel, oil or hydraulic fluid. Machinery found to be leaking would be repaired or replaced.

9.8 Drainage

Existing Situation

The hilly nature of the country and the predominance of granite soils provide for good drainage of the area. The erodible nature of the soil would need careful treatment when disturbed particularly on steep grades, along drainage lines and at culvert inlets and outlets.

It is not intended to interfere with the drains that are deemed to be working satisfactorily, however some table drains would require lining with either concrete or jute mesh for erosion control measures. Concrete SK profile gutters would be installed where the formation is widened in cuttings.

Treatment would also involve improving and / or providing the subsoil drainage system and the extension of all the culverts crossing the highway along the length of the Proposal.

There are 19 transverse structures within the section, all of which would require extension. The centreline has been positioned such that most of the culverts would require extension on one side only. Refer to ***Table 8.2,*** below.

Table 8.2 - The affect on culverts as a result of the proposed works.

CHAINAGE	SIZE	EXTENSION
63.15 km	900 mm	3.66 m RHS
63.49 km	3 / 1050mm RCP	3.66 m RHS
63.7 km	525 mm	3.66 m RHS
64.03 km	450 mm	3.66 m RHS
64.42 km	450mm	1.22 m LHS
		3.66 m RHS
64.72 km	450 mm	4.88 m RHS
64.85 km	450 mm	3.66 m RHS
65.225 km	2 / 600 mm	3.66 m RHS
65.45 km	2 / 900 mm	1.22 m LHS
		3.66 m RHS
65.61 km	450 mm	2.44 m LHS
65.96 km	2 / 900 mm	2.44 m LHS
		2.44 m RHS
66.24 km	450 mm	2.44 m RHS
66.37 km	2 / 1.63 x 1.63 RCBC	3.66 m RHS
66.67 km	525 mm	2.44 m RHS
66.94 km	375 mm	2.44 m RHS
67.00 km	525 mm	2.44 m RHS
67.05 km	450 mm	2.44 m RHS
67.21 km	450 mm	2.44 m LHS
		2.44 m RHS
67.51 km	750 mm	3.66 m LHS
		2.44 m RHS
67.66 km	450 mm	3.66 m RHS

The extension of the above culverts would allow a 2 to 1 batter (generally) on the extended side; the requirement for guard-fence would be examined at each individual structure on a needs basis. The largest structure to be widened is the 2-cell box culvert at 66.3 km, which is to be widened only on the right hand side.

Impacts

Impacts associated with culvert extension are erosion and sedimentation of waterways. To a lesser extent, impacts on roadside vegetation would also occur.

Proposed Safeguards

Reference would be made to the principles outlined in the *NSW Fisheries Policy and Guidelines for bridges, roads, causeways, culverts and similar structures (1999)*. Additional safeguards outlined in **Section 9.7** would also be appropriate for mitigating potential drainage impacts.

9.9 Climate

Existing Situation

The average annual rainfall recorded at Glen Innes Post Office is 854.5mm/year (1996). Generally the shire experiences higher rainfalls during the warmer months with 35% of rain falling in summer and 25% of rainfall occurring in spring.

The area experiences warm summers and cool to cold winters. The average maximum summer temperature is approximately 25°C and the average minimum winter temperature is approximately 1°C.

Potential Impact

The soils of the study area can be difficult to dry out sufficiently for road construction, particularly in winter. Frosts experienced during the colder months in the New England area can make laying the seal difficult.

Proposed Safeguards

Works would be undertaken only when the soil is sufficiently dry. In the case of heavy frost events, the site would be assessed and work would potentially be delayed, or start later when conditions are more suitable for construction.

9.10 Air Quality

Existing Situation

Presently there is little data to be found on air quality for the region. The study area is considered to be within a high air quality environment due to the low population density, combined with low levels of industrial activity. Air quality is expected to decline closer to the Highway corridor due to traffic emissions as compared to the greater proportion of the shire.

Potential Impact

The use of machinery in the study area would potentially cause an increase in the Total Suspended Particulates of the locality. Pollutants would include dust and emissions from vehicles. The effect on local residents is likely to be minimal as houses are located at least 100m from the proposed works, and therefore unlikely to be affected by the Proposal.

Proposed Safeguards

- All construction plant (including exhaust systems), equipment, vehicles and machinery would be maintained in accordance with manufacturer's specifications in order to meet the requirements of the POEO Act and associated regulations. Visual checks of exhaust system emissions would be periodically undertaken.
- A water tanker would be available to dampen disturbed areas and reduce dust generation, particularly in windy weather. Regular on-site watering would be carried out to control dust generation during construction.
- Any materials transported in trucks would be appropriately covered to reduce dust generation.

- Vehicles and operating equipment used on site would be in good working order and switched off when not operating so as to minimise exhaust emissions from vehicles and other operating equipment.
- No burning of timber or other combustible materials would occur.
- Revegetation of reformed surfaces would take place as soon as possible.
- No work would be undertaken during high wind conditions.
- Tailgates of all vehicles transporting materials to and from the site would be securely fixed prior to loading and immediately after unloading.
- Any stockpiles of material would be kept covered or damp to prevent dust generation.

9.11 Noise and Vibration

Existing Situation

There are 5 houses within the vicinity of the study area. There are 2 houses at the southern end of the Proposal. The residence on the western side of the road is located approximately 100m from the Highway. The residence on the eastern side of the highway is located approximately 750m from the road. Three residences are located at the northern end of the Proposal, all within 300m of the highway. It was therefore unnecessary for specific noise measurements to be undertaken as part of this REF. However, a desktop review of likely impacts was undertaken to determine the potential impacts of the Proposal during both construction and operation.

Potential Impact

It is considered that the proposed works would result in a slight improvement in road traffic noise levels. This prediction is based on the proposed design which:

- Does not alter the existing alignment.
- Does not provide for a design increase in traffic volume.
- Provides a lower traffic noise pavement.
- Improves upon the rideability characteristics of the road.

Construction Noise

Construction activities are programmed to take place for 50 weeks, commencing in 2003/2004. The guidelines for assessment of construction noise are those established by the EPA in Chapter 171 of the EPA's *Environmental Noise Control Manual.*

The EPA criteria for construction noise are as follows:

- For a construction period of greater than 26 weeks, the L10 levels must not be exceeded by more than 5dBA.

The EPA recognises that construction operations are typically noisy. Therefore, if noisy activities are of short duration, the above noise criteria may be exceeded provided that the standards outlined in chapter 82-3 of the EPA's *Environmental Noise Control Manual* are adhered to. The residence located approximately 100m from the proposed works area would potentially be affected to a small degree by construction noise. Any noise impact would be minimised as much as possible.

Vibration

International standards such as DIN 4150 (1986) set safe vibration levels for structural damage at 5mm/ second. These limits could be expected to be exceeded if vibratory rollers are used within 10 metres of any habitable dwelling.

It is possible to safely use alternative methods or equipment to lower levels of vibrations within these distances. Human perception and comfort level are, however, usually reached at a much lower level. In this regard the British Standard BS6472 is most appropriate. Deductions from this are detailed in ***Table 9.1*** below:

Table 9.1 – British Standard BS6472 (Vibration)

Approximate Vibration Level	Degree of Perception
0.10 mm/s	Not Felt
0.15 mm/s	Threshold of Perception
0.35 mm/s	Barley Noticeable
1.0 mm/s	Noticeable
2.2 mm/s	Easily Noticeable
6 mm/s	Strongly Noticeable
14 mm/s	Very Strongly Noticeable

Note: These approximate vibration levels (in floors of buildings) are for vibration having a frequency content in the range of 8Hz to 80Hz.

The nearest dwelling is approximately 100 metres from the proposed works site. It is not expected that residents would be affected by construction vibration. The vibration energy from construction activities is not considered to be sufficient to cause structural damage to any residences or buildings located at this distance.

Proposed Safeguards

All reasonable practical steps would be undertaken to reduce construction noise and vibration from the construction site in the plan. As far as practicable, activities would comply with the requirements of Chapter 171 of the EPA Noise Control Manual and individual items of plant and equipment would comply with the requirements of Chapters 119 and 157 of the Manual. If those levels are likely to be exceeded, all potentially affected residents would be notified in accordance with EPA requirements.

Construction activities would be restricted to the following hours:

7:00 am - 6:00 pm Monday to Friday;

7:00 am - 1:00 pm Saturday.

For any work outside normal standard hours the RTA's procedure for 'Roadworks outside normal working hours' would be followed and Proposal specific goals would be established; and any community consultation regarding "out of hours work" would be undertaken in accordance with the RTA Community Involvement Practice Notes and Resource Manual;

- High efficiency mufflers would be used on all construction equipment and manufacturers noise control equipment would remain intact. All construction equipment would be well maintained.

- Noise monitoring would be undertaken if noise complaints are received during construction to determine if temporary noise control measures are required to allow construction to continue. This system of complaints as a monitoring trigger would also apply to vibration complaints.

- Low impact vibratory rollers and other plant would be used where practicably possible. Residents would be provided with a contact number in the event that problems associated with construction vibration arise

9.12 Waste Minimisation and Management

Impacts

Wastes generated from the Proposal would include:

- Bitumen, concrete and asphalt.
- Cleared vegetation and topsoil.
- Waste oils and liquids from maintenance of construction plant and equipment.
- Garbage and sewage from site compounds.

Proposed Safeguards

A Waste Management Plan would be prepared by the Contractor prior to the commencement of construction. The RTA adopts the Resource Management Hierarchy principles embodied in the *Waste Avoidance & Resource Recovery Act 2001* (WARR Act). The Resource Management Hierarchy principles of the WARR Act are 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.

The Waste Management Plan would include the following safeguards:

- Waste suitable for recycling would be managed in accordance with the NSW Government's Waste Reduction and Purchasing Policy.
- Recycled materials would be used where possible (eg. Recycled crushed road base).
- Waste oil would be sent to approved recyclers.
- Excavated soil would be stockpiled at the compound and used in this and other road works in the district.
- The site compound would be suitably bunded and screened from the Highway through revegetation works once work is completed.
- Cleared vegetation or other materials would not be burned.
- Weeds would be taken to a licensed landfill while native vegetation would be mulched and used to revegetate the disturbed areas.
- Portable, self-contained toilet and washroom facilities would be provided at the work sites and would be regularly emptied and serviced by the Contractor providing them.
- Putrescible and other waste not able to be recycled would be regularly collected and disposed of at a licensed landfill or other disposal site in the area. Prior to offsite removal of any waste to a waste facility/landfill, the proponent would check the validity of the waste facility's (landfill) licence and/or Council consent to receive this type of waste.
- Secure rubbish bins would be provided within site compounds. These would be regularly emptied.
- Waste oil would be sent to an approved recycler.
- The construction site would be maintained in a clean and tidy condition.
- Upon completion of works, the worksite would be left in a tidy and rubbish-free manner.

9.13 Contaminated Land

Existing Situation

Scott Riley of Tenterfield Shire Council is "not aware of any contaminated lands adjacent to the road reserve in that area" (Pers comm. 5/11/01).

Impacts

The Proposal has the potential to expose contaminated land as earthworks are being undertaken. However, given that the area is largely undeveloped and rural, it is highly unlikely that there would be any existing contaminated land in the study area.

The Proposal also has the potential to create contaminated land through the spillage of fuels and other chemicals used for roadworks. Again, the risk is low as the amount of fuels and chemicals used for road upgrading Proposals is relatively low.

Proposed Safeguards

- If any contaminated waste is identified during construction, this would be removed to an EPA approved facility for the purpose of disposal of these materials. All necessary permits for the removal, transportation and disposal of contaminated waste would be obtained prior to any works being undertaken.
- If any contaminated waste is generated, the appropriate EPA licences and approvals would be obtained for its disposal and the operators of the disposal site would be notified in advance. Limits on the quantity and storage duration of contaminated waste at site would be observed.
- The storage of chemicals on site would comply with the requirements of relevant authorities (EPA and Workcover).
- A schedule of all hazardous materials (as defined by the *Waste Minimisation and Management Act* 1995 and Regulations, 1996) in use on the works would be maintained and recorded for the duration of the works.
- Any contaminants would be collected and removed from the construction area.

9.14 Socio-economic Considerations

Existing Situation

Tenterfield Shire contains 6 main villages – the townships of Tenterfield, Urbenville, Jennings, Legume, Liston and Torrington. Of the total shire population, approximately 50% live in the 6 villages and the remaining 50% live in rural areas.

Agriculture, Forestry and Fishing are the main industries within the New England Tablelands; employing 48.9% of the workforce. Fine wool and beef production are the major facets of the agricultural industry. Other agricultural land use activities that occur in the shire include intensive cattle feedlotting, sapphire mining, wheat, maize and soy beans.

An important landuse and economic aspect of the region is tourism, as the surrounding shires take in Gibraltar Range, Washpool, Guy Fawkes River and Nymboida National Parks. Gibraltar Range and Washpool National Parks are included on the World Heritage List for subtropical and temperate rainforest parks of Eastern Australia. The Mann River Nature Reserve is also of significant recreational value, as are tourist attractions such as gold fossicking, fresh water fishing and historical tours of disused tin and arsenic mines.

There are four road intersections within the Proposal length; McClifty's Rd (left of 65.26km), an access road to a four lot subdivision (left of 66.905km), Bluff River Rd (left at 67.575km), and an access opposite Bluff River Rd which connects to Primrose Hill Rd and the property

Primrose Hill. There are 5 houses within the vicinity of the study area. There are 2 houses at the southern end of the Proposal. The residence on the western side of the road is located approximately 100m from the Highway. The residence on the eastern side of the highway is located approximately 750m from the road. Three residences are located at the northern end of the Proposal, all within 300m of the Highway.

Impacts

The proposed works are highly unlikely to negatively alter the socio-economic circumstances of the region as the Proposal would ensure continued accessibility for transport including freight and tourist traffic. In the short term, however, the Proposal would cause a small amount of delay for residents and businesses using the road for transport purposes.

Proposed Safeguards

- A Traffic Control Plan would be prepared and implemented during the construction period in accordance with the RTA's *Traffic Control at Worksites Volume 2*, and AS 1742.3 *Manual of Uniform Traffic Control Devices for Works on Roads*.
- A letterbox drop would be undertaken to ensure all residents are aware of the works.
- Access to properties would be maintained at all times and restored once works are complete.
- A phone number would be made available for the public to contact the RTA with noise or other complaints. That phone number, as well as the contact name, organisation and contact hours would be displayed on signage at either end of the works area.
- Checks would be made of the surrounding area to make sure no further structures exist that require condition surveys.
- A register of public complaints would be established at the commencement of construction and maintained for the full duration of the works. The register would record details of complaints, complainant contact information and action taken to address complaints. The complaints register would include records of the timeliness of the response and the type of response for resolving any complaint. On receiving a complaint, works would be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback would be provided to the complainant explaining what outcomes resulted.

9.15 Utilities

Existing Situation

No utilities are known to exist within the area that would be subject to disturbance as a result of the Proposal.

Impacts

If there are no utilities within the study area, as is known at this stage, there would be no impacts on utilities.

Proposed Safeguards

Ring the "dial before you dig" hotline prior to undertaking any works. A check would also be undertaken for clearances to overhead power lines.

9.16 Cumulative Environmental Effects

Within the next 12 months, the RTA is proposing to undertake a number of road upgrading Proposals along the New England Highway. The potential cumulative environmental effects of multiple upgrading Proposals would include:

- A short term decrease in water quality in the local catchments would occur as potential point sources of pollution are increased. Works are relatively minor in nature, however, and major rivers are located large distances from the works, therefore the decrease in water quality is likely to be minor.
- A short term decrease in air quality of the Highway corridor would occur as the amount of heavy machinery and vehicles associated with the works would increase the traffic volume of the area during construction.
- Cumulative short term increases in travel time would occur as the travel speeds are reduced in the area of works.
- Long term cumulative impact would be a reduction in accidents as the safety of the road is increased.

9.17 Principles of Ecologically Sustainable Development

The *National Strategy for Ecologically Sustainable Development* (NSESD) has been formulated to ensure ESD is accounted for in 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.
- To protect biological diversity and maintain essential ecological processes and life-support systems.

These objectives are complemented with a number of guiding principles which are considered below in ***Table 9.3*** in terms of the Proposal.

Table 9.3: Principles of ESD applied to the Proposal

Principle	Consideration for Proposal
Precautionary Principle	The Proposal would lie within the existing road corridor and mitigation measures have been proposed which would minimise the impacts of the Proposal. None of the studies undertaken identified any serious or irreversible damage.
Intergenerational Equity	The Proposal considers future land use, would improve congestion to future motorists and makes provision for a more efficient and safer transport corridor for use by future residents. At the same time, the Proposal considers and minimises impacts on the local environment to ensure that no further degradation would occur.
Conservation of Biological Diversity & Ecological Integrity	The Proposal has avoided, where possible, disturbance to the local ecology. Where this has not been possible, mitigation measures have been

Principle	Consideration for Proposal
	included in this REF (Table 9.1) to ensure the Proposal would not compromise biological diversity or ecological integrity.
Improved Valuation and Pricing of Environmental Resources	The integrity of the local environment is recognised as a valuable resource to the area in terms of its recreational value, commercial value, water quality and supply and life support system for aquatic communities. The resources associated with the Little Llangothlin Nature Reserve are also recognised as a valuable resource in terms of its life support system for local and migratory species alike. To ensure that these resources remain, the Proposal addresses issues relevant to water quality and ecological integrity. Mitigation measures outlined in this REF (Table 9.1) have been provided to ensure the value of these environmental resources is maintained.

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The Commonwealth Environment Protection and Biodiversity Act 1999 (EPBC Act) requires that the following matters of National Environmental Significance (NES) must be considered:

- **World Heritage Properties:** None Found.
- **Wetlands of International Importance:** The Proposal is located within the catchment of Little Llangothlin Nature Reserve.
- **Conservation Reserves:** The proposed works are located in the vicinity of Washpool and Capoompeta National Parks.
- **Commonwealth Listed Threatened Species and Ecological Communities:** There are no Threatened Ecological Communities and 34 listed threatened species potentially occurring in the vicinity of the proposed works.
- **Commonwealth Listed Migratory Species:** There are 9 species potentially occurring.
- **Nuclear Actions:** The Proposal would not involve a nuclear action.
- **Commonwealth Marine Areas:** None Found
- **Commonwealth Land:** None Found
- **Regional Forest Agreements:** The proposed works are located within the area of the Upper North East NSW Regional Forest Agreement (RFA).

Although there have been 9 migratory species, 34 threatened species and 9 marine protected species recorded within 20km of the proposed works, it is not anticipated that the Proposal would impact on any of these species.

There are two conservation reserves and the Upper North East RFA located in the vicinity of the proposed works, it is not anticipated that there would be an impact on these locations as a result of the Proposal. However, the nature of the proposal is such that it has the potential to impact on the water quality of the localised catchment that holds the Internationally significant

Little Llangothlin Nature Reserve, a listed RAMSAR site. Stringent mitigation measures would be put in place to ensure the risk of sedimentation to the local tributaries is kept to an absolute minimum.

10 Implementation Stage

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A Project Environmental Management Plan would be developed incorporating the safeguard measures identified in ***Table 10.1*** of the REF below. The PEMP would be reviewed and certified by the RTA Environmental Adviser, Northern Region, prior to the commencement of any site works.

Table 10.1 – Proposed Safeguards

Impact	Mitigation Measure
General	• The RTA Project Manager would notify the RTA Environmental Adviser, Northern Region in writing (fax or email) when works are to commence. • Works would be subject to an environmental audit(s) and/or inspection at any time.
Indigenous and Non-indigenous Heritage	• Monitoring would be undertaken by the Moombahlene LALC during the removal of topsoil for the Proposal beginning from 62.7km to 68.04km north of Glen Innes. The study area begins on the northern side of Sandy Creek and ends just to the north of the intersection of Bluff Creek Rd and the New England Highway. • Should future activities associated with the Proposal uncover anything which may be interpreted as Aboriginal in origin, work should cease immediately. The NPWS and the RTA's Environmental Adviser should be contacted immediately and works would not commence in the subject area until the find has been examined and dealt with appropriately. Information about such finds should be passed on to both the NSW NPWS, Coffs Harbour, and Moombahlene LALC as soon as possible, for further discussion and negotiation. The provisions of the National Parks and Wildlife Act 1974 state that it is illegal to damage, deface or destroy a relic without written permission of the Director of the Service.
Flora	A Vegetation Management Plan would be undertaken incorporating the following: • Introduced species should not be used for rehabilitation. Particularly harmful species include the grasses Phalaris aquatica, Festuca pratensis, Phleum pratense and Eragrostis curvula, which are already common in the study area. These species permanently displace native vegetation, invade native bushland, produce copious dry matter that is a fire hazard, and choke drains. • Suitable species suitable for dry and less fertile areas (such as steeper slopes, rocky areas, cut batters) include: Large Trees: Eucalyptus viminalis, Eucalyptus stellulata. Shrubs/small trees: Acacia dealbata Ground layer grasses and herbs: Themeda australis, Danthonia linkii ,

Impact	Mitigation Measure
	Bothriochloa decipiens, Poa labillardieri, Sorghum leiocladum and Scleranthus biflorus. Trees and shrubs would be planted sparsely in these areas. • Suitable species for moister and more fertile areas (such as gentle slopes, fill batters) include: Large Trees: Eucalyptus viminalis, Eucalyptus stellulata, Eucalyptus pauciflora. Shrubs/small trees: Acacia dealbata Acacia melanoxylon Ground layer grasses and herbs: Poa labillardieri, Sorghum leiocladum, Bracteantha bracteata, Ammobium alatum, Acaena nova-zelandiae, Themeda australis, Psoralea tenax. Trees and shrubs would be planted densely in these areas. • Suitable species for wet areas: Ground layer grasses and herbs: Pennisetum alopecuroides, Lythrum salicaria. • A qualified botanist would mark out and fence off the areas containing rare or threatened plants prior to the commencement of any earth moving activities. The staff on site would be made aware of the areas. These measures would prevent vehicles and machinery from entering them. • Vegetation disturbance would be generally kept to a minimum; • If introduced species are present in abundance, removal by scraping away weeds and the topsoil layer may be beneficial immediately prior to regeneration with native species; • Progressive rehabilitation of exposed areas using locally native plant species would be undertaken. • Topsoil would be retained, if suitable (ie weed free where feasible), and used during re-vegetation of the site. Soil that may be contaminated with introduced grasses or weeds would be disposed of. • Any plants that would be affected by clearing would be assessed as to their suitability for replanting. • Trees to be retained within the worksite would be protected from damage by machinery or unnecessary removal by paraweb or other appropriate fencing. • Stockpile materials would be placed a minimum of 5 metres away from trees to be retained. • During construction there would be no parking of equipment in areas where vegetation is protected. • Construction works would be restricted to the existing road corridor. • Cleared and mulched vegetation would not be dumped into adjacent

Impact	Mitigation Measure
	bushland or stockpiled in these sites. • Noxious weed species in the area of the works would be controlled in accordance with the Noxious Weeds Act, 1993 particularly to prevent any further spread of weeds, and would be undertaken according to best practice principles, such as using alternative methods to herbicides where practical; where herbicides are needed, they would be used strictly in accordance with the manufacturer's instructions and would not be used within 10 metres of a watercourse; and washing down of vehicles in bunded areas of the site, especially tyres which can carry weed seeds. • Revegetated areas would be adequately protected and a maintenance program adopted (watering, weeding, replanting) for 12 months.
Fauna	• If it is necessary to remove a tree containing hollows, a qualified ecologist would inspect the tree, immediately before removal, to determine if at that time it is being used by a threatened species. If a threatened species is observed the advice of the NSW NPWS would be sought and measures implemented to minimise the impact of the removal of the tree on the species. • Water quality down stream of the study area would not be impacted upon by the activity either by sedimentation or pollution. Best practice would be implemented. • As some threatened species & species of conservation concern are carrion eaters road maintenance crews would adopt a policy of removing road kills from the road in order to avoid carrion eaters being struck by vehicles.
Landforms, Geology and Soils	An Erosion and Sedimentation Control Plan (ESCP) would be developed for the works in accordance with RTA Road Design Guide 1989, Section 8 - Erosion and Sedimentation, and the NSW Department of Housing's Managing Urban Stormwater Soils and Construction 1998. That plan would be approved by the Regional Environmental Adviser before works commence and would address requirements for the roadworks and drainage works separately, as well as any requirements for the stripping, stockpiling and respreading of topsoil. The ESCP would detail the following: • The provision of sediment and filter traps, in advance of and in conjunction with, earthworks operations in order to prevent contaminated run-off leaving the site. • Appropriate scour protection and energy dissipation measures to be placed in drainage lines below drainage outlets. • All drainage lines would be identified prior to works and bunded with sandbags at the perimeter of the site, to prevent accidental spills or sediment entering the easterly drainage system, in addition to normal erosion controls. • All stockpiles would be located no less than 50 metres from drainage lines and covered when not in use.

Impact	Mitigation Measure
	• Erosion and sediment controls would be used as appropriate at culverts, to prevent sediment form entering waterways. • No work would be undertaken within the creek bed at Sandy Creek during times of high flow, in order to minimise sedimentation impacts. • All plant and equipment would be maintained (including washing out of machinery) in an appropriately protected area to prevent any polluting of streams or groundwater. • An appropriate spill containment kit would be kept on site at all times. • Exposed areas would be revegetated progressively and restored progressively as work is completed for each section. A cover crop of non-invasive sterile species and locally native species of vegetation would be used. • Disturbed areas would be kept to a minimum. • Controls would be implemented on site prior to commencement of clearing or drainage works and would be inspected at a minimum of weekly intervals and within 24 hours of rainfall events until the works have been completed and the area stabilised. Any problems would be rectified without delay. Regular routine maintenance (and records to illustrate that maintenance) would be undertaken to replace damaged sediment control structures and maintain and improve other temporary measures as required. • DLWC would be contacted, prior to earthworks on the failing embankments, to discuss methods of preventing future slope failure. Those methods would be incorporated into the CEMP.
Hydrology and Water Quality	• Prior to the commencement of construction, an emergency procedure for chemical spills and other potential incidents would be developed. • Consultation would be undertaken with DLWC prior to commencement of works, regarding the requirement for a permit to draw water for roadworks from local water sources, if necessary. • Consultation would be undertaken with NSW Fisheries prior to any works in Sandy Creek. • Re-fuelling would not occur in the vicinity of waterways. • The compound site would be bunded to confine any spills/ water loss. • On-site chemicals would be stored in a bunded area with an impermeable floor. • The erosion and sediment control measures outlined in the ESCP would be sufficient for mitigating against the impacts of water pollution. • All construction plant, equipment, vehicles and machinery must be maintained in accordance with manufacturer's specification in order to meet the requirements of the POEO Act and associated regulations. • Should there be any spillage it would be immediately contained,

Impact	Mitigation Measure
	removed, treated (if necessary) and disposed of to the satisfaction of the EPA. • If any activities are likely to cause pollution of Sandy Creek, a licence would be obtained for the works under the POEO Act. • If concrete was delivered to the site, cleaning out of concrete truck agitators would be limited to environmentally sound designated areas, such as existing stockpile site, to ensure runoff does not leave the site. These areas would be cleaned up on completion of works. • All plant/equipment would be inspected daily for leakage of fuel, oil or hydraulic fluid. Machinery found to be leaking would be repaired or replaced. • A check of any drainage works would be undertaken promptly during and after the first few heavy rain events following completion of the works.
Climate	• To ensure construction is successful, works would be undertaken only when the soil is sufficiently dry.
Air Quality	• All construction plant (including exhaust systems), equipment, vehicles and machinery would be maintained in accordance with manufacturer's specifications in order to meet the requirements of the POEO Act and associated regulations. Visual checks of exhaust system emissions would be periodically undertaken. • A water tanker would be available to dampen disturbed areas and reduce dust generation, particularly in windy weather. Regular on-site watering would control dust generation during construction. Additional options to reduce dust emissions would include alternative timing of dust generating activities. • Any materials transported in trucks would be appropriately covered to reduce dust generation. • Vehicles and operating equipment used on site would be in good working order and switched off when not operating in order to minimise exhaust emissions from vehicles and other equipment operating. • No burning of timber or other combustible materials would occur. • Revegetation of reformed surfaces would take place as soon as possible. • No work would be undertaken during high wind conditions. • Tailgates of all vehicles transporting materials to and from the site would be securely fixed prior to loading and immediately after unloading. • Any stockpiles of material would be kept covered or damp to prevent dust generation.

Impact	Mitigation Measure
Noise and Vibration	• All reasonable practical steps would be undertaken to reduce construction noise and vibration from the construction site in the plan. As far as practicable, activities would comply with the requirements of Chapter 171 of the EPA Noise Control Manual and individual items of plant and equipment would comply with the requirements of Chapters 119 and 157 of the Manual. If those levels are likely to be exceeded, all potentially affected residents would be notified in accordance with EPA requirements. Construction activities would be restricted to the following hours: Monday to Friday: 7am to 6pm Saturdays: 8am to 1pm No construction on Sundays or Public Holidays. These hours may be varied with the approval of affected local residents/owners and only after prior notification has been provided to the EPA 5 days prior to works occurring (Documentation would be kept to this effect). Works undertaken outside the above hours should be those activities that generate the least amount of noise and vibration. That does not include dust suppression and associated rolling activities to maintain gravel surfaces in a dust free and safe condition. Affected residents would be consulted in regard to hours for proposed operations outside of these times and the EPA notified of the results of this consultation and proposed hours of work. Any construction works that are outside the times specified as standard hours above would conform to the RTA's Consultation Procedure for Road Works Undertaken Outside Normal Working Hours guidelines. • High efficiency mufflers would be used on all construction equipment and manufacturers noise control equipment would remain intact. All construction equipment would be well maintained. • Noise monitoring would be undertaken if noise complaints are received during construction to determine if temporary noise control measures are required to allow construction to continue. This system of complaints as a monitoring trigger would also apply to vibration complaints. • Plant would be checked daily to ensure that mufflers and exhausts are working efficiently. • Low impact vibratory rollers and other plant would be used where possible.
Waste Management	The principles of waste management are to minimise the amount of waste generated, recycle wastes wherever possible and dispose of the remainder in a responsible manner in accordance with relevant legislation and RTA policy. A Waste Management Plan would be prepared by the Contractor prior to the commencement of construction. In undertaking this commitment, the RTA is following the Resource Management Hierarchy principles embodied in the Waste Avoidance & Resource Recovery Act

2001 (WARR Act). The Resource Management Hierarchy principles of the WARR Act are 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.

The plan would include the following safeguards:

- Where feasible, waste suitable for recycling would be managed in accordance with the NSW Government's Waste Reduction and Purchasing Policy.
- Recycled materials would be used where possible (eg. Recycled crushed road base).
- Waste oil would be sent to approved recyclers.
- Excavated soil would be stockpiled at the compound and used in this and other road works in the district. The site would be suitably bunded and screened from the Highway through revegetation works once work is completed.
- Cleared vegetation or other materials would not be burned. Weeds would be taken to a licensed landfill while native vegetation would be mulched and used to revegetate the disturbed areas.
- Portable, self-contained toilet and washroom facilities would be provided at the work sites and would be regularly emptied and serviced by the Contractor providing them.
- Putrescible and other waste not able to be recycled would be regularly collected and disposed of at a licensed landfill or other disposal site in the area. Prior to offsite removal of any waste to a waste facility/landfill, the proponent would check the validity of the waste facility's (landfill) licence and/or Council consent to receive this type of waste.
- Secure rubbish bins would be provided within site compounds. These would be regularly emptied.
- Site generated waste including garbage, waste pavement material, concrete etc would be recycled where possible and any remaining waste would be contained and removed from the site and disposed of to a licensed landfill. The proponent would check the validity of the licence and/or Council consent to receive this type of waste.
- Recycled materials would be used where possible (eg. recycled crushed road base).
- Waste oil would be sent to an approved recycler.
- The construction site would be maintained in a clean and tidy condition.
- All rubbish and waste generated on site would be disposed of in an approved manner.
- Upon completion of works, the worksite would be left in a tidy and rubbish-free manner.

Impact	Mitigation Measure
Contaminated Land	• If any contaminated waste was identified during construction, this would be removed to an EPA approved facility for the purpose of disposal of these materials. All necessary permits for the removal, transportation and disposal of contaminated waste would be obtained prior to any works being undertaken. • If any contaminated waste is generated, the appropriate EPA licences and approvals would be obtained for its disposal and the operators of the disposal site would be notified in advance. Limits on the quantity and storage duration of contaminated waste at site would be observed. • The storage of chemicals on site comply with the requirements of relevant authorities (EPA and Workcover). • A schedule of all hazardous materials (as defined by the Waste Minimisation and Management Act 1995 and Regulations, 1996) in use on the works would be maintained and recorded for the duration of the construction. • Any contaminants would be collected and removed from the construction area. • Clean up of materials would occur progressively to avoid stockpiling and minimise downslope effects. • No waste materials would be buried on site. • Dangerous goods including fuels, oils and other chemicals would be stored as specified in the Dangerous Goods Act.
Socio-economics	• A Traffic Control Plan would be prepared and implemented during the construction period in accordance with the RTA's Traffic Control at Worksites Volume 2, and AS 1742.3 Manual of Uniform Traffic Control Devices for Works on Roads. • A letterbox drop would be undertaken to ensure all residents are aware of the works. • Access to properties would be maintained at all times and restored once works are complete. • A phone number would be made available for the public to contact the RTA with noise or other complaints. That phone number, as well as the contact name, organisation and contact hours would be displayed on signage at either end of the works area. • Checks would be made of the surrounding area to make sure no further structures exist that require condition surveys. • Adjacent property owners would be contacted, outlining the likely timing of the Proposal and other relevant information. The affected community would be given reasonable advance warning of construction impacts such as traffic delays and construction noise. • Consultation would occur with occupiers of any accesses directly affected by the works to ensure access is maintained where possible

Impact	Mitigation Measure
	and to give sufficient warning of any disturbance resulting from the work. • A register of public complaints would be established at the time of construction commencing and maintained for the full duration of construction. The register would record details of complaints, complainant contact information and action taken to address complaints. The complaints register would include records of the timeliness of the response and the type of response for resolving any complaint. On receiving a complaint, works would be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback would be provided to the complainant explaining what outcomes resulted.
Utilities	• Ring the "dial before you dig" hotline before undertaking any works. A check would be undertaken for clearances to overhead power lines.

t l l ne**K**d rrt dr / r r

- Presence of threatened plant species.
- Potential archaeological / cultural significance.
- Potential for water pollution via drainage lines.
- Potential for landslip / erosion on failed embankments.

10.2.1 Summary of Beneficial Effects

- Increased safety for road users.
- Increased rideability for road users.
- Opportunity to remove roadside weed species.
- Reduction in road maintenance time and cost.

10.2.2 Summary of Adverse Effects

- Short term increase in travel time.
- Short term disruption to traffic and residents.
- Potential for water pollution episodes.

t r d c s ( ) d r s

The fifteen factors listed in Clause 228(2) of the *EP&A Regulation* 2000 have been addressed in ***Table 10.2*** below to ensure that the likely impacts of the proposed activities on the natural and built environment are fully considered.

An additional seven factors must be considered as a requirement of the EPBC Act. Those seven factors are addressed in ***Table 10.3*** below to ensure that the likely impacts of the proposed activities on matters of national environmental significance are fully considered.

Table 10.2 – Factor (NSW Legislation)

Clause 228 Factors	Impact
a. Any environmental impact on a community? There would be a short term disruption to the local community due to construction noise, air pollution and traffic management. In the long term, the community would be provided with a better Highway that would potentially reduce accidents and travel time.	Short term negative, Long term positive.
b. Any transformation of a locality? The road already exists and works are relatively minor. Therefore there would only be a short term transformation of the locality during construction.	Short term negative
c. Any environmental impact on the ecosystems of the locality? There would be a short term negative impact on the local ecosystem as vegetation would be removed and creek beds and drainage lines disturbed. These ecosystems would be regenerated through weed removal and the use of native plants for regeneration, thereby having a long term positive impact.	Short term Negative, Long term positive.
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? There would be a short term negative impact on the aesthetic and environmental quality of the locality as vegetation would be removed and creek beds and drainage lines disturbed. The environment would be regenerated through weed removal and the use of native plants for regeneration, thereby having a long term positive impact.	Short term Negative, Long term positive.
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 or future generations? The Proposal has the potential to impact on the indigenous archaeological and cultural value of the area, however this potential has been identified to be low. Monitoring by the LALC and the safeguards that are proposed in **Sections 9 & 10** would minimise impacts on indigenous heritage.	Negative
f. Any impact on the habitat of protected fauna (within the meaning of the national parks and wildlife act 1974)? Approximately 3.7 ha of wildlife habitat would be removed by the Proposal. Although this is a net loss, the mitigation measures proposed would ensure that the value of the remaining habitat is improved.	Short term Negative, Long term positive.

g. Any endangering of any species of animal, plant or other form of life whether living on land, in water or in the air? The Proposal would not endanger any species.	Nil.
h. Any long term effects on the environment? The road is already in existence and works are minor in nature, therefore there would be no long term effects on the environment.	Nil.
i. Any degradation of the quality of the environment? There would be a short term negative impact on the local environment as vegetation would be removed and creek beds and drainage lines disturbed. However, the local environment would be improved through weed removal and the use of native plants for regeneration, thereby having a long term positive impact.	Short term Negative, Long term positive.
j. Any risk to the safety of the environment? There is a risk of landslip at the cuttings on site during works. It is proposed to consult with DLWC prior to works in these areas to effectively stabilise the cuttings to reduce future risk.	Short term negative, Long term nil.
k. Any reduction in the range of beneficial uses of the environment? Presently the road is used for high speed vehicle travel. During road works, there would be a reduction in the allowable speed.	Short term negative.
l. Any pollution of the environment? The Proposal has the potential to pollute waterways, the soil, the air and the surrounding bushland. The mitigation measures outlined in this REF would reduce or prevent those impacts.	Short term negative.
m. Any environmental problems associated with the disposal of waste? The Proposal is not expected to have any environmental problems associated with the disposal of waste.	Nil.
n. Any increased demands on resources (natural or otherwise) that are or are likely to become in short supply? The Proposal would not increase demands on resources, natural or otherwise, that are or are likely to become in short supply.	Nil.
o. Any cumulative environmental effect with other existing or likely future activities? Other road upgrading projects along the New England Highway also have the potential to be polluting, causing an overall increase in the pollution load.	Negative.

Table 10.3 – Factor (Commonwealth Legislation)

Commonwealth Environment Protection and Biodiversity Conservation Act (1999) Factors	Impact
a. Any environmental impact on a world heritage property?	Nil.
There are no world heritage properties within the vicinity of the Proposal. The closest world heritage area is located on the Dorrigo Plateau, over 150km south of the study area.	
b. Any environmental impact on wetlands of international importance?	Nil.
The closest wetland of international importance is Little Llangothlin Nature Reserve, roughly 60km south east. The Proposal is at a sufficient distance to not impact upon that wetland.	
c. Any environmental impact on Commonwealth listed threatened species and ecological communities?	Nil
No critical habitat, threatened vegetation communities or plant populations listed under the TSC Act or the EPBC Act occur in the study area.	
d. Any environmental impact on Commonwealth listed migratory species?	Nil
No Commonwealth listed migratory species were observed on site. There is no optimum habitat on site for Commonwealth listed migratory species.	
e. Does any part of the Proposal involve a nuclear action?	Nil.
The Proposal does not involve a nuclear action.	
f. Any environmental impact on a Commonwealth marine area?	Nil.
The study area is located over 150km inland, therefore there would be no environmental impact on any Commonwealth Marine area.	
g. Any impact on Commonwealth land?	Nil.
The works would be undertaken entirely within the designated road reserve, therefore there would be no impact on Commonwealth Land	

11 References

- Austeco Environmental Consultants, *Addendum to Roadside Vegetation Study – New England Highway, McCclifty's, 62.69km to 68.04km north of Glen Innes*, February 2002.
- Austeco Environmental Consultants, *Addendum to Roadside Fauna Study – New England Highway, McCclifty's, 62.69km to 68.04km north of Glen Innes*, February 2002.
- Davies Heritage Consultants Pty Ltd, *Indigenous Cultural Heritage Assesment of Terrain to be Impacted by Road Works at McClifty's Study Area, Between Glen Innes and Tenterfield, Northern NSW*, April 2001.
- Elks, G, *Roadside Vegetation Study: New England Highway, McClifty's, 62.7km to 68.04km north of Glen Innes*, March 2001.
- Kendall and Kendall Ecological Services Pty Ltd, *Roadside Fauna Study, McClifty's*, June 2001.
- New South Wales Consolidated Regulations website: (http://www.austlii.edu.au/au/legis/nsw/consol_reg/tlep1996333/)
- NSW Fisheries 1999 Update. *Policy and Guidelines. Aquatic Habitat Management and Fish Conservation 1999.*
- NSW State Government. *Action for Transport 2010. An integrated transport plan for NSW.*
- Premiers Department NSW, *Regional Data Profile – Northern Tablelands (summary)*, 2000.
- RTA, *Environmental Impact Assessment Policy, Guidelines and Procedures* - NSW RTA, April 2001.
- RTA, *Project Development Report (Concept), McClifty's Pavement Rehabilitation and Formation Widening*, NSW RTA, May 2001.
- RTA, Preliminary Environmental Investigation, *2000/2001 National Highway Major Works Programme – Packaged Widening Works (Northern Region)*, January 2001.
- Tenterfield Shire Council – *State of the Environment Report 1997.*

12 Declaration

This Review of Environmental Factors provides a true and fair review of the activity in relation to its likely 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 proposed activity, and provides sufficient information to determine whether there is likely to be a significant impact on the environment as a result of the proposal.

Signed:

Designation: Jesse Death, Environmental Officer, Environmental Assessments.

Date: 19 March, 2002.

I have examined this Review of Environmental Factors and the certification by Jesse Death and accept the Review of Environmental Factors on behalf of the Roads and Traffic Authority.

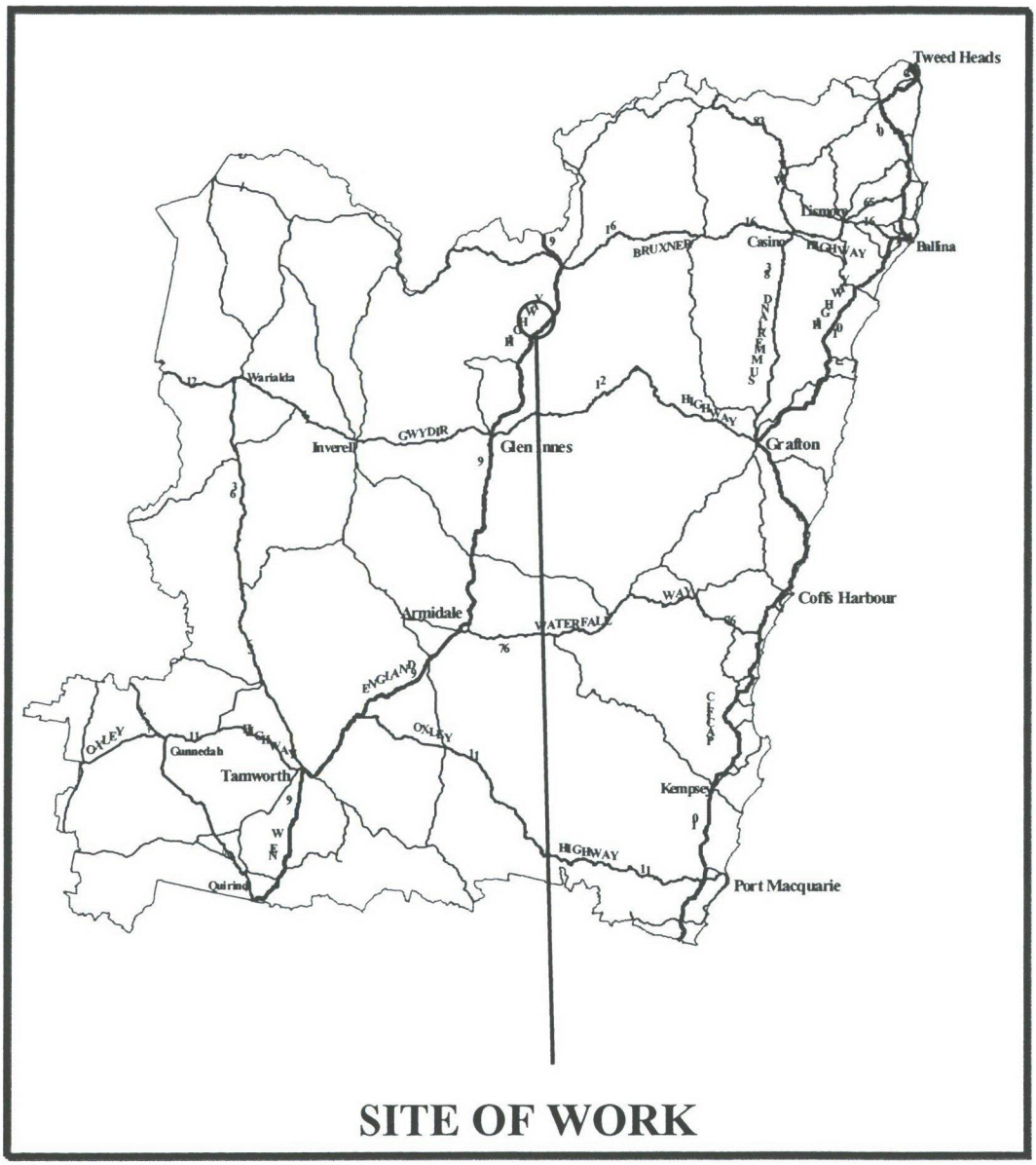
Signed:

Designation: Belinda Randall, Acting Manager, Environmental Assessments

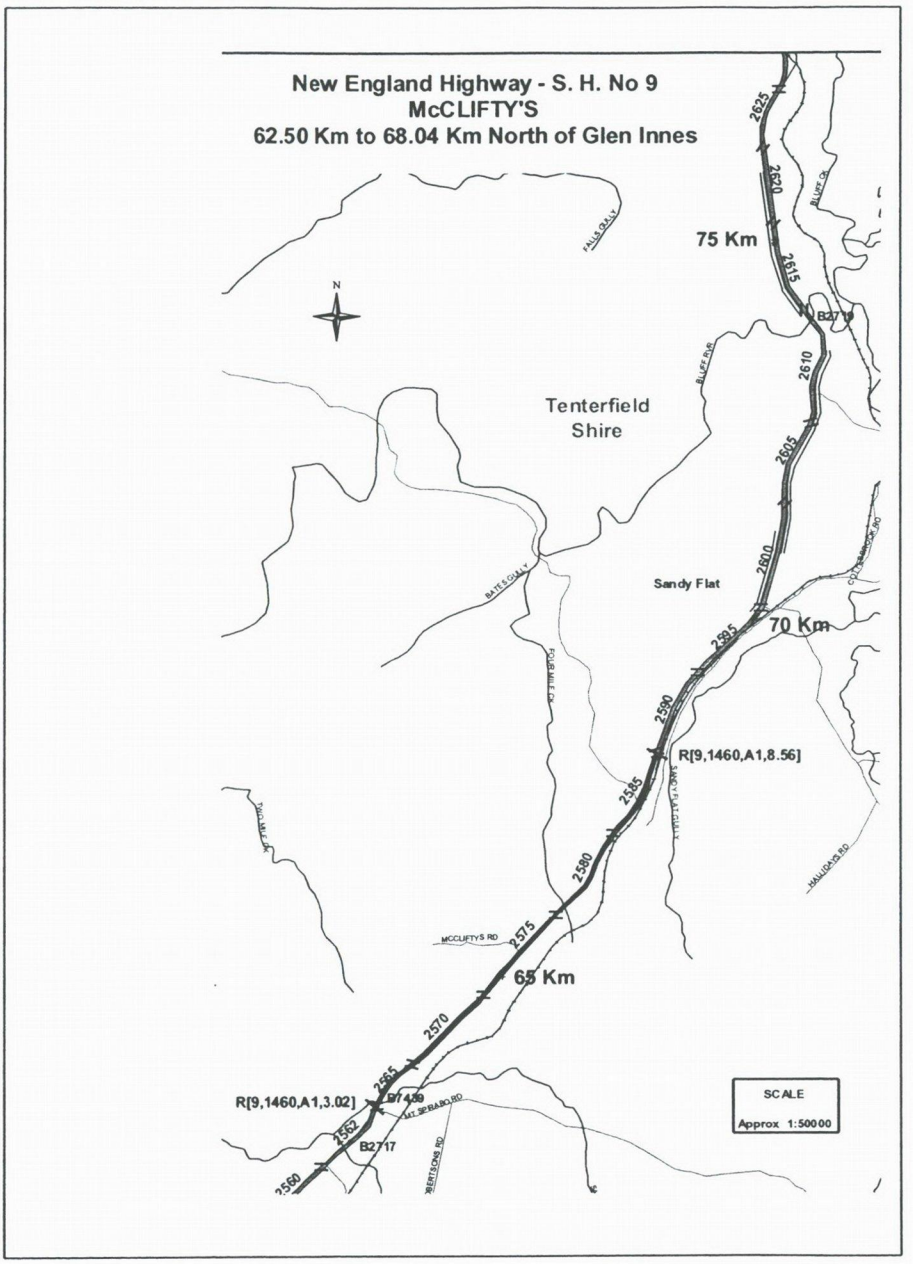
Date: 19 March, 2002.

13 Appendices

Appendix A


Tweed Heads
Ballina
Casino
BRUXNER
DUNORAMUS
Grafton
Coffs Harbour
Glen Innes
GWYDIR
Inverell
Warialda
Armidale
WATERFALL
ENGLAND
OXLEY
Gunnedah
Tamworth
Kempsey
Port Macquarie
Quirindi
SITE OF WORK

Appendix A(2)


New England Highway - S. H. No 9
McCLIFTY'S
62.50 Km to 68.04 Km North of Glen Innes
75 Km
70 Km
65 Km
Tenterfield
Shire
Sandy Flat
R[9,1460,A1,8.56]
R[9,1460,A1,3.02]
B2717
MCCLIFTYS RD
SCALE
Approx 1:50000

Appendix B



Plate 1: 63km 100. The start of the study area. Looking north.

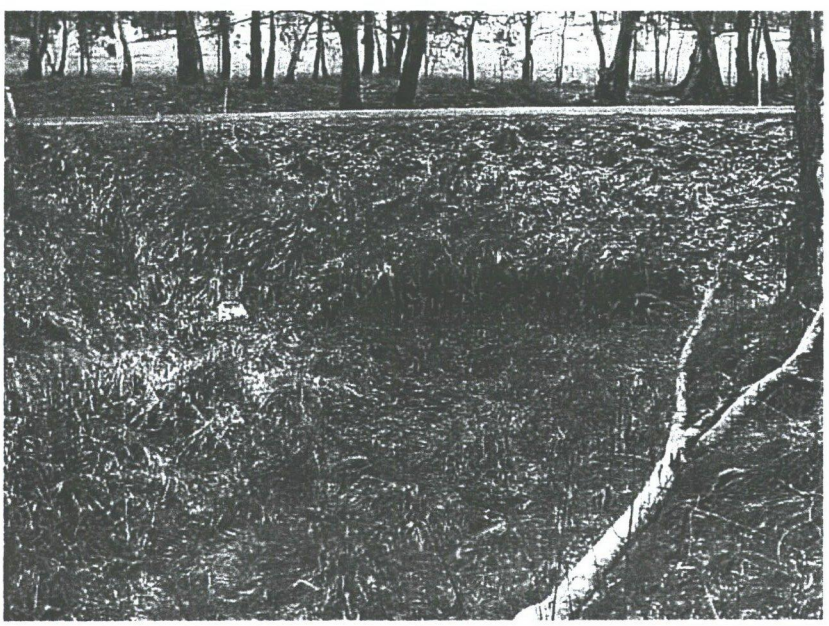


Plate 2: 63km 500. Culvert. Looking west.



Plate 3: 64km 300. Looking north.



Plate 4: 65km 700. Looking south.

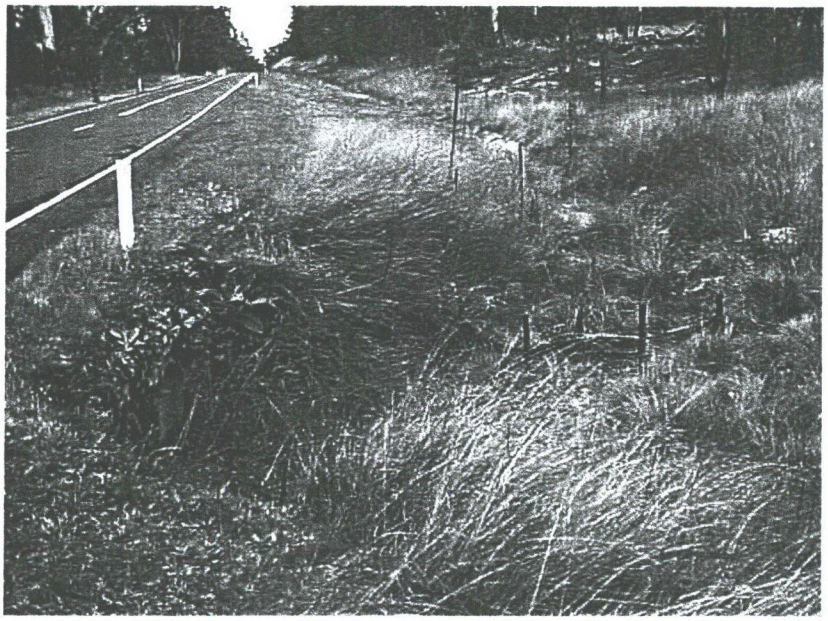


Plate 5: 65km 400. Looking north.

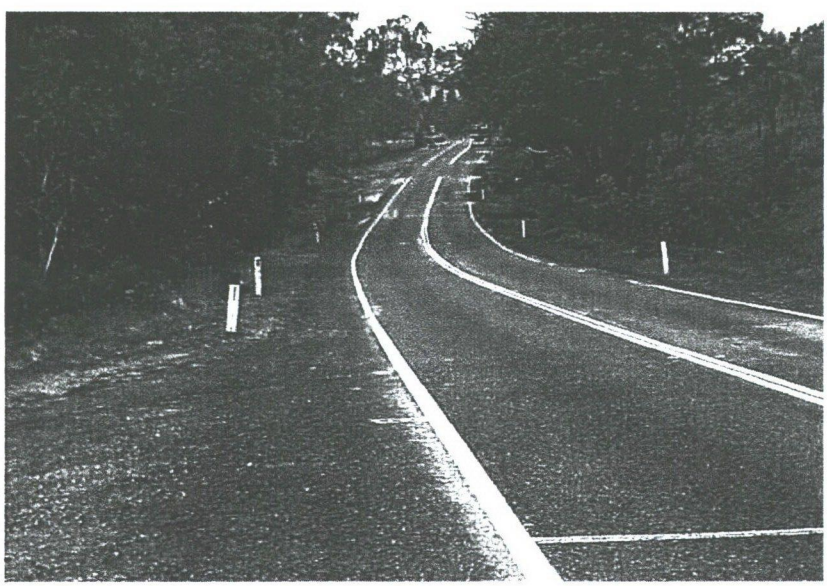


Plate 6: 67km 700. End of study area. Looking north.

Appendix C

NEW ENGLAND HIGHWAY- STATE HIGHWAY NO.9
TENTERFIELD SHIRE COUNCIL
McCLIFTY'S REHABILITATION AND PAVEMENT WIDENING
62.70km TO 68.04km NORTH OF GLEN INNES

CONCEPT ESTIMATE

ITEM	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	CONSTRUCTION PRELIMINARIES			2% of dir.costs	$143,700
	CONTROL OF TRAFFIC				$350,000
	CONTROL OF EROSION AND SEDIMENTATION				$50,000
	STORMWATER DRAINAGE				
	Excavation for stormwater drainage structures	70	m3	$100	$7,000
	Excavation for Open Drains	200	m3	$80	$16,000
	Precast Concrete and Fibre Reinforced Concrete Pipes				
	450mm dia. Concrete Pipe	70.76	m	$450	$31,842
	525mm dia. Concrete Pipe	6.10	m	$500	$3,050
	600mm dia. Concrete Pipe	25.62	m	$550	$14,091
	900mm dia. Concrete Pipe	23.18	m	$900	$20,862
	1050mm dia. Concrete Pipe	10.98	m	$1,100	$12,078
	Precast Concrete Box Culverts				
	3/1800 x 1200 RCBC	7.32	m	$5,000	$36,600
	Drainage Structures Other Than Pipes and Box Culverts				$0
	Headwalls -- Pipes	17	each	$1,000	$17,000
	Headwalls -- Box Culvert	2	each	$10,000	$20,000
	Gully Pits etc.	6	each	$3,000	$18,000
	Concrete Lining of Open Drains	300	m2	$125	$37,500
	KERBS AND GUTTERS				
	SK Gutter	700	m	$95	$66,500
	TRENCH DRAINS				
	Excavation for Drains	200	m3	$125	$25,000
	Strip filter pipe plus cleanouts	400	m	$75	$30,000
	Perforated Plastic drainage pipe	1,000	m	$95	$95,000
	CLEARING AND GRUBBING				
	Clearing and Grubbing (Clearing of trees)	4.00	ha	$10,000	$40,000
	EARTHWORKS (Cut, Fill, Imported Fill and Imported Select)				
	Removal and Stockpiling of Topsoil	4,500	m3	$30	$135,000
	General Earthworks (Cut/Fill)	7,500	m3	$50	$375,000
	Spoil	3,500	m3	$25	$87,500
	Imported Select Fill	11,500	m3	$100	$1,150,000
	IN SITU PAVEMENT RECYCLING BY DEEPLIFT CEMENTITIOUS RECYCLING				
	In Situ Stabilisation	65,000	m2	$17	$1,105,000
	Supply, Spread and Compact New Pavement Material	22,000	m3	$100	$2,200,000
	SPRAYED BITUMINOUS SURFACING - 10mm Primer Seal	65,000	m2	$4	$260,000
	SPRAYED BITUMINOUS SURFACING - 14mm Final Seal	65,000	m2	$7	$422,500
	GUIDEPOSTS				
	Supply and Installation of Guideposts	300	each	$50	$15,000
	SAFETY BARRIER SYSTEMS				
	Construction of Post & Rail Safety Barrier	600.0	m	$75	$45,000
	Construction of Terminals	14.0	each	$3,500	$49,000

NEW ENGLAND HIGHWAY- STATE HIGHWAY NO.9
TENTERFIELD SHIRE COUNCIL
McCLIFTY'S REHABILITATION AND PAVEMENT WIDENING
62.70km TO 68.04km NORTH OF GLEN INNES

CONCEPT ESTIMATE

ITEM	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT
	PAVEMENT MARKING - Primer Seal				
	Water Borne Paint – Longitudinal Lines	19,000	m	$3	$47,500
	Chevrons	800	m2	$25	$20,000
	PAVEMENT MARKING - Final Seal				
	Water Borne Paint – Longitudinal Lines	19,000	m	$3	$47,500
	Chevrons & turn arrows	800	m2	$25	$20,000
	RAISED PAVEMENT MARKERS				
	Installation of Retroreflective Raised Pavement Markers - Prime	1,720	each	$9	$15,480
	Installation of Retroreflective Raised Pavement Markers - Final	1,720	each	$9	$15,480
	SIGNPOSTING				
	Adjustment of Existing Signs and Support Structures	60.00	each	$300	$18,000
	New sign Structures	50.00	m2	$300	$15,000
	VEGETATION				
	Spraying Weeds with Herbicide	15,000.00	m2	$1	$15,000
	Topsoil and Grass Batters	15,000	m2	$9	$135,000
	LINING WITH ORGANIC MAT - Jute Mesh & Bitumen	12,000	m2	$7	$84,000
	GENERAL CONCRETE PAVING				
	Concrete Paving	350	m2	$50	$17,500
	Sub Total				$7,184,983
	CONSTRUCTION COSTS				**$7,328,683**
	ALLOWANCES				
	a) Contingencies			5%	$366,434
	b) Variations			3%	$219,860
	TOTAL COST				***$7,914,977***

Appendix D

Roadside Vegetation Study:

New England Highway, McClifty's,

62.69km to 68.04km North of Glen Innes

Prepared for
RTA Operations Environmental Services

Greg Elks BSc MLitt
Botanist and Ecologist
21 Titans Close, Bonville NSW 2441
(02) 6653 4190

for

Austeco Environmental Consultants

March 2001

Executive Summary

This report examines the potential impacts on flora associated with the proposed improvement of New England Highway in the vicinity of McClifty's Road, 62.69km to 68.04km North of Glen Innes

Vegetation survey was undertaken on 14 March 2001 and incorporated targeted searches for threatened plant species known to occur and plant species or species habitat likely to occur in the locality. The single site visit was a limitation of the survey because seasonally absent or unrecognisable plant species may not have been detected. The survey utilised random meander and parallel line searches to sample 20% of the native vegetation of the study area. Vegetation community boundaries and the location of threatened species were mapped on 1:8000 scale aerial photographs in the field.

The forest communities of the study area are considered to be poorly reserved in the region. A small population of the Vulnerable species *Thesium australe,* and potential habitat for other threatened flora species, was found in the study area.

The study found that the 3.7 hectares of native vegetation that would be destroyed by the proposed activity consists of a narrow strip beside the existing road, and that flora habitat values of that vegetation have been compromised by prior clearing of tree cover, general absence of senescent trees and mid-stratum vegetation, and the replacement of native ground layer vegetation by introduced weeds. The vegetation that would be destroyed was therefore considered unlikely to be of conservation significance for threatened flora species.

The study recommends measures for conservation of roadside vegetation during roadwork, for control of specific introduced species, and proposes mitigation of impacts by improving the roadside habitat for native plants generally. Given implementation of these measures the study considers that a Species Impact Statement or approval of the Commonwealth Environment Minister would not be required.

1 Introduction

The aim of this report is to examine the potential impacts on flora associated with the proposed improvement of New England Highway in the vicinity of McClifty's Road, 62.69km to 68.04km North of Glen Innes

Specific objectives are:
(a) Review of Threatened plant species records in the locality of the study area;
(b) Survey of roadside vegetation in the study area;
(c) Provide a flora species list for the study area;
(d) Provide an overview of habitat values including
- weed infestations;
- presence of dead, senescing, hollow or large fallen trees;
- cover of shrub and ground layer vegetation;
- substrate, and
- disturbance impacts.

(e) Describe and map the vegetation of the study area and proximal habitats, and
(f) Compile a report describing the above and identifying any flora species, populations, communities or critical habitat present that are listed by the *Threatened Species Conservation Act* (TSC Act 1995), *Environmental Protection and Biodiversity Conservation Act* (EPBC Act 1999), or Rare or Threatened Australian Plants (ROTAP) (Briggs and Leigh 1995).

2 Methodology

2.1 Review of previous studies and plant species records

Records of plant species known to occur within the locality were obtained under license from the National Parks and Wildlife Service database (NPWS, March 2001). Records of threatened plant species or species habitat likely to occur in the locality were obtained from the Federal Department of Environment Sport and Territories web site (http//www.dest.gov.au/search/databases.html February 2 2001)

Tenterfield Shire Council, which is responsible for the study area, has no roadside vegetation management policy or plan. A Draft State of the Environment Report just completed by Council recommends that a shire wide vegetation study be done, but contains no reference to roadside vegetation in the study area (pers. comm. Bryce Heinz, Tenterfield Shire Council), and will not be further considered in this report.

2.2 Vegetation Survey

Study area

The study area was defined in the brief as being from 62.69km to 68.04km North of Glen Innes, and within 15 metres from the edge of the road. This gives a total study area of 16.05 hectares.

Survey method

Vegetation survey was undertaken over a period of seven hours on 14 March 2001.

An initial vehicle based survey, assisted by maps and 1:8000 scale aerial photographs, determined the study area boundaries and evaluated the overall condition and distribution of native vegetation therein.

Each significant patch of native vegetation (0.3 hectares or greater) was then traversed on foot using the random meander technique (Cropper 1993), with a minimum sample being 20% of the area of the patch. Particular attention was paid to likely habitat for species listed in Tables 1and 2. Smaller patches were examined as needed for coverage of any potential threatened species habitat and to ensure vegetation sampling at intervals not exceeding 500 metres.

Parallel line searches (Cropper 1993) at intervals of approximately two metres were undertaken within 10 metres of any occurrence of a threatened plant species detected during the survey in order to delineate the extent of the population, which was then mapped on the relevant aerial photograph and concept plan (see Figures 1a – 1d).

Plant species of significance and those difficult to identify in the field were collected (under the provisions of Scientific Investigation Licence A2595) and preserved for later identification in the laboratory.

A description of typical vegetation structure, floristics and disturbance history was obtained from informal plots located in typical vegetation communities. Vegetation classification follows the methodology and schema of Walker and Hopkins (1990) and Groves (1999), with some modification for disturbed communities.

Survey limitations

Weather conditions were overcast and warm. The vegetation was moist, and there was no evidence to indicate that drought stress was likely to limit the effectiveness of the survey.

As the survey was limited to a single site visit at the end of summer, it is possible that some plant species were not detected. Undetected plants would be either seasonally absent (eg: cool season annuals), without above-ground parts (eg: some terrestrial orchids), or cryptic species (above-ground parts not recognisable unless flowering – for example the threatened orchid *Diuris pedunculata,* known from the locality).

2.3 Vegetation Mapping

Mapping of threatened species populations and vegetation community boundaries utilised 1:8000 scale colour aerial photographs supplied by the RTA. Threatened species populations and vegetation community boundaries were located in the field and marked on overlays using stereoscopic interpretation of relevant photo pairs.

Markings were then transferred to alternate photos in the office, and the resulting linework scanned, coloured and labeled to produce the vegetation maps included in this report. Note that these vegetation maps have not been rectified to remove the distortion in the aerial photo image that arise from the interaction of the camera lens geometry and the topography of the study area.

3 Results

3.1 Threatened plant species records or habitats within the locality

Table 1. *TSC Act* Threatened plant species known to occur within 30km of the study area (NSW NPWS Wildlife Atlas database March 2000)

species	Legal status	Habitat
Acacia pycnostachya	Vulnerable	Granite outcrops in dry open forest
Almaleea cambagei	Endangered	Wet heath & swamp on granite over 1000m
Diuris pedunculata	Endangered	Grassy areas in sclerophyll forest
Eucalyptus nicholii	Vulnerable	Woodland on shallow infertile soils
Grevillea beadleana	Endangered	Dry open forest, scarps, cliffs
Homoranthus croftianus	Endangered	Exposed granite outcrops in woodland and shrubland
Lepidium peregrinum	Endangered	unknown
Pimelea venosa	Endangered	Granite geology
Prostanthera staurophylla	Vulnerable	Heath and dry open forest on granite outcrops
Pultenaea stuartiana	Vulnerable	Open forest on granite
Thesium australe	Vulnerable	Headlands, woodland

Table 2. *EP&BC Act* Threatened plant species or species habitat likely to occur within 10km of the study area (http//www.dest.gov.au/search/databases.html, February 2 2001)

species	Legal status	Habitat
Acacia macnuttiana	Vulnerable	Dry open forest & heath near creeks, on granite
Acacia pubifolia	Vulnerable	Dry sclerophyll forest on heath
Acacia pycnostachya	Vulnerable	Granite outcrops in dry open forest
Bertya pinifolia	Vulnerable	unknown
Boronia granitica	Endangered	Granite outcrops and crevices
Callistemon pungens	Vulnerable	Sandy creek beds of rocky watercourses
Diuris pedunculata	Endangered	Grassy areas in sclerophyll forest
Eucalyptus nicholii	Vulnerable	Woodland on shallow infertile soils
Goodenia macbarronii	Vulnerable	Moist areas on sand
Haloragis exalata ssp. velutina	Vulnerable	Damp places near watercourses
Pimelea venosa	Endangered	Granite geology
Pultenaea stuartiana	Vulnerable	Open forest on granite
Thesium australe	Vulnerable	Headlands, woodland
Tylophora woollsii	Endangered	Wet sclerophyll forest

3.2 Description of Vegetation Communities

Community 1 – *Cleared*

This vegetation community is characterised by an absence of trees (and woody vegetation generally) and dominance by exotic grasses and weeds. Native plant species, where they occur, usually represent less than 50% of the vegetation foliage cover and are primarily common grasses and herbs.

Community 2 - *Eucalyptus viminalis – E. conica* (ribbon gum – fuzzy box) Open Forest

This community occurs on deeper soils on gentle slopes near Two Mile Creek.

The overstorey consists mainly of large mature trees around 25 metres tall, although there are significant amounts of regrowth and senescing trees. Ribbon gum is the dominant species, with fuzzy box subdominant on lower slopes but declining in cover with distance from the creek.

The midstratum is absent.

The ground layer consists of a dense cover of native and exotic grasses, herbs and legumes to 0.6metres tall.. Exotics include Sudan grass *Sorghum bicolor ssp drummondii,* phalaris *Phalaris aquatica,* African lovegrass *Eragrostis curvula,* paspalum *P. dilatatum*, haresfoot clover *Trifolium arvense* and vetch *Vicia sativa*. Native species include golden everlastings *Bracteantha bracteata*, acaena *A. agnipila,* rasperry *Rubus parvifolius,* and glycine *G. tomentella.*

This community is notable for the presence of hollows and the large size of the trees.

Community 3 – *Eucalyptus blakelyi – E. bridgesiana – E .subtilior – E. viminalis* (Blakely's red gum – apple box – stringybark - ribbon gum) Open Forest

This community occurs on sandier soils than Community 2, on lower- and mid-slopes in the southern part of the study area, or on almost level country in the north of the study area.

The overstorey consists mainly of small to medium mature trees around 15 metres tall with few hollows, although there are occasional larger senescent red gum and ribbon gum with large hollows, particularly in the northern part of the study area.

Figure 1a. Map of vegetation communities of southern part of study area

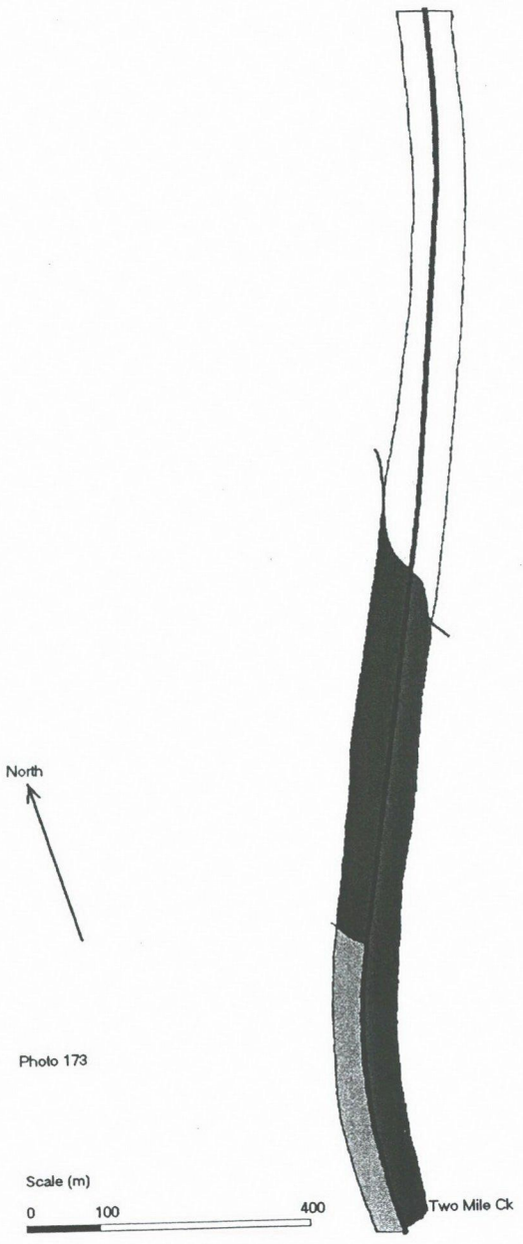


Figure 1b. Map of vegetation communities of south-central part of study area

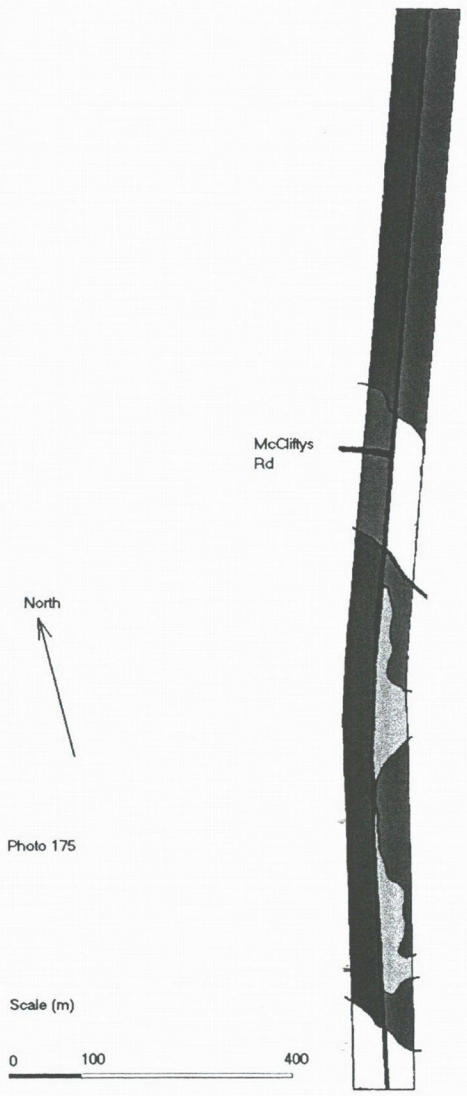


Figure 1c. Map of vegetation communities of central-northern part of study area

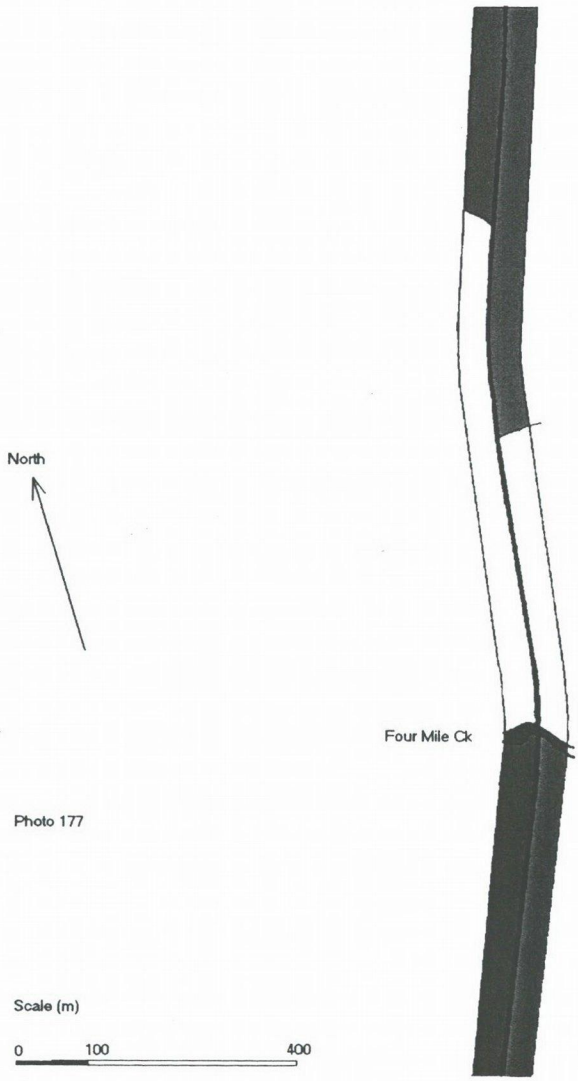
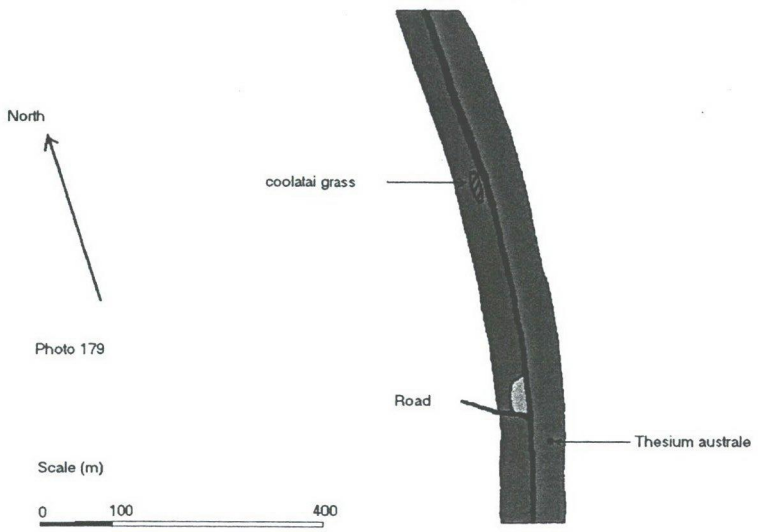


Figure 1d. Map of vegetation communities of northern part of study area



LEGEND

- Cleared
- Eucalyptus viminalis, E. conica Open Forest
- Eucalyptus blakelyi, E. bridgesiana, E. subtilior, E. viminalis Open Forest
- Disturbed Eucalyptus blakelyi, E. bridgesiana, E. subtilior, E. viminalis Open Forest
- Eucalyptus blakelyi, E. melliodora, E. subtilior, Angophora floribunda Open Forest
- Disturbed Eucalyptus blakelyi, E. melliodora, E. subtilior, Angophora floribunda Open Forest
- Pennisetum alopecuroides, Isachne globosa Closed Grassland

Blakely's red gum, apple box and stringybark are codominant, and the distribution of ribbon gum is patchy, being subdominant (and often in poor condition) in moister sites on lower slopes or on deeper soils, and sparse to absent elsewhere.

The midstratum consists of a sparse layer of white sally wattle *Acacia floribunda* to 15 metres tall over a very sparse layer of dogwood *Jacksonia scoparia* and cherry ballart *Exocarpos cupressiformis* to 6 metres.

The ground layer consists of a sparse cover of primarily native plant species including lomandra *L. longifolia*, grasses such as spear grass *Aristida vagans* and barbed-wire grass *Cymbopogon refractus*, and herbs such as the purple burr-daisy *Calotis cuneifolia*, to 0.3 metres tall. Some fallen trees are present.

Community 4 – Disturbed *Eucalyptus blakelyi – E. bridgesiana – E .subtilior – E. viminalis* (Blakely's red gum – apple box – stringybark - ribbon gum) Open Forest

This community is similar to Community 3 but occurs in a landscape that is extensively cleared for pasture.

The overstorey is as for Community 3, but is often thinned or dominated by regrowth trees. The midstratum is generally absent, and the ground layer is typically dominated by a moderately dense cover of exotic grasses and herbs to 0.6 metres tall.

Of particular concern is the presence of coolatai grass *Hyparrhenia hirta*, a very invasive grass that is invading large areas of native vegetation to the west of Tenterfield and excluding most native species.

This exotic species is likely to be a major threat to species such as Austral toadflax *Thesium australe*, several plants of which occur on the boundary of the road reserve with the rail corridor in the northern part of the study area.

Community 5 – *Eucalyptus blakelyi – E. melliodora - E .subtilior – Angophora floribunda* (Blakely's red gum – yellow box – stringybark – rough-barked apple) Open Forest

This community occupies shallower soils on the crest of the hill above McClifty's Road and the undulating terrain to the north, particularly those exposed to the harsher northwesterly aspect. The community generally shows evidence of recent fire and past severe fire, especially in the vicinity of McClifty's.

The overstorey consists mainly of small to medium mature trees around 15 metres tall with few hollows, although there are occasional larger senescent red gum and ribbon gum with hollows, particularly in the northern part of the study area.

Blakely's red gum, stringybark and rough-barked apple are generally co-dominant throughout. The distribution of yellow box is patchy, being common above McCliftys but uncommon elsewhere in the community.

The midstratum consists of a sparse layer of dogwood *Jacksonia scoparia* and cherry ballart *Exocarpos cupressiformis* to 6 metres.

The ground layer consists of a sparse cover of primarily native plant species including lomandra *L. longifolia*, grasses such as spear grass *Aristida vagans,* barbed-wire grass *Cymbopogon refractus*, love grass *Eragrostis benthamii* and hardy herbs such as the daisy *Vittadinia dissecta var hirta*, to 0.3 metres tall. No fallen trees or large woody debris are present.

Community 6 – Disturbed *Eucalyptus blakelyi – E. melliodora - E .subtilior* – Angophora floribunda (Blakely's red gum – yellow box – stringybark – rough-barked apple) Open Forest

This community is similar to Community 5 but occurs in a landscape that is extensively cleared for pasture.

The overstorey is as for Community 5, but is often thinned or dominated by regrowth trees. The midstratum is generally absent, and a moderately dense cover of exotic grasses and herbs to 0.6 metres tall typically dominates the ground layer.

Community 7 – *Pennisetum alopecuroides – Isachne globosa* (swamp foxtail – swamp millet) Closed grassland

This community occupies the moist areas of Four Mile Creek, a shallow and poorly defined intermittent watercourse. Swamp foxtail and swamp millet are the dominant species, with occasional plants of purple loosestrife *Lythrum salicaria*.

3.3 Habitat values

Vegetation corridors across the highway and significant at the local or regional scale are absent from the study area.

The roadsides of the study area are apparently effective corridors for the dispersal of plant propagules along the road, in particular for English broom *Cytisus scoparius*, which occurs throughout most vegetation communities, and coolatai grass *Hyparrhenia hirta*, a very invasive grass.

Seed dispersal of many plants along roads may also be facilitated by the impact of wind tunnel effects of fringing vegetation and wind generated by traffic, grazing by domestic animals during drought or movement between properties, and movement of soil and propagules slashing and grading. Such dispersal often favours weedy species that are able to colonise areas disturbed by road maintenance.

Roadside vegetation corridors in largely cleared landscapes such as that of the study area may be an important corridor connecting forest remnants for native birds and animals, thereby facilitating the dispersal of fruits and seeds of many native plants between remnants. For example the native mistletoe *Amyema miquelii* appears to be more common on the road reserve than elsewhere

Other habitat values of the vegetation communities in the study area are summarised in Table 3 below.

Table 3. Habitat values of vegetation communities

Community **Habitat value**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
trees with large hollows	-	Uncommon	Rare	-	Rare	-	Na
trees with small hollows	-	Common	Uncommon	Very rare	Uncommon	Very rare	Na
large woody debris	-	Uncommon	Uncommon	-	-	-	Na
mid-stratum vegetation	-	-	Sparse	-	Sparse	-	Na
shrubby ground layer	-	-	-	-	-	-	Sparse
rock outcrops	-	-	Rare	-l	Rare	-l	Occas ional
water	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Intermittent
weed infestation	Heavy - total	Moderate	Light - moderate	Heavy	Light - moderate	Mod - heavy	Light - absent

3.4 Disturbance impacts

The habitat values of the vegetation communities have been compromised by prior disturbance impacts. These have resulted in the thinning or clearing of tree cover, the preponderance of regrowth and the general absence of senescent trees, the general absence of native mid-stratum vegetation, and the invasion or replacement of ground layer vegetation by introduced weeds, pasture grasses and shrubs.

Of particular concern is the dominance of introduced pasture grasses on more fertile areas (such as moist areas, level areas, drains and fill batters), which because of their height and dense cover are likely to exclude the regeneration of native shrubs and trees in these areas for the foreseeable future. It should be noted however that the dominance of these species appears to be a result of soil disturbance associated with road construction and maintenance, and often declines markedly with distance from the road edge.

4 Discussion

4.1 Conservation significance

Threatened vegetation communities, threatened plant populations, and critical habitat

No critical habitat, threatened vegetation communities or plant populations listed under the *Threatened Species Conservation Act* 1995 (TSC Act) or the *Environment Protection and Biodiversity Conservation Act* 1999 (EP&BC Act) occur in the study area.

Threatened plant species

The threatened plant species *Thesium australe*, listed as Vulnerable by the TSC Act and the EP&BC Act, was detected in the study area. One small population occurs in the study area in Community 4, comprising 3 plants spread over 20 square metres

Part of the study area is therefore of conservation significance for *Thesium australe.*

Potential habitat for threatened plants

Potential habitat for the threatened species *Acacia macnuttiana, Diuris pedunculata, Goodenia macbarronii, Grevillea beadleana, Haloragis exalata subsp. velutina, Pimelea venosa, Pultenaea stuartiana* and *Thesium australe* was detected in the study area. Whether or not potential habitat for *Lepidium peregrinum* and *Bertya pinifolia* also exists in the study area is not known, as habitat descriptions for these species are not available.

Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum and *Pultenaea stuartiana* are small and without distinctive vegetative features, are not readily detected except when flowering and may therefore occur in the study area. *Bertya pinifolia* is not reported from the locality and is known only from near the Queensland border. Populations of *Diuris pedunculata* are very rare in the locality, with only one population known from within 30 kilometres of the study area. *Lepidium peregrinum* is also very rare, known only from a location west of Tenterfield. Two populations of *Pultenaea stuartiana* are known from within the locality, occurring at least 20 kilometres to the east.

Pimelea venosa has been reported from within 10 kilometres of the study area (west of the Four Mile Creek study area). It is readily recognisable by means of distinctive vegetative features, but was not detected in the study area.

Therefore Community 2 and Community 3 may be of conservation significance for *Diuris pedunculata*, Communities 3 and 5 may be of significance for *Pultenaea stuartiana*, and Communities 2,3 and 5 may be of significance for *Pimelea venosa.* The study area generally may be of significance for *Bertya pinifolia* and *Lepidium peregrinum.*

Potential habitat for *Acacia macnuttiana* and *Goodenia macbarronii* may occur on the edges of Community 7 where it adjoins Communities 3 and 5. However as neither species has been reported within 30 kilometers of the study area, their inclusion here is on the basis of a habitat model only, and as they were not detected in the study area, it is considered unlikely that the species occur in the study area.

Numerous records of *Grevillea beadleana* occur at least 20 kilometres west of the study area, but it is not known from the any locations closer to the study area. *Haloragis exalata subsp. velutina* is a coastal species not reported from the locality but included here on the basis of a habitat model.
As both species are recognisable on the basis of distinctive vegetative features and were not detected in the study area, it is considered unlikely that the species occur in the study area.

Therefore the study area considered as unlikely to be of conservation significance for *Acacia macnuttiana, Goodenia macbarroni, Grevillea beadleana* and *Haloragis exalata subsp. velutina.*

Rare plants

No rare plants were detected in the study area.

Vegetation communities

The conservation status of the forest communities of the study area is regarded as poor, with communities dominated by *Eucalyptus viminalis, E bridgesiana , E blakelyi,* and *E melliodora* not reserved or poorly reserved both in northern NSW and NSW generally (Hager and Benson 1994). The study area is therefore of significance for the preservation of the existing vegetation communities.

4.2 Assessment of Impacts

The approximate area of each vegetation community that would be removed by the proposal, as estimated from the vegetation map and the concept design for the road upgrading, is listed below. Note that the area of vegetation to be removed is typically a narrow strip adjacent to the existing roadway that is already significantly disturbed by previous road construction and maintenance activities and dominated by introduced plants, especially weeds of disturbed habitats.

Community 1.	Not estimated
Community 2.	0.51 ha
Community 3.	1.26 ha
Community 4.	1.04 ha
Community 5.	0.62 ha
Community 6.	0.23 ha
Community 7.	0.01 ha
Total	3.67 ha

As one threatened plant species occurs in the study area and potential habitat for other threatened plant species reported from the locality also occur in the study area, there is potential for impact of the proposal on threatened plant species, populations or ecological communities and their habitats.

The TSC Act and the EP&BC Act each list eight factors to be considered in deciding whether the proposed activity is likely to have a significant effect on those threatened species or their habitats, and therefore whether a Species Impact Statement or approval of the Environment Minister is required prior to approval.

Section 5A of the EP&A Act 1979: the Eight Part Test

(a) in the case of threatened species, whether the life cycle of these species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

A small population of the threatened species *Thesium australe* occurs 20 metres from the roadside and is unlikely to be disturbed by the proposed activity. Potential habitat for threatened species such as

Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum, Pimelea venosa, Pultenaea and *stuartiana* within the study area occurs mainly outside of the area likely to be disturbed by the proposed activity. The life cycle of these species is not known to be dependent on factors outside of this habitat. It is therefore considered unlikely that the life cycle of these species will be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised

Endangered populations (as defined under the TSC Act) do not occur within the site.

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

No known habitat will be removed by the proposed activity.

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

The proposed activity would marginally increase the width of an existing road. This would not cause potential habitat to become isolated from currently interconnecting or proximate areas of habitat.

(e) whether critical habitat will be effected

Critical habitat (as defined under the TSC Act) does not occur in the study area.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region

The threatened species *Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum, Pimelea venosa, Pultenaea stuartiana* and *Thesium australe* are not known to be adequately represented in conservation reserves in the region (Briggs and Leigh 1995), nor is habitat for these species (Hager and Benson 1994).

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process

The proposed activity is not a threatening process (as defined by Schedule 3 of the TSC Act)

(h) whether any threatened species, population or ecological community is at the limit of its known distribution

The study area is not at the limit of known distribution for the threatened species *Diuris pedunculata, Lepidium peregrinum, Pimelea venosa* and *Pultenaea stuartiana* and *Thesium australe. Bertya pinifolia* and *Lepidium peregrinum,* were they to occur in the study area, would represent a new limit of known distribution for these species.

EP&BC Act: Administrative guidelines

The guidelines also utilise eight tests to examine whether an action has, will have, or is likely to have a significant impact on an endangered/*vulnerable* species.

(a) Does, will, or is the activity likely to lead to a long-term decrease in the size of a population/ *important population*?

The population of the vulnerable species *Thesium australe* is unlikely to be an *important population i.e.*: one that is necessary for a species' long-term survival and recovery. The small size of the study area's *Thesium australe* population suggests that it will not be important for the long-term survival and

recovery of the species. Therefore the activity is unlikely to lead to a long term decrease in the size of an important population of *Thesium australe*.

As the activity is confined to a narrow strip of roadside vegetation in a significantly forested landscape, and as populations of *Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum* and *Pultenaea stuartiana* are either very rare or absent within 20 kilometers of the study area, it is considered that the activity is unlikely to lead to a long term decrease in the population size of these species. As *Pimelea venosa* was not detected in the study area the activity is unlikely to lead to a long term decrease in the population of that species.

(b) Does, will, or is the activity likely to reduce the area of occupancy of the species/*important population*?

As indicated above, *Thesium australes* in the study area is unlikely to constitute an important population, and there is no evidence to suggest that the activity will reduce the area of occupancy of *Bertya pinifolia, Diuris pedunculata, Lepidium peregrinum* or *Pultenaea stuartiana.*

(c) Does, will, or is the activity likely to fragment an existing population/*important population* into two or more populations?

No. The activity is unlikely to fragment an existing population or important population.

(d) Does, will, or is the activity likely to adversely affect habitat critical to the survival of a species?

No. As the species are widespread and the habitat of the study area is very small and largely outside the area to be modified by the activity, it is unlikely that the activity will adversely affect habitat critical to their survival.

(e) Does, will, or is the activity likely to disrupt the breeding cycle of a population/*important population*?

No. The activity is unlikely to disrupt the breeding cycle of threatened plant populations.

(f) Does, will, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The proposed action is likely to temporarily impact on a small area of habitat unoccupied by the species, and provided that opportunities for expansion of invasive introduced plant populations are minimised it is unlikely that the activity will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

(g) Does, will, or is the activity likely to result in invasive species that are harmful to endangered/*vulnerable* species becoming established in the endangered/*vulnerable* species' habitat?

No. Invasive species harmful to potential endangered/vulnerable species' habitat are already well established in the study area. Weed control measures recommended by this report will reduce the likelihood of further harmful weed invasion.

(h) Does, will, or is the activity likely to interfere with the recovery of the species?

No. The recovery of the species is not known to relate in any way on the study area or proximal habitats.

5 Conclusions and Recommendations

Summary of expected impacts on species of conservation significance.

Up to 3.67 hectares of poorly conserved forest dominated by *Eucalyptus viminalis, E bridgesiana , E blakelyi,* and *E melliodora* may be removed by the proposal.

This includes: up to 1.77 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Diuris pedunculata*, 1.77 hectares of habitat considered unlikely to be of conservation significance for the Vulnerable species *Pultenaea stuartiana*, 2.39 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Pimelea venosa,* and 3.67 hectares of habitat considered unlikely to be of conservation significance for the Endangered species *Lepidium peregrinum* and *Bertya pinifolia,* that may be removed by the proposal.

Recommendations for appropriate measures of conservation or mitigation of impacts on any species of conservation significance

General measures for conservation of roadside vegetation during roadworks are detailed in "Roadside Management Guidelines" (Severn Shire Council 2000, pp 12-17) and the Roadside Handbook (NSW Roadside Environment Committee 1997). In summary these include:

- Identify the exact location of significant species or vegetation communities in the field;
- Protect all native vegetation that is to remain undisturbed with barrier tape;
- Make all construction and maintenance staff aware of the identity and location of significant species or vegetation communities;
- Avoid any disturbance to native vegetation and keep vegetation disturbance generally to a minimum;
- If introduced species are present in abundance, removal by scraping away weeds and the topsoil layer may be beneficial immediately prior to regeneration with native species;
- Do not spread soil that may have introduced grasses or weeds in it.

As the invasive introduced species Coolatai grass occurs in the northern part of the study area it is specifically recommended that all occurrences of the species in the study area be marked in the field and controlled by application of a suitable herbicide, and that movement of soil, vegetable matter, vehicles or machinery from marked areas be prohibited unless sterilised or otherwise decontaminated.

Mitigation of impacts may be best undertaken by improving the roadside habitat for native plants generally and thereby for species of conservation significance. For example, native grasses such as kangaroo grass *Themeda australis* and barbed-wire grass *Cymbopogon refractus* are dominant species in undisturbed ground layer vegetation throughout the study area, and are regarded as having a substantial role in contributing to ecological equilibrium. Successful establishment of native grasses is possible using several methods if soil enriching nutrients favoring exotic grasses such as phalaris can be avoided or eliminated (Native Grass Resources Group Inc 1998).

An indication as to whether a Species Impact Statement would need to be prepared.

Given appropriate measures of mitigation and conservation as outlined above, it is expected that neither a Species Impact Statement nor approval of the Commonwealth Environment Minister will be required.

Flora species suitable for revegetation.

Avoid using introduced species that set viable seed as they can spread into surrounding native vegetation. This includes the grasses *Sorghum spp* (Johnson grass, Sudan grass) and *Eragrostis curvula* (African lovegrass), which are already common in the study area. These species permanently displace native vegetation, invade native bushland, produce copious dry matter that is a fire hazard, and choke drains.

Suitable species suitable for dry and less fertile areas (such as steeper slopes, rocky areas, batters) include
Large Trees: *Angophora floribunda, Eucalyptus blakelyi, Eucalyptus bridgesiana, Eucalyptus melliodora, Brachychiton populneus.*
Shrubs/small trees: *Cassinia quinquefaria, Acacia fimbriata, Acacia neriifolia.*
Ground layer grasses and herbs: *Themeda australis, Chrysocephalum apiculatum, Lomandra longifolia, Hardenbergia violacea, Cymbopogon refractus, Sorghum leiocladum.*
Trees and shrubs should be planted sparsely in these areas.

Suitable species for moister and more fertile areas include
Large Trees: *Eucalyptus viminalis, Eucalyptus bridgesiana, Eucalyptus subtilior, Eucalyptus conica.*
Shrubs/small trees: *Leptospermum polygalifolium ssp montanum, Cassinia quinquefaria, Acacia fimbriata, Acacia neriifolia.*
Ground layer grasses and herbs: *Poa labillardieri, Sorghum leiocladum, Bracteantha bracteata, Ammobium alatum, Acaena nova-zelandiae, Themeda australis..*
Trees and shrubs should be planted densely in these areas.

Suitable species for wet areas:
Ground layer grasses and herbs: *Isachne globosa, Pennisetum alopecuroides*

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Appendix - Flora Species List for the Study Area

CLASS Family	Ex	*Scientific name*	common name	Community			
				2	3&4	5&6	7
FILICOPSIDA (FERNS)							
Sinopteridaceae		Cheilanthes seiberi ssp seiberi	rock fern	x	x		
MAGNOLIOPSIDA							
Magnoliidae (Dicotyledons)							
Asteraceae	*	Bidens pilosa	farmers friends			x	
Asteraceae		Bracteantha bracteata	golden everlasting	x			
Asteraceae		Calotis cuneifolia	purple burr-daisy	x	x	x	
Asteraceae		Cassinia quinquefaria			x	x	
Asteraceae		Chrysocephalum apiculatum	yellow buttons	x	x	x	
Asteraceae	*	Cirsium vulgare	spear thistle	x	x	x	
Asteraceae	*	Conyza sp	fleabane	x	x	x	
Asteraceae	*	Hypochaeris radicata	catsear	x	x	x	
Asteraceae		Vittadinia dissecta var hirta				x	
Campanulaceae		Wahlenbergia graniticola	bluebell	x			
Caryophyllaceae		Scleranthus biflorus	canberra grass	x	x	x	
Clusiaceae		Hypericum gramineum			x		
Convolvulaceae		Dichondra sp A	kidney weed	x	x	x	
Dilleniaceae		Hibbertia obtusifolia			x	x	
Fabaceae (Faboideae)	*	Cytisus scoparius	english broom	x	x	x	x
(Faboideae)		Glycine tomentella		x			
(Faboideae)		Hardenbergia violacea	hardenbergia		x	x	
(Faboideae)		Jacksonia scoparia	dogwood		x	x	
(Faboideae)	*	Trifolium arvense	hares-foot clover	x			
(Faboideae)	*	Vicia sativa ssp angustifolia	vetch	x			
(Mimosoideae)		Acacia neriifolia	wattle	x			
Geraniaceae		Geranium retrorsum		x			
Lamiaceae	*	Prunella vulgaris	self-heal	x	x	x	
Loranthaceae		Amyema miquelii	mistletoe	x	x	x	
Lythraceae		Lythrum salicaria	purple loosestrife				x
Malvaceae	*	Sida rhombifolia	paddys lucerne		x		
Myrtaceae		Angophora floribunda			x	x	
Myrtaceae		Eucalyptus blakelyi	Blakely's red gum		x	x	
Myrtaceae		Eucalyptus bridgesiana	apple box		x		
Myrtaceae		Eucalyptus conica	fuzzy box	x			
Myrtaceae		Eucalyptus melliodora	yellow box			x	
Myrtaceae		Eucalyptus subtilior			x	x	
Myrtaceae		Eucalyptus viminalis		x	x	x	
Oxalidaceae		Oxalis exilis		x			
Plantaginaceae	*	Plantago lanceolata	plantain	x	x	x	
Polygonaceae		Polygonum hydropiper	water pepper				x
Santalaceae		Exocarpos cupressiformis	cherry ballart	x	x	x	
Santalaceae		Thesium australe	austral toadflax		x		
Scrophulariaceae		Veronica plebeia		x			
Scrophulariaceae	*	Verbascum thapsis	blanket weed	x	x	x	
Sterculiaceae		Brachychiton populneus	kurrajong			x	
Thymeliaceae		Pimelea linifolia ssp linifolia	rice flower		x		

CLASS Family	Ex	*Scientific name*	common name	Community			
				2	3&4	5&6	7
Liliidae (Monocotyledons)							
Cyperaceae		Cyperus eragrostis	umbrella sedge				x
Hypoxidaceae		Hypoxis hygrometrica var villosisepala	Golden weathergrass			x	
Lomandraceae		Lomandra longifolia	mat rush		x	x	
Orchidaceae		Spiranthes sinensis	spiral orchid				
Phormiaceae		Dianella longifolia var longifolia	flax lily		x	x	
Phormiaceae		Thelionema caespitosum		x			
Poaceae		Aristida vagans	spear grass	x	x	x	
Poaceae		Bothriochloa macra	red grass	x			
Poaceae		Cymbopogon refractus	barbed wire grass	x	x	x	
Poaceae		Eragrostis benthamii		x	x	x	
Poaceae	*	Eragrostis curvula	african lovegrass	x	x	x	
Poaceae	*	Hyparrhenia hirta	coolatai grass		x		
Poaceae		Isachne globosa	swamp millet				x
Poaceae		Panicum effusum		x	x	x	
Poaceae	*	Paspalum dilatatum	paspalum	x	x	x	
Poaceae	*	Pennisetum clandestinum	kikuyu				x
Poaceae		Pennisetum alopecuroides	swamp foxtail				x
Poaceae	*	Phalaris aquatica	phalaris	x	x		
Poaceae		Poa labillardierei	tussocky poa	x	x	x	
Poaceae	*	Setaria gracilis		x			
Poaceae	*	Sorghum bicolor ssp drummondii	sudan grass	x			
Poaceae	*	Sorghum halepense	johnson grass		x		
Poaceae		Sorghum leiocladum		x			
Poaceae		Sporobolus elongatus	rats-tail grass	x	x	x	
Poaceae		Stipa ramosissima			x	x	
Poaceae		Themeda australis	kangaroo grass	x	x	x	

Addendum to

Roadside Vegetation Study:

New England Highway, McClifty's,

62.69km to 68.04km North of Glen Innes

Prepared for
RTA Operations Environmental Services

Greg Elks BSc MLitt
Botanist and Ecologist
21 Titans Close, Bonville NSW 2441
(02) 6653 4190

for

Austeco Environmental Consultants

19 February 2002

Summary

This report updates a previous report (Elks 2001) assessing the potential impacts on flora associated with the proposed improvement of the New England Highway in the vicinity of McClifty's Road, 62.69km to 68.04km North of Glen Innes. This addendum has been undertaken as a number of new plant species and key threatening processes have been listed on the TSC Act since the original report was undertaken.

The report examined all Scientific Committee final determinations, and all NPWS Wildlife Atlas records for the study area and adjoining localities for any new records of threatened plant species, since 1st March 2001.

One new Wildlife Atlas threatened species record, the Vulnerable grass *Arthraxon hispidus*, has been reported for the locality as a result of a previous study undertaken for RTA Operations Environmental Services (Elks 2001a). Two new Scientific Committee determinations were relevant to the study area, these being the listing of clearing of native vegetation as a threatening process , and the listing of the plant *Euphrasia ciliolata* as Vulnerable.

The study found that the threatened species *Euphrasia ciliolata* is unlikely to occur in the study area or the locality, and that the conclusions of the previous report remain valid *ie*: that given the measures of mitigation and conservation recommended in the original report, it is expected that a Species Impact Statement would not be required.

1 Introduction

The aim of this report is to review and update a previous report (Elks 2001) assessing the potential impacts on flora associated with the proposed improvement of the New England Highway of New England Highway in the vicinity of McClifty's Road, 62.69km to 68.04km North of Glen Innes

Specific objectives are:
1. Examine all Scientific Committee final determinations since 1st March 2001 for listing of any threatened plant species, ecological communities, plant populations, critical habitat, or key threatening processes, occurring or potentially occurring in the study area.
2. Review all NPWS Wildlife Atlas records for the study area and adjoining localities for any new records of threatened plant species since 1st March last year.
3. Undertake 8 part tests for any new threatened species etc occurring in the study area, or occurring in the locality and with potential habitat in the study area.
4. Prepare an addendum to the original report, in similar but abbreviated format, including conclusions with summary of expected impacts, and (if relevant) recommendations for conservation and mitigation of impacts, and an indication of whether an SIS would be required.

2 Methodology

All Scientific Committee final determinations gazetted since 1st March 2001 were reviewed online at http://www.npws.nsw.gov.au/news/tscdets/index.html (15/February 2002). The plant species list compiled for the study area (Elks 2001 Appendix, Flora Species List) was examined for the presence of any newly determined threatened plant species.

Records of plant species known to occur within 30 kilometres of the study area were obtained under license from the National Parks and Wildlife Service database (NPWS, February 2002). The threatened species records were compared with those obtained in March 2001 for any new listings.

3 Results

Two new Scientific Committee determinations are of relevance to the study area. These are:

1. the listing of clearing of native vegetation as a threatening process (Scientific Committee 21/09/01), and
2. the listing of the plant *Euphrasia ciliolata* as Vulnerable (Scientific Committee 18/01/02). This species was last recorded in 1961, over 20 kilometres south of the study area.

There is also a new threatened species record for the study area and adjoining localities in the NPWS Wildlife Atlas database since March 1 2001. This is the Vulnerable species *Arthraxon hispidus*, previously unknown from the locality but recorded by a previous study (Elks 2001a).

4 Discussion

No new records of critical habitat, threatened vegetation communities or plant populations listed under the *Threatened Species Conservation Act* 1995 (TSC Act) occur in the study area.

Potential impacts of the proposed roadworks on the Vulnerable species *Arthraxon hispidus* were addressed by a previous study in the locality (Elks 2001a). The species was not found in the McCliftys study area.

Potential habitat for the newly listed threatened plant *Euphrasia ciliolata*, which is found in grassy sites, near bogs or swamps or in subalpine woodland (Scientific Committee 2002) may occur in the moist areas of Communities 2, 8, 9, and 10. Potential habitat for *Arthraxon hispidus* also occurs in the study area, in Community 7.

. Other communities are dry, or have a ground layer dominated by tall introduced grasses. Therefore, there is potential for impact of the proposal on a threatened plant species other than those previously assessed (Elks 2001).

Section 5A of the EP&A Act 1979: the Eight Part Test

(a) in the case of threatened species, whether the life cycle of these species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

There is no evidence to indicate that any population of the threatened plant *Euphrasia ciliolata* occurs in the study area or locality, viable or otherwise. As the species occurs primarily on the Barrington Tops (Scientific Committee 18/01/02), and has not been reported from the study area locality for over 40 years (NPWS Wildlife Atlas), it is considered unlikely to occupy the study area.

Similarly, there is no evidence that any population of the threatened plant *Arthraxon hispidus* occurs in the study area.

It is therefore considered unlikely that the life cycle of these species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised

Endangered populations (as defined under the TSC Act) do not occur within the site.

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

No known habitat will be removed by the proposed activity.

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

The proposed activity would marginally increase the width of an existing road. This would not cause potential habitat to become isolated from currently interconnecting or proximate areas of habitat.

(e) whether critical habitat will be effected

Critical habitat (as defined under the TSC Act) does not occur in the study area.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region

The threatened species *Euphrasia ciliolata* and *Arthraxon hispidus* are not known to be adequately represented in conservation reserves in the region (Briggs and Leigh 1995), nor is habitat for the species (Hager and Benson 1994).

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process

The proposed activity would marginally increase the width of an existing road, and is unlikely to require clearance of mature vegetation not previously disturbed by road construction or maintenance. It would therefore not be regarded as a threatening process.

(h) whether any threatened species, population or ecological community is at the limit of its known distribution

The study area is not at the known limit of distribution of the threatened species *Euphrasia ciliolata* and *Arthraxon hispidus*.

5 Conclusion

Given the likelihood that the threatened species *Euphrasia ciliolata* does not occur in the study area or the locality, that the threatened species *Arthraxon hispidus* does not occur in the study area, and the measures of mitigation and conservation as proposed in the original report (Elks 2001), it is expected that a Species Impact Statement will not be required.

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ROADSIDE FAUNA STUDY

McCLIFTY'S

New England Highway, McCliffty's Road to Bluff River Road 63.19km to 68.04km North of Glen Innes

FOR

RTA OPERATIONS ENVIRONMENTAL TECHNOLOGY

June 2001



KENDALL & KENDALL
ECOLOGICAL SERVICES PTY LTD
ABN. 91 076 759 969

PO BOX 196
WEST KEMPSEY NSW 2440
PHONE-FAX 02 65669280
Email kendall@midcoast.com.au

For
Austeco Environmental Consultants

Executive Summary

1. This fauna assessment report examines the potential impacts on fauna of the proposed upgrading of the New England Highway approximately 65 kms north of Glen Innes, from McClifty's Road to Bluff River Road and was prepared in response to a NSW Road and Traffic Authority (RTA) brief.

2. Searches of the NSW National Parks and Wildlife Service's database, NSW Fisheries and the Commonwealth's Environment Australia websites and other sources of information identified significant fauna species that may occur in or near the study area.

3. Habitats present in the study area were identified by Elks (2001). A short fauna survey was conducted which recorded sixty eight native vertebrate fauna species. During the survey no threatened fauna species listed in the Schedules of the *Threatened Species Conservation Act 1995* or the *Environment Protection & Biodiversity Conservation Act 1999* were recorded. No threatened, migratory or wetland fauna species listed in the schedules of the *Environment Protection & Biodiversity Conservation Act (EP&BC) 1999* were recorded. The Forest Raven *Corvus tasmanicus* a species of conservation concern was recorded during the survey. Three introduced fauna species were recorded during the survey. A SEPP 44 Koala habitat assessment indicates that the study area is not core koala habitat as defined in the SEPP.

4. In regard to the significant species that may occur in or near the study area, applications of the Eight Part Test (Section 5A NSW *Environmental Planning and Assessment (EPA) Act 1995)* and the Commonwealth Administrative Guidelines (*Environment Protection and Biodiversity Conservation (EP&BC) Act 1999*) indicate that, given appropriate ameliorative measures, the proposal would not have a significant impact on any threatened species. Therefore the preparation of a Species Impact Statement is not necessary, nor is the proposal a matter of national environmental significance.

5. Ameliorative measures recommended were retention of trees with hollows, maintenance of water quality and prompt removal of roadkills from the highway.

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1 Introduction

The aim of this report is to examine the potential impacts on fauna of the proposed upgrading of the New England Highway from 62.70km to 68.04km north of Glen Innes.

Specific objectives are:

- Review of available information on aquatic or threatened or migratory fauna species records in the locality of the study area with specific reference to relevant legislation and planning instruments;
- Provide a list of species of conservation significance likely to utilise the study areas in the schedules to the *Fisheries Management Act 1994 (FM ACT), Commonwealth Environment Protection & Biodiversity Conservation Act 1999 (EP&BC Act)*, and the *NSW Threatened Species Conservation Act 1995 (TSC Act)*;
- Survey of roadside fauna in the study area using appropriate methodologies to target the full range of fauna species that may occur in the study area;
- Provide a fauna species list for the study area;
- Provide an overview of habitat values;
- Describe and map important fauna habitat of the study area;
- Provide a SEPP 44 (koala habitat) assessment;
- Provide an assessment of the conservation significance of the study areas in relation to threatened species or communities, representiveness, wildlife corridors, biodiversity and other habitat values;
- Provide an assessment of the potential impacts (direct & indirect) of the proposal on all fauna species of conservation significance using the "8 Part test" in accordance with the TSC Act 1995;
- Provide recommendations for appropriate measures of mitigation and conservation where impacts are likely on any species of conservation significance; and
- Compile a report describing the above which also includes an indication of whether a Species Impact Statement would need to be prepared.

2 Methodology

2.1 Review of previous studies and fauna species records

Records of fauna species known to occur within the locality were obtained under license from the National Parks and Wildlife Service database (NPWS, March 2001). Records of threatened fauna species or species habitat likely to occur in the locality were obtained from the Federal Department of Environment Sport and Territories (Environment Australia) web site (http//www.dest.gov.au/search/databases.html March 2001).

Species of Conservation Concern, Gilmore & Parnaby (1994), are species subject to a known or presumed threatening process or for which North-eastern NSW represents a significant part of their known range, were also considered.

Habitats of the study area are described in detail in Elks (2001), and maps and descriptions of habitats from that report were utilised as a basis for this study.

The Tenterfield Council State of the Environment report provides a draft list of significant species known or considered likely to occur in the Tenterfield Shire. This list is consistent with the species considered in this report. No management recommendations were provided with the list.

2.2 Fauna Survey

Study Area

The study area was defined in the brief as being from 62.70km to 68.04km north of Glen Innes. and within 15 metres from the edge of the road, giving a total study area of 16.05 hectares.

Survey Period

Hair tubes were set on 13th March 2001 and collected during the period of 27/03/01 to 30/03/01. All other methodologies were implemented during the period of 27/03/01 to 30/03/01.

Survey Constraints

The weather conditions during the survey were mild to warm nights and warm days with no rain. The weather and the season in which the survey was undertaken during the survey were conducive to recording target species.

Target Species

Sources for compilation of a list of target species included the schedules of the TSC Act, FM Act and the EP&BC Act; the NSW NPWS Wildlife Atlas database; NSW Fisheries and Environment Australia websites, and other relevant habitat requirement information (sources listed in the bibliography).

Table 1 - Target Species

Common Name	Scientific Name	Status
Square-tailed Kite	*Lophoictinia isura*	Vulnerable
Barking Owl	*Ninox connivens*	Vulnerable
Powerful Owl	*Ninox strenua*	Vulnerable
Masked Owl	*Tyto novaehollandiae*	Vulnerable
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable
Turquoise Parrot	*Neophema pulchella*	Vulnerable
Swift Parrot	*Lathamus discolor*	Vulnerable
Painted Honeyeater	*Grantiella picta*	Vulnerable
Regent Honeyeater	*Xanthomyza phrygia*	Endangered
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable
Tiger Quoll	*Dasyurus maculatus*	Vulnerable
Brush-tailed Phascogale	*Phascogale tapoatafa*	Vulnerable
Eastern Cave Bat	*Vespadelus troughtoni*	Vulnerable
Yellow-bellied Glider	*Petaurus australis*	Vulnerable
Squirrel Glider	*Petaurus norfolcensis*	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable
Rufous Bettong	*Aepyprymnus rufescens*	Vulnerable
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Vulnerable
Eastern Little Mastiff-bat	*Mormopterus norfolkensis*	Vulnerable
Common Bent-wing Bat	*Miniopterus schreibersii*	Vulnerable
Little Bent-wing Bat	*Miniopterus australis*	Vulnerable
Large Pied Bat	*Chalinolobus dwyeri*	Vulnerable
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Vulnerable
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable
Hastings River Mouse	*Pseudomys oralis*	Endangered

Table 1 – (Continued) Target Species

Common Name	Scientific Name	Status
Border Thick-tailed Gecko	*Underwoodisaurus sphyrurus*	Vulnerable
New England Swamp Frog	*Litoria castanea*	Endangered
New England Tree Frog	*Litoria subglandulosa*	Vulnerable

2.3 Fauna Survey

Site Selection

Survey site selection was based on the vegetation communities identified by Elks 2001, with reconnaissance of habitat undertaken whilst placing hair tubes enabling selection of more likely habitat for target species. Survey site locations are shown on Figures 1a,1b &1c.

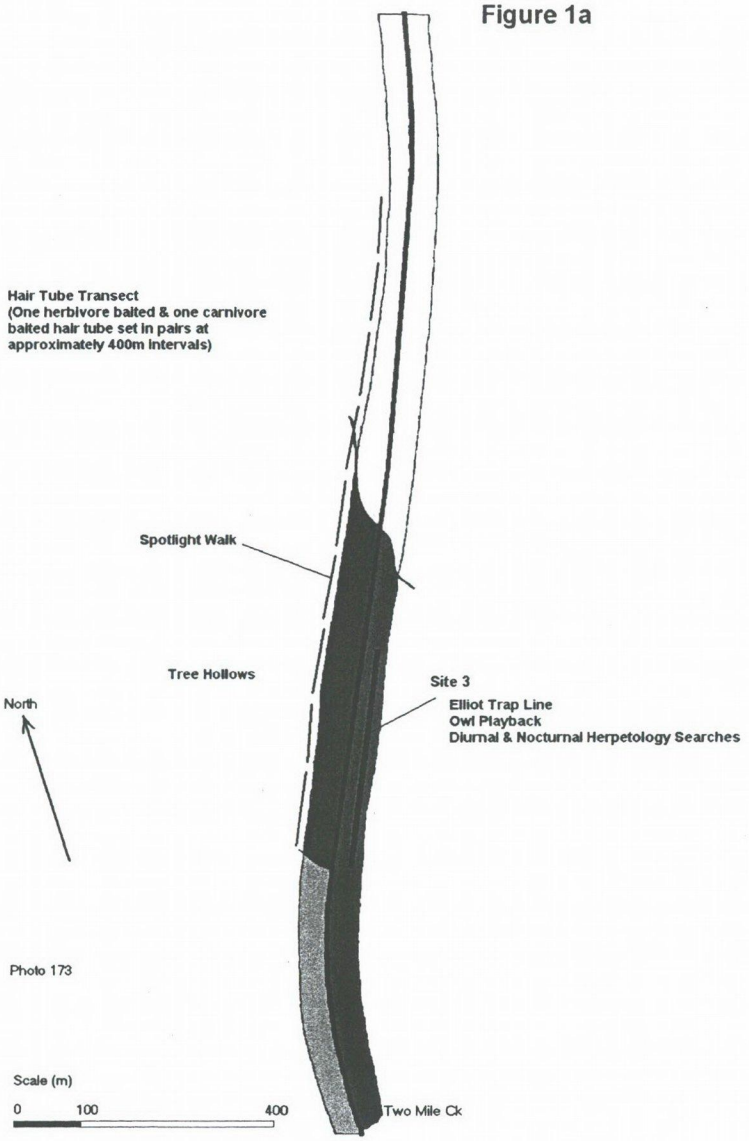
Survey Methods

The following survey methods were used:

- Hair tubes were set in pairs (one carnivore bait and one herbivore bait) at 400 m intervals throughout the study area;
- Thirty three size A Elliot traps including tree mounted traps were set over three nights;
- Diurnal random meander searches were undertaken for reptiles and frogs, including scat searches for indirect evidence of animal activity;
- Diurnal bird identifications were conducted at all opportunities whilst in the study area;
- Nocturnal random meander searches using 2 by 50 watt spotlights were undertaken to detect arboreal and terrestrial mammals, frogs & reptiles;
- Call Playback was undertaken using a 13 Watt megaphone and field survey tapes to elicit responses from targeted species including owls, waterfowl and frogs;
- Ultrasonic bat detection was undertaken at 2 sites for 30 minute censuses conducted within 2 hrs of sunset;
- Harp trapping was conducted at one site;
- Opportunistic observations of species not recorded at survey sites were also recorded; &
- Opportunistic diurnal herpetology searches and searches for animal sign were conducted whilst collecting hair tubes.

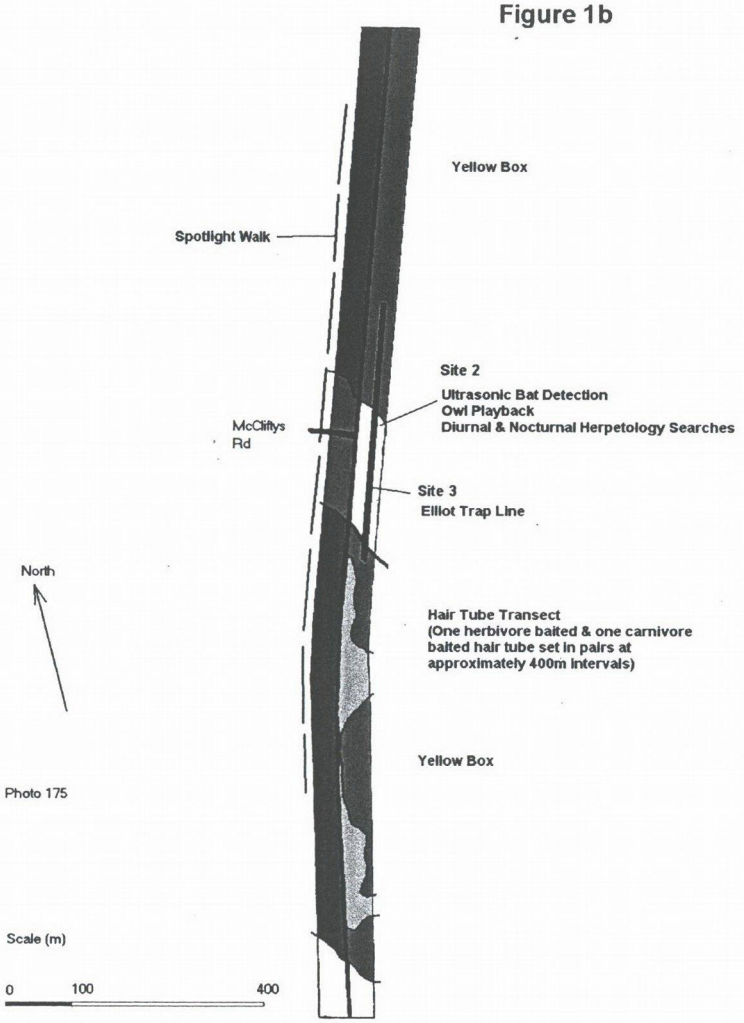
McClifty's

Figure 1a



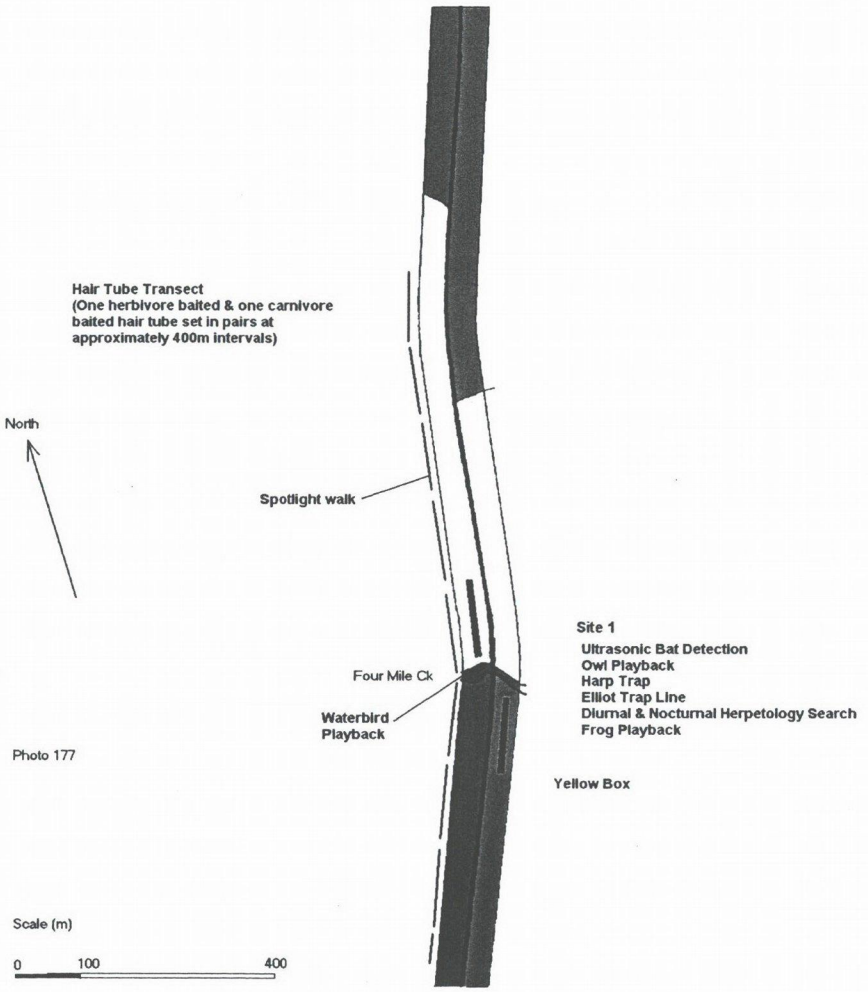
McClifty's

Figure 1b



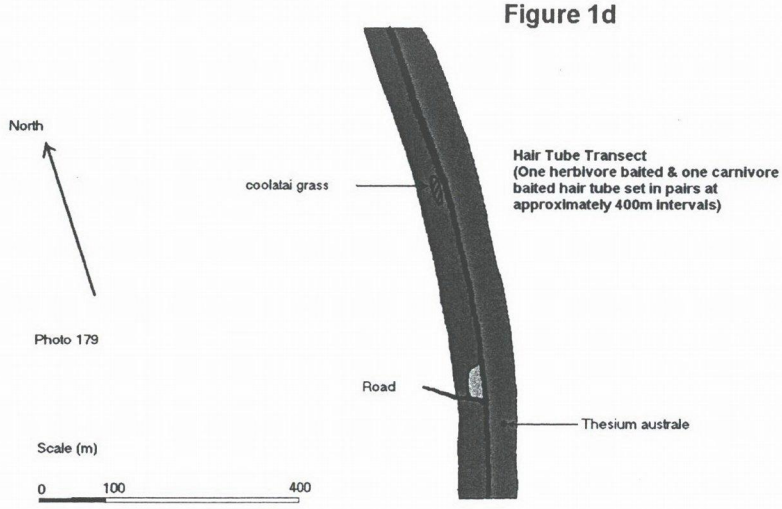
McClifty's

Figure 1c



McClifty's

Figure 1d



LEGEND

- Cleared
- Eucalyptus viminalis, E. conica Open Forest
- Eucalyptus blakelyi, E. bridgesiana, E. subtilior, E. viminalis Open Forest
- Disturbed Eucalyptus blakelyi, E. bridgesiana, E. subtilior, E. viminalis Open Forest
- Eucalyptus blakelyi, E. melliodora, E. subtilior, Angophora floribunda Open Forest
- Disturbed Eucalyptus blakelyi, E. melliodora, E. subtilior, Angophora floribunda Open Forest
- Pennisetum alopecuroides, Isachne globosa Closed Grassland

3 Results

3.1 Fauna species records

The Forest Raven *Corvus tasmanicus* a species of conservation concern was recorded during the survey.

Threatened fauna species (TSC Act) known to occur within the locality are listed in Table 3a. Other threatened fauna species considered by the consultant as potentially occurring in or near the study area are listed in Table 3b. Threatened aquatic species (FM Act) possibly occurring downstream of the study area are listed in Table 3c.

Terrestrial and wetland fauna species covered by migratory provisions of the EP&BC Act and potentially occurring in the study area (http//www.dest.gov.au/search/databases.html March 2001) are listed in Table 4a and 4b respectively. Similarly, threatened fauna species are listed in Table 4c.

Species of conservation concern are listed in Table 5.

3.2 Habitat

Vegetation Communities

Elks (2001) identifies seven vegetation communities in the study area:

Community 1 – *Cleared*

This vegetation community is characterised by an absence of trees (and woody vegetation generally) and dominance by exotic grasses and weeds. Native plant species, where they occur, usually represent less than 50% of the vegetation foliage cover and are primarily common grasses and herbs.

Community 2 - *Eucalyptus viminalis – E. conica* (ribbon gum – fuzzy box) Open Forest

This community occurs on deeper soils on gentle slopes near Two Mile Creek.

The overstorey consists mainly of large mature trees around 25 metres tall, although there are significant amounts of regrowth and senescing trees. Ribbon gum is the dominant species, with fuzzy box subdominant on lower slopes but declining in cover with distance from the creek.

The midstratum is absent.

The ground layer consists of a dense cover of native and exotic grasses, herbs and legumes to 0.6metres tall.

This community is notable for the presence of hollows and the large size of the trees.

Community 3 – *Eucalyptus blakelyi – E. bridgesiana – E .subtilior – E. viminalis* (Blakely's red gum – apple box – stringybark - ribbon gum) Open Forest

This community occurs on shallower soils than Community 2, on lower and mid-slopes in the southern part of the study area, or on almost level country in the north of the study area.

The overstorey consists mainly of small to medium mature trees around 15 metres tall with few hollows, although there are occasional larger senescent red gum and ribbon gum with large hollows, particularly in the northern part of the study area.

Blakely's red gum, apple box and stringybark are codominant, and the distribution of ribbon gum is patchy, being subdominant (and often in poor condition) in moister sites on lower slopes or on deeper soils, and sparse to absent elsewhere.

The midstratum consists of a sparse layer of white sally wattle *Acacia floribunda* to 15 metres tall over a very sparse layer of dogwood *Jacksonia scoparia* and cherry ballart *Exocarpos cupressiformis* to 6 metres.

The ground layer consists of a sparse cover of primarily native plant species including lomandra *L. longifolia*, grasses such as spear grass *Aristida vagans* and barbed-wire grass *Cymbopogon refractus*, and herbs such as the purple burr-daisy *Calotis cuneifolia*, to 0.3 metres tall. Some fallen trees are present.

Community 4 – Disturbed *Eucalyptus blakelyi – E. bridgesiana – E .subtilior – E. viminalis* (Blakely's red gum – apple box – stringybark - ribbon gum) Open Forest

This community is similar to Community 3 but occurs in a landscape that is extensively cleared for pasture.

The overstorey is as for Community 3, but is often thinned or dominated by regrowth trees. The midstratum is generally absent, and the ground layer is typically dominated by a moderately dense cover of exotic grasses and herbs to 0.6 metres tall.

Of particular concern is the presence of coolatai grass *Hyparrhenia hirta*, a very invasive grass that is invading large areas of native vegetation to the west of Tenterfield and excluding most native species.

This exotic species is likely to be a major threat to species such as Austral toadflax *Thesium australe*, several plants of which occur on the boundary of the road reserve with the rail corridor in the northern part of the study area.

Community 5 – *Eucalyptus blakelyi – E. melliodora - E .subtilior – Angophora floribunda* (Blakely's red gum – yellow box – stringybark – rough-barked apple) Open Forest

This community occupies shallow soils on the crest of the hill above McClifty's Road and the undulating terrain to the north, particularly those exposed to the harsher northwesterly aspect. The community generally shows evidence of recent fire and past severe fire, especially in the vicinity of McClifty's.

The overstorey consists mainly of small to medium mature trees around 15 metres tall with few hollows, although there are occasional larger senescent red gum and ribbon gum with hollows, particularly in the northern part of the study area.

The distribution of yellow box is patchy, being common above McClifty's but uncommon elsewhere in the community.

The midstratum consists of a sparse layer of dogwood *Jacksonia scoparia* and cherry ballart *Exocarpos cupressiformis* to 6 metres.

The ground layer consists of a sparse cover of primarily native plant species including lomandra *L. longifolia*, grasses such as spear grass *Aristida vagans,* barbed-wire grass *Cymbopogon refractus*, love grass *Eragrostis benthamii* and hardy herbs such as the daisy *Vittadinia dissecta var hirta*, to 0.3 metres tall. No fallen trees or large woody debris are present.

Community 6 – Disturbed *Eucalyptus blakelyi – E. melliodora - E .subtilior* – Angophora floribunda (Blakely's red gum – yellow box – stringybark – rough-barked apple) Open Forest

This community is similar to Community 5 but occurs in a landscape that is extensively cleared for pasture.

The overstorey is as for Community 5, but is often thinned or dominated by regrowth trees. The midstratum is generally absent, and a moderately dense cover of exotic grasses and herbs to 0.6 metres tall typically dominates the ground layer.

Community 7 – *Pennisetum alopecuroides – Isachne globosa* (swamp foxtail – swamp millet) Closed grassland

This community occupies the moist areas of Four Mile Creek, a shallow and poorly defined intermittent watercourse. Swamp foxtail and swamp millet are the dominant species, with occasional plants of purple loosestrife *Lythrum salicaria.*

Habitat Values

Habitat values of the vegetation communities in the study area are summarised in Table 2 below.

Significant vegetation corridors across the highway at the local or regional scale are absent from the study area. However roadside vegetation corridors in largely cleared landscapes such as that of the study area may be an important corridor connecting forest remnants for native birds and animals.

Koala food tree species occur in the study area and some communities are potential koala habitat as defined by SEPP 44. No feed tree species of the Glossy Black Cockatoo occur on the study area. Flowering eucalypts would provide a seasonal nectar flow for nectar feeding fauna species.

Table 2. Habitat values of vegetation communities (Elks 2001)

Community Habitat value	1	2	3	4	5	6	7
trees with large hollows	-	Uncommon	Rare	-	Rare	-	Na
trees with small hollows	-	Common	Uncommon	Very rare	Uncommon	Very rare	Na
large woody debris	-	Uncommon	Uncommon	-	-	-	Na
mid-stratum vegetation	-	-	Sparse	-	Sparse	-	Na
shrubby ground layer	-	-	-	-	-	-	Sparse
rock outcrops	Occasional	-	Occasional	Occasional	Occasional	Occasional	Common
water	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Ephemeral	Intermittent
weed infestation	Heavy - total	Moderate	Light - moderate	Heavy	Light - moderate	Mod - heavy	Light - absent

Disturbance impacts

The habitat values of the vegetation communities have been compromised by prior disturbance due to road construction. These impacts have resulted in the thinning or clearance of tree cover, the preponderance of regrowth, the general absence of senescent trees, the general absence of native mid-

stratum vegetation, and the invasion or replacement of ground layer vegetation by introduced weeds, pasture grasses and shrubs. (Elks 2001)

Mortality due to roadkills would impact on the populations of those species prone to collisions with vehicles such as ground dwelling species and carrion eaters. In general it is assumed that the benefits of the presence of habitat along roadsides outweighs the impact of wildlife mortality due to collisions with vehicles.

3.3 Field Survey

Sixty-eight native vertebrate species protected under the NSW *National Parks and Wildlife Act 1974* were recorded in the study area during the field survey. Three introduced vertebrate species were recorded in the study area during the field survey. Fauna species recorded in the study area are listed in Appendix 1.

The Forest Raven *Corvus tasmanicus* a species of conservation concern was recorded during the survey. The field survey did not reveal the presence of any of the target species listed in Table 1, nor of any other significant species in the study area as listed in Tables 3,4 and 5.

Table 3a. *TSC Act* Threatened fauna species known to occur within 20km of the study area (NSW NPWS Wildlife Atlas database March 2001)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Ptilinopus magnificus*	V	Wompoo Fruit-Dove	Rainforest and forests with fruiting "rainforest plant" species	Unlikely	Nil. No suitable habitat on study areae
	Ephippiorhynchus asiaticus	E	Black-necked Stork	Wetlands, dams, still water	Unlikely	Nil. No suitable habitat on study area
	Anseranas semipalmata	V	Magpie Goose	Wetlands, dams, still water	Unlikely	Nil. No suitable habitat on study area
	Ninox strenua	V	Powerful Owl	Large tree hollows for nesting Wet & dry sclerophyll forest	Medium	Low. Extremely small area of foraging habitat to be removed compared to home range
	Tyto novaehollandiae	V	Masked Owl	Large tree hollows for nesting; Dry sclerophyll forest	Medium	Low. Extremely small area of foraging habitat to be removed compared to home range
	Tyto tenebricosa	V	Sooty Owl	Rainforest and wet sclerophyll forest	Low	Nil. No suitable habitat on site
	Calyptorhynchus lathami	V	Glossy Black-Cockatoo	Large tree hollows for nesting; Mature Allocasuarina, Casuarina tress	Medium	Low. Small area to be removed compared to home range of individuals. Study area does not contain significant food resource
	Neophema pulchella	V	Turquoise Parrot	Dry sclerophyll forests & woodlands, feeds on grass seeds	Medium	Low. Extremely small area of foraging habitat to be removed compared to home range
Mammalia	*Dasyurus maculatus*	V	Spotted-tailed Quoll	Variety of forest types	Medium	Low. Small area of habitat to be removed compared to home range of individuals
	Vespadelus troughtoni	V	Eastern Cave Bat	Wet sclerophyll forest Roosts in caves, overhangs and crevices Potential roost habitat occurs close to study area	Medium	Low. Small area of possible foraging habitat to be removed compared to home range of individuals. Nearby potential roost habitat
	Phascolarctos cinereus	V	Koala	Forest & woodland containing suitable food tree species	Medium	Low. Small area of habitat to be removed compared to home range of individuals

Table 3a. (Continued) *TSC Act* Threatened fauna species known to occur within 20km of the study area (NSW NPWS Wildlife Atlas database March 2001)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
	Aepyprymnus rufescens	V	Rufous Bettong	Dry sclerophyll forests & woodlands	Low	Low. Small area of marginal habitat to be removed compared to home range of individuals
	Miniopterus schreibersii	V	Common Bent-wing Bat	Roosts in caves forages in a variety of forest types	Medium	Small area of possible foraging habitat to be removed compared to home range of individuals
	Myotis adversus	V	Large-footed Mouse-eared Bat	Roosts in caves, mines and under bridges, feeds over water surface	Medium	Low. Small area of possible foraging habitat to be disturbed compared to home range of individuals
	Scoteanax rueppellii	V	Greater Broad-nosed Bat	Variety of forest types	Medium	Small area of possible foraging habitat to be removed compared to home range of individuals. Small area of potential roosting and breeding habitat to be removed. Ameliorative measures recommend retention of areas of low senescence
	Kerivoula papuensis	V	Golden-tipped Bat	Variety of forest types	Low	Low. Small area of possible foraging habitat to be removed compared to home range of individuals
	Falsistrellus tasmaniensis	V	Eastern False Pipistrelle	Variety of forest types, roosts in tree hollows	Medium	Small area of possible foraging habitat to be removed compared to home range of individuals. Small area of potential roosting and breeding habitat to be removed. Ameliorative measures recommend retention of areas of low senescence

Table 3a. (Continued) *TSC Act* Threatened fauna species known to occur within 20km of the study area (NSW NPWS Wildlife Atlas database March 2001)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Reptilia	*Pseudomys oralis*	E	Hastings River Mouse	Grassy/heathy dry sclerophyll forest	Low	Low. Very unlikely to occur on study area due to disturbance
	Underwoodisaurus sphyrurus	V	Border Thick-tailed Gecko	Rocky outcrops in woodlands	Low	Low. Although occasional rocky outcrops occur they appear to be marginal habitat, e.g. occurrences of features such as rock on rock are minimal and theses areas are disturbed
Amphibia	*Mixophyes balbus*	V	Stuttering Frog	Grass besides swamps & rivers	Medium	Low. Small area of potential disturbed habitat to be removed compared to home range of individuals
	Philoria loveridgei	V	Loveridge's Frog	Creeks in moist rainforests and wet sclerophyll forest with closed canopy over creek	Low	Low. Very unlikely to occur on study area due to lack of suitable habitat
	Litoria subglandulosa	V	New England Tree Frog	Variety of forest types	Low	Low. Unlikely to occur on study area due to lack of suitable habitat although important maintain water quality downstream

Table 3b. Other threatened species that may occur in or near the study area.

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Lophoictinia isura*	V	Square-tailed Kite	Variety of dry forest types	Medium	Low. Small area of possible foraging habitat to be removed compared to home range of individuals
	Ninox connivens	V	Barking Owl	Variety of dry forest types	Medium	Low. Small area of possible foraging habitat to be removed compared to home range of individuals
	Lathamus discolor	V	Swift Parrot	Dry sclerophyll forest and woodlands, diet composed of primarily of eucalypt nectar	Medium	Low. Small area to be removed compared to home range of individuals. Study area does not contain significant food resource
	Grantiella picta	V	Painted Honeyeater	Dry sclerophyll forest and woodlands, diet composed of mistletoe fruits	Medium	Low. Small area of potential foraging habitat removed compared to home range of individuals. Mistletoe in vegetation communities 2, 3, 4, 5 &6, which may be used for feeding
	Xanthomyza phrygia	E	Regent Honeyeater	Forests with large mature trees, Yellow Box a favoured food tree species	Medium	Low. Extremely small area of potential foraging habitat to be removed compared to home range. Yellow Box occurs in communities 5 & 6.
Mammalia	*Phascogale tapoatafa*	V	Brush-tailed Phascogale	Dry sclerophyll forest & woodland	Medium	Low. Small area of possible foraging habitat to be removed compared to home range of individuals. Ameliorative measures recommend retention of areas of low senescence

Table 3b. (Continued) Other threatened species that may occur in or near the study area.

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
	Petaurus australis	V	Yellow-bellied Glider	Wet &dry sclerophyll forest & woodland, roosts & nests in tree hollows	Low	Low. Small area of possible foraging habitat to be removed compared to home range of individuals. Ameliorative measures recommend retention of areas of low senescence
	Petaurus norfolcensis	V	Squirrel Glider	Dry sclerophyll forest & woodland, roosts & nests in tree hollows	Medium	Low. Small area of possible foraging habitat to be removed compared to home range of individuals. Ameliorative measures recommend retention of areas of low senescence
	Mormopterus norfolkensis	V	Eastern Little Mastiff-bat	Generally dry eucalypt forest & woodland, roosts in tree hollows	Medium	Small area of possible foraging habitat to be removed compared to home range of individuals. Small area of potential roosting and breeding habitat to be removed. Ameliorative measures recommend retention of areas of low senescence
	Miniopterus australis	V	Little Bent-wing Bat	Primarily roosts in caves forages in a variety of forest types	Medium	Low. Not recorded during survey. Small area of possible foraging habitat to be removed compared to home range of individuals
	Chalinolobus dwyeri	V	Large Pied Bat	Generally drier vegetation types, roosts in caves & sandstone overhangs	Medium	Small area of possible foraging habitat to be removed compared to home range of individuals
Amphibia	*Litoria subglandulosa*	V	New England Tree Frog	Variety of forest types	Low	Low. Unlikely to occur on study area although important to maintain water quality downstream
	Litoria castanea	E	New England Swamp Frog	Wet sclerophyll forest, still water	Low	Low. Unlikely to occur on study area although important to maintain water quality downstream

Table 3c Threatened aquatic species possibly occurring in the locality of the study area and listed in the FM Act 1994

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Fish	*Maccullochella ikei*	E	Eastern Freshwater Cod	Deep pools in tributaries of the Clarence River	Low	Nil. Temporary disturbance to streams on study area. Important to ensure sedimentation does not impact on aquatic habitat downstream. This species is only known from the Clarence River. Study area is not in the catchment of the Clarence River.

Table 4a. Terrestrial species covered by migratory provisions of the EP&BC Act 1999. Species or species habitat likely to occur within locality (*Derived from a general distribution map > 1 degree)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Haliaeetus leucogaster*	Species habitat	White-bellied Sea-Eagle	Areas adjoining and including water bodies containing fish	Low	Low. No suitable habitat on site
	**Hirundapus caudacutus*	Species habitat	White-throated Needletail	Aerial over a variety of landscapes	Medium	Low. Habitat would not be impacted by proposal
	**Rhipidura rufifrons*	Breeding habitat	Rufous Fantail	Moist Forest, Rainforest	Low	Low. No suitable habitat on site
	Myiagra cyanoleuca	Breeding habitat	Satin Flycatcher	Tall to medium open forests	Medium	Low. Small area of possible habitat to be removed compared to home range of individuals
	**Monarcha melanopsis*	Breeding habitat	Black-faced Monarch	Moist Forest, Rainforest	Low	Low. No suitable habitat on site
	Xanthomyza phrygia	Species habitat	Regent Honeyeater	Forests with large mature trees, Yellow Box a favoured food tree species	Medium	Low. Extremely small area of potential foraging habitat to be removed compared to home range. Yellow Box occurs in communities 5 & 6.

Table 4b. Wetland species covered by migratory provisions of the EP&BC Act 1999. Species or species habitat likely to occur within locality (*Derived from a general distribution map > 1 degree)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Gallinago hardwickii*	Species habitat	Latham's Snipe	Open wooded swamps	Low	Low. Small area of possible habitat to be removed compared to home range of individuals
	Rostratula benghalensis	Species habitat	Painted Snipe	Marsh with moderate cover	Medium	Low. Small area of possible habitat to be removed compared to home range of individuals

Table 4c. Threatened species as listed by EP&BC Act 1999. Species or species habitat likely to occur within area locality (*Derived from a general distribution map > 1 degree)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Lathamus discolor*	E	Swift Parrot	Dry sclerophyll forest and woodlands, diet composed of primarily of eucalypt nectar	Medium	Low. Small area to be removed compared to home range of individuals. Study area does not contain significant food resource
	Neochmia ruficaudaemporalis	V	Star Finch	Grass besides swamps & rivers	Medium	Low. Small area of habitat to be removed compared to home range of individuals
	Poephila cincta	V	Black-throated Finch	Woodland and riverine	Medium	Low. Small area to be removed compared to home range of individuals. Study area does not contain significant food resource
Mammalia	*Dasyurus maculatus*	V	Spotted-tailed Quoll	Variety of forest types	Medium	Low. Small area of habitat to be removed compared to home range of individuals
	Potorous tridactylus	V	Long-nosed Potoroo	Variety of forest types with dense ground & shrub layer	Low	Low. Very unlikely to occur on study area
	Petrogale penicillata	V	Brush-tailed Rock-wallaby	North to northeast facing cliffs and rocky slopes	Low	Low. Very unlikely to occur on study area due to lack of suitable habitat
Reptilia	*Anomalopus mackayi*	V	Long-legged Worm-skink	Scattered eucalypt on moist black soil	Low	Low. Unlikely to occur on study area.
	Underwoodisaurus sphyrurus	V	Border Thick-tailed Gecko	Rocky outcrops in woodlands	Low	Low. Although occasional rocky outcrops occur they appear to be marginal habitat, e.g. occurrences of features such as rock on rock are minimal and these areas are disturbed

Table 4c. (Continued) Threatened species as listed by EP&BC Act 1999. Species or species habitat likely to occur within area locality (*Derived from a general distribution map > 1 degree)

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Reptilia	*Elseya sp.nov*	V	Namoi River Elseya	River environments	Low	Low. Very unlikely to occur on study area
Amphibia	*Mixophyes balbus*	V	Stuttering Frog	Moist eucalypt forest & rainforest	Low	Low. Small area of potential disturbed habitat to be removed compared to home range of individuals
	Litoria castanea	E	New England Swamp Frog	Wet sclerophyll forest, still water	Low	Low. Unlikely to occur on study area due to lack of suitable habitat although important to maintain water quality downstream
	Litoria piperata	V	Peppered Tree Frog	Dense vegetation close to fast flowing rocky streams of upper Clarence River	Low	Low. Unlikely to occur on study area due to lack of suitable habitat although Important that water quality is maintained

Table 5. Species of conservation concern likely to occur in the study area.

Order	Common name	Scientific name	Status	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	Forest Raven	*Corvus tasmanicus*	C	Eucalypt forests and farmlands	Recorded in study area	Low. Small area of habitat to be removed compared to home range of individuals

4 Discussion

Threatened fauna populations and critical habitat.

No threatened fauna populations or critical habitat, as listed under the TSC Act or the EP&BC Act, were recorded or are considered to occur in the study area.

Threatened fauna species.

No threatened fauna species listed in the Schedules of the TSC Act 1995 were recorded during the survey. Greater survey effort would have increased the likelihood of recording target species.

However, Tables 3a, 3b & 4c indicate that some threatened species that may utilise the habitat of the study area. These species require further consideration under the "eight part test" under section 5A of the (EP&A Act) and the "test of significance" under the administrative guidelines of the EP&BC Act.

The Eastern Freshwater Cod, an endangered species as listed on the FM Act (Table 3c) is restricted to the upper reaches of the Clarence River. The species does not occur west of the Great Dividing Range. However, it is considered that as described in the species' draft recovery plan there is a need to control sedimentation and prevent pollution. The draft plan does not provide specific measures to achieve these aims. Best practice procedures should be implemented in order to maintain water quality and be developed by consultation with relevant government authorities.

Terrestrial species covered by migratory provisions of *the EP&BC Act 1999.*

The proposal is considered to have low or nil impact on the six species listed in Table 4a.

Wetland species covered by migratory provisions of *the EP&BC Act 1999.*

The proposal is considered to have low or nil impact on the two species listed in Table 4b.

Fauna Species of Conservation Concern

One fauna species of conservation concern, the Forest Raven, was recorded in the study area. Although the proposal is considered to have only a low impact on this species it is important to recognize that this species is a carrion eater and therefore it is recommended that roadkills be removed from the road as quickly as possible after they occur.

Removal of vegetation

The approximate area of each vegetation community that would be removed for the proposal has been estimated from the vegetation map and the concept design for the road upgrading (Elks 2001) as follows:

Community 1.	Not estimated
Community 2.	0.51 ha
Community 3.	1.26 ha
Community 4.	1.04 ha
Community 5.	0.62 ha
Community 6.	0.23 ha
Community 7.	0.01 ha

As the study area contains potential habitats of threatened fauna species there is a potential impact of the proposal on threatened fauna species.

The TSC Act and the EP&BC Act each list eight factors to be considered in deciding whether the proposed development is likely to have a significant effect on threatened species or their habitats, and therefore whether a Species Impact Statement or approval of the Federal Environment Minister is required for the project.

4.1 Application of the "Eight Part Test"

The potential impacts associated with the proposed upgrading of the New England Highway on threatened species listed in the schedules of the TSC Act 1995 or the FM Act, and which are considered as possible occurrences in the study area (see tables 3a, 3b & 3c), are considered using the eight part test under section 5A of the EP&A Act.

The purpose of the "8 Part Test" is to provide information to the determining authority so that a decision can be made as to "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats" and consequently whether a Species Impact Statement is required.

In accordance with the National Parks and Wildlife Service's information circular (No. 2 Section 3.3.1) this "8 Part Test" has been applied to the important habitat features of the species listed in Tables 3a, 3b & 3c rather than to each individual species.

(a) in the case of threatened species, whether the life cycle of these species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Provided that areas of forest with low level senescence (trees with hollows) are retained, that water quality is maintained, and that roadkills are promptly removed from the road to lower mortality due to vehicular collisions, the removal of approximately 3.7 ha of habitat would not be likely to disrupt the life cycle of threatened species listed in Tables 3a, 3b and 3c such that a local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised

Endangered populations (as defined under the TSC Act 1995) do not occur within or near the study area.

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

The removal of approximately 3.7 ha of habitat not containing abundant key habitat features such as tree hollows is considered an insignificant area in a regional context.

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

The proposal would not cause potential habitat to become isolated from currently interconnecting or proximate areas of habitat.

(e) whether critical habitat would be effected

Critical habitat (as defined under the TSC Act 1995) does not occur in the study area.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region

The NSW NPWS website indicates that no threatened population or ecological community occurs in the locality (at the date this report was compiled).

Due to the lack of records of many potentially occurring threatened fauna species and lack of ecological knowledge of many threatened fauna species, it is not possible to quantitatively assess whether many of the species are adequately conserved in the regions conservation reserves. Many ecologists consider that the current conservation reserve system may not be adequate to support many threatened species.

A number of large national parks occur in the upper Clarence valley. The NSW Wildlife Atlas records and the consultants own records indicate that there are records of threatened species in or close to the reserves or forests. These areas generally contain similar habitat to the study area but of a higher quality and are expected to be contributing to the representativeness of the threatened species in the reserve system.

Furthermore the proposal only affects a small area of disturbed marginal habitat of potentially occurring threatened species. In regard to off reserve management of these species the consultant considers that the habitat on the study area would not provide a significant contribution.

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process

The proposed development is not a threatening process (as defined by Schedule 3 of the TSC Act).

(h) whether any threatened species, population or ecological community is at the limit of its known distribution

The study area is situated on to the Great Dividing Range and is therefore located in the Tumbunan zoogeographical division. In this part of NSW this division is a narrow band extending along the Great Dividing Range. It is sandwiched between two areas of the Bassian zoogeographical division, one occurring on the coast and one on the western slopes. In addition influences of the Eyrian zoogeographical division may influencing the study area from the west. (Gilmore & Parnaby 1994)

The consequences of the complicated influences of the various zoogeographical regions are that many fauna species would be at the edge of their distribution limit in this area of NSW. However the impact of the proposed activity would not contribute to the retraction of the range of threatened species that potentially occur in the study area.

4.2 Environmental Planning & Biodiversity Conservation Act: Administrative Guidelines for Endangered/Vulnerable Species.

These guidelines have been applied to the important habitat features of the species listed in Tables 4a, 4b & 4c rather than to each individual species, as no Commonwealth listed species has been recorded, or given a high likelihood of occurrence on the study area.

This assessment also utilises eight factors to examine whether an action has, would have, or is likely to have a significant impact on any Commonwealth endangered/*vulnerable* species.

(a) Does, would, or is the activity likely to lead to a long-term decrease in the size of a population/ *important population*?

Provided that the ameliorative measures identified in section 5.2 are implemented it is considered that the loss of 3.7 ha of marginal habitat is not likely to contribute to a long-term decrease in the size of a fauna species population for those species listed in Tables 4a, 4b & 4c.

(b) Does, would, or is the activity likely to reduce the area of occupancy of the species/*important population*?

Provided that the ameliorative measures identified in section 5.2 are implemented it is considered that the loss of 3.7 ha of marginal habitat is not likely to contribute to a decrease in the distributional range of a potentially occurring threatened fauna population.

(c) Does, would, or is the activity likely to fragment an existing population/*important population* into two or more populations?

No. The activity would not fragment an existing population. The species that are considered as a medium likelihood of occurrence would either be able to fly over the highway or pass under the new bridge at Four Mile Creek.

(d) Does, would, or is the activity likely to adversely affect habitat critical to the survival of a species?

For many threatened species the study area contains potential marginal habitat. Some important habitat features occur such as tree with hollows, seasonally flowering eucalypts, rocky areas and ephemeral streams. However considering the small disturbed areas in the study area these features are not considered critical to the survival of species identified in Tables 4a, 4b & 4c. Nevertheless, recommendations are provided in order to retain habitat features or to lower the impact of the proposed activity on these features.

(e) Does, would, or is the activity likely to disrupt the breeding cycle of a population/*important population*?

No. The activity is unlikely to disrupt the breeding cycle of the species identified in Tables 4a, 4b & 4c. Recommendations are provided to avoid the breeding seasons of potentially occurring hollow dependant threatened species.

(f) Does, would, or is the activity likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

No. The removal of 3.7 ha of potential habitat is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

(g) Does, would, or is the activity likely to result in invasive species that are harmful to endangered/*vulnerable* species becoming established in the endangered/*vulnerable* species' habitat?

No. Invasive species harmful to potential endangered/vulnerable species' habitat are already well established in the study area. Feral animal records within 20kms of the study area indicate the presence of cat, dog, fox, rabbit, and pig, the survey also indicated the presence of black rat and house mouse. It is not expected that the activity would affect the impact that these species are already having on the study area's protected and threatened fauna.

(h) Does, would, or is the activity likely to interfere with the recovery of the species?

No. The removal of 3.7 ha of potential habitat of the species identified in Tables 4a, 4b & 4c is unlikely to interfere with the recovery of the potentially occurring threatened species.

4.3 Further EP&BC Act 1999 Considerations:

The study area:

- is not part of a world heritage area;
- is not a wetland protected by international treaty;
- is not a Commonwealth Marine area; and

- is not a nuclear action.

At this stage surveys and wildlife records indicate that the study area does contain:
- habitat suitable for nationally listed threatened species; &
- does contain habitat suitable for nationally listed migratory species.

The assessment undertaken above, when considered in conjunction with the recommendations in below, indicates that there would not be a significant impact on Commonwealth listed species.

Therefore under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the proposal is not a matter of national environmental significance and does not require referral to the Federal Environment Minister.

4.4 State Environmental planning Policy No. 44 Koala Habitat Protection

The provisions SEPP 44 do not apply as no development application would be submitted to Council. However the following assessment is provided to determine the presence of koala habitat on the study area.

The study area is within Tenterfield shire area. This shire is listed on Schedule 1 of SEPP 44 and therefore the SEPP is applicable to the shire area.

In the study area four vegetation communities (communities 2, 3, 4, 5 & 6) contain a proportion of a Schedule 2 Feed Tree Species (*Eucalyptus viminalis*) that is greater than 15% of the total numbers of trees in a tree strata. Therefore these communities are potential koala habitat as defined by the SEPP.

Once an area has been defined as potential koala habitat further assessment is required to determine if the area is core koala habitat as defined in the SEPP.

Core koala habitat is defined as "an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young), and recent sightings of and historical records of a koala population.

The study area does not constitute core koala habitat as
- no evidence of koalas was observed, i.e. no scats or koalas were observed during the field survey; &
- the NSW NPWS wildlife atlas records indicate that there is a sparse distribution of historical records of koalas within 20km of the study area, there only being 2 records one in 1975 and one in 1994 the closest being approximately 4 km from the study area.

5 Conclusions and Recommendations

5.1 Summary of expected impacts on species of conservation significance.

The loss of 3.7 ha of degraded and marginal habitat would not constitute a significant impact on any threatened, migratory or wetland species or their habitats.

5.2 Recommendations for appropriate measures of conservation or mitigation of impacts on any species of conservation significance

It is recommended that the new road alignment be designed to avoid those areas of Vegetation Communities 2 where hollow bearing trees occur.

If a tree containing hollows has to be removed it is recommended the tree be removed during the late summer period when there is a lower chance that the tree would be used by breeding threatened species. Before removal the tree should be inspected to determine if at that time it is being used by a breeding native mammal or nesting bird. If a breeding native mammal or nesting bird is observed the advise of the NSW NPWS should be sought and measures implemented to minimise the impact of the removal of the tree on the species.

Vegetation communities 5 & 6 contain Yellow Box, *Eucalyptus melliodora*, a favoured food tree of the regent honeyeater. It is recommended that the road be designed to avoid vegetation community 5. Vegetation community 5 occurs on the eastern side of the road with vegetation community 6 occurring on the western side of the road. Vegetation community 6 generally has the same species composition as vegetation community 5 however it is more disturbed. If a mature specimen of Yellow Box occurs in vegetation community 6 where no similar specimen occurs across the road it is recommended that the road design avoid this tree.

It is recommended that the new road alignment be designed to avoid rocky areas.

Water quality down stream of the study area should not be impacted upon by the activity either by sedimentation or pollution. Best practice should be implemented in consultation with the NSW Environment Protection Authority.

As some threatened species and species of conservation concern are carrion eaters it is recommended that road maintenance crews adopt a policy of removing road kills from the road as quickly as possible in order to avoid carrion eaters being struck by vehicles.

5.3 An indication as to whether a Species Impact Statement would need to be prepared.

Given appropriate measures of mitigation as outlined above, it is expected that a Species Impact Statement would be not required.

5.4 An indication as to whether approval of the Federal Environment Minister would be required.

Given appropriate measures of mitigation as outlined above, it is expected that approval of the Federal Environment Minister would not be required.

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APPENDIX 1 – SPECIES LIST "McCLIFFTY"S STUDY AREA"

Common Name	Scientific Name	Status
Forest Raven	*Corvus tasmanicus*	C
Wood Duck	*Chenonetta jubata*	P
Wedge-tailed Eagle	*Aquila audax*	P
Rainbow Lorikeet	*Trichoglossus naematodus*	P
Scaly-breasted Lorikeet	*Trichoglossus chorolepidotus*	P
Musk Lorikeet	*Glossopsitta concinna*	P
Little Lorikeet	*Glossopsitta pusilla*	P
Galah	*Cacatua roseicapilla*	P
Red-winged parrot	*Aprosmictus erythropterus*	P
Crimson Rosella	*Platycercus elegans*	P
Eastern Rosella	*Platycercus eximius*	P
Laughing Kookaburra	*Dacelo novaeguineae*	P
Fan-tailed Cuckoo	*Cuculus flabelliformis*	P
Welcome Swallow	*Hirundo neoxena*	P
Tree Martin	*Hirundo nigricans*	P
Grey Fantail	*Rhipidura fuliginosa*	P
Willie Wagtail	*Rhipidura leucophrys*	P
Satin Flycatcher	Myiagra cyanoleuca	P
Restless Flycatcher	*Myiagra inquieta*	P
Jacky Winter	*Microeca fascinans*	P
Eastern Yellow Robin	*Eopsaltria australis*	P
Golden Whistler	*Pachycephala pectoralis*	P
Rufous Whistler	*Pachycephala rufiventris*	P
Crested Shrike-tit	*Falcunculus frontatus*	P
Grey Shrike-thrush	*Colluricincla harmonica*	P
Black-faced Cuckoo Shrike	*Coracina novaehollandiae*	P
White-bellied Cuckoo-shrike	*Coracina papuensis*	P
White-throated Gerygone	*Gerygone olivacea*	P
Striated Thornbill	*Acanthiza lineata*	P
Brown Thornbill	*Acanthiza pusilla*	P
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	P
Superb Fairy-wren	*Malurus cyaneus*	P
Dusky Woodswallow	*Artamus cyanopterus*	P
Varied Sittella	*Daphoenositta chrysoptera*	P
Brown Treecreeper	*Climacteris picumnus*	P
White-throated Treecreeper	*Climacteris leucophaea*	P
Misletoebird	*Dicaeum hirundinaceum*	P
Spotted Pardelote	*Pardalotus punctatus*	P
White-naped Honey-eater	*Melithreptus lunatus*	P
Brown-headed honeyeater	*Melithreptus brevirostris*	P
Scarlet Honeyeater	*Myzomela sanguinolenta*	P
Eastern Spinebill	*Acanthorhynchus tenuirostris*	P
Fuscous Honeyeater	*Lichenostomus fuscus*	P
Yellow-faced Honeyeater	*Lichenostomus chrysops*	P

APPENDIX 1 (Continued) – SPECIES LIST "McCLIFFTY"S STUDY AREA"

White-plumed Honey-eater	*Lichenostomus penicillatus*	P
Noisy Miner	*Manorina melanocephala*	P
Red Wattlebird	*Authochaera carunculata*	P
Noisy Friarbird	*Philemon corniculatus*	P
Diamond Firetail	*Stagonopleura bella*	P
Double-barred Finch	*Taeniopygia bichenovii*	P
Red-browed Finch	*Neochmia temporalis*	P
Little Crow	*Corvus bennetti*	P
Pied Currawong	*Strepera graculina*	P
Pied Butcherbird	*Cracticus mentalis*	P
Grey Butcher Bird	*Cracticus torquatus*	P
Australian Magpie	*Gymnorhina tibicen*	P
Australian Raven	Corvus coronoides	P
Striated Pardelote	*Pardalotus striatus*	P
Yellow-footed Antechinus	*chinus flavipes*	P
Common Brushtail Possum	*Trichosurus vulpecula*	P
Swamp Wallaby	*Wallabia bicolor*	P
Jacky Lizard	*Amphibolurus muricatus*	P
Nobbi	*Amphibolurus nobbi*	P
Eastern Water Dragon	*Physignathus lesueurii*	P
Striped Skink	*Ctenotus robustus*	P
Plains Froglet	*Crinia parinsignifera*	P
Common Eastern Toadlet	*Crinia signifera*	P
Verreaux's Tree Frog	*Litoria verreauxii*	P
Black Rat	*Rattus rattus*	I
House Mouse	*Mus musculus*	I
Domestic Rabbit	*Oryctolagus cuniculus*	I
Australian Admiral Butterfly		
Blue Triangle Butterfly		
Meadow Argus Butterfly		
Orchard Swallow Butterfly		
Meadow Argus Butterfly		
Wonder Brown Butterfly		
Meadow Argus Butterfly		



SUPPLEMENTARY REPORT (CONSIDERING ADDITIONS TO THE THREATENED SPECIES CONSERVATION ACT 1995 SCHEDULES SINCE 1ST MARCH 2001)

TO THE

ROADSIDE FAUNA STUDY (June 2001)

McCLIFTY'S

New England Highway, McClifty's Road to Bluff River Road 63.19km to 68.04km North of Glen Innes

FOR

RTA OPERATIONS ENVIRONMENTAL TECHNOLOGY February 2002

KENDALL & KENDALL
ECOLOGICAL SERVICES PTY LTD
ABN. 91 076 759 969

PO BOX 196

WEST KEMPSEY NSW 2440
PHONE-FAX 02 65669280
Email kendall@midcoast.com.au

For

Austeco Environmental Consultants

This report is an addendum to a fauna study on potential impacts on fauna associated with the proposed upgrading of the New England Highway McClifty's Road to Bluff River Road 63.19km to 68.04km North of Glen Innes, and has been prepared for RTA Operations Environmental Technology in accordance with the requirements of Section 5a of the EP&A Act.

The author of this report is

K. R. Kendall,
Principal Zoologist and Fauna Ecologist,
Kendall & Kendall Ecological Services Pty Ltd,

whose qualifications are B.A (Biological Sciences) Macquarie University.

During the field survey K.R. Kendall was assisted by R.K Jago.

The information presented in this report is based on an objective study undertaken in response to a brief provided by the client. While every attempt has been made to ensure the accuracy and objectivity of the report, the variability of the natural environment and the paucity of comparative research data may require that professional judgment be applied in reaching conclusions.

Any opinions expressed in the report are the professional opinion of the author. They are not intended to advocate any specific proposal or position.

Keith Kendall

19th February 2002

Executive Summary

1. This fauna assessment is an addendum to a report, which examined the potential impacts on fauna of the proposed upgrading of the New England Highway approximately 65 kms north of Glen Innes, from McClifty's Road to Bluff River Road, and was prepared in response to a NSW Roads and Traffic Authority (RTA) brief.

2. The addendum addresses additions to the schedules of the *Threatened Species Conservation Act 1995*. These additions included the Brown Treecreeper and Diamond Firetail, species that were recorded during the field survey.

3. Searches of the NSW National Parks and Wildlife Service's database were conducted to identify if any of the target species have been recorded in or near the study area.

4. In regard to the significant species that may occur in or near the study area, applications of the Eight Part Test (Section 5A NSW *Environmental Planning and Assessment (EPA) Act 1995)* indicate that, given appropriate ameliorative measures, the proposal would not have a significant impact on any threatened species. Therefore the preparation of a Species Impact Statement is not necessary.

5. The Brown Treecreeper nests in tree hollows. An ameliorative measure recommended in the original report was the retention of trees with hollows. It is recommended that trees and shrubs that provide nesting habitat for the Diamond Firetail should not be removed during the breeding season that occurs between October and January.

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1 Introduction

This report is an addendum to a report prepared by Kendall & Kendall Ecological Services Pty Ltd i.e. "Roadside Fauna Study – McClifty's – New England Highway, McClifty's Rd to Bluff River Road 63.1 km to 68.04km north of Glenn Innes for RTA Operations Environmental Technology June 2001".

This report is provided in a similar but abbreviated format. In sections of the report where no additional information or considerations are required only the section heading is provided. In sections where additional information or considerations are necessary only the additional information is provided i.e. information in the original report is not repeated.

The specific objectives of this report are:

1. Review all NPWS Wildlife Atlas records for the study areas and adjoining locality for records of threatened species, added to the schedules to the TSC Act since 1st March 2001.
2. Check all new Scientific Committee final determinations since 1st March 2001 to determine if any of these species, endangered ecological communities etc, or key threatening processes, was located during the original survey of the study area.
3. Undertake 8 part tests for any new threatened species etc occurring in the study areas, or occurring in the locality and likely to occur (i.e. with suitable habitat in the study area).
4. Write up as an addendum to the original report, in similar but abbreviated format, including conclusions with summary of expected impacts, and (if relevant) recommendations for conservation and mitigation of impacts, and whether a Species Impact Statement would be required.

Since 1st March 2001 the following species that are considered possible occurrences in the study area have been added to the schedules of the TSC Act 1995:

Black-chinned Honeyeater	Brown Treecreeper
Diamond Firetail	Grey-crowned Babbler
Grey-headed Flying-Fox	Eastern Pygmy Possum
Hooded Robin	Speckled Warbler

The Brown Treecreeper and Diamond Firetail were recorded in the study area during the survey.

2 Methodology

2.1 Review of previous studies and fauna species records

Records of fauna species known to occur within the locality were obtained under license from the National Parks and Wildlife Service database (NPWS, February 2002).

2.2 Fauna Survey

The fauna survey data was reviewed to determine whether any of the species were recorded during the survey.

3 Results

3.1 Fauna species records

The Brown Treecreeper and Diamond Firetail were recorded during the survey. These species have been added to the schedules of the TSC Act since the 1st March 2001.
The Brown Treecreeper was recorded at three locations within the study area. The Australian Map Grid references of these locations are:

Easting	Northing
402250	6763800
400700	6761400
399700	6760150

The Diamond Firetail was recorded at three locations within the study area. The Australian Map Grid references of these locations are:

Easting	Northing
402250	6763800
401500	6762300
400700	6761400

None of the threatened fauna added to the TSC Act schedules are listed as occurring with 20km of the study area on the NSW NPWS wildlife atlas.

Threatened fauna species added to the TSC Act schedule since 1st March 2001 known or considered as potentially occurring in or near the study area are listed in Table 1.

3.2 Habitat

As per original report.

3.3 Field Survey

As per original report.

Table 1. *TSC Act* Threatened fauna species known to occur on or considered as possible occurrences within the study area.

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves	*Melanodryas cucullata*	V	Hooded Robin	Temperate woodlands, favouring open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover	Medium	Low. Small area of habitat to be removed compared to home range
	Pomatostomus temporalis	V	Grey-crowned Babbler	Open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.	Unlikely. Presumed extinct on the New England Tablelands	Low. Small area of habitat to be removed compared to home range
	Chthonicola sagittata	V	Speckled Warbler	Woodlands with a grassy understorey, often on ridges or gullies. Nests on the ground in grass tussocks, dense litter and fallen branches.	Medium	Low. Small area of habitat to be removed compared to home range.
	Climacteris picumnus	V	Brown Treecreeper	Open woodland lacking a dense understorey. Nests in tree hollows	Recorded in study area	Low. Small area of habitat to be removed compared to home range.

Table 1. Continued *TSC Act* Threatened fauna species known to occur on or considered as possible occurrences within the study area.

Order	Scientific name	Status	Common name	Habitat Requirements	Likelihood of Occurrence	Likely Impacts
Aves (cont)	*Melithreptus gularis*	V	Black-chinned Honeyeater	Eucalypt box-ironbark associations and River Red Gum	Medium	Low. Small area of habitat to be removed compared to home range
	Stagonopleura bella	V	Diamond Firetail	Eucalypt woodlands, forests and mallee where there is a grassy understorey	Recorded in study area	Low. Small area of habitat to be removed compared to home range
Mammalia	*Cercartetus nanus*	V	Eastern Pigmy-possum	At higher elevation only, feeds mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit.	Low	Low. Small area of marginal habitat to be removed
	Pteropus poliocephalus	V	Grey-headed Flying Fox	Canopy-feeding frugivore, blossom-eater and nectarivore of rainforests, open forests, woodlands, *Melaleuca* swamps and *Banksia* woodlands	Low	Low. Extremely small area of marginal foraging habitat to be removed compared to home range

4 Discussion

4.1 Threatened fauna populations and critical habitat

No threatened fauna populations or critical habitat, as listed under the TSC Act was recorded or is considered to occur in the study area.

4.2 Threatened fauna species

The Brown Treecreeper and Diamond Firetail are species that have been listed on the schedules to the TSC Act since 1st March 2001 and were recorded during the survey. These species require consideration under the "eight part test" under section 5A of the (EP&A Act).

Other species listed on the schedules to the TSC Act since 1st March 2001 that may occur in the study area are listed in Table 1. These species also require further consideration under the "eight part test" under section 5A of the (EP&A Act).

4.3 Removal of vegetation

The approximate area of each vegetation community that would be removed for the proposal has been estimated from the vegetation map and the concept design for the road upgrading (Elks 2001) as follows:

Community 1.	Not estimated
Community 2.	0.51 ha
Community 3.	1.26 ha
Community 4.	1.04 ha
Community 5.	0.62 ha
Community 6.	0.23 ha
Community 7.	0.01 ha

As the study area contains potential habitats of threatened fauna species there is a potential impact of the proposal on threatened fauna species.

The TSC Act lists eight factors to be considered in deciding whether the proposed development is likely to have a significant effect on threatened species or their habitats, and therefore whether a Species Impact Statement is required.

4.4 Application of the "Eight Part Test"

The potential impacts associated with the proposed upgrading of the New England Highway on threatened species listed in the schedules of the TSC Act 1995 considered as possible occurrences in the study area and added to the schedules of the TSC Act since 1st March 2001 are considered using the eight part test under section 5A of the EP&A Act.

The purpose of the "8 Part Test" is to provide information to the determining authority so that a decision can be made as to "whether there is likely to be a

significant effect on threatened species, populations or ecological communities, or their habitats" and consequently whether a Species Impact Statement is required.

In accordance with the National Parks and Wildlife Service's information circular (No. 2 Section 3.3.1) this "8 Part Test" has been applied to the important habitat features of the species listed in Table 1 rather than to each individual species.

(a) in the case of threatened species, whether the life cycle of these species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction

Provided that areas of forest with low level senescence (trees with hollows) are retained, it is considered that the removal of approximately 3.7 ha of habitat as a long narrow band adjoining the existing highway would not be likely to disrupt the life cycle of threatened species listed in Table 1 such that a local population of the species is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised

Endangered populations (as defined under the TSC Act 1995) do not occur within or near the study area.

(c) in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed

The removal of approximately 3.7 ha of habitat not containing abundant key habitat features such as tree hollows is considered an insignificant area in a regional context.

(d) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community

The proposal would not cause potential habitat to become isolated from currently interconnecting or proximate areas of habitat. The proposal would not significantly contribute to the process of habitat fragmentation.

(e) whether critical habitat would be effected

Critical habitat (as defined under the TSC Act 1995) does not occur in the study area.

(f) whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region

The NSW NPWS website indicates that no threatened population or ecological community occurs in the locality (at the date this report was compiled).

Due to the lack of records of many potentially occurring threatened fauna species and lack of ecological knowledge of many threatened fauna species, it is not possible to quantitatively assess whether many of the species are adequately conserved in the

regions conservation reserves. Many ecologists consider that the current conservation reserve system may not be adequate to support many threatened species.

A number of large national parks occur in the upper Clarence valley. The NSW Wildlife Atlas records and the consultants own records indicate that there are records of threatened species in or close to the reserves or forests. These areas generally contain similar habitat to the study area but of a higher quality and are expected to be contributing to the representativeness of the threatened species in the reserve system.

Furthermore the proposal only affects a small area of disturbed marginal habitat of potentially occurring threatened species. In regard to off reserve management of these species it is considered that the habitat on the study area would not provide a significant contribution.

(g) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process

Clearing of native vegetation is now recognised as a key threatening process, each key threatening process requires the preparation of a threat abatement plan by the NSW National Parks and Wildlife Service. At the time of writing this report no threat abatement plan has been prepared, therefore at this stage it is not possible to review the plan in light of the proposed activity.

However advice from the NSW National Parks and Wildlife Service is that clearing of native vegetation should be considered as a threatening process in a generic sense. Based on this advise it is considered that the removal of approximately 3.7 ha of habitat as a long narrow band adjoining the existing highway would not be likely to disrupt the life cycle of threatened species listed in Table 1 of this report or species listed in Tables 3a, 3b & 3c of the original report such that a local population of the species is likely to be placed at risk of extinction.

(h) whether any threatened species, population or ecological community is at the limit of its known distribution

The study area is situated on the western escarpment of the Great Dividing Range and is therefore located in the Tumbunan zoogeographical division. In this part of NSW this division is a narrow band extending along the Great Dividing Range. It is sandwiched between two areas of the Bassian zoogeographical division, one occurring on the coast and one on the western slopes. In addition aspects of the Eyrian zoogeographical division may influencing the study area from the west. (Gilmore & Parnaby 1994)

The consequences of the complicated influences of the various zoogeographical regions are that many fauna species would be at the edge of their distribution limit in this area of NSW. However it is considered that the impact of the proposed activity would not contribute to the retraction of the range of threatened species that potentially occur in the study area.

4.5 Environmental Planning & Biodiversity Conservation Act: Administrative Guidelines for Endangered/Vulnerable Species.

As per original report.

4.6 Further EP&BC Act 1999 Considerations:

As per original report.

4.7 State Environmental planning Policy No. 44 Koala Habitat Protection

As per original report.

5 Conclusions and Recommendations

5.1 Summary of expected impacts on species of conservation significance.

The loss of 3.7 ha of primarily degraded and marginal habitat would not constitute a significant impact on any threatened, migratory or wetland species or their habitats.

5.2 Recommendations for appropriate measures of conservation or mitigation of impacts on any species of conservation significance

The Brown Treecreeper nests in tree hollows. An ameliorative measure recommended in the original report was the retention of trees with hollows. In the original report it was recommended in the original report that the new road alignment be designed to avoid those areas of Vegetation Community 2.

It is recommended that trees and shrubs that provide nesting habitat for the Diamond Firetail should not be removed during the breeding season that occurs between October and January.

It is not considered that the impact on the foraging habitat of the Diamond Firetail is not sufficient to warrant implementation of ameliorative measures.

5.3 An indication as to whether a Species Impact Statement would need to be prepared.

Given appropriate measures of mitigation as outlined above, it is expected that a Species Impact Statement would be not required.

5.4 An indication as to whether approval of the Federal Environment Minister would be required.

As per original report.

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APPENDIX 1 – SPECIES LIST "McCLIFTY"S STUDY AREA"

As per original report.

DAVIES HERITAGE CONSULTANTS PTY LTD

PO Box 208, RED HILL, Qld 4059
ACN 079943678

INDIGENOUS CULTURAL HERITAGE ASSESSMENT OF TERRAIN TO BE IMPACTED BY ROAD WORKS AT McCLIFTY'S STUDY AREA, BETWEEN GLEN INNES AND TENTERFIELD, NORTHERN NEW SOUTH WALES.

By

Susan Davies

April, 2001

EXECUTIVE SUMMARY

This report presents the results of an Indigenous cultural heritage assessment of a 5.34 kilometre section of terrain to be potentially impacted by an upgrade of the New England Highway. This upgrade, at a locality known as McClifty's Study Area, extends from 62.7 to 68.04 kilometres north of Glen Innes. The study area begins on the northern side of Sandy Creek and ends just to the north of the intersection of Bluff Creek Road and the New England Highway. The main aims of the study were to identify Indigenous cultural heritage sites in the proposed development area, to discuss the significance of any sites located, the likely impact of the proposed development on these sites, and provide management recommendations.

The New South Wales Roads and Traffic Authority (RTA) proposes to upgrade and widen this section of road. The entire development is within existing road reserve. The development work would include the widening of narrow formations and sub-standard curves and the improvement of the vertical alignment with proposed extension of existing culverts. The development would include the widening of an eastern cutting and the widening of culverts. A site for a southbound overtaking lane is also being investigated from McClifty's Road junction south. The junctions of the New England Highway and McClifty's and Bluff Creek Roads would also be improved. The proposed development has the potential to severely damage or completely destroy archaeological site types that may exist within the development area. Both surface and sub-surface archaeological material could be under threat of impact from this proposed development.

Based on environmental and prior archaeological research it was considered that the study area was of low to medium archaeological potential. Both cultural and natural processes may have impacted upon the terrain within the study area, considerably reducing both the likelihood of locating sites and/or locating material *in situ*. The main site types predicted to be located by a field survey were stone artefact scatters (including isolated stone artefacts), quarries and scarred trees.

Archaeological fieldwork was conducted in the study area on the 27th February, 2001, by Su Davies (Davies Heritage Consultants Pty Ltd) and Bruce McIntosh and Darren Daley (Moombahlene Local Aboriginal Land Council). The majority of the study area was surveyed. Where the boundary of the road reserve was not clear, the survey team inspected an area no more than 30 metre wide along the western side of the New England Highway and on the eastern side of the Highway used the now disused railway line as the boundary indicator.

Two scarred trees were located within the study area during the survey. Both trees are located on the western side of the New England Highway to the south of the junction of McClifty's Road and the New England Highway. Both trees are considered to have significance and are potentially under threat of impact by the proposed development.

Given the topography within the study area it is considered that there is a possibility that undetected archaeological material could be present. Nevertheless, given the consideration that only isolated stone artefacts or background scatter would be located within the study area and in the absence of any firm indications that subsurface materials are present, further archaeological work is not considered warranted.

On the basis of the findings the following recommendations were made:

- **Before construction on the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area) commences, a buffer zone of no more than five (5) and no less than two (2) metres be established around the two scarred trees at Location 1 and Location 2.**

- **The location of the two scarred trees should be noted on the contract documents and the protection of these trees should be incorporated in the Construction Environmental Management Plan (CEMP) for the project. All personnel working on site should be briefed on the significance of the items and the need to protect them during the construction phase.**

- **That after the above two recommendations have been implemented, no further Indigenous heritage constraints should be placed on the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area).**

- **Should future activities associated with the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area), uncover anything which may be interpreted as Aboriginal in origin, work should cease immediately. The NPWS and the RTA's Environmental Adviser should be contacted immediately and works would not commence in the subject area until the find has been examined and dealt with appropriately. Information about such finds should be passed on to both the NSW NPWS, Coffs Harbour, and the LALC, as soon as possible, for further discussion and negotiation. The provisions of the NSW *National Parks and Wildlife Act 1974* state that it is illegal to damage, deface or destroy a relic without written permission of the Director of the Service.**

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1.0 INTRODUCTION

This report presents the results of an Indigenous cultural heritage assessment of a 5.34 kilometre section of terrain to be potentially impacted by upgrading of the New England Highway beginning approximately 62.7 kilometres north of Glen Innes in the Northern Tablelands of New South Wales (**Figure 1**). Susan Davies (Davies Heritage Consultants Pty Ltd.) and the Moombahlene Local Aboriginal Land Council (LALC) undertook the assessment for the client, the New South Wales Roads and Traffic Authority (RTA).

1.1 Area of Study

The study area, known as McClifty's, is located within the New England Highway road reserve extending from 62.7 to 68.04 kilometres north of Glen Innes (**Figure 2**). The study area begins on the northern side of Sandy Creek and ends just to the north of the intersection of Bluff Creek Road and the New England Highway.

1.2 The Proposed Roadwork Activity

The RTA propose to upgrade and widen a 5.34 kilometre section of the New England Highway between Glen Innes and Tenterfield (**Figure 3**). The entire proposal is located within the existing road reserve. Generally, works would include the widening of an eastern cutting, the widening of culverts and the provision of northbound and southbound overtaking lanes. The junctions of the New England Highway and McClifty's and Bluff Creek Roads would also be improved (RTA 2001).

1.3 Construction Methods

Some of the tasks involved in the upgrade and widening of the New England Highway include:

- Clearing;
- Erosion and sediment control;
- Topsoil stripping;
- Earthworks, and
- Extension of culverts.

Most of the above tasks involve considerable disturbance or total removal of the original ground surface.

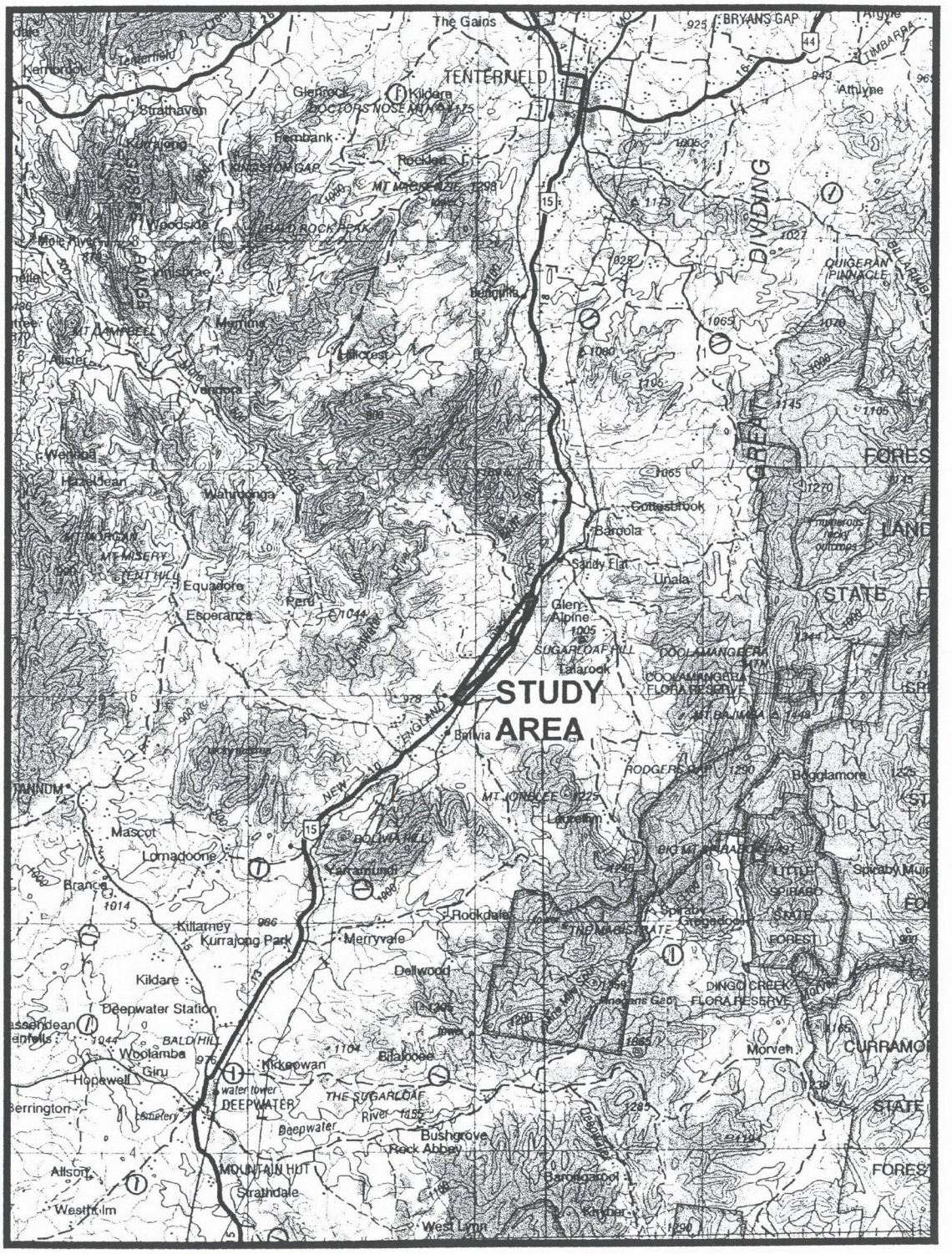


Figure 1. Location of the Study Area in New South Wales (Grafton 1:250,000 Topographic Map)

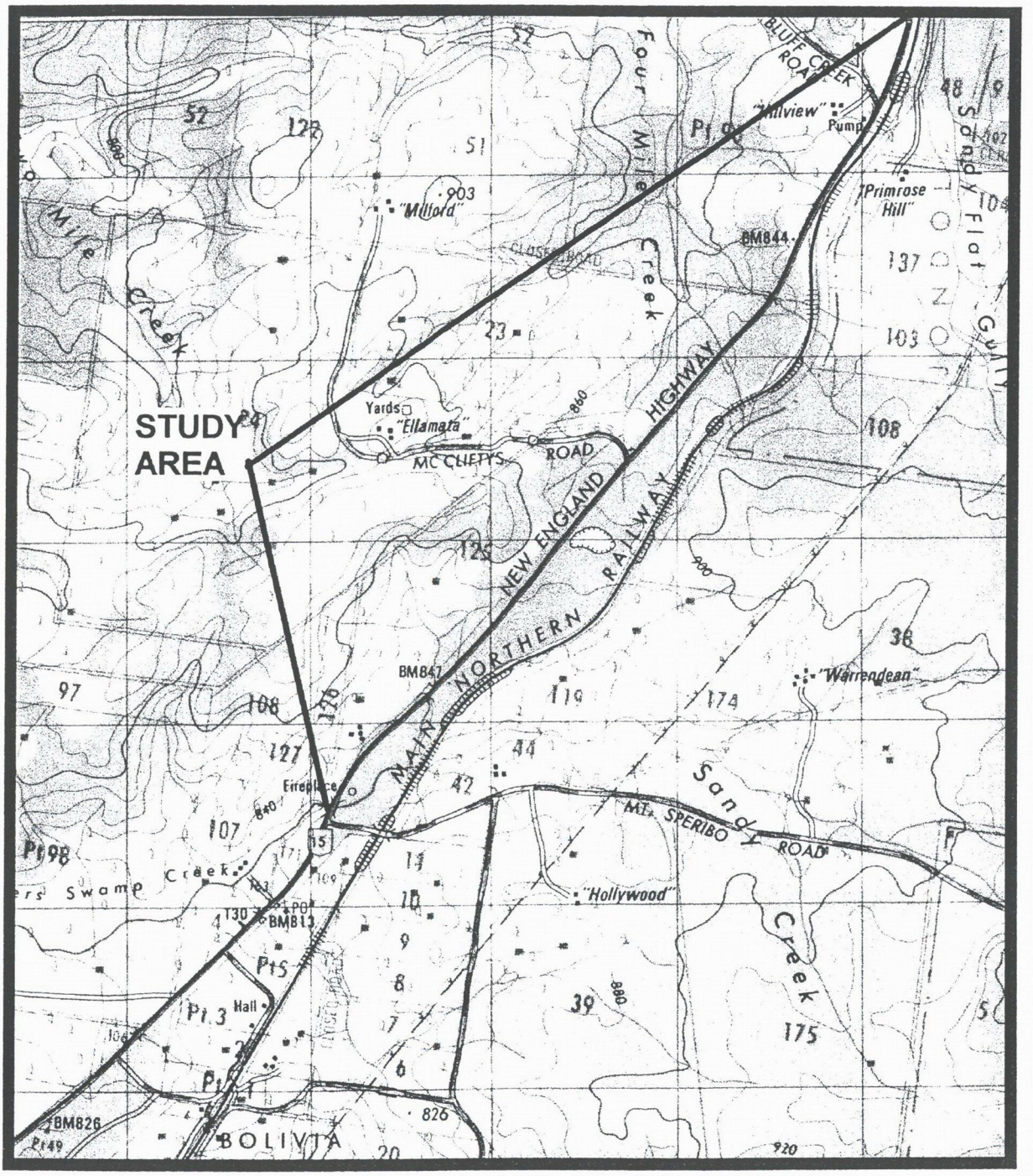


Figure 2. Location of the Study Area (Emmaville 1:50,000 Topographic Map)

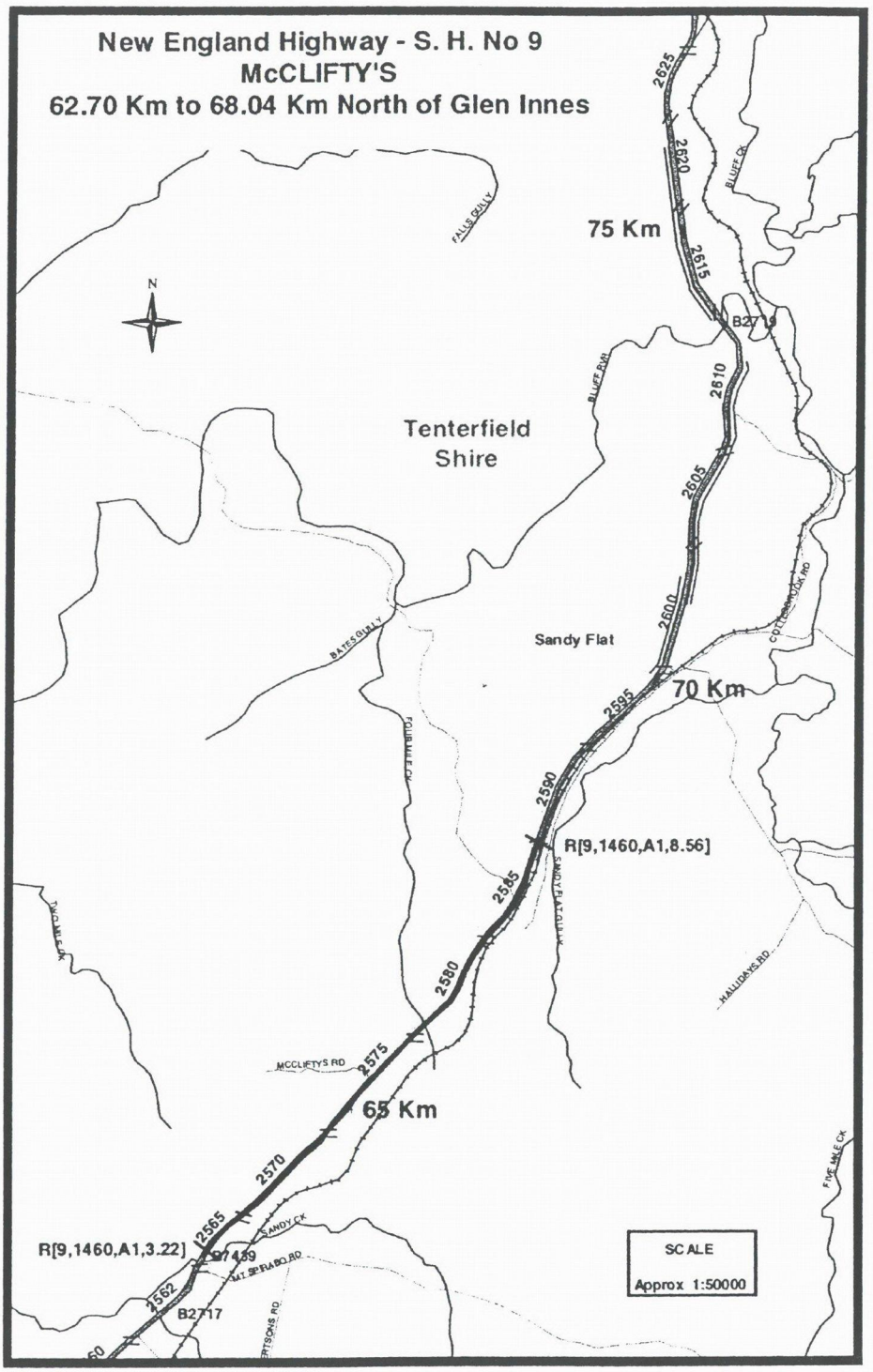


Figure 3. Plan of Study Area, highlighted in red (RTA 2001)

1.4 Potential Impact of the Proposed Roadwork Activity

From the above outline of construction methods it is postulated that disturbance to both the ground surface and subsurface layers would occur as a result of the proposed roadwork activity. Such disturbance will be restricted to within the existing road reserve.

The proposed roadwork activity has the potential to severely damage or completely destroy archaeological site types that may exist within the roadwork activity area. Both surface and sub-surface archaeological material, if they are present, could be under threat of impact from this proposed roadwork activity.

1.5 The Scope of the Study

The RTA (RTA 2001) in its "Archaeological Brief for REFs - Indigenous Heritage" provided the scope of the study as follows:

> "The indigenous heritage assessment shall be undertaken in accordance with the legislative requirements of the *NSW National Parks and Wildlife Act 1974* and the procedures outlined in the NSW NPWS Aboriginal Cultural Heritage Standards and Guidelines Kit. The assessment shall include:
>
> - A review of archaeological literature including a review of the NSW NPWS Aboriginal Sites Register, Archaeological Reports Register and the Register of the National Estate, for listed sites within or adjacent to the proposal site.
> - A field study undertaken with the nominated representatives of the relevant Local aboriginal Land Councils and/or Aboriginal community groups acting in the area of the proposal, to identify sites which may be of significance. Any new sites found shall be recorded on NPWS standard recording forms and submitted to the NPWS site register.
> - Reference to other potential sites, including sub surface items.
> - A discussion of past environmental factors which may influence the likelihood of sites being present.
> - A predictive model of site location (discussing what type of sites may be expected and where they might occur within the landscape of the study area).
> - An assessment of the heritage significance of the sites found, according to established heritage assessment criteria outlined by the relevant State and Federal agencies and NSW NPWS.
> - The assessment of cultural significance as undertaken by the local Aboriginal community groups / Land Councils. Any written assessment prepared by an Aboriginal community group shall be included in the report. The outcome of the Aboriginal community assessment shall be discussed in the consultant's report.
> - A statement of the likely effect of the proposal on any Indigenous heritage items discovered, known or predicted within the study area and whether any mitigation measures are practicable.
> - A written report summarising the findings of the above, the heritage values of the sites and recommendations in relation to preservation, recording,

and/or destruction of sites. Relevant plans or diagrams should be included. The report should satisfy the requirements of the National Parks and Wildlife Service. Copies shall be forwarded to the Local Aboriginal Land Council for comments before the submission of the final report.

- Consultation with the relevant Local Aboriginal Land Councils and/or Aboriginal community group acting in that area throughout the study.
- A Native Title Claim search.
- Management recommendations including information on permits to be sought (if required) and any other requirements."

2.0 CONSULTATION WITH INDIGENOUS GROUPS

The RTA's Aboriginal Liaison Officer, Mary-Lou Buck, was contacted by the RTA's Environmental Technology Section (L. Brown pers. comm, 2001) during the preliminary investigation phase of the project, prior to commencement of the tender phase. The Moombahlene LALC were initially contacted during the tender phase of the project. As soon as Davies Heritage Consultants Pty Ltd were advised by the RTA that their tender was successful, the Moombahlene LALC were contacted and informed of the project and a tentative date for the field survey arranged. Mary-Lou Buck, was also contacted and invited to assist with the field survey, but was unable to participate due to other commitments. The field survey date was later confirmed with the Moombahlene LALC and the field survey was undertaken on Tuesday, 27th February, 2001, with Bruce McIntosh and Darren Daley. Davies Heritage Consultants Pty Ltd received a report from the Moombahlene LALC regarding the results of the field survey on the 6th March, 2001 (see Sub-section 15.0).

3.0 CULTURAL HERITAGE MANAGEMENT

Cultural Heritage Management involves the recognition of culturally significant places through the processes of identification and assessment, and the subsequent making of recommendations regarding their future. The ideal outcome of such studies is the conservation of these places. Where this is not possible or practicable recommendations that go towards lessening negative impacts (known as mitigation), are made. Strategies for mitigation can range from suggested alterations to proposed development plans so that a smaller amount of culturally significant fabric is destroyed, to recording places prior to their destruction so that some knowledge can be salvaged from the situation.

The identification process is often initiated from the results of research using the documentary record and the assessment process minimally requires a field survey of the relevant place, and generally community consultation. Recommendations as to the future of culturally significant places are usually guided by the philosophy of conservation practice outlined in the Burra Charter, and such recommendations must be operationalised within a legal framework.

3.1 The Burra Charter

The Burra Charter (Marquis-Kyle and Walker 1992) guides the practice of cultural conservation in Australia. Within this Charter cultural significance is defined as meaning: *"aesthetic, historic, scientific or social value for past, present or future generations"* (Article 1.2). Each of these values is defined in the attached Guidelines to the Burra Charter for Cultural Significance (Articles 2.2 to 2.5):

- ***Aesthetic Value***

"Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric".

- ***Historic Value***

"Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section.

- ***Scientific Value***

"The scientific research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information".

- ***Social Value***

"Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group".

The Guidelines also note that other categories of cultural significance may be developed as understanding of a particular place increases (Article 2.6). Article 5 of the Burra Charter promotes the position that: "Conservation of a place should take into consideration all aspects of its cultural significance without unwarranted emphasis on any one aspect at the expense of others".

3.2 Assessing Aboriginal Site Significance

Archaeology is primarily concerned with the interpretation of human history and cultural evolution through the study of material remains, discarded as a result of past human activities. This archaeological record is both fragile and non-renewable and any major disturbance of the environment such as landscape-altering development, poses a threat to this valuable cultural resource. The major cause of obliteration of much of the archaeological record (information upon which the prehistory of Australia can be constructed) is development by non-indigenous people during the past 213 years, with the impact by natural agencies playing a minor role. Thus, that which remains is all the more valuable due to its scarcity.

The Aboriginal cultural record can generally be divided into two sections: physically identifiable object/s (archaeological sites) and object/s that are not physically identifiable (sites sacred or

significant to Aboriginal people which can be unmodified features of the landscape) (Bowdler 1983:38). Archaeological sites can include stone artefact scatters, shell middens, axe-grinding grooves, quarries, scarred trees, ceremonial grounds, stone arrangements, burials and rockshelter sites (see Section 7.1). The assessment of the significance of these sites, both potential and realised, are fundamental to cultural heritage management planning (see Moratto and Kelly 1978). Significance can be assigned to particular sites/places, or to a grouping of sites/places within an area. In the latter case, the importance of a cultural heritage area or precinct may be greater than the sum of its individual sites/places. Put simply, cultural heritage significance is the value of cultural heritage sites/places to us and our society (Kerr 1990:3). The major, non-mutually exclusive criteria by which the significance of Aboriginal cultural heritage sites/places can be assessed internally are:

1. Social and political
2. Scientific
3. Historical
4. Educational and economic
5. Aesthetic

Each of these significance **criteria** can be assigned a relative **value** from low to very high and at a regional, state or national interest level. The following explanation of these criteria is taken from McNiven *et al.* 1994.

➢ ***Social and Political Significance***

If a site/place has importance for a particular cultural or ethnic group, either a majority or minority group (Lennon 1992:4), for religious, mythological, spiritual, or other symbolic reasons - it has social significance (Johnson 1992; Moratto and Kelly 1978:10). Sites/places of social significance are usually important in maintaining a community's integrity and **sense of place** (Hall and McArthur 1993a:8; King *et al.* 1977:96). Bowdler (1983:26) recognises two kinds of sites that are significant to Aboriginal people; one relates to pre-contact times, the other to the period since colonisation. For most Aboriginal groups, Aboriginal archaeological sites (e.g. burials) and Aboriginal contact sites (e.g. missions) have strong social significance. In recent years, such associations have become increasingly politicised as Aboriginal people regain control of their ancestral lands and re-establish their sense of place following the devastating effects of non-indigenous invasion and colonisation (see Boyd and Ward 1993:112). Some of these sites/places may be recognisable due to landscape modification or material remains whereas others may consist of a noticeable but natural physical feature. Bowdler (1983:30) stresses that "identification of sacred sites and sites of significance to Aboriginal people is of necessity a matter for Aboriginal people. No-one else can decide either the fact of significance or the degree of that significance to an Aboriginal community, except members of that community".

➢ ***Scientific Significance***

The scientific significance of sites/places represents their ability to furnish data on, and insight into, either past cultural activities (social, technological and ecological) and/or past natural/environmental conditions (see Bickford and Sullivan 1984; Moratto and Kelly 1978; Pearson 1984). For example, archaeological sites provide unique information on human activities, particularly everyday lifeways, which more often than not are not available in documentary sources. Such insights apply equally to literate and non-literate societies.

Similarly, such insights may relate to questions of local culture history spanning tens or even thousands of years, and more general and theoretical questions relating to the evolution of cultural systems. Archaeological sites can also supply unique information on past climates and vegetation patterns (e.g. pollen grains) and past fauna (e.g. shell and bone remains).

The scientific significance of sites/places should be assessed according to "timely and specific research questions (research potential) on the one hand, and representativeness on the other" (Bowdler 1984:1). The focus of both research potential and representativeness can change over time. As research interests vary and archaeological methods and techniques change through time, criteria for assessing site significance are also re-evaluated. Consequently, the sample of site types conserved must be large enough to account for such changing variables. The concepts of "research potential" and "representativeness" are detailed below.

Research potential

A number of criteria may be employed to gauge the research potential of a site. These include site integrity, site structure and site content (Dancey 1981).

Site integrity is a property of the archaeological record concerned with the degree of preservation represented by a given deposit (site) (Dancey 1981:20). Both cultural and non-cultural processes affect site preservation. Examples of these processes are post-colonisation development and/or erosion. Sites least affected by such processes may contain significant information regarding the occupation of that site. Where disturbance is extensive there is a greater likelihood that information has been destroyed. Hence, the research potential of such disturbed sites is reduced.

Site structure refers to factors such as stratification, size and patterning of archaeological material within a site. As artefacts and soils accumulate at a given place the resulting deposit may attain a layered appearance. Where layering (stratification) occurs the bottom layer is generally older than the top layer. Thus, stratified sites offer the possibility of detecting changes in the cultural deposit through time. Larger sites may indicate major campsites that may have been occupied over generations, or intensively by larger groups. Internal site patterning may indicate distinctive activities undertaken at a site, or other preferences of site use or organisation.

Site content refers to the different types of archaeological material which occur in a site. These may be both cultural and non-cultural. Cultural material may include artefacts and the waste material from artefact manufacture, discarded food remains, and charcoal (from hearths). Non-cultural material may include sediments and pollen, both of which may be analysed for information about the environment of the site at the time of its occupation.

Representativeness

Representativeness takes account of how common a particular type of site is (Bowdler 1984:2). That is, it allows sites to be evaluated with reference to the known archaeological record within the region of a particular site. As a rule, the more common a site type, the lower the significance of individual examples of such site types. Similarly, the older the site the greater its significance given that older sites tend to be rarer due to the vagaries of time and decay (Coutts and Fullagar 1982:61). However, an area exhibiting numerous similar (read common) sites can have considerable significance as it may provide a rare opportunity to investigate past land-use

patterns. In this instance, the significance of the area is greater than the sum of its constituent sites (see Bowdler 1983:40). From a different perspective, representativeness also relates to maintaining the diversity of archaeological sites for future generations. This notion helps compensate for the biases inherent in academic research agendas that may ignore certain site types today but focus on these in the future (King *et al.* 1977:99). Sites may also be assessed to have scientific value if (based on current archaeological understanding of the area) they exhibit unique or rare qualities. The singular rarity or uniqueness of a site should be judged from a local, regional or national perspective.

➢ ***Historical Significance***

A site or place has historical significance if it is associated with either significant person(s) or significant event(s). As Kerr (1990:10) notes, these "may include incidents relating to exploration, settlement foundation, Aboriginal-European contact, disaster, religious experience, literary fame, technological innovation and notable discovery". However, historical significance may also include the ability of a site/place to be representative of cultural patterns from a particular historical period (Moratto and Kelly 1978:4). As a rule, the greater the degree of physical integrity of a site and its setting the greater its significance (Lennon 1992:4).

➢ ***Educational and Economic Significance***

Cultural heritage sites/places can have important educational significance by providing opportunities for people to visually examine and better appreciate the nature of these sites for themselves. Such opportunities not only have important or indeed profound social consequences in terms of maintaining a community's identity, authenticity and sense of place (Lipe 1984:6), but also can have significant economic consequences in terms of cultural tourism (Hall and McArthur 1993b). From another perspective, economic significance of sites is increasingly becoming an issue of competing with alternative land-use activities (e.g. development). Although traditionally seen as mutually exclusive pursuits, cultural heritage preservation and economic development can work together. Best results occur when heritage issues are considered and accommodated for in the early stages of development planning (Rickard and Spearritt 1991).

➢ ***Aesthetic Significance***

The aesthetic qualities of a site/place relate to the visual appeal, however subjective, of sites/places and their setting (Kerr 1990:10; also see Ramsay and Paraskevopoulos 1994).

3.3 Managing Significant Aboriginal Places

The Burra Charter has not always been found appropriate for places of significance to Aboriginal people. For this reason the *'Guidelines for the Protection, Management and Use of Aboriginal and Torres Strait Islander Cultural Heritage Places'* has been drafted in a project by the Department of Communication and the Arts, managed for the Australian Heritage Commission and the Australian Institute of Aboriginal and Torres Strait Islander Studies, the Australian Nature Conservation Agency and Aboriginal and Torres Strait Islander Commission. It includes five points:

A. Aboriginal and Torres Strait Islander Involvement

1. *Aboriginal or Torres Strait Islander people have the right to be involved in decisions affecting their cultural heritage, and in the on-going management of their cultural heritage. Aboriginal or Torres Strait Islander involvement in management must be continuous and at the level they consider appropriate.*
2. *Aboriginal or Torres Strait Islander people who have rights to speak for the place, and/or have interests in the place, should be identified and involved in decisions affecting that place. This will include wide and inclusive consultation, at the beginning of and throughout the process.*
3. *Decisions which have an effect at the local level need to have full local level involvement. Regional planning should accommodate local level input. Local level planning should be integrated with regional planning.*

B. All Interest should be Considered

4. *The concerns of all interest groups must be taken into account. Some places have cultural values for both Indigenous people and other groups in the community. All relevant groups should be consulted to allow agreement to be reached on the future of the place.*

C. Cultural Significance

5. *Cultural heritage place management must look after the cultural significance of a place. The 'cultural significance' of a place describes the value or importance the place has to a community and includes the 'social, aesthetic, historic, and research or scientific value of the place for present, past or future generations'. The term 'social value' includes spiritual values. The cultural significance of a place can change over time.*

D. Process and Actions

6. *Decisions about cultural heritage places should be made as a result of a conscious and logical planning process. This process, guided by and maintaining the cultural significance of the place, takes into account all the management issues affecting the place and identifies the objectives for the management of the place.*

   . actions affecting places need to be considered only after the cultural significance of the place has been established, and a statement of objectives has been agreed upon by the relevant Indigenous community or owners.

   . physical intervention or other management actions should be taken to support cultural significance and should be the minimum required to achieve this aim. Actions which conserve cultural significance have top priority.

E. Making and Keeping Records

7. *Records of places, records of decisions made about them and records of actions taken at heritage places should be made, kept, stored and accessed in a way which is appropriate to the place and meets the wishes of the community. Ownership of, storage and use of, and access to information should be openly agreed at the outset of a project with the people who own, provide or have rights to the information. Availability of information supports the cultural significance of the place.*

3.4 Impact Assessment and Mitigation Strategies

Once the cultural record has been identified and its significance assessed, an important step in cultural heritage management studies is to predict the specific impacts on the cultural record that

a particular proposal will generate. Negative impacts may need to be avoided or at least mitigated (lessened). Prediction of impacts calls upon an awareness of the various components of the cultural record in a particular area, as well as of the varying impacts that an activity may have on these components. Both human and natural processes impact upon the archaeological record. In considering development impacts, consideration must be given to the overall scope for potential impacts, beyond the construction stage to the operational stage.

- ***Impact of Natural Processes***

Natural processes have always played a part in the disruption of the archaeological record. As soon as they have been discarded, artefacts undergo post-depositional processes that are integral to the nature of the cultural record, particularly the archaeological record, as we see it today. Such processes may include erosion, tree growth, weathering, and the impact of chemicals, tree roots or animals. On-going natural processes are not to be confused with impacts arising from any proposed development. However, some development can accelerate these natural processes (e.g. intensified erosion) and these are then considered associated impacts.

- ***Impact of Cultural Processes***

Cumulatively, cultural activities (particularly since non-indigenous settlement) have led to often substantial though varying degrees of disturbance to the cultural record. The damage caused may be either direct (eg. through quarrying, ploughing or land clearing) or indirect (such as with changes to the erosion patterns of an area). The level of damage caused will also depend on a correlation between the site type and the kind of activity carried out. The degree of site survival in the study area will ultimately depend upon such factors, in addition to the general extent and intensity of historical disturbances. Prior cultural impacts are not considered part of any particular development proposal but the nature of prior impacts can affect the severity of potential impacts of proposed development. Where the record is relatively undisturbed, any new impacts will have a severe impact. Where the record has been disturbed, new impacts will correspondingly be of less severity.

- ***Scope of Impacts***

Activities during active construction phases of development proposals are perhaps the most obvious source of impacts. However, impacts are not restricted to this stage. In particular, the changes in land use due to a development can bring about new threats to the cultural record. For instance, even though a place may not have been destroyed during a residential subdivision, the new concentration of people in the locality may lead to inadvertent or malicious damage of retained sites by new residents. Impacts may also relate to the cultural record outside of the study area. Where access roads or living camps need to be provided during the course of construction, this construction and also the influx of people into the area can generate impacts on parts of the cultural record.

So, in summary the potential impact of a particular development will vary according to a number of factors, amongst them being the inherent characteristics of a site type and the degree of previous site disturbances. The lesser the degree of disturbance in an area, the greater is the impact of new activities there.

- ***Mitigation Options***

At times it will be recommended that proposed developments be modified to avoid impacts. Where this is not feasible, mitigative strategies may be employed. In the case of significant Aboriginal archaeological sites, a mitigation option would entail salvage work to recover the potential scientific knowledge of a site prior to its disturbance or destruction. Specific salvage mitigative work would depend upon the nature of the site and procedures can range from detailed recording, surface collection of artefacts to excavation of sites. Generally in assessing the need for mitigative measures, attention should be focused first upon areas of least disturbance and then progressively applied to other, increasingly disturbed locations (Hall and Lomax 1993). Additionally, any mitigative options must be formulated and operationalised in consultation and with the co-operation of the relevant Aboriginal community/s.

Detailed recording may be undertaken on immovable site types such as quarries and axe grinding grooves, as well as extensive sites. Surface collection of artefacts would normally be recommended for relatively undisturbed sites, or in regions where there have been few other recorded sites. Relocation of scarred trees is another form of collection. Excavation would be warranted if there are indications of a depth to deposits, in particular if stratification is in evidence.

Although these salvage procedures go towards recovery of scientific information, they are nevertheless destructive of the site. Where the sites are strongly valued by the Aboriginal community, such destructive mitigative activities may not have the approval of the relevant community. In these cases in particular, avoidance of impacts is considered the base management option.

3.5 Legislative Protection

Some culturally significant places are regulated by various pieces of legislation. The relevant provisions usually intend to prevent their unnecessary destruction. In making management recommendations about places, this legislative context must be borne in mind.

3.5.1 Federal Legislation

Two pieces of relevant Federal legislation are the *Australian Heritage Commission Act 1975-1990* and the *Aboriginal and Torres Strait Islander Heritage Protection Act 1986.*

- ***Australian Heritage Commission Act 1975-1990***

This Act is comprehensive in its approach, covering a wide range of culturally significant places. Classes of items which might be placed on the Register of the National Estate include those of the historic environment (including buildings and structures, modified landscapes and archaeological sites); the natural environment; and items from the Aboriginal environment (both archaeological sites and unmodified natural features such as sacred sites). Section 30 provisions protect items on the Register from unnecessary destruction by actions of Federal Government Departments, agencies and instrumentalities.

State Governments and private developers are not constrained by the provisions of this Act unless Federal funding is involved.

➢ ***Aboriginal and Torres Strait Islander Heritage Protection Act 1986***

The purpose of this Act is to preserve and protect areas and objects of particular significance to Aboriginal Australians from injury or desecration. In particular, this legislation can provide protection for sacred sites. Any steps necessary for the protection of a threatened place are outlined in a gazetted Ministerial Declaration (Sections 9 and 10), and this can include the prevention of development. As well as providing protection to areas, it can also protect objects by Declaration, and in particular Aboriginal skeletal remains (Section 12). Heavy penalties may be levied in the case of contravention of provisions of a Declaration (Section 22).

Although a Federal Act, it can be invoked in a State if the State is unwilling or unable to provide protection for such sites or objects.

3.5.2 New South Wales Legislation

The two major pieces of legislation at the New South Wales state level are the *National Parks and Wildlife Act, 1974* and the *Environmental Planning and Assessment Act, 1979.*

➢ ***National Parks and Wildlife Act, 1974***

This Act protects Aboriginal Places and Relics, the former being sites of demonstrated mythological significance to Aboriginal people and Relics essentially the material remains of Aboriginal culture, including human remains. It is an offence under the Act to knowingly disturb or destroy Aboriginal places or relics without the consent of the Director of National Parks and Wildlife Service (NSW).

➢ ***Environmental Planning and Assessment Act, 1979***

In effect, this Act generates a broad spectrum of protection for Aboriginal sites by requiring that an Environmental Assessment, incorporating an assessment of anthropological and archaeological values be prepared for certain developments and activities. Any site located during such an assessment would be automatically protected under the above Act.

The Review of Environmental Factors (REF), incorporating this Cultural Heritage Assessment, has been prepared by the RTA in accordance with Part 5 of the *Environmental Planning and Assessment Act* 1979, and Clause 228 of the *Environmental Planning and Assessment Regulation* 2000. The purpose of the REF is to describe the Proposal, to document its likely impacts on the environment, including cultural heritage impacts, and to detail protective measures to be implemented.

4.0 INDIGENOUS CULTURAL CONTEXT

This Section provides a brief outline of the settlement patterns (Sub-section 4.1), economy (Sub-section 4.2), material culture (Sub-section 4.3) and population density (Sub-section 4.4) of the

Indigenous people whose traditional land did and still does cover the present study area. This Section outlines the intensity of land use activities and the items that may now form part of the archaeological record for this area. This information has relevance for the significance assessment of individual sites and places.

4.1 Settlement

Settlement patterns and regional interaction between groups can be ascertained, to a certain extent, through the examination of language groupings. According to Tindale (1974), there were a number of languages spoken in the New England Tablelands Region. According to Tindale's (1974) work the study area appears to be located close to the boundary of the Jukambal and Ngarabal language groups. Tindale (1974: 191) notes that the location of the Jukambal language group was within an area "from Glen Innes northeastward across New England to Drake, Tenterfield, and near Wallangarra". Tindale (1974:194) comments that "western hordes, including those of the upper Severn River, Beardy River, Stonehenge, and Bolivia, are best considered a separate tribe called Ngarabal" with the "true Jukambal living east of a line joining Glen Innes and Tenterfield". Crowley (1976) suggests, however, that Marbal was spoken around Tenterfield and that Ngarbal was spoken in the area from Stonehenge to Bolivia, including Glen Innes, Wellingrove and Deepwater (see **Figure 4**). Based on this information the study area is close to the boundary of the Marbal and Ngarbal language groups. Crowley (1976:21) believes that Marbal (Tenterfield area), Ngarbal and Yugambul (Inverell region) were mutually intelligible and were possibly dialects of a single language. Although some words are identical to words from the Bandjalang dialects to the east, Crowley (1976:21) suggests that the Yugambul-Marbal-Ngarbal languages seem to be related to the languages of the Macleay Valley.

A more recent review of the evidence by Godwin (1991:2) suggests that on the Tablelands proper, there were at least two, and possibly three languages spoken. He places Nganjaywana on the southern half of the Tablelands, with Yugambul spoken in the northern half. In between these two may have been a third language, Eneewin, covering a small area in the Guyra-Glen Innes area (**Figure 5**). This configuration is similar to Crowley, although they differ in regards to the languages spoken along the eastern margin of the Tablelands. The present study area, therefore, could be considered to be (according to Tindale and Crowley) on the margin between Marbal and Ngarbal language groups. If these two languages are dialects of Yugambul then the information provided by all three researchers generally conform.

It is expected that within each language grouping there would have been local groups, or bands, with associated local territories. These bands typically could have included 50-250 members who would have been related by marriage to members of other bands. Individual bands probably had their own names but very few of these have been recorded. The daily seasonal and ceremonial activities of these local groups and the interactions between them (as well as those preceding them) gave rise to the formation of the present prehistoric archaeological record.

An important question raised in the literature concerns seasonal movement and regional interaction of local bands and there is considerable debate about the extent of movement between the Tablelands and coastal groups. McBryde (1974:338) recorded a strong oral tradition of

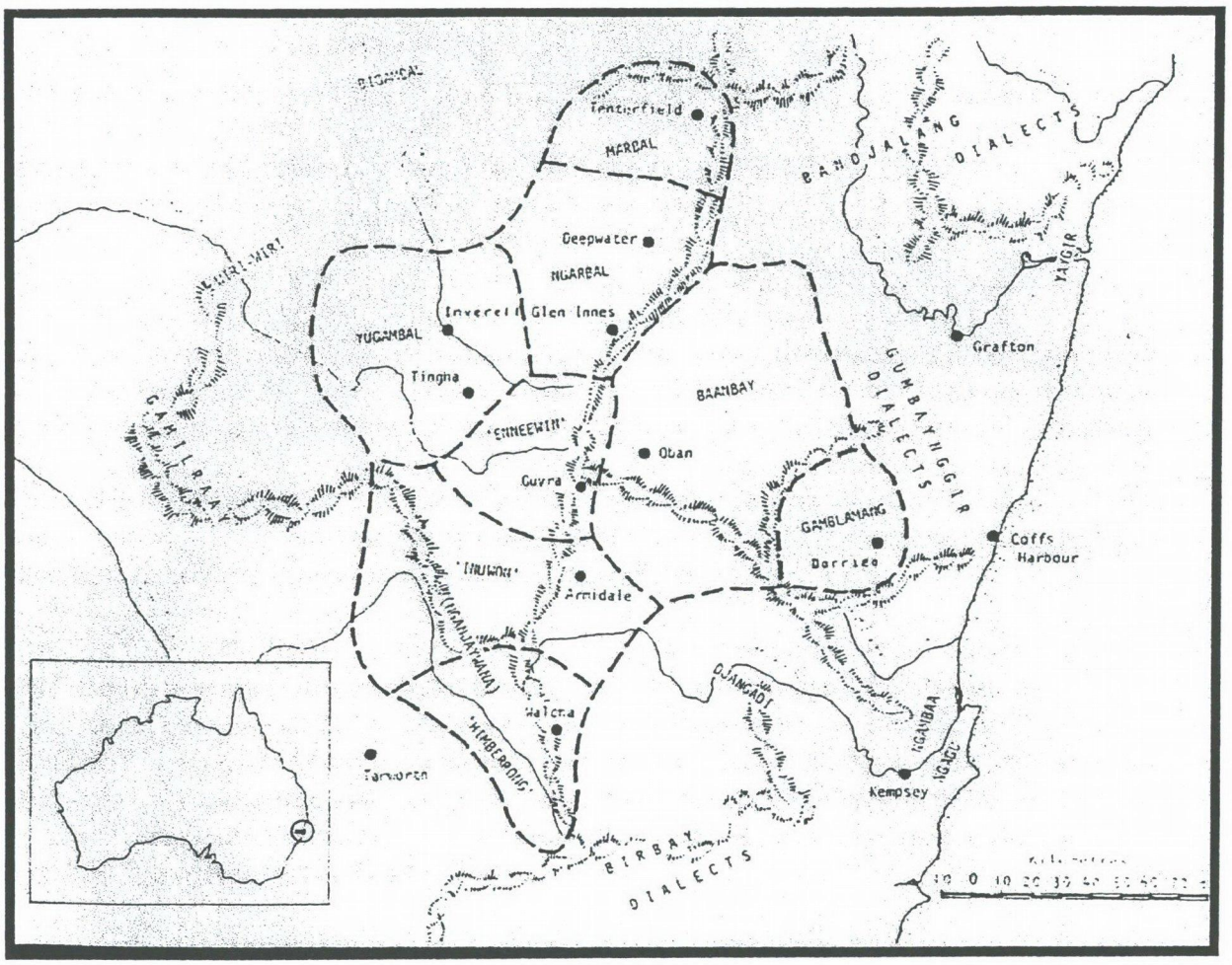


Figure 4. Languages of New England and northern New South Wales (from Crowley 1976)

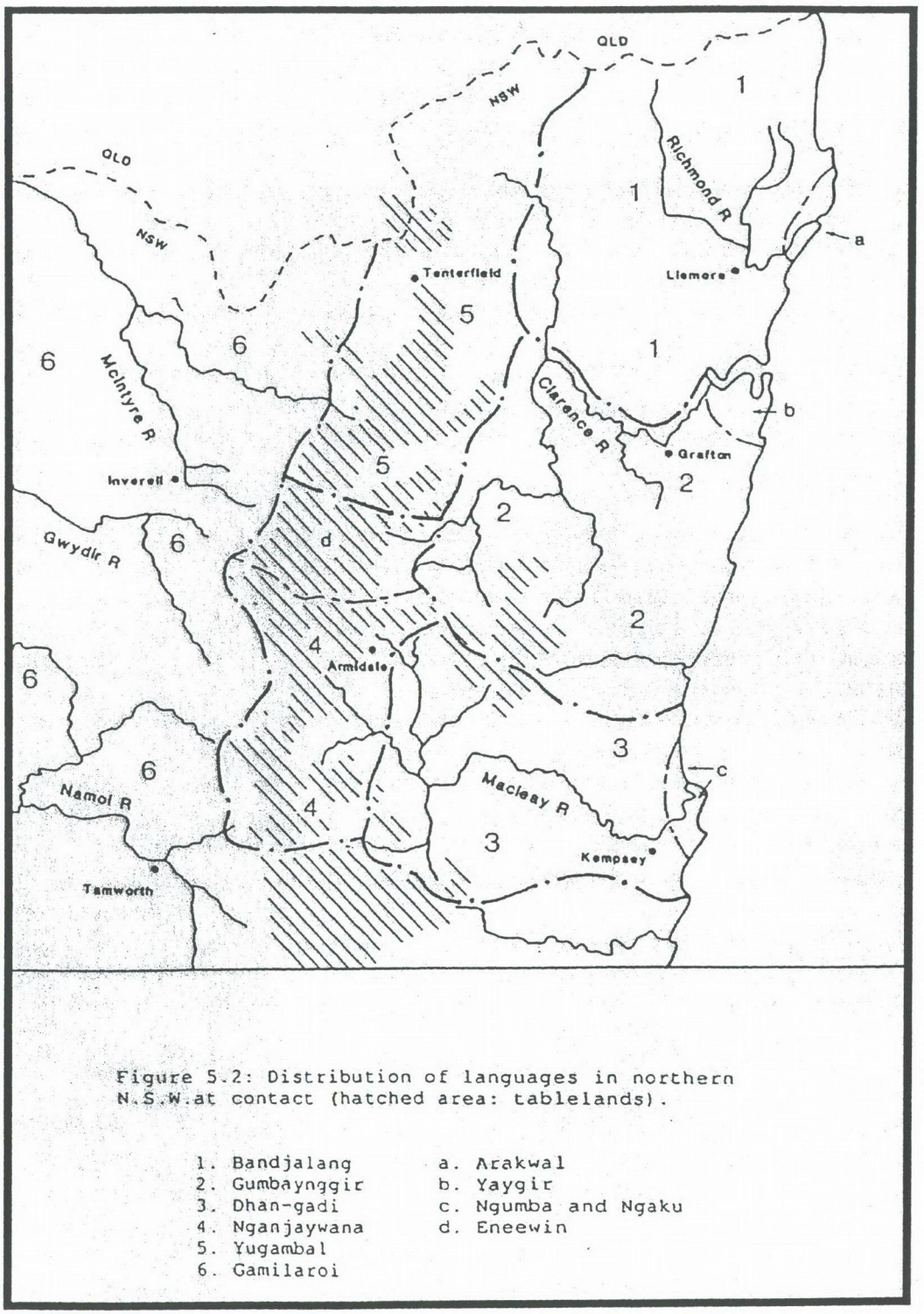


Figure 5.2: Distribution of languages in northern N.S.W.at contact (hatched area: tablelands).

1. Bandjalang
2. Gumbaynggir
3. Dhan-gadi
4. Nganjaywana
5. Yugambal
6. Gamilaroi

a. Arakwal
b. Yaygir
c. Ngumba and Ngaku
d. Eneewin

Figure 5. Distribution of Aboriginal Language Groups in Northeastern New South Wales (from Godwin 1991).

movement from the coastal plains to the Tablelands, via the gorge system. She (McBryde 1976) argued that there was large-scale relocation of people on a seasonal basis, with summers spent on the coast fishing and collecting shellfish and winters spent hunting in the hinterland. Observations by non-indigenous people in the mid-nineteenth century support this position. For example, Oakes (1842:65) commented that Aboriginal people from the Macleay River Valley traversed "the coast during the season favourable for fishing, and the interior during the hunting season". Similarly Hodgkinson (1845:26) stated that the Macleay River Aborigines had little contact with groups to the north in the Nambucca Valley but had "a widespread and persuasive tradition of contact with the tablelands" to the west. For example, Macleay and Clarence River Aborigines as well as New England groups (Belshaw 1966) attended a corroboree near Armidale. This information supports Crowley's (1976) hypothesis regarding the relationship of Tablelands languages with the language of the Macleay Valley.

Godwin (1990, 1991) has reviewed the question of the relations between coastal and New England Tableland groups. He concluded that although Tableland groups did interact moderately with sub-coastal groups on the eastern margins of the Tablelands (the eastern falls area), they did not interact with groups based on the coastline. This pattern of coastal/inland interaction appears to have been different to the south of the Tablelands as Brayshaw (1986:41) has noted that the Birpai (Taree area) along with the Worimi (Newcastle area) had economic, social and religious links with inland groups of the Hunter Valley.

Ethnohistorical accounts report sub-coastal groups moving to the Tablelands, as well as in a north-south direction along the sub-coastal strip from river valley to river valley. This movement appears to have been associated with ceremonial gatherings, which ranged from clan-size gatherings through to inter-tribal meetings. Godwin (1991) also suggests that small bands moved around the Tablelands throughout the year. During the summer months, some, if not all, Tableland groups travelled on to the western slopes and held reciprocal ceremonies with the people of that area. Ethnohistorical accounts do mention small raiding parties occasionally moving into the gorges in the east and onto the sub-coastal plain. There is, however, little evidence of large-scale movement to the east by either the Nganjaywana or Yugambul speakers, either for ceremonies or to escape the exigencies of winter. Despite reports of the movement of sub-coastal people onto the Tablelands, the ethnohistorical record suggests a marked enmity between the more easterly coastal groups and Tableland groups. Conversely, there is little ethnohistorical evidence for joint activities between Tablelands and coastal groups. There are, however, a number of sources that indicate joint ceremonial activity between Tablelands and western slopes groups.

Evidence regarding social organisation also suggests similar networks of alliance and interaction between the Tablelands and western slopes groups. People of the coastal and sub-coastal areas had patrilineal totemic clans, whilst those of the Tablelands and western slopes were matrilineally oriented. Tablelandsand western slopes groups also shared section names, although there were significant differences in their totemic systems (Godwin 1991:3). A further line of evidence about regional interaction patterns comes from the distribution of axes (Godwin 1991:4). Axes from sources on the Tablelands and western slopes are widely distributed across these two areas. Similarly, coastal axes have a wide distribution on the coastal plain. There is,

however, only a single incidence of an axe from either the Tablelands /western slopes or the coast crossing from the Tablelands to the coast or vice versa.

Godwin (1991:4), in relation to patterns of regional interaction, also reviewed art styles. The coastal art demonstrates marked differences with that of the Tablelands / western slopes, particularly in the area of technique and motif selection. In the Clarence Valley, drawings in red ochre and charcoal, with a wide range of motifs rendered in various ways (stick figure, infilled figures, and outlined only figures) are dominant. There is also some stencilling in white clay, and a distinctive engraving style of tally marks, U-shapes, and crown-like or trident shaped motifs. On the Tablelands, however, the art consists purely of red paintings of simple geometric shapes and human stick figures. Bird tracks are also common. There are a few representations of items of material culture (e.g. spears or digging sticks), and some animals, but they are not common. The art of the western slopes is similar to that of the Tablelands with printings of simple shapes and stick figures dominating, although there is some stencilling in red ochre. There are also some engravings. It should be noted, however, that the engravings are of an entirely different form to those found on the coast.

4.2 Economy

Godwin (1983:44) has explored the question of the types of food resources exploited on the Tablelands. He points out that while it is true that the New England Tablelands are a generally poorer environment than, for example, the north coast of New South Wales, the area possessed a number of resources that would have been particularly attractive to the Aboriginal inhabitants. From historical sources he identified three distinct resource zones. The most extensive of these were what the early non-indigenous colonisers described as 'parklands'. These consisted of large areas of fairly lightly wooded country, with heavy pasture. This parkland supported vast numbers of kangaroos, an important Aboriginal resource, as well as other native fauna.

Large expanses of marsh and swamp once found in many parts of the Tablelands (and now uncommon) were also considered to be an important resource zone. For example, the Enmore District, about 20 kilometres north of Walcha, was known as the 'Macquarie marshes' because of these features. These swamps were rich in a variety of foods: crayfish, two types of yams as well as the roots and stems of various reeds, waterfowl and eels. Given the resource richness of these areas, it is not surprising that a number of sites have been found near some of the few remaining vestiges of the Tableland swamps (e.g. near Black Mountain and Llangothlin Lagoons).

The third major resource zone consisted of the numerous grassy clearings found on the Tablelands and along the banks and upper reaches of rivers flowing east off the Tablelands. They were areas devoid of any tree cover, surrounded by the parklands, or, in the Dorrigo area, rainforest. These clearings were recorded with a good deal of surprise by early explorers who chanced on them after tramping through thick bush. They were only 20 – 60 hectares in extent, but were quite common. The cause of these clearings is still debated but fire, swampy conditions and frost hollows are thought to be the agents responsible.

Early non-indigenous observers record Aboriginal firing on the Tablelands; in some cases this was associated with burning off old grass to encourage new growth, thereby attracting kangaroos. The eastern grey kangaroo and red-necked wallaby are noted as being most abundant at the interface of forest and grassland, and it is likely the clearings would have attracted them, creating important hunting areas.

In summary of the resource exploitation on the Tablelands, Godwin believed that the Tablelands were occupied throughout the year (not periodically abandoned as otherwise suggested) by bands of people from the three main language groups. Bands would have ranged widely over the Tablelands and upper western slopes, and occasionally into the gorge country. Resources were exploited when available from both naturally resource rich environments (e.g. swamps/lagoons) and artificially created areas (e.g. fired clearings in woodlands). Plant resources were gathered from the forest/woodland and swamps.

4.3 Material Culture

Material culture items for the Tablelands region of New South Wales comprised spears, clubs, waddies, boomerangs, tomahawks and stone knives (McBryde 1974:13). Spears include barbed fishing spears with the barbs being made from kangaroo teeth (McBryde 1974:13). Gorman (1998:4) notes that stone axes were bound to the haft using strips taken from the inside of stringy bark. Huts were made of bark or reeds, grass and boughs and were often grouped together "in numbers to form small settlements" (McBryde 1974:9). Rugs and cloaks were made of kangaroo and possum skins, sewn with the aid of a bone needle using kangaroo tail sinew for thread. Netted bags made from cord of fur and bark fibres were used for carrying utensils. Nets of bark fibre cord were also used extensively in fishing and hunting. Weirs were constructed across rivers to trap fish. Plant foods were procured and prepared using a toolkit which comprised digging sticks, bags of plant fibre, and pebbles to pound some substances to a paste.

4.4 Population Density

The Aboriginal population density for the New England Tablelands has been estimated at 1 person/ 26-38/kilometres^2 (Godwin 1990:114). Godwin (1990:114) notes that although the density is very low when compared to the coast (1.5-2.5 people/kilometres^2) it compares favourably with population densities for similar environment zones (e.g. Southern Alps). After non-indigenous incursion into the region, the Aboriginal population was decimated by smallpox and other introduced diseases as well as through armed resistance to the takeover of their lands.

4.5 Post-Contact History

The two earliest explorers of the region, John Oxley in 1818 and Alan Cunningham in 1827, saw only a few Aborigines in their travels. It was with the 1830s invasion of pastoralists, who came to take the land and stay, that contact became more extensive. Subsequent to this scale of contact are associated changes in the archaeological record. In this case, the most obvious effect

is a change in Aboriginal demographic patterns and as a result site distribution and frequency. Associated with the non-indigenous settlement are a number of other changes such as the cessation of seasonal movement and the establishment of fringe camps. Contact places (e.g. massacre sites, fringe camps, missions, reserves, etc.) can in themselves be considered by members of the Aboriginal community as sites and places of cultural heritage significance. The aim of this Sub-section is to provide both a social and cultural context to these changes.

The typical pattern of initial friendly contact, followed by Aboriginal population decline through open conflict and diseases, was repeated time and time again as the frontier spread across the continent (ATSIC 1990). As settlement spread beyond the government-established areas, random shootings and premeditated massacres of groups of women, children and men were undertaken by squatters in an effort to clear their selections of Aborigines. Sometimes Aboriginal waterholes were poisoned, or Aboriginal people given flour, sugar or damper mixed with arsenic.

Within the study region massacres occurred at places such as East Tabulam and Myall Creek (near Inverell). Campbell (1978:8) notes "that the ramifications of the Myall Creek massacre, and of the executions of its perpetrators, were far reaching. On the frontier, the effect was to intensify and inflame the relations between the two races". Campbell (1978:9) notes that the period of greatest violence and racial antagonism was between 1832 and 1841. During this period ecological interference and the disruption of the traditional Aboriginal economy occurred. As Campbell (1978:9) notes:

> "The ultimate effect of white colonisation, therefore, was to make indigenous sources of food harder to exploit, while forbidding the introduced substitutes (sheep and cattle) which were both tasty and easily caught. The only alternatives were not pleasant: starve or be hunted down. Such was the pattern of initial contact".

Around 1841 the pattern of conflict changed. Campbell (1978:10) notes that "racialism gave way to paternalism as the structure of the white population changed". However, violent encounters still occurred. Campbell (1978:10) comments that the fertile Tablelands not the rugged country along their eastern margin was preferred by the non-indigenous settlers. Hence, by 1841 "those Aborigines who were not captivated by the marvellous ways of the white men had withdrawn to the gorge country, whence they kept up guerilla raids for a number of years. It is significant that all residual instances of violence between black and white in New England after 1841 took place on or close to the eastern edge of the tableland". By 1849, the Commissioner for Crown Lands in the district reported "the strong and growing good feeling between the two races, and the absence of violence and tension" (Campbell 1978:11).

As Aboriginal people were dispossessed of their land many became dependant fringe-dwellers around the new settlements. Some were employed as stockmen, domestic servants and shepherds. Other Aborigines were forced into government reserves or church missions, where they had to rely on non-indigenous people for handouts of food and clothing. In the 1870s churches again became interested in the welfare of the Aborigines and set up more missions. In 1882 the Aborigines Protection Board of New South Wales was formed and the first reserves were established. For almost the next 100 years - until the 1960s - Aborigines were increasingly institutionalised and their rights restricted by legislation (ATSIC 1990). In the New England region, Aboriginal reserves and settlements were established at Walcha, Armidale, Bellbrook

(Bloomfield 1986:102) and Ingelba (Cohen and Somerville 1990). However, Hall (1992) notes that "important ceremonies such as initiations and burials were continued late into the century. Even today traditional knowledge of ceremonial and occupation sites is retained by some elders".

In 1909 the *New South Wales Aborigines Protection Act* was passed (ATSIC 1990). The Board established by this Act owned all the improvements on reserves, had the power to move Aboriginal people out of towns, appoint police as local guardians for reserves and to control all aspects of the lives of Aboriginal people living on reserves. Amendments to the Act in 1915 and 1918 allowed the Board to remove children from their parents for training, and to force "half-castes" to leave the reserves. These actions led to a considerable loss of traditional knowledge from being passed on between generations, and the break up of families. The practise of traditional lifestyles, including language and religion, were actively discouraged or prohibited.

From the 1920s the official government policy changed from blanket 'protectionism' to forced assimilation for 'part-Aborigines' and in 1940 this assimilation policy was extended to all Aborigines. An implication of this policy was the eventual closure of all reserves. However, the Commonwealth policy of 'self-determination' for Aboriginal people was presented in 1972.

In 1983 the *Aboriginal Land Rights Act* was passed in New South Wales. This Act recognises that the State of New South Wales was traditionally owned and occupied by Aboriginal people and acknowledges the vital importance of land in Aboriginal culture. Under this Act, a system of Land Councils - at State, regional and local levels - were set up. The Act provided for the annual payment of 7.5% of gross State Land Tax revenue in a fund until 1998. Half of this fund was set aside as capital to finance Aboriginal development in future years, with the balance meeting the costs of land council administration and land purchases.

Aboriginal culture in New South Wales is thus being revitalised. An important issue is the management and protection of Aboriginal sites and heritage items. Land Councils and other organisations (e.g. Aboriginal Corporations) provide advice to the National Parks and Wildlife Service, museums and consulting archaeologists on community wishes on these matters.

4.6 Native Title

A search by the National Native Title Tribunal has revealed that there are presently no Native Title Claims over the area where the study area is located (National Native Title Tribunal 2001).

5.0 HISTORICAL CONTEXT

A brief sketch of the non-indigenous history of the region is provided so that the history of the study area is placed in context and so, from an Indigenous heritage perspective, an understanding of prior impacts on the landscape can be understood.

5.1 Colonisation

A number of official and unofficial explorers followed Oxley and Cunningham's exploration of the region (see Lea *et al* 1976:16). The early reports from these people described the Tablelands as being lightly timbered, with some naturally clear areas, ideally suited for pastoral purposes.

As reports of the region's potential became known, squatters soon arrived and in 1839 the New England Pastoral District was declared. Deepwater Station was taken up in 1839, Tenterfield Station probably occupied in 1840 and Boliva Station taken up in 1840 or 1841. Other stations included Glen Innes, Bonshaw and Mole River. The Darling Downs Pastoral District, easily reached from the Tablelands, was excised from this District in 1843. Wool from the Tablelands was shipped out via the Clarence and Port Macquarie. The first New England wool moved to the coast via Tenterfield, Tabulam and Smith's Flat to Copmanhurst. All wool went via this route until 1842. Between 1844 and 1847, wool from Glen Innes went to the coast down the big hill, travelling via Newton Boyd to Buccarumbi, following the valley of the Little River, along the ridge tops to the north of the Glen Innes to Grafton Road (Halliday 1988:11). From 1847 this route fell into disuse and for twenty years all the New England wool was moved by teams through Tenterfield and Drake to the Clarence River near Tabulam (Halliday 1988:11).

The timber cover was an important factor in the siting of new selections in uncleared bush country. For example, country vegetated in Peppermint and White Ash was considered favourable since it supported an extensive grass cover even before clearing and burning. The well-drained ridges, however, were avoided since the soil was thin and the timber dominantly Stringybark, supporting little grass in the natural state and hard to clear with much natural regrowth (Smailes and Molyneaux 1965:43).

Later, miners, then selectors, agriculturalists and orchardists also settled and developed the region. The number of pastoral licences rose to 132 in 1848, and peaked in 1879 at 176 runs, although by this time some of the older runs had been sub-divided. Miners joined pastoralists in the region in 1849 with the discovery of gold at Baldblair Station near Guyra. In 1856 gold was being mined at Oban and in 1859 the Rocky (or Timbarra) River to the east of Tenterfield became a gold field. A general decline in gold mining occurred after 1857-58. From the 1880s through the 1890s there were several attempts to establish reef mining in the area (e.g. Glen Elgin, Kookabookra). However, this venture did not last (Steel 1990). Tin mining occurred in the Mole River area in 1872 and in 1881 tin was discovered in the Torrington district and tin mining in this area expanded and continued until the first two decades of this century (Rosen 1991). Arsenic was mined in the Mole River area from 1920 to 1940.

The development of towns within the region was closely associated not only with large squattages, but also with stage camps, watering places and fords along the main communication routes. Armidale and Somerton were proclaimed villages in 1839, followed by Warialda and Wee Waa in 1848. Tamworth was surveyed in 1849 and Walcha in 1851. Proclamations of towns included Tenterfield in 1851, Glen Innes in 1852, Gunnedah in 1856 and Tamworth in 1859. Most of the other main centres were proclaimed in the mid-1880s.

The diversification of the region's economy led to changes in transport. Halliday (1988:12) notes up to 500 bullock teams transported goods between the Tablelands and the coast. However, the penetration into the region by railways saw their decline. The Great Northern Railway was extended to West Tamworth from the junction town of Werris Creek in 1878, to Armidale in 1883, Glen Innes in 1884, and Tenterfield in 1886, before reaching the Queensland border in 1888. This railway helped to further open up the region, including tourist visitation.

From this time non-indigenous settlement in the region flourished. The bridging of rivers, the development of road and rail transport facilities, the growth of urban centres, changing emphasis in land use and the exploitation of the natural resources have brought about dramatic changes to the landscape.

5.2 Implications for the Archaeological Record

With the invasion of the area by non-indigenous people, the traditional lifeways of the local Aborigines were severely disrupted. Although some Aboriginal site types may have continued to be formed after non-indigenous occupation (e.g. camps - especially along the eastern margin of the Tablelands), the formation of these sites would have declined considerably. Nonetheless, a variety of non-traditional sites from the post-invasion period can be of significance to Aboriginal people, in particular occupational places such contemporary camp locations, missions, reserves and places of work.

The land use activities of the non-indigenous settlers (pastoral activity, logging, settlements) quickly and radically altered the physical environment; this too, has implications for the survival of the archaeological record. In particular, activities that disturb the ground surface are liable to disturb, or indeed, obliterate sites lying on, or within the ground.

Generally, pastoral activities have great potential to damage the archaeological record, initially through extensive clearing of trees. The hard hooves of stock can disturb archaeological sites, especially those located near heavily-frequented watering areas (e.g. creek banks). The erection of stock-associated structures and items such as fences and dams would also threaten any sites in the area of activity.

Construction and development of homesteads whilst forming the cultural record of the historic period, would nonetheless also be particularly destructive to archaeological sites in the area of activity, as would the associated infrastructure such as roads and rail lines.

6.0 ARCHAEOLOGICAL CONTEXT

The aim of this Section is to provide a general understanding regarding Aboriginal archaeological site potential within the study area. Sub-section 6.1 provides a broad outline of the results of archaeological research at a regional level. Further Sub-sections review archaeological consultancies undertaken within and in the vicinity of the study area (Sub-section 6.2). Sub-section 6.3 discusses previously recorded sites within and in the region of the study

area. The purpose of presenting this data is to provide a comprehensive background so that sound predictions regarding the archaeological potential of the study area can be formulated.

6.1 Northern New South Wales Archaeological Record

Although Aboriginal occupation of Australia is dated to about 50,000 years ago (see Lourandos 1997; Brown 1997), dated Aboriginal sites in northeast New South Wales place initial occupation of these sites to the Holocene Period (i.e. from 10,000 years ago).

Hall (1992) notes that "McBryde's (1974; 1977) work in the New England region was one of the first attempts in Australia to construct a regional cultural sequence". Excavations conducted on the coast, in the Clarence River Valley (Seelands Rockshelter), on the Tablelands (Bendemeer Rockshelters) and on the western slopes (Graman Rockshelter), revealed a continuous sequence of occupation dating from 9,000BP (Before Present) and differences between Tablelands and coastal cultures.

Seelands rockshelter in the Clarence River Valley (near Grafton) was first occupied some 6,500 years ago (McBryde 1974). The faunal remains for the Seelands excavation provides information about Aboriginal subsistence along the Clarence River. The bone remains indicate that forest mammals (rainforest and sclerophyll) such as wallaby, kangaroo, possum, bandicoot and native cat were the main component of the diet with fish, tortoise and fresh water molluscs making a minor contribution (Byrne 1985).

On the New England Tablelands analysis from excavations at Bendemeer Rockshelters 1 and 2 and Graman Rockshelters have revealed an initial occupation date of 4,400BP and 9,000BP respectively. The Graman Rockshelter sites lie on the western fall of the Tablelands, on Ottley Creek where the geology is predominantly basalt and sandstone. Two of the four sites excavated yielded backed blade industries dating to 4,960BP and 5,450BP. The presence of grindstones may also reflect some reliance on grass seeds as part of the prehistoric diet. Dietary remains include brush-tailed possum, bandicoot, grey kangaroo, lizard, fish and shellfish. The upper layers in site GB4 (McBryde 1976) demonstrated an increased presence of bandicoot (and decrease in the presence of grey kangaroo) which was also associated with higher numbers of edge-ground axes.

Located on the Tablelands to the west of Bendemeer township, Bendemeer Site 1 and Bendemeer Site 2 yielded sequences of c. 3,000BP to 300BP and c. 4,350BP to 950BP respectively. In these sites, yam replaces grass seeds as a food source, backed blades are prominent and grinding equipment is absent (McBryde 1976). As a result of the analysis of excavated material from these sites McBryde (1974:336) notes that stone tool assemblages on the coast and Tablelands were distinct for the period following c.3,000BP and comments: "whether this difference represents a cultural boundary, or assemblages geared to the demands of two distinct natural environments and associated subsistence economies is a vital question for New England prehistory". McBryde (1974) also used the spatial distribution of art styles and stone axes in her reconstruction of the Tablelands prehistory. Art types were discussed in Sub-section 4.1. The distribution of stone axes derived from quarries on the Tablelands was

exclusively to the west of the escarpment boundary (Binns and McBryde 1972); a finding that supported the proposed cultural division between the Tablelands and the coast. More recent research (Hall and Lomax 1993) has revealed that this division may not have been so rigid in the north-eastern section of the Tablelands as axes from quarries on the Tablelands were located in the sub-coastal ranges.

Belshaw (1978) formulated the 'marchlands' hypothesis that proposed that the Tablelands climate was the dominant influence on seasonal migration and, with the onset of cold weather, the Aboriginal people were forced to move to new areas. Within this hypothesis, the Tablelands were regarded as a marchland between the western slopes and the coastal areas. The central Tablelands maintained a steady population throughout the year, while the northern section was occupied during the summer months by Aborigines from the western slopes and the southern section by Aborigines from both the western slopes and the coast (Belshaw 1978:78).

Bowdler (1981:107) believed that Belshaw's hypothesis could be redefined to suggest that the marchland was in fact an area common to several social groups because of its religious significance. This redefinition was based largely on the distribution of archaeological sites located by McBryde (1974) during her research. According to McBryde there were no recorded artefacts, stratified occupation deposits, or surface Bondaian sites on land over 1,000 metres. Hence Bowdler (1981:107) using this information along with other sources, suggested that land above 1,000 metres was used for ceremonial activities and the economic range of the Aboriginal inhabitants was between 600 and 1,000 metres.

More recent archaeological research by Godwin (1983), however, has located sites above 1,000 metres. Godwin suggests that the apparent lack of sites in McBryde's work was due to her survey methodology, which while suited to her research question would have only been expected to reveal the more obvious sites (e.g. ceremonial sites). Godwin (1983:45) noted that the New England sites with which he was familiar exhibited a high degree of variation in terms of size and density of stone artefacts. To class all of them as 'transit' sites with extremely sparse occupation, as suggested by Bowdler (1981), would appear to him to be an oversimplification of the evidence. Godwin (1991:2) therefore provides a more fine-grained interpretation regarding regional interaction in northeastern New South Wales. Generally, he argues that although there was interaction between the Tableland people and those on the adjoining sub-coastal plains and western slopes, there was little interaction between Tablelands and coastal people (**Figure 6**).

Godwin (1990) also addressed the issue of open site dating and proposed that open sites in the Tablelands region do not pre-date 4,000BP. This proposal was based on comparisons of the morphological attributes of stone artefacts from dated layers of excavated sites. Godwin (1990) also noted that generally stone artefact scatters are small and of low density although more extensive sites have been located near stone quarries and major watercourses.

Other archaeological work in the region includes excavations by Horton and Connah (1981) and Williams (1980) and a field survey by Davidson (1982).

Horton and Connah (1981) excavated a site at Reddestone Creek to the north-west of Glen Innes. The major interest in this site was the presence of megafauna. However, stone artefacts were

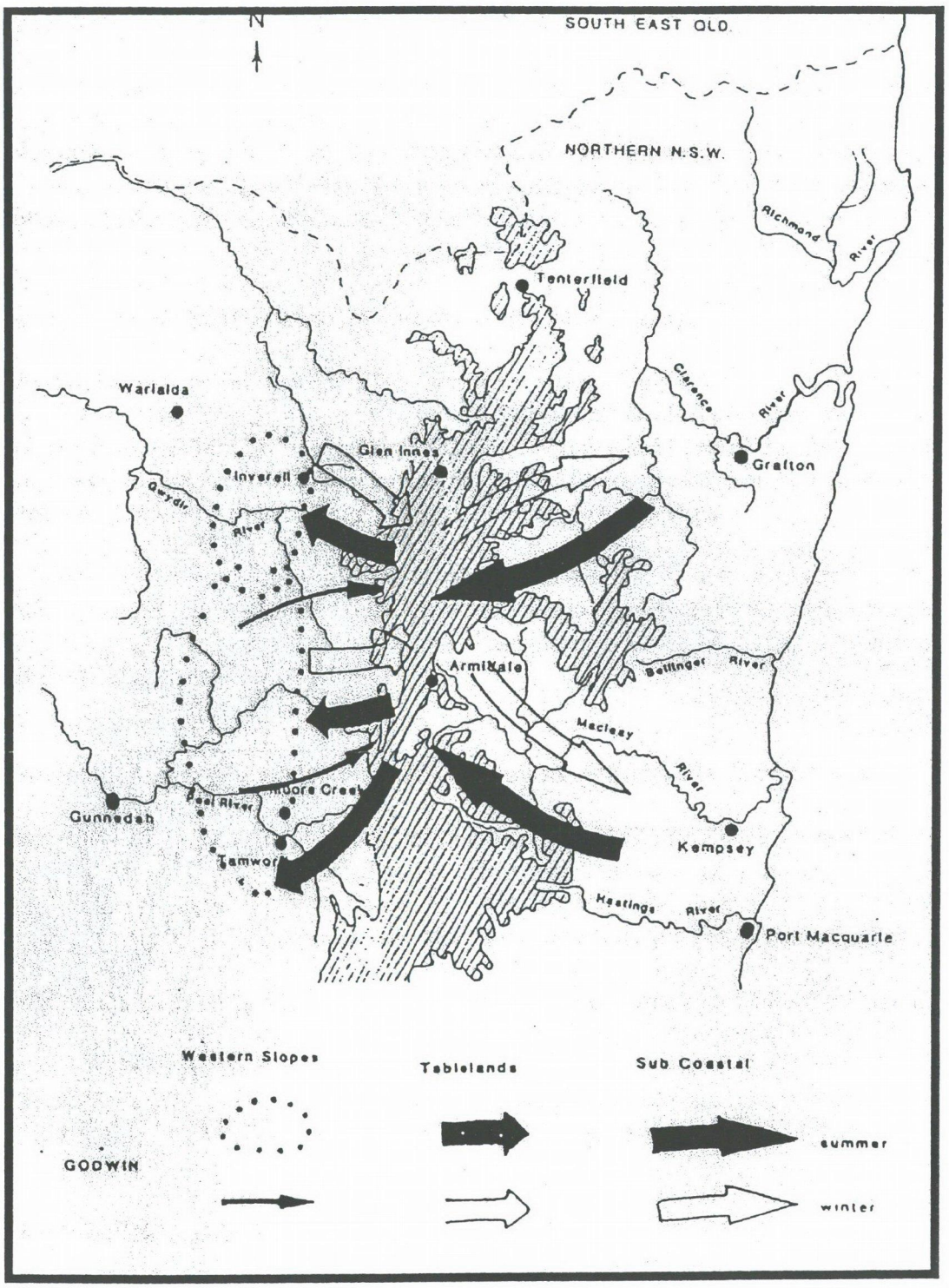


Figure 6. Godwin's Model of Seasonal Movement in Northeastern NSW (Godwin 1990: 124).

found not only on the ground surface but also in a sub-surface context. This site is located at 1,040 metres a.s.l.

Williams (1980) excavated sediments within several rockshelters in the vicinity of the Mount Yarrowyck art site, previously recorded by McBryde (1974). From her analysis, Williams (1980) concluded that the sites were occupied between 400 and 5,000 years ago.

Davidson (1982) undertook research at Llangothlin Lagoons to the north of Guyra. The lagoons are located 1,300-1,400 metres a.s.l. As noted above (see Sub-section 4.2) such areas were considered to be an important resource zone for Aboriginal exploitation. Davidson (1982) located a number of stone artefact scatters in the vicinity. Additionally, edge-ground hatchets and grinders were also reported to be located adjacent to the Lagoon.

6.2 Cultural Heritage Surveys within and in the vicinity of the Study Area

Byrne (1983) undertook an investigation of the Aboriginal archaeological record in the Tenterfield area for the State Forests. His investigation included Forestland State Forest (to the east of the present study area). A total of 19 sites were located during the survey. Byrne (1983:28) noted that there is a tendency for artefacts recorded in the plateau areas to be most dense close to swamps.

Griffiths (1995) undertook a survey of a proposed optic fibre cable route between Deepwater and Tenterfield (to the east of the present study area). Griffiths (1995:18) noted that "no Aboriginal sites or relics or areas [of] potential for Aboriginal site location were found during this investigation. The area does not contain Aboriginal sites of significance to local Aboriginal Communities".

Davies (1998) undertook a survey of the location of Telstra optic fibre cable routes and scad sites in the vicinity of Sandy Flat (southeast of the present study area). A stone artefact scatter and an isolated stone artefact were located during this survey. The stone artefact scatter was located on a low spur adjacent to an unnamed tributary of Five Mile Creek and the isolated stone artefact was located on a dirt track on a major ridgeline. The artefacts included flakes, broken flakes and flaked pieces. The artefacts were manufactured from a variety of raw materials including quartz (including crystal quartz), volcanics and mudstone.

In 1998 the Moombahlene LALC advised (see Davies 1998) that a few archaeological surveys had been undertaken on the western side of the New England Highway (to the west of the present study area). However, Aboriginal sites were not located during theses surveys (Bruce McIntosh, Moombahlene LALC, pers. comm., 1998).

6.3 Previously Recorded Indigenous Cultural Heritage Sites in and adjacent to the Study Area

Information provided by the New South Wales National Parks and Wildlife Service (NPWS) show that there are no recorded sites located within the study area. However, there are sites in the vicinity. For example, a Bora Ground is located at Bolivia to the immediate south–south east of the present study area; a rockshelter with art is located at Mt Mackenzie to the north-northwest of the study area; and to the southeast of the present study area is the Sugarloaf Hill Bora Ground / Ceremonial site. The stone artefact scatter and isolated stone artefact mentioned in Sub-section 6.2 are also located to the south-southeast of the present study area.

A search of the Register of the National Estate shows 26 records within the Tenterfield Shire. No places on this Register are within the present study area.

6.4 Summary of Archaeological Context

Although not a substantial amount of archaeological research or consultancies has been undertaken in the immediate vicinity of the study area, it is considered that archaeological knowledge regarding possible site types and potential areas for site location is relatively detailed. Based substantially on the information contained within this Section (6.0) with additional information from Section 7.0, a predictive model of site location is proposed (see Sub-section 8.2.1).

7.0 THE POTENTIAL CULTURAL HERITAGE RECORD

Although Aboriginal people would have exploited all parts of the terrain present within the study area, their activities will only be reflected in the **archaeological** record if there are physical remains. However, many sites of significance to Aboriginal people do not contain such remains. In the following Sub-sections and based on information provided in the previous sections of this report, the most likely archaeological (Sub-section 7.1) and cultural (Sub-section 7.2) site types that may be found within or immediately adjacent to the study area are discussed. The notion of Cultural Landscape is discussed in Sub-section 7.3.

7.1 Archaeological Site Types

There are potentially at least five archaeological site types than may be located within the study area:

- ***Stone Artefact Scatters***

Stone Artefact Scatters are the remains of activity sites and contain evidence of Aboriginal activities such as the manufacture of stone artefacts. These sites may represent periods of variable duration and may reflect a variety of activities. Due to the resilient nature of stone material, Stone Artefact Scatters are also the most common archaeological site type.

Aboriginal people fractured fine-grained isotropic rocks to produce sharp cutting and scraping instruments. The raw material and form of stone tool artefacts can be quite varied, although fine-grained isotropic rocks, such as quartz, chert and silcrete, were preferred where sharp cutting and scraping edges were required. Crystalline volcanic rocks such as basalt, or pebbles of raw material such as argillite or greywacke, were flaked and then ground to form hatchet-heads for a variety of chopping and cutting tasks. The results of such activities as well as stone artefacts themselves occur as scatters of modified stone (e.g. cores, flakes, flaked pieces, hammerstones, and anvils). Owing to site frequency and artefact density, Stone Artefact Scatters provide valuable information relating to past Aboriginal settlement and culture.

Stone Artefact Scatters often indicate the remains of occupational camp sites where other associated organic material has decayed, but they can also reflect the results of a specific activity (e.g. stone knapping site or food processing site). Sometimes Stone Artefact Scatters are recorded as Knapping Sites where only that specific activity is present. Knapping Sites and Stone Artefact Scatters, along with other site types such as hearths (fireplaces), shell middens, burials, shelters, etc., are often called Site Complexes.

Stone Artefact Scatters have been found in various locations, although the majority tend to be located on reasonably level ground. Higher density artefact scatters will generally be located closer to permanent water, whereas lower density and background scatters may be found some distance from permanent water.

Scatters of stone artefacts can be found in varying concentrations either in open terrain, or in rockshelter settings. The designation "site" is most commonly applied to high-density concentrations of archaeological material, whilst the surrounding intermittent, low-density material is referred to as "background scatter". This "background scatter" often occurs in the form of isolated artefacts. Researchers often assume that all significant cultural information occurs within high-density concentrations of artefacts and areas of low artefact density or isolated items (background scatter) are of no value. A more accurate approach is to view the archaeological record as a more or less continuous artefact distribution of variable density across the landscape (see Dancey 1981; Dunnell and Dancey 1983:272; Dunnell 1992:34).

Within the study region stone artefact scatters have been located in various positions including ridge lines, low spurs and elevated locations immediately adjacent to streams and swamps.

- ***Quarries***

Quarry sites occur where outliers of suitable tool-making stone or ochre occur. Both igneous and sandstone outcrops were quarried. A quarry may be generally recognised by the evidence of human extractive activities and preliminary processing of the extracted material (knapping location manifesting as a stone artefact scatter) (Bell 1986:33; Flood 1983:247).

Binns and McBryde (1972) noted that the source of raw materials for artefacts were sometimes from local shingle beds. Also, other archaeological surveys have located quarries of loose surface rock (see Hall and Lomax 1993). Both quarry types may be present where the geology is suitable. For example, silcrete, chert and/or quartzite cobbles present on the ground surface may have been used for stone artefact manufacture.

➢ ***Scarred Trees***

Trees are scarred as a result of the removal of bark for the manufacture of material culture items such as shields, water containers, canoes and roofing for shelters (Bell 1986:32; Sullivan 1984). Scars may also result from the extrication by Aborigines of possums or honey from trees, and may be in the form of toe-holds in the trunk or larger branches. Scarred trees are common in riverine areas.

There are non-cultural reasons that a tree can be scarred (e.g. lightning strike, fire, branch throw). However, a number of criteria can be used to distinguish culturally derived scarring. Such criteria include (see Aboriginal Heritage Unit n.d.):

* the maturity of the tree, particularly for pre-contact scarring;
* a generally regularly shaped, elongated, oval scar;
* the termination of the scar before the ground level;
* an exposed heartwood which does not exhibit major irregularities;
* no evidence that a branch was present at the top of the scar; and
* the presence of axe marks at the top or base of the scar. The axe marks may be either from stone axes or metal axes (post-contact site).

These criteria hold best for scars originating from the production of shields, water containers, canoes and roofing for shelters. However, scars that were made as toeholds are generally much smaller, and less regular. Also, the above criteria does not take into account that regrowth around the scar not only has the potential to conceal outline cuts but also conceal the original shape of the scar. Differential regrowth may also result in a shape that is not regular.

➢ ***Burials***

Burials are generally found close to areas where occupation was concentrated, though individual burials can occur almost anywhere. Burials are frequently associated with carved trees (Bell 1982). The majority of burials occur where soft sediments are available (e.g. alluvial flats adjacent to watercourses, sand dunes) and in caves or rockshelters (Bell 1986:30).

➢ ***Contact and Post-Contact Period Sites***

Aboriginal settlement patterns and lifestyles changed significantly as non-indigenous people moved into local areas. Destruction of major portions of the natural landscape forced Aboriginal groups into a dependent relationship with the non-indigenous settlers. Locations where initial contact between non-indigenous and Aboriginal people occurred, and fringe encampments which began to develop after contact, are often remembered by Aboriginal people living today (Goulding 1993). Because of the close and personal historic contact Aborigines may have with these camps and locations, they regard them as significant and part of their history to be documented and, in some cases, preserved.

7.2 Cultural Site Types

The following site types generally do not have physical indicators of their presence:

➢ ***Mythological Sites and Places of Significance to Aboriginal People***

Mythological Sites usually involve no alteration to the natural landscape. As such they are archaeologically invisible and can only be identified with the aid of Aboriginal consultants. Such sites hold particular cultural significance to Aboriginal people.

Despite assumptions to the contrary, there exists a vital knowledge of 'sites of significance' amongst Aboriginal people. The Aboriginal Sites of Significance Survey conducted in New South Wales during the 1970s resulted in the recording of over 500 sites of Aboriginal significance. A large proportion of these sites were mythological or ceremonial sites (Godwin and Creamer 1984). A case study by Godwin and Creamer (1984) at Yamba, at the mouth of the Clarence River, yielded numerous places of significance to Aboriginal people which were classified under a number of categories as follows:

Good Food Places

These were places from which good supplies of fish, yams, birds' eggs, and so on, can be obtained.

Recent Camping Places

These consisted of two kinds. First were those associated with the location of Aboriginal missions and reserves in the area over the past 100 years. Second were those associated with getting away from town, and these often served as base camps for food-gathering activities.

Dangerous Places

These were identified as being where there had been a manifestation of a spirit, or where such manifestation might occur. Usually it involved a person being physically harassed by a spirit.

Mythological Sites

These were identified by the presence of a feature central to a myth or that is explained by a myth. Mountains, rocks, swamps, and other natural places may be mythological places.

Ancestral Camping Places

These were usually identified by spirit harassment.

➢ ***Violent Contact Sites/Massacre Sites***

These sites often have no physical alterations to the landscape and no documentation. Consultation with local and Aboriginal informants assists in the identification of such sites.

Archaeologists cannot predict the presence of cultural sites of significance. However, from background research and Aboriginal consultation the presence of such sites may be revealed.

7.3 Cultural Landscape

Although all the above mentioned site types are described in isolation of each other the pattern of distribution of such sites in the landscape should be viewed as providing information regarding the cultural landscape. That is, sites do not occur in isolation from other sites but are linked by various overlapping and interconnected relationships. Aboriginal people also managed the landscape in various ways (e.g. firing, deliberate plantings, fish traps, etc.) for resource

utilisation. Thus, to Aboriginal people the landscape is part of the cultural heritage. As Ross (1996:9) notes:

> Generally speaking, Aboriginal people view landscapes differently from non-Aboriginal people. To most Aboriginal people a landscape is an entity in its own right. And it is more than the land alone, as the concept incorporates relationships between place and people, both in a spiritual sense and from the perspective of the resources which the landscape supplies. Although different components of the landscape may be recognised and named, the whole is more than the sum of its parts.

8.0 LANDSCAPE ARCHAEOLOGY

This Section of the report outlines the environment and resources of the study area. These are discussed in terms of their possible implications for the archaeological and cultural record. Following this discussion, and based on information contained in all the preceding sections of this report, a predictive model for the study area will be proposed.

8.1 Environment and Resource Background

The following sections outline the topography, geology, vegetation, and fauna patterns within the study area. These aspects of the environment are indicators for archaeologically sensitive areas. For example, the archaeological implications for these related factors include:

- ***Topography***

This factor relates specifically to access and available camping locations.

- ***Geology and Soils***

An understanding of the geology of the region provides information related to the types of lithic materials available for exploitation by Aboriginal people. Soils are derived from the underlying geology or from fluvial or alluvial processes that have the potential to conceal or expose sites. In areas where a deep soil profile is present the potential for stratified archaeological sites is greater. Soils can also influence vegetation patterns.

- ***Vegetation***

The type of vegetation communities present in the region relate directly to the types of plant species available for exploitation and indirectly to the faunal species supported by the available plant species.

- ***Fauna***

The type of faunal species present relates to various factors including vegetation type and water availability. Additionally, terrain types (e.g. open coast, estuarine, valleys, ranges, etc) also affect the presence/absence of particular species.

All these factors affected the types of exploitation strategies employed by Aboriginal people and hence the formation of the archaeological record. Additionally, these factors also affect the survival and present detectability of sites (see Sub-section 8.2).

8.1.1 Topography

The study area is located between Bolivia and Sandy Flat on the Northern Tablelands of New South Wales (see **Figures 1 and 2**). It is generally slightly undulating to flat topography with elevations around 840 – 860 metres a.s.l. (above sea level). The study area does not contain any major rivers or creeks, rather it cuts across the upper reaches of ephemeral branches of (mainly) Four Mile and Sandy Creeks.

➢ ***Archaeological Implications***

Based on available ethnographic data and knowledge of site location for the region, terrain adjacent to permanent watercourses and swamps was the preferred area for long-term or consistently used camping places. However, as the watercourses in the study area are minor and swamps are not present, there is a potential that long-term or consistently used camping places will not be located. However, low-density stone artefact scatters or isolated stone artefacts may be located (see Sub-section 8.2). Evidence of the use of this area would be in the form of one or more of the potentially occurring archaeological site types (see Sub-section 7.1). Although not evident from the archaeological record, cultural factors may have also affected the placement of camps within the study area.

8.1.2 Geology and Soils

The underlying geology for the study area is Permian deposits of Sandy Flat Adamellite with deposits of Dundee Adamellite Porphyrite being located to the immediate west (Grafton 1:250,000 Geological Series Sheet SH56-6). Both are igneous derived material (granites) with the Dundee Adamellite containing more imbedded quartz than the Sandy Flat Ademellite.

Granite derived soils are generally erodible duplex soils, often contrasting between sandy A horizons and clay B horizons. Most of the soils tend to have a high proportion of quartzitic sandy material (Severn Shire Council 1999). Soil depths are variable depending on the topography.

➢ ***Archaeological Implications.***

It is likely that lithic raw material (a variety of igneous materials) suitable for the manufacture of stone artefacts would have been available specifically within the study area. It is also likely that suitable stone material would have been available from the lag and shingle deposits within creek beds.

Where soils present in the study area have a deep soil profile and are within an aggrading landform generally there is a high potential for the presence stratified archaeological deposits. Due to the regular deposition of sediments in these areas, however, detectability of such deposits is often constrained. In areas with skeletal soils (i.e. with a shallow soil profile) site detectability is enhanced. However, such areas are often subject to erosive factors (e.g. wind or water). These erosive processes have the potential to modify or disturb the internal structure of sites (e.g. stone artefact scatters). Only a few site types are not affected by these processes (e.g. scarred trees). In sum, the detectability and preservation of sites is often related to soil characteristics (see Sub-section 8.2).

8.1.3 Vegetation

Since non-indigenous settlement, the study area has been subjected to extensive clearing. Additionally, much of the vegetation within the road reserve has been previously cleared for road works and the present vegetation is generally regrowth. However, mature tree species are evident in some sections of the road reserve indicating that these sections have either been selectively cleared or have not been previously cleared for road works. Vegetation species include a variety of dry sclerophyll forest types (Open Eucalypt Woodland community). As a result of rains over the past few months, the grass cover in the area is dense and high.

➢ ***Archaeological Implications.***
Before being heavily modified by non-indigenous settlement, the naturally occurring vegetation communities in the area would have provided a wide variety of resources for exploitation (food and material culture items; see Sub-sections 4.2 and 4.3). Physical indications of this activity are likely to be visible as scarred trees. However, the implications of clearing that has occurred within the study area is that the occurrence of this site type would be restricted in extent to locations where mature tree species are still present. As a result of thick grass cover ground surface visibility will generally be poor.

8.1.4 Fauna

As mentioned above (Sub-section 8.1), the appearance and distribution of fauna within an area relates to factors such as vegetation communities, water availability and terrain types. It is considered that prior to non-indigenous settlement the study area would have contained a diverse range of faunal species. Species present would have included kangaroo, wallaby, wombat, possum, dingo, flying fox, and koala, as well as reptiles (e.g. lizard, snake), birds and aquatic species. Non-indigenous settlement and associated economic activities have significantly disrupted the area's original faunal communities.

➢ ***Archaeological Implications***
All the faunal species mentioned above were utilised by Aboriginal people and indicators of this activity may be present in the form of bone remains that are most likely to occur within stratified archaeological deposits.

8.1.5 Summary Implications

It is considered that, given the environment and resources available, the terrain within the study area would have been exploited by Aboriginal people. This exploitation would have related to flora, faunal and lithic resources. The detectability of certain site types (e.g. stone artefact scatters, isolated stone artefacts) may be considerably reduced by poor ground surface visibility.

8.2 Landscape Archaeology Approach

One useful approach to generating predictive models for Aboriginal archaeological site location employs the notion of landscape archaeology. This approach follows the tenets of predictive modelling in hunter-gatherer archaeology whereby different environmental zones are seen to have provided distinctive sets of constraints on land-use patterns, particularly in terms of foraging behaviour and camp placement. Predictions are based on the known pattern of site distribution in similar land systems. The division into environmental zones relies on factors such as landforms, soils, vegetation, etc. These factors are assumed to have provided distinctive sets of constraints, which influenced prehistoric land use patterns in each zone. Hence, site types and their distribution should differ between zones. However, the detection of sites in each zone often depends on the following factors:

- ***Ground surface Visibility.***

The nature and extent of the ground cover (e.g. vegetation) determine this factor.

- ***Burial of Original Land Surfaces*** (e.g. by aggrading flood alluvium or slope wash).

- ***Exposure of Prior Land surfaces*** (e.g. surfaces eroded by water or wind erosion forming features such as gullies and sheet-eroded surfaces or washouts along vehicle tracks).

Exposure can also be enhanced by activities which disturb the ground surface (and at the same time disturb the site). Ploughing and logging are two examples of this form of disturbance.

- ***Site Obtrusiveness.***

Some sites such as stone arrangements are easier to detect than (for example) sparse scatters of flaked stone artefacts, especially where the latter occur on well-vegetated surfaces.

- ***Archaeological Visibility.***

This factor relates to how observable archaeological material is on a given land surface. For example, stone artefacts will be easily observed on gravel free soils, where as on stony terrain these artefacts will be less easily detected.

8.2.1 Preliminary Predictive Model

Generating a predictive site location model has two components - 1. predicting the range of possible site types, and 2. predicting where those different site types might be found. For the purposes of this study, the predictive site location model was based on previous surveys in similar environmental area - specifically those mentioned in Sections 4 and 6. Hence this Sub-section addresses the implications of the above research and discusses in detail the potential archaeological site types and distribution of these types within the present study area.

The study area is generally gently undulating terrain dissected by a few minor watercourses. The geology of the study area suggests that lithic material would have been available for the manufacture of stone artefacts. The area has generally been cleared of its original vegetation cover. As a result of recent rains, a dense cover of grasses and weeds are present throughout the

study area. It is considered that a variety of food resources would have been available within the area and it is likely that exploitation of these occurred.

Ethnohistoric data and the known archaeological record suggest that Aboriginal people frequented the area, especially terrain adjacent to watercourses and swamps. The material culture remains of the exploitation of resources in the study area would include stone artefacts, quarries and scarred trees. A number of archaeological consultancies have been undertaken in the vicinity of the study area. Site types recorded were open campsites (stone artefacts scatter and isolated stone artefact). Bora Grounds have also been recorded in the vicinity.

It is predicted that the main archaeological **site types** likely to occur in the study area would be stone artefact scatters (including isolated stone artefacts), quarries and scarred trees. However, the possibility that other site types, such as burials, may also be present should not be dismissed. Based on the above discussions, predictions regarding **site location** relating to the study area are provided. Given the environment of the study area, it is predicted that:

- Stone artefact scatters (including isolated stone artefacts) would most likely to be present on the crest of ridge or spur lines or on high banks adjacent to creeks.
- Quarry sites may be present where suitable raw material is outcropping or where stream shingle beds and/or overlying lag deposits within creeks contain suitable raw material.
- Scarred Trees may be located within selectively cleared sections of the road reserve.

Given that a high percentage of the study area has been disturbed from past road works, the likelihood of locating *in situ* material is considerably reduced. Archaeological visibility, as a result of the sandy soil, should be good but ground surface visibility, as a result of the presence of dense grass cover, would generally be poor.

The archaeological potential of the study area is considered to be low to medium. That is, the study area does not contain feature indicative of a high potential. Such features would include the high banks of a major creek or river, swamp terrain and/or major spur or ridgelines.

8.2.2 Summary

It is considered that the study area is of generally low to medium archaeological potential. Prior disturbance throughout the study area has considerably reduced both the likelihood of locating sites and/or of locating *in situ* material.

9.0 SURVEY BACKGROUND

This Section of the report outlines the methodology of the field work phase of the study and includes Sub-sections outlining the survey aims (Sub-section 9.1), site definition (Sub-section 9.2) and site recording methods used (Sub-section 9.2.1).

9.1 Survey Aims

The aims of the field survey were to locate and document Indigenous cultural heritage sites that occurred within the study area. It was considered that should sites be located that basic data on site form and content would be recorded so that significance assessments of sites could be undertaken and the appropriate recommendations for each site determined.

9.2 Site Definition

For this study the individual artefact was taken as the basic unit of analysis and areas of higher artefact density were regarded as only a part of the total pattern. Hence, for this study, an archaeological site was defined as any location exhibiting physical evidence of past Aboriginal activity. However, areas of significance identified by the Moombahlene LALC representatives during the survey would also be given a site number.

Discreteness of a site was determined by defining a site as being spaced a distance of more than 50 metres from the nearest other location exhibiting evidence of past Aboriginal activity. If, however, cultural material (less than 50 metres apart) was separated by a creek or gully, then this would be regarded as two sites.

9.2.1 Site Recording

The location of all sites was recorded with a Gamin GPSII Plus GPS Unit. Information recorded included northing and easting of location, site type, site description, site area, environmental setting and condition of the site including any disturbance. Sites were numbered sequentially as recorded.

10.0 THE FIELD SURVEY

This section of the report details the survey methods and constraints of the archaeological field work conducted in the study area on the 27th February, 2001, by Su Davies (Davies Heritage Consultants Pty Ltd) and Darren Daley and Bruce McIntosh (Moombahlene LALC).

10.1 Survey Methods

To achieve the survey aims, the strategy employed for this survey was for the archaeologist and the representatives from the Moombahlene LALC to walk the length of the study area spaced evenly within the road reserve. For example, where the reserve was narrow on one side of the road and wider on the other side, one of the field crew would survey the narrow side while the remaining two members of the field crew would be spaced evenly across the wider road reserve. Where the boundary of the road reserve was not clear, the survey team inspected an area no more

than 30 metres wide along the western side of the New England Highway and on the eastern side of the Highway used the now disused railway line as the boundary indicator.

10.2 Constraints

The major constraints to the survey were ground surface visibility and ground surface disturbance. Ground surface visibility was generally poor (i.e. less than 10%) and the only areas where the ground surface was visible were areas of disturbance. Ground surface visibility was categorised as follows:

1.. Poor ground surface visibility (0-10%) was a characteristic of the majority of the study area (**Plates 1**). Thick, and long, grasses were present throughout the study area.



Plate 1. Poor Ground Surface Visibility

2. Medium ground surface visibility (11-70%) was extremely restricted in extent and occurred in areas where leaf litter on the ground surface was not thick.

3. Good ground surface visibility (71-100%) was present in areas of ground surface disturbance (e.g. road cuttings, road verge) (**Plate 2**).



Plate 2. Good Ground Surface Visibility.

Ground surface disturbance as a result of previous road works was evident throughout the study area. Generally, this disturbance was not evident within the entire area of the road reserve. In some sections the disturbance seemed to extend out to around 8 – 10 metres to either side from the edge of the bitumen. The tops of road cuttings have been disturbed from the installation of drains and table drains of varying depths are located on both sides of the road. The areas of new growth vegetation also assisted in defining the most disturbed areas.

The areas of ground surface exposure were generally areas of extensive disturbance or erosion (e.g. eroding road cuttings). Although these areas provided ground surface visibility, if archaeological material was located in such an environment it would most likely not be *in situ* (i.e. in its original location) and hence the integrity of the site would be questionable. Additionally, the method of fracture would also be questionable. That is, stones that are fractured by heavy machinery (e.g. graders, tractors, etc.) may exhibit similar features to culturally fractured artefacts.

10.3 Survey Coverage

An accurate estimate of the survey coverage is not possible as the exact width of the study area (road reserve) was extremely variable and at times unclear. However, it is conservatively estimated that 16.05 kilometres of transects (three people surveying a transect length of 5.35 kilometres) with an average width of 10 metres were covered during the survey. Hence, approximately 160,500 square metres (16.05 hectares) of the study area were subjected to an archaeological survey. The study area is approximately 5.34 kilometres in length and, on average around 30 metres wide. This width is an estimate only as, at times, the boundary of the road reserve was not clear. However, this calculation results in a study area of 160,200 square metres (16.02 hectares) in size; a size smaller than the survey area. This discrepancy can be explained as a result of the lack of a peg marking the northern boundary of the study area. The location of the northern boundary was estimated by the survey team from available maps. **Table 1** provides a general estimate of the percentage of area that was actually available for site detection within the study area.

Table 1. Estimated Percentage of Area Available for Site Detection

Size of Study Area (ha.)	Exposure %	Area of Exposure (ha.)	Average Visibility (%)	Area avail. for Site Detection (ha.)	% of area available for Site Detection
16.02	5	0.8	80	0.64	3.995

Considering that the survey team covered a large percentage of the study area, it is considered that all areas available for site detection were surveyed. It is stressed, however, that all areas of exposure are a result of prior disturbance. It is considered highly unlikely that there were any exposed areas of ground surface that were not previously disturbed. Hence, if this information is

calculated into the above figures, the percentage of area available for *in situ* site detection for site types such as stone artefact scatters (including isolated stone artefacts) would be zero.

11.0 SURVEY RESULTS

It should be noted that the following results cannot be taken as a comprehensive statement about all archaeological materials within the study area. Rather they offer guidelines as to the archaeological sensitivity of the various locations within the study area from which informed cultural resource management recommendations may be made.

Although ground surface visibility was generally poor throughout, the entire length of the study area was walked except for a section of around 400-500 metres at the southern end of the study area. This section commenced from the northern side of Sandy Creek. Due to thick long grass, the ground surface was not visible in this section (especially the western side of the Highway) and all trees (which were present on the eastern side of the Highway) were regrowth.

Two Indigenous items were located within the study area during the survey. Both were Scarred Trees. The two items are described below and their locations shown on **Figure 7**.

- ***Location 1***

Item Type: Scarred Tree ("Coolum Tree")
Grid Reference: 400141/6761382
Map: Emmaville 1:50,000 Topographic Map
Environment: Tree is located on the southern slope of a low hill in undulating terrain.
Location: The tree is located around 30 metres west from the margin of the bitumen.
Tree species: Gum. Scar Shape: Offset Elliptical.
Height of Tree: The tree is around 15 metres in height. The top of one of the main branches has broken off.
Girth of Tree: 2.5 metres. Size of Scar: 35 centimetres long, 15 centimetres wide.
Depth of Regrowth: 10 centimetres.
Distance between base of scar and ground: 90 centimetres.
Description of Heartwood: The heartwood is not present.
Orientation of Scar: The scar faces in an easterly direction.
Condition of Tree: The tree is alive but damaged from wind or lightning.

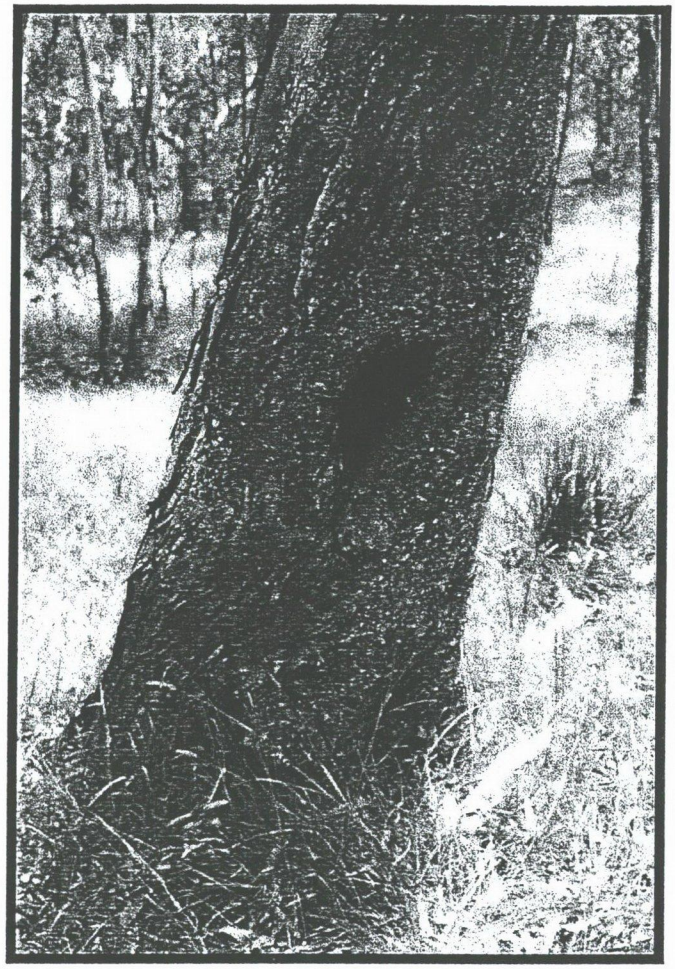


Plate 3. Scarred Tree at Location 1.

➢ ***Location 2***

Item Type: Scarred Tree
Grid Reference: 400203/6760773
Map: Emmaville 1:50,000 Topographic Map
Environment: Tree is located on the southern slope of a low hill in undulating terrain.
Location: The tree is located around 15 metres west from the margin of the bitumen.
Tree species: Gum. Scar Shape: Elliptical.
Height of Tree: The top of the tree has broken off.
Girth of Tree: 2.8 metres. Size of Scar: 50 centimetres long, 20 centimetres wide.
Depth of Regrowth: 10 centimetres.
Distance between base of scar and ground: 1.2 metres.
Description of Heartwood: Only around 60% of the heartwood is present. The wood is rotting. There is some fire damage but insects have caused the majority of damage.
Orientation of Scar: The scar faces in a southerly direction.
Condition of Tree: The tree is alive but damaged from wind or lightning.



Plate 4. Scarred Tree at Location 2.

The scarred tree at Location 1 is around 100-150 metres south of the scarred tree at Location 2. It should be noted that the GPS readings for the location of the scarred trees do not appear to be accurate when plotted onto a topographic map. The eastings appear to be relatively accurate but the northings do not reflect the location of the trees. When the location of the trees is plotted onto the Emmaville 1:50,000 Topographic Map, the northing for Location 1 is around 6760800 and the northing for Location 2 is around 676085. The trees are located in the vicinity (to the west) of RTA peg 2575. On Figure 3 this peg is shown at the McClifty's Road junction with the New England Highway. In reality, this peg is located further to the south.

The representatives from the Moombahlene LALC advised that the tree at Location 1 was a "Coolum Tree" and explained that food was stored within the hollow of this tree – access being through the "scar".

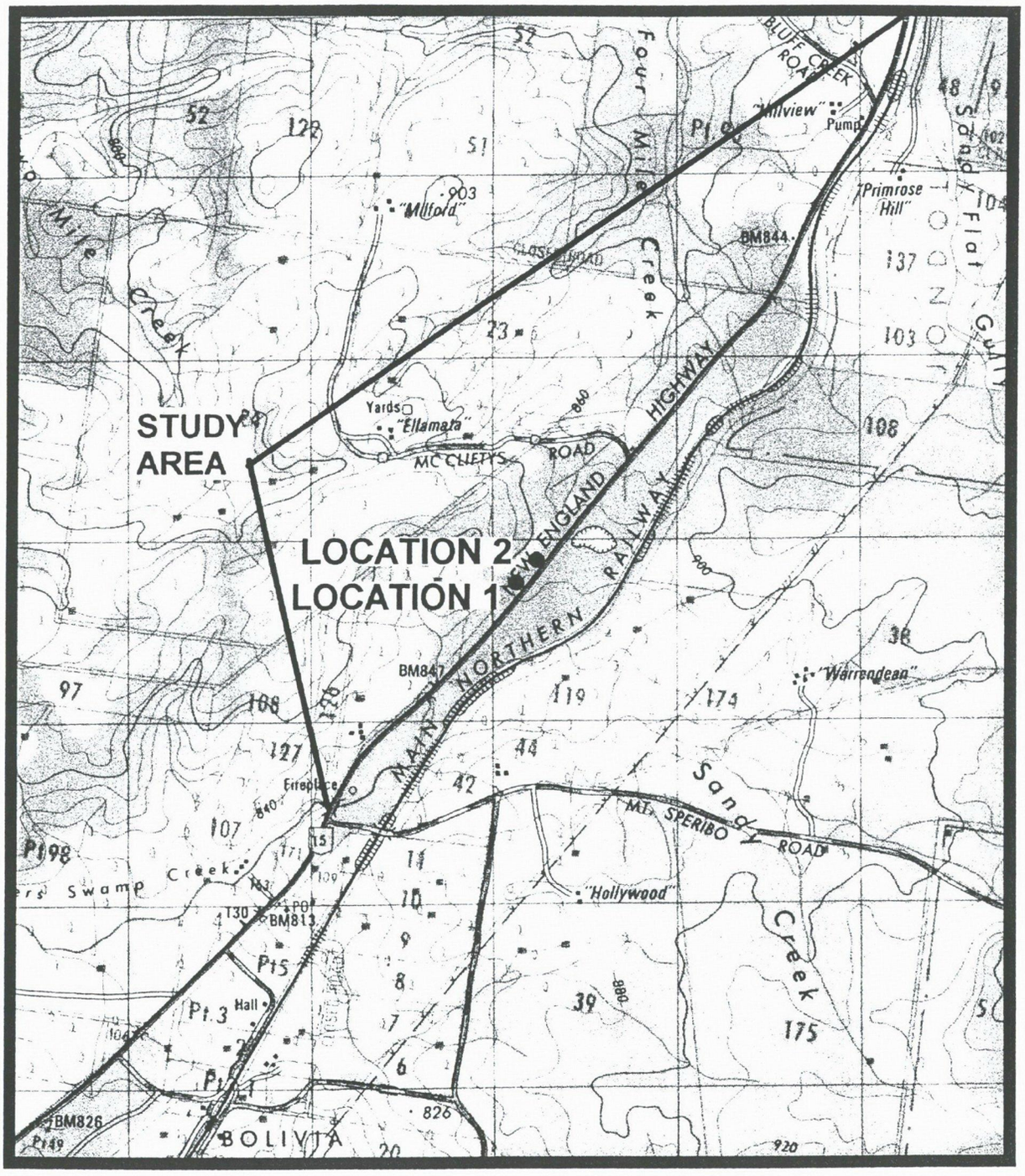


Figure 7. Location of two Scarred Trees (Emmaville 1:50,000 Topographic Map).

Although it is considered that all areas of archaeological potential were subject to an archaeological survey, it is stressed that undetected archaeological material may be present within the study area (see Sub-section 13).

11.1 General Discussion of Results

It was predicted that the study area would have a low to medium archaeological potential for site location. This prediction was generally met. The detection of two scarred trees within the study area was not unexpected. Nevertheless, very poor ground surface visibility and possible disturbance from prior road works may have affected the results of the survey. Low ground surface visibility due to vegetation cover effectively reduces the archaeologist's and Indigenous representatives' ability to discern sites on the ground surface and it is possible that archaeological material has been undetected by this survey. This is especially applicable to stone artefacts (surface and sub-surface). However, after inspecting the study area, it is considered that the survey results are a generally accurate reflection of the potential cultural heritage record and other expectations (see Sub-section 8.2.1) within the road reserve area. That is, that ground surface visibility would generally be poor; that ground surface disturbance would be present and that mature trees had the potential to exhibit scarring from prior Indigenous activities. It is considered that if high-density stone artefact scatters were present in the study area they would have been detected. As high density stone artefact scatters were not detected, it is considered most likely that if undetected stone artefact material is present it would be in the form of isolated stone artefacts or background scatter. Additionally, artefacts were not located eroding from the side of cuttings or erosion channels.

12.0 SIGNIFICANCE OF THE CULTURAL RECORD

This Section addresses the significance of the two Indigenous cultural heritage sites located during the survey.

12.1 Social and Political Significance

Both the scarred trees located during the survey are of significance to the Moombahlene LALC (see Section 15). The scars on these trees constitute physical evidence of prior occupation of the area, and as such may add to the value and significance assigned by members of the Aboriginal community (see Sub-section 12.3 and Section 15.0).

12.2 Scientific Significance

Scientific Significance is assessed using research potential and representativeness as the main criteria (see Sub-section 3.2).

12.2.1 Research Potential

Two scarred trees were located during the survey. Generally, individual scarred trees offer little research potential. Nevertheless, the pattern of the location of these trees may provide insights into landscape utilisation. Further, there is variability in the size and shape of the scars on trees, which may provide insights into a range of cultural activities.

12.2.2 Representativeness

The rationale for constructing a representative sample of Aboriginal archaeological sites is to provide enough sites to accommodate future research questions. Such samples are calculated from the known archaeological resource viewed from a regional perspective and taking into account the full range of site types and environmental variables. In this case the known archaeological resource is regarded as being those Aboriginal sites located in relative proximity to the study area (see Sub-section 6.3). These sites include two Bora Grounds, a stone artefact scatter and an isolated stone artefact. As the known cultural heritage record for the broader study area does not include scarred trees, the two scarred trees located during the survey should be considered important as a site type to be retained for a representative sample.

12.3 Educational and Economic Significance

As scarred trees have not been previously recorded within the broader study area, the Moombahlene LALC may wish to incorporate the trees into an educational program for their community. This is especially applicable to the scarred tree at Location 1. The author was advised that this is a "Coolum Tree" (Darren Daley and Bruce McIntosh, pers. comm., 2001). Such trees were used for the storing of food.

12.4 Summary of Significance of Located Sites

The two scarred trees located during the survey are considered to be significant for social, educational and scientific value.

13.0 IMPACT ON THE CULTURAL RECORD

One of the objectives of this study is to assess the impact that the proposed development activities would have on the cultural resources within the study area. A number of points need to be raised with respect to this assessment. First, both cultural and natural processes impact upon the archaeological record and have done so ever since its formation. Second, as a resource the archaeological record is entirely unrenewable and is therefore in need of careful management. Third, that such management calls upon an awareness of the various components of the archaeological record in a particular area, as well as of the varying impact that an activity may

have on these components. Ultimately, however, it is possible that mitigation strategies may be implemented alongside such activities to lessen any (potential) damage caused.

13.1 Impact of the Proposed Development

The proposed development can impact on both the known and unknown components of the cultural record. Both components are discussed separately below.

➢ ***Impact on the Known Archaeological Record***

The two scarred trees located during the survey are respectively around 15 metres and 30 metres west of the western margin of the bitumen of the New England Highway. It is unlikely that Location 1 would be impacted upon by the proposed roadwork activity as these activities are not expected to extend beyond 15 metres from the edge of the existing bitumen (L. Brown, RTA, pers. comm. 2001). However, Location 2 has the potential to be impacted upon by the proposed roadwork activity.

➢ ***Impact on the Unknown Archaeological Record***

Consideration needs to be given to the possibility that undetected archaeological material may be present in the study area. The unknown portion of the archaeological record is perhaps the most vulnerable, as it is liable to inadvertent damage.

Given the topography within the study area it is considered that there is a possibility that undetected archaeological material is present. Development activities have the potential to uncover and/or destroy such materials.

14.0 MITIGATION STRATEGIES FOR THE CULTURAL RECORD

➢ ***Mitigation and the Known Cultural Record***

To avoid any potential damage to both scarred trees, a buffer zone around each tree should be established. The buffer zone should be wide enough to protect the root system of each tree. Prior to roadwork activity commencing, the location of the two scarred trees should be noted on the contract documents for the project. The recommendations to protect these trees should be incorporated in the Construction Environmental Management Plan (CEMP) for the project. All personnel working on site should be briefed on the significance of the items and the need to protect them during the construction phase.

➢ ***Mitigation and the Unknown Cultural Record***

Given the lack of ground surface exposure within the study area, there is the potential for undetected archaeological material to be present. There is also the potential for sub-surface material to be present. However, given the consideration that only isolated stone artefacts or background scatter would be located within the study area, and that these artefacts would most likely not be *in situ*, and in the absence of any firm indications that subsurface materials are present, further archaeological work is not considered warranted.

15.0 RESPONSE FROM THE MOOMBAHLENE LOCAL ABORIGINAL LAND COUNCIL

The Moombahlene LALC report is included in **Appendix 1.** The report notes the location of each scarred tree and recommends a two metre buffer zone be established around each tree.

16.0 RECOMMENDATIONS

On the basis of the foregoing discussions, and in relation to the Indigenous cultural record of the study area, it is recommended that:

16.1 The Known Cultural Record

- **Before construction on the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area) commences, a buffer zone of no more than five (5) and no less than two (2) metres be established around the two scarred trees at Location 1 and Location 2.**

- **The location of the two scarred trees should be noted on the contract documents and the protection of these trees should be incorporated in the Construction Environmental Management Plan (CEMP) for the project. All personnel working on site should be briefed on the significance of the items and the need to protect them during the construction phase.**

- **That after the above two recommendations have been implemented, no further Indigenous heritage constraints should be placed on the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area).**

16.2 The Unknown Cultural Record

- **Should future activities associated with the proposed widening and upgrading by the New South Wales Roads and Traffic Authority of a 5.34 kilometre section of the New England Highway from 62.7 to 68.04 kilometres north of Glen Innes ("McClifty's" study area), uncover anything which may be interpreted as Aboriginal in origin, work should cease immediately. The NPWS and the RTA's Environmental Adviser should be contacted immediately and works would not commence in the subject area until the find has been examined and dealt with appropriately. Information about such finds should be passed on to both the NSW NPWS, Coffs Harbour, and the LALC, as soon as possible, for further discussion and negotiation. The provisions of the NSW *National***

Parks and Wildlife Act 1974 **state that it is illegal to damage, deface or destroy a relic without written permission of the Director of the Service.**

17.0 ACKNOWLEDGMENTS

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19.0 APPENDICES

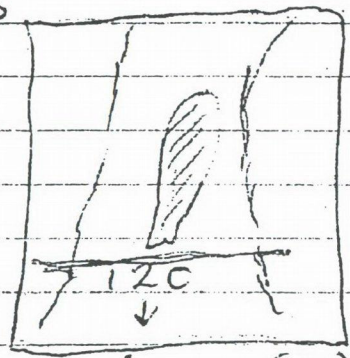
19.1 Appendix 1: Correspondence from the Moombahlene Local Aboriginal Land Council

27.2.01 Report - New England Highway

S.M No 9

~~McCliffy~~ McCLIFTY

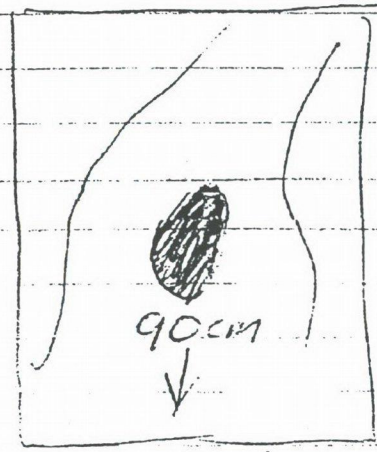
~~Started~~ Recomenced survey about 500metres up from start point because of NIL visibility (long grass + only young trees), about halfway through survey we found (1) one Scared Tree G.P.S point are around 400203/6750473



Scared Tree
50cm long
20" wide
10" regrowth
GUM - (narrow leaf)

We would appreciate a (2) metre Buffer Zone around this tree)

About 150/200 metres from S.T we also found a Modified tree (COOLUM) G.P.S points around 400141/6761382



COOLUM TREE
35cm long
15cm wide
10cm regrowth
GUM

Same Buffer Zone applies for this tree as well.

Finished survey at Peg 2590 well

2 of 2

past mark R(9 1460.A1 856)(it is in my opinion that these pegs have been moved or tampered with as they didnt corraspond with map.)
4:00 pm Knocked off.

Report written by
Bruce McIntosh
Regards
Bill

Appendix E

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE
ABN 30 841 387 271

12 December 2000

Ms Lisa Brown
Environmental Officer, RTA
Level 3, 52 Rothschild Avenue
Rosebery NSW 2018

Our Reference: 00/1752.emr.
Your reference: 000297

Dear Ms Brown,

NPWS REQUIREMENTS FOR REF FOR PROPOSED NEW ENGLAND HIGHWAY UPGRADE

Reference is made to your letter dated 30 October 2000 in which you seek the National Parks and Wildlife Service's (NPWS) requirements for preparation of the above Review of Environmental Factors (REF). The NPWS has a statutory responsibility for the care and protection of native flora and fauna and sites of Aboriginal heritage throughout NSW and for the management of the NPWS estate. The following comments relate to these statutory responsibilities.

It is recommended that the relevant issues in the attached general list of environmental issues be addressed in the REF. Some of the issues detailed will be of greater relevance than others, depending on the natural and cultural heritage values of the area involved.

Of particular interest are the following:

- Areas of significance for native vegetation, with particular reference to the value of habitat for threatened species, populations or ecological communities and their habitats, or regionally significant species and vegetation associations, including Rare or Threatened Australian Plants.
- Areas of potential significance for native fauna with particular reference to the value of habitat for threatened species, populations or ecological communities, or regionally significant species.
- Areas of archaeological potential and Aboriginal heritage value as identified by the Aboriginal community and sites registered on the NPWS Aboriginal Sites Register.
- Areas of NPWS estate.

A preliminary search of the NPWS database indicates that the following threatened species have been noted from the general area of the existing road alignment:

Conservation
Programs and
Planning Division
Northern Directorate
GIO House
24 Moonee Street
Coffs Harbour NSW
2450 Australia
Locked Bag 914
Coffs Harbour NSW
2450 Australia
Tel: (02) 6651 5946
Fax: (02) 6651 6187

Head Office
43 Bridge Street
P.O. Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

Australian-made 100% recycled paper

Threatened Fauna

Powerful Owl	*Ninox strenua* (V)
Koala	*Phascolarctos cinereus* (V)
Eastern Quoll	*Dasyurus viverrinus* (E1)
Glossy Black Cockatoo	*Calyptorhynchus lathami* (V)
Brush-tailed Rock Wallaby	*Petrogale penicillata* (V)
	Litoria castanea (E1)
Border Thick-tailed Gecko	*Underwoodisaurus sphyrurus* (V)
Magpie Goose	*Anseranus semipalmata* (V)

Threatened Flora

Small Snake Orchid	*Diuris pedunculata* (E1)
Narrow-leaved Black Peppermint	*Eucalyptus nicholii* (V)
	Homoranthus croftianus (E1)
	Pimelea venosa (E1)
	Eucalyptus magnifica (E1)
	Acacia pycnostachya (V)
	Bothriochloa biloba (V)
	Thesium australe (V)
	Dichanthium setosum (V)
Australian Anchor Plant	*Discaria pubescens* (U) (ROTAP)
	Euphrasia ciliolata (U) (ROTAP)
	Thelionema grande (U) (ROTAP)

It is recommended that, initially, a search of the NPWS Wildlife Atlas be undertaken for flora and fauna records. If the study area possess attributes such as those identified above, it is recommended that detailed surveys be undertaken to determine the natural heritage values of the area and potential impacts on these values.

Attention should be given to mitigating impacts through appropriate amelioration methods including modifications to the proposal. Depending on the nature and extent of impacts and the natural heritage values of the study area consideration should be given to amelioration measures which compensate for impacts such as securing native vegetation protection or restoring native vegetation within or adjacent to the study area.

It is noted that several Aboriginal cultural heritage sites are located in the vicinity of the proposed upgrade. To assist evaluation of the potential impacts of the proposal on Aboriginal heritage values, it is recommended that the proponent undertake a search of the NPWS Aboriginal Sites Register. An assessment of the archaeological sensitivity of the subject land should be undertaken by an appropriately experienced person in consultation with the local Aboriginal community.

The outcome of the assessment and consultation should be incorporated in the REF. Pending the outcome of this preliminary assessment, there may be a need for an archaeological survey of the subject site to be carried out by a suitably qualified person.

Your attention is drawn to the recently proclaimed Commonwealth legislation, the *Environment Protection and Biodiversity Conservation Act 1999*. If any areas or species requiring consideration under this legislation may be affected by the proposal, approval for the development may also be required from Environment Australia.

If you have any queries regarding this matter please contact Estelle Ross, Conservation Planning Officer, on (02) 6659 8256.

Yours faithfully,

BRENDAN DIACONO
Manager, Conservation Planning Unit
for **Director-General**

attachment

NSW NATIONAL PARKS AND WILDLIFE SERVICE, NORTHERN ZONE

ENVIRONMENTAL ISSUES TO BE ADDRESSED

INTRODUCTION

The following list is provided to assist in the preparation of environmental impact assessment reports. The list details the type of information that is recommended by the New South Wales National Parks and Wildlife Service (NPWS) for inclusion in such assessments.

Please note that the provision of information in accordance with this list does not negate the applicant's obligations under any legislative or planning instruments. NPWS suggests that the applicant contact the relevant local council and the Department of Urban Affairs and Planning to ascertain these obligations.

GENERAL

1. Map(s) showing the locality of the proposed development in a regional and local context. Local context maps should be based on 1:25 000 topographic plans. Photographs of the site's key attributes may provide useful documentation.

2. A description of the existing environment on the subject land and surrounding land, the proposed development and ancillary works, and the manner in which the environment will be modified by the proposal (particularly with regard to the clearing of native vegetation and impacts on fauna habitat).

3. The area subject to development should be clearly identified on an appropriately scaled plan. This includes all ancillary works such as buildings and other structures, parking areas, loading/processing/treatment areas, access roads, and material stockpiling areas.

4. The applicability or otherwise of Local Environment Plans (LEP), Regional Environment Plans (REP) and State Environmental Planning Policies (SEPP) and Regional Vegetation Management Plans (RVMPs) to the site should be determined and detailed. In particular, your attention is drawn to SEPP No. 14 - Coastal Wetlands, SEPP No. 26 - Littoral Rainforest, SEPP No. 44 - Koala Habitat Protection and the *Native Vegetation Conservation Act 1997*.

5. Your attention is also drawn to the new Commonwealth legislation, the *Environment Protection and Biodiversity Conservation Act* 2000. The Act specifically focuses on matters of national environmental significance (NES matters) which include listed threatened species and ecological communities, World Heritage properties, Ramsar wetlands of international importance, internationally protected migratory species and Commonwealth Marine Areas. If any NES matters under this legislation may be affected by the proposal, approval for the development may also be required from Environment Australia.

FLORA

1. A comprehensive description of the vegetation on the site. This will include an assessment of the condition of the plant communities present, including the designation of conservation significance at a local, regional and State level, and an assessment of the likely occurrence of any threatened species, populations or ecological communities listed under Schedules 1 or 2 of the *Threatened Species Conservation Act 1995* and any Rare or Threatened Australian Plant (ROTAP) species.

2. A plan showing the distribution of any threatened or ROTAP species and the vegetation communities on the site, and the extent of vegetation proposed to be cleared. This plan should be at the same scale as the plan of the area subject to development in order to assist in the assessment the impact of the proposal on the existing vegetation.

3. Where the assessment concludes that threatened species, populations or ecological communities, or their habitats, exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the eight point test described in Section 5A of the *Environmental Planning and Assessment Act* 1979. An assessment of the impact of the development on the plant communities and/or ROTAP species should also be provided.

4. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the plant communities, threatened and ROTAP species.

FAUNA

1. A fauna survey to identify the distribution and abundance of fauna species known or likely to utilise the site, including a description of available fauna habitats and an assessment of the conservation status of each of the faunal components at a local, regional and State level.

2. A plan showing the results of the above survey. This plan should be at the same scale as the plan of the area subject to development to assist in the assessment of the impact of the proposal on fauna.

3. An assessment of the impact of the development on the identified fauna.

4. An assessment of the existence or likely occurrence of threatened species, populations or ecological communities, or their habitats on the subject land. Where the assessment concludes that threatened species, populations or ecological communities, or their habitats exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the eight point test described in Section 5A of the *Environmental Planning and Assessment Act* 1979.

5. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on fauna.

CULTURAL

1. The presence or absence of Aboriginal sites should be identified and the significance of the area to the local Aboriginal community must be determined. Accordingly, a search of the NPWS Aboriginal sites register should be made and the local Aboriginal community should also be consulted with regard to any Aboriginal heritage issues associated with the proposed development.

2. Aboriginal sites and places of significance to the Aboriginal community are to be detailed on a plan. This plan should be at the same scale as the plan of the area subject to development to assist in the assessment of the impact of the proposal on the identified cultural components.

3. An assessment of the impact of the development on the identified cultural sites.

4. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the identified cultural sites.

5. A contingency plan that details the measures to be taken in the event that archaeological sites are discovered during the course of operations must be prepared.

NATIONAL PARKS ESTATE

1. Where the proposal may result in impacts on NPWS estate or is on land adjacent to NPWS estate, an assessment of the impact of the development on NPWS estate.

2. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the NPWS estate.

NOTES

Surveys and Assessments

1. Fauna, flora and cultural surveys and assessments should be undertaken by suitably qualified persons and the qualifications and experience of the persons undertaking the work detailed.

2. Dates, site locations, design, methodology, analysis techniques, and weather conditions at the time of the assessments and surveys must be described. The limitations of surveys should be identified and the results interpreted accordingly.

3. Conclusions drawn in surveys and assessments should be substantiated by evidence resulting from those surveys and assessments. The document being supported by the surveys and assessments should reflect these conclusions and clearly state where recommendations of the survey and assessments have been incorporated in the proposal.

NPWS Databases

1. The NPWS can provide records of flora and fauna held in the Wildlife Atlas and / or Rare or Threatened Australian Plants (ROTAP) databases. In addition NPWS has an Aboriginal Sites Register of which searches can be made. These services generally attract a fee. Enquires should be made to NPWS Hurstville office, telephone (02) 9585 6444.

2. It should be noted that the above databases are not comprehensive and should only be used as a guide. They do not negate the need for specific site investigations.

NSW Department of Land and Water Conservation

FAX

To:
Lisa Brown, Environmental Officer
RTA

Fax No: 02 9662 5045
Phone: 02 9662 5244

From:
Patric Millar
Catchment Manager
Glen Innes

Fax No: (02) 6732 4059
Phone: (02) 6732 5901
e-mail: pmillar@dlwc.nsw.gov.au
Time: 16:08

Date: 20 November 2000

Pages (following cover sheet): 2

Glen Innes District Office, PO Box 92 Glen Innes NSW 2370

LAND & WATER CONSERVATION

[X] Routine [ ] Urgent [ ] Confidential

Subject: Comments on *New England Highway Road Rehabilitation* Environmental Assessment

Lisa

Please find attached herewith are the DLWC's comments on the above mentioned RTA Project proposal. I apologise for the delay in returning the comments but the original letter was sent to the wrong office. In future could you please direct any correspondence relating to road works within Severn Shire, Tenterfield Shire and the Glen Innes Municipality to this Office in future.

If you require any further information please contact me on (02) 6732 5901

Regards

Patric Millar

Catchment Manager

GLEN INNES

[C:\Patric\Patric Data\Word Docs\Agencies\RTA\NE Highway REF FAX1.doc]

The information contained in this facsimile is intended for the named recipient only. It may contain privileged and confidential information. If you are not the intended recipient, do not read, copy or disclose any details of the fax to anyone. If you have received this fax in error please notify us immediately and destroy the original.

LAND & WATER CONSERVATION

Contact: Patric Millar
Phone: (02) 6732 5901
Fax: (02) 6732 4059
e mail: pmillar@dlwc.nsw.gov.au

Our Ref: GIDO
[NE Highway Rehabilitaiton Letter1.doc]

MS Lisa Brown
Environmental Officer
Roads and Traffic Authority
Level 3, 52 Rothschild Avenue
ROSEBERRY
2018

20 November, 2000

Dear Ms Brown

Re: Invitation to Comment, *New England Highway Road Rehabilitation* Environmental Assessment

Thank you for your letter dated 30th October 2000. I apologise for the delay I replying, but the letter was sent to the wrong Office and has only just arrived. In future could you please direct any correspondence relating to road works within Severn Shire, Tenterfield Shire and the Glen Innes Municipality to this Office in future.

The Department of Land and Water Conservation (DLWC) is the lead agency in the management of the State's land, soil, water and vegetation resources and as such the comments provided are restricted to these natural resource areas.

When preparing a Review of Environmental Factors (REF) the DLWC advises that the following issues require addressing:

1. The erosion and sediment control measures proposed prior to, during and post construction operations. The DLWC views an erosion and sediment control plan be prepared for each site. Such a plan should contain a detailed description of the soils present on each site and information on the type, size and location of both temporary and permanent erosion and sediment control works.

2. How the sites will be rehabilitated, in particular the final landforms and revegetation strategies proposed. This should include the type species to be utilised.

3. A detailed description of the vegetation present at each site, in particular whether any Threatened Species contained within the provisions of the Threatened Species Conservation Act 1995 are present.

4. Information on how native vegetation which is cleared in accordance with the provisions of Section 12 of the Native Vegetation Conservation Act 1997 is to be undertaken.

5. A statement of land title for each of the works locations. **IF** works are not being undertaken within the Road Reserve.

6. Details of the timing of construction and proposed construction methods to be utilised. Particularly if any temporary dams are likely to be constructed in the watercourses.

The Department of Land and Water Conservation administers a number of legislative instruments pertaining to land management in New South Wales. This includes the Native Vegetation Conservation Act, the Soil Conservation Act, the Rivers and Foreshores Improvement Act and the Water Act.

In terms of the legislative requirements of the Department of Land and Water Conservation outlined above consents are required for the following Acts :

1. Native Vegetation Conservation Act **IF** the proposed activity is not undertaken in accordance with the conditions of Section 12 (m) and Section 12 (n) of the Native Vegetation Conservation Act.

2. The Rivers and Foreshores Improvement Act **IF** the construction authority is not a "public or local authority" as defined in Part 3A Section 22 (II) 1 b of the Rivers and Foreshores Improvement Act

Should you require any further information please contact me.

Yours sincerely

Patric Millar
Catchment Manager, Glen Innes

NSW FISHERIES

November 20, 2000

Ms. Lisa Brown
Environmental Officer
Level 3, 52 Rothschild Ave
ROSEBURY NSW 2018

RE: Invitation to comment, New England Highway Road Rehabilitation-Environmental Assessment

Dear Ms. Brown

Thank you for your recent letter (30th October 2000) informing me of the proposed works on the above highway. The following issues need to be addressed in a Review of Environmental Factors:

- The RTA should be aware of the *NSW Fisheries Policy and Guidelines for bridges, roads, causeways culverts and similar structures* (1999) and the *Fisheries Management Act 1994* (Part 7. Protection of aquatic habitats).
- The above policy and guidelines would concern the proponents in the event that a new creek crossing or the rehabilitation of an old crossing was necessary for the proposed road works. The possible impacts on fish passage and water velocity would need to be addressed. Barriers erected across permanent or intermittent watercourses can prevent fish access to spawning and feeding.
- Efficient sediment and erosion control methods must be used during of the works. This is to ensure that at no stage aquatic organisms will be impacted by increased sedimentation or turbidity. Disposal of soil in a waterway is unacceptable. Silt screens and fences should be erected and maintained.
- Maintenance of fish passage – NSW Fisheries must be informed if fish passage is to be blocked or altered during the course of the works. Consultation with NSW fisheries should be sought on the design of new culvert crossings and their impacts on fish passage.
- Consultation and comment from NSW Fisheries would be required for any dredging and reclamation works on any creeks (sections 198 to 203 of the Fisheries Management Act 1994).
- Any temporary sidetracks or crossings should be constructed of large clean rock.
- Site rehabilitation – the REF should address the issues of site rehabilitation after works are complete.
- Threatened species – new threatened species provisions came into force under the *Fisheries Management Act 1994* on July 1st 1998. Any possible impacts on listed threatened species should be assessed.

P.O. Box 893, 24 Andrew Street, INVERELL, NSW 2360
Phone: (02) 6722 1129/6721 3524 Fax: (02) 6722 4733 - Mobile: 042 842 6044
Email: molloys@fisheries.nsw.gov.au

If you have any further queries please do not hesitate to contact me on (02) 6722 1129/ (02) 6721 3524.

Yours sincerely,

SHARON MOLLOY
CONSERVATION MANAGR

P.O. Box 893, 24 Andrew Street, INVERELL, NSW 2360
Phone: (02) 6722 1129/6721 3524 Fax: (02) 6722 4733 - Mobile: 042 842 6044
Email: molloys@fisheries.nsw.gov.au

Northern New England
Rural Lands Protection Board

HEAD OFFICE
332 Grey Street (PO Box 108)
GLEN INNES NSW 2370
Telephone 02 6732 1200
Fax 02 6732 1420
Please address all correspondence to the Administrative Officer

BRANCH OFFICE
142 High Street (PO Box 115)
TENTERFIELD 2372
Telephone 02 6736 1355
Fax 02 6736 2614

E-mail: nnerlpb@northnet.com.au

23 November 2000

Ms Lisa Brown
Environmental Officer
RTA
Level 3
52 Rothschild Ave
ROSEBERY 2018

Your Ref: 000297

Dear Lisa,

Re: Invitation to Comment on Proposed Upgrading of New England Highway

Your letter 30 October 2000 was tabled at the Board's November meeting.

Directors raised no objection to the proposed upgrades.

The normal RLPB concerns over matters such as this relate to soil conservation and rehabilitation and any repair of fencing when earthworks impinges on Travelling Stock Reserves.

If the proposals go ahead we would like the opportunity to comment further as details crystallise.

Thank you for this opportunity to provide comment.

Yours faithfully,

Tony Eshman
Administrative Officer
Emailed 23Nov2000 11:00am

McClifty's

17 November 2000

RTA Operation
Environment Technology
PO Box K198
HAYMARKET NSW 1238
ATT: Lisa Brown

Our Ref: 8375 (a)
Your Ref: 0297

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Dear Lisa,

RE: Aboriginal sites search for
Proposed Development in the following the Area Zone 56 Easting: 397000-404000, Northing: 6758000-6765000 Emmaville

Reference is made to your recent enquiry in respect to whether any Aboriginal sites are registered at the above location.

A search of the National Parks and Wildlife Service's (NPWS) Aboriginal Sites Register database has shown that 2 Aboriginal sites are currently recorded in or near the proposed development area (refer attached Site Register report for details).

The following qualifications apply to the Aboriginal Sites Register database;

- The database only includes recorded sites. Large areas of New South Wales have not been the subject of systematic survey or the recording of Aboriginal history. These areas may contain sites which are not currently listed on the Aboriginal Sites Register.

- Site records come from a variety of sources and are variable in their accuracy. When a database search identifies sites in or near the area it is recommended that the exact location of the sites be determined by relocation on the ground.

- The criteria used to search the database are derived from information provided by the client and assume that this information is correct.

You should be aware that all Aboriginal sites are protected under the *National Parks and Wildlife Act 1974,* regardless of their inclusion on the Sites Register, and it is an offence to damage or destroy them without the prior permission of the Director-General of the NPWS.

If you are considering development, please note the following:-

In determining development applications under the *Environmental Planning and Assessment Act 1979,* local councils must include matters relating to Aboriginal heritage in the decision making process. As part of this process, the NPWS may be asked for advice on whether an area proposed for development should be subject to Aboriginal heritage assessment. NPWS advice is broadly based on the following criteria;

1) The NPWS would normally recommend an Aboriginal heritage assessment under the following circumstances:

43 Bridge Street
PO Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au

Australian-made 100% recycled paper

The Sites Register identifies sites in or near the development area, and these could be impacted during or after the development (this includes indirect impacts, such as increased run-off or sedimentation, changes in visitation, etc).

- the proposed development is likely to impact areas of bushland or undisturbed ground.

- the proposed development is likely to impact areas containing sandstone outcrops (greater than $1m^2$), rock shelters and overhangs, old growth trees, sand bodies, and ground adjacent to creeks, rivers, lakes and swamps.

- the proposed development is likely to impact an area of importance to the Aboriginal community not included in the above (eg. story places, buildings, missions, etc)

2) The NPWS would **not** normally recommend an Aboriginal heritage assessment under the following circumstances:

- the proposed development is within land previously subject to intensive ground disturbance, such as quarrying, repeated market gardening, earthworks for pipelines, roads, sports fields etc. However it should be noted that sites could still occur in these context for example, ploughing generally impacts the top 20cm of ground and there is potential that *undisturbed archaeological deposit may occur* in areas where soil depth exceeds 20cm. *Scarred trees* may be located within road reserves and adjacent sport fields, etc.

- the development is within an existing residential or industrial area, or the redevelopment of an existing building is proposed, and the above criteria (listed in section 1) do not apply.

An Aboriginal heritage assessment would provide you with information about the location and significance of sites or sensitive areas, as well as advice on appropriate management options for these areas. It is recommended that an Aboriginal heritage assessment be carried out by a person qualified in undertaking Aboriginal heritage assessments. It is also recommended that the Aboriginal community (Local Aboriginal Land Council, Tribal Council etc) be contacted and its views sought on possible impacts to Aboriginal heritage.

If the proposed development area is found to contain an Aboriginal site, reference should be made to the NPWS requirements for Aboriginal heritage under the Integrated Development Approval Process (*Environmental Planning & Assessment Amendment Act 1997*).

If you wish to discuss this further, please contact Archaeologist, Rebecca Edwards-Booth on (02) 6659-8225.

Yours faithfully

Paul Houston
Aboriginal Sites Registrar
Cultural Heritage Services Division

ASR Site Search Criteria

SiteID (like)		Zone: 56	District:
AMGE:	397000 to 404000		SiteType1:
AMGN:	6758000 to 6765000		SiteType2:
Name(like):			SiteType3:
Recorder:			Contact:
Date from:	to		DateModified: to
LGA:			
Local ALC:			

ASR Standard Site List - 8375a

17/11/2000 10:18:15

SiteID:	SiteName:	Location:	Zone:	AMGE:	AMGN:	Check Method:	Site Type:	Recorder:	Record Date:	Assoc. Report:
12-1-0005	Bolivia;		56	399000	6758400		Bora/Ceremonial	McBryde, I.	1/01/74	
12-2-0008	Sandy Flat;Sugarloaf Hill;		56	403700	6762800		Bora/Ceremonial	McBryde, I.	1/01/62	

NSW National Parks and Wildlife Service

*** End of Report *** Site Count: 2

Aboriginal Sites Register
DATA REQUEST FORM ASR: _____

Date requested: 7/11/00

Company name: RTA Environmental Technology

Contact name: Lisa Brown

Address: Level 3, 52 Rothschild Ave, Rosebery 2018

Telephone: 9662 5244 Fax: 96625045

Proposed use of data : Environmental Assessment - proposed road rehabilitation

Search area (A):

Description: _____ See attached map: ☐

Map details:

Map name:

- ☐ 1:250k _____
- ☐ 1:100k _____
- ☑ 1:50k Emmaville
- ☐ 1:25k _____

AMG Zone: _____ Easting Min: 398000 Max: 403000 Northing Min: 6759000 Max: 6764000

Signature: Brown

***OFFICE USE ONLY

Date received: _____ Date completed: _____ By: _____

Results: Primary Search area (A): _____

Search area (B): _____

(AMGE: _____ AMGN: _____)

Sent to: _____ Fee: _____

RETURN TO: THE ABORIGINAL SITES REGISTRAR, PO BOX 1967, HURSTVILLE, 2220
(FAX: 02 95856325)

Environment Australia Online

Environment **P**rotection and **B**iodiversity **C**onservation Act

Online Database

Report created on : Wednesday, Nov 1 2000
Report on : Threatened, marine protected or migratory species, Ramsar sites, Commonwealth areas, World Heritage Areas
Search type : point
Approx buffer : 20 km (minimum buffer is approx 1km)
Coordinates used :

Longitude	Latitude
152	-29.17



view map

Migratory species
9 species

Threatened species
28 species

Marine protected species
0 species

World Heritage Areas [dataset information]
None found

Ramsar sites [dataset information]
In the same drainage basin as Little Llangothlin Nature Reserve

Commonwealth areas
Note: The database on Commonwealth areas is incomplete and includes only Commonwealth marine areas and Commonwealth reserves
None found

Extra Information

Conservation reserves [dataset information]
Washpool National Park
Capoompeta National Park

Regional Forest Agreements
Note: all RFA areas including those still under consideration have been included [dataset information]
Upper North East NSW RFA

Species Report

This report provides a general indication of the species that may occur in your nominated area

Terrestrial species covered by migratory provisions of the EPBC Act 1999

	Scientific Name	Common Name	Type of Presence
Aves	Haliaeetus leucogaster (943)	White-bellied Sea-Eagle	Species or species habitat likely to occur within area
Aves	Hirundapus caudacutus (682)	White-throated Needletail	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree
Aves	Monarcha melanopsis (609)	Black-faced Monarch	Breeding or breeding habitat likely to occur within area - Derived from a general distribution map > 1 degree
Aves	Monarcha trivirgatus (610)	Spectacled Monarch	Breeding or breeding habitat likely to occur within area
Aves	Myiagra cyanoleuca (612)	Satin Flycatcher	Breeding or breeding habitat likely to occur within area
Aves	Rhipidura rufifrons (592)	Rufous Fantail	Breeding or breeding habitat likely to occur within area - Derived from a general distribution map > 1 degree
Aves	Xanthomyza phrygia (430)	Regent Honeyeater	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree

Wetland species covered by migratory provisions of the EPBC Act 1999

	Scientific Name	Common Name	Type of Presence
Aves	Gallinago hardwickii (863)	Latham's Snipe, Japanese Snipe	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree
Aves	Rostratula benghalensis (889)	Painted Snipe	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree

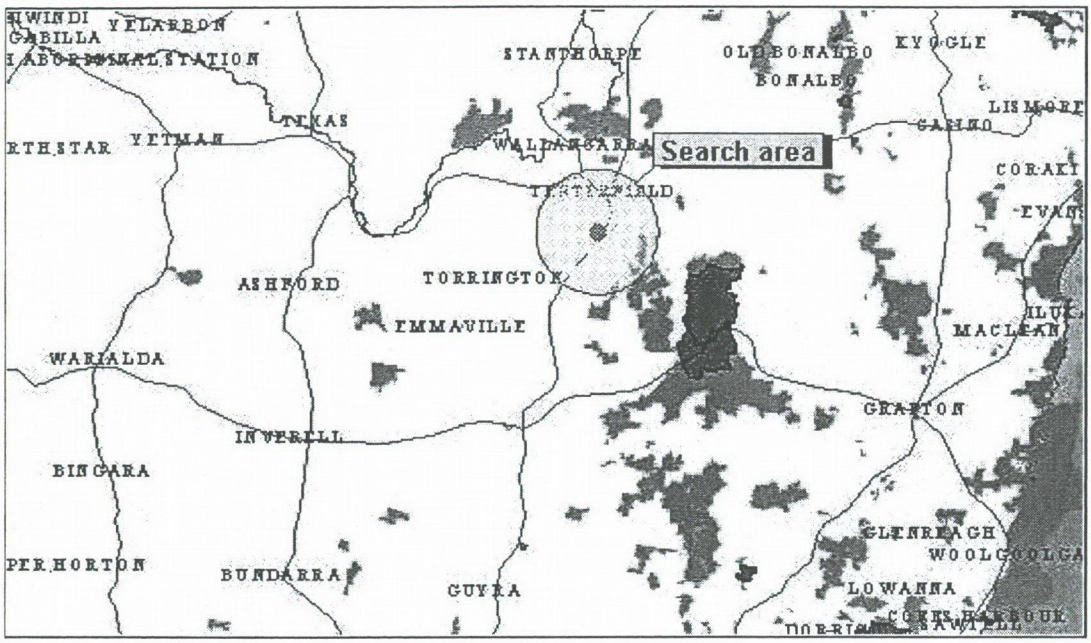
Threatened species

	Scientific Name	Common Name	Type of Presence	Status
Amphibia	Mixophyes balbus (1942)	Stuttering Frog	Species or species habitat likely to occur within area	Vulnerable
Amphibia	Mixophyes iteratus (1944)	Southern Barred Frog	Species or species habitat likely to occur within area	Endangered
Aves	Lathamus discolor	Swift Parrot	Species or species	

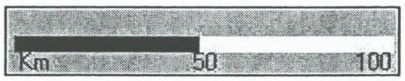
	(744)		habitat likely to occur within area - Derived from a general distribution map > 1 degree	Endangered
Aves	Poephila cincta subsp. cincta (64447)	Black-throated Finch (southern subspecies)	Species or species habitat likely to occur within area	Vulnerable
Aves	Xanthomyza phrygia (430)	Regent Honeyeater	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree	Endangered
Mammalia	Dasyurus maculatus subsp. maculatus (64476)	Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeast mainland and Tasmanian subspecies)	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree	Vulnerable
Mammalia	Petrogale penicillata (225)	Brush-tailed Rock-wallaby	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree	Vulnerable
Mammalia	Potorous tridactylus subsp. tridactylus (66645)	Long-nosed Potoroo (SE mainland)	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree	Vulnerable
Mammalia	Pseudomys oralis (98)	Hastings River Mouse	Species or species habitat likely to occur within area	Endangered
Plant	Acacia macnuttiana (10711)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Acacia pubifolia (19799)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Acacia pycnostachya (13415)	Bolivia Wattle	Species or species habitat likely to occur within area	Vulnerable
Plant	Bertya pinifolia (8587)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Boronia granitica (18598)	Granite Boronia	Species or species habitat likely to occur within area	Endangered

Plant	Cadellia pentastylis (9828)	Ooline	Species or species habitat likely to occur within area	Vulnerable
Plant	Callistemon pungens (55581)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Cynanchum elegans (12533)	-	Species or species habitat likely to occur within area	Endangered
Plant	Diuris pedunculata (18325)	Small Snake Orchid	Species or species habitat likely to occur within area	Endangered
Plant	Eucalyptus nicholii (20992)	Narrow-leaved Peppermint	Species or species habitat likely to occur within area	Vulnerable
Plant	Goodenia macbarronii (55948)	Narrow Goodenia	Species or species habitat likely to occur within area	Vulnerable
Plant	Haloragis exalata subsp. velutina (16839)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Pimelea venosa (16385)	-	Species or species habitat likely to occur within area	Endangered
Plant	Pultenaea campbellii (12128)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Pultenaea stuartiana (3314)	-	Species or species habitat likely to occur within area	Vulnerable
Plant	Thesium australe (15202)	Austral Toadflax, Toadflax	Species or species habitat likely to occur within area	Vulnerable
Plant	Tylophora woollsii (20503)	-	Species or species habitat likely to occur within area	Endangered
Reptilia	Elseya sp. nov. (AMS-R140984) (64485)	Namoi River Elseya (Namoi River, NSW)	Species or species habitat likely to occur within area - Derived from a general distribution map > 1 degree	Vulnerable
Reptilia	Underwoodisaurus sphyrurus (1660)	Border Thick-tailed Gecko	Species or species habitat likely to occur within area	Vulnerable

Map of area defined including buffer



Nominal scale



Legend

- Builtup areas
- Ramsar sites
- World heritage areas
- Major roads
- Reserves
- Commonwealth areas
- Land

Aknowledgements

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

- New South Wales National Parks and Wildlife Service
- Department of Natural Resources and Environment, Victoria (Secretary)
- 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
- Queensland Environment Protection Agency
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- Royal Botanic Gardens and 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.

For further information see http://www.environment.gov.au/epbc



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