Review of Environmental Factors

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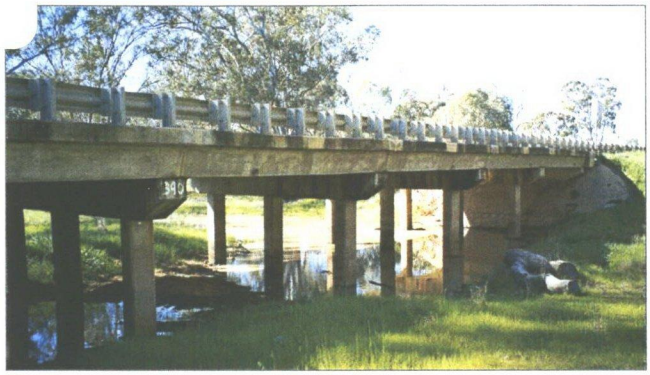
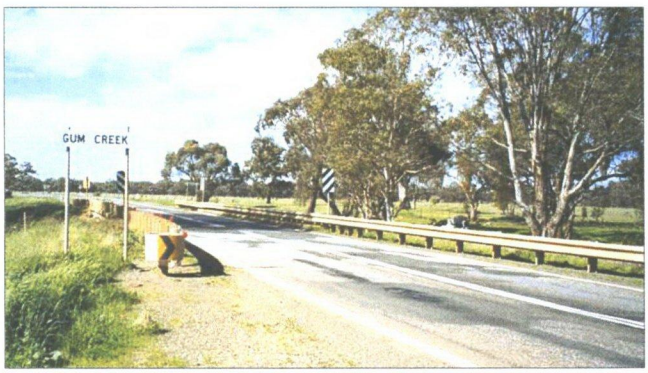
Proposed Bridge Widening
Gum Creek, Sturt Highway, Narrandera





Prepared for
RTA South Western Region
Wagga Wagga

29 JUL 2005
ROADS & TRAFFIC AUTHORITY

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Appendices

Proposal Identification

Name of Proposal:	**Proposed Bridge Widening Gum Creek, Sturt Highway, Narrandera**
Region:	**South Western Region**
Local Government Area:	**Murrumbidgee Shire Council**
File No.:	**99M3390**

1 Introduction and Background

This Review of Environmental Factors (REF) has been prepared by Operations Environmental Technology Branch, on behalf of the South Western Region of the NSW Roads and Traffic Authority (RTA). Input on the concept design and construction components has been provided by the RTA's South Western Regional Office and Bridge Branch.

The REF has been prepared to assess the potential impacts of widening the bridge over Gum Creek on the Sturt Highway, 75 km west of Narrandera. The widening is required for safety reasons and to comply with current National Highway standards (ie 11 m between kerbs).

For the purpose of these works, the RTA is the proponent and the determining authority under Part V of the Environmental Planning and Assessment Act, 1979. The REF describes the proposed works and the associated environmental impacts in the context of Clause 82 of the *Environmental Planning and Assessment Regulation, 1994.* In doing so, this REF helps to fulfil the requirements of Part V, Section 111 of the EP&A Act. The REF has been prepared in accordance with the RTA's Proforma 2 detailed in the RTA's Environmental Impact Assessment Policy, Guidelines and Procedures, (Environmental Manual Volume 3).

The findings of the REF will be considered when assessing:

- whether the Proposal is likely to have any significant impact on the environment and therefore the necessity for an 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 Proposal Description

2.1 Location

Gum Creek Bridge is a concrete bridge on SH14 - Sturt Highway, 75 km west of Narrandera (16.3 km west of Main Road No. 321 – Irrigation Way). **Figure 1** (Appendix A) shows the location of the Proposal.

2.2 Description of Site and Surroundings

The Sturt Highway is the main route connecting Sydney in NSW to Adelaide in South Australia. Gum Creek is a small waterway with ephemeral flows which is part of the lagoon system of the Murrumbidgee River floodplain. The Sturt Highway crossing of Gum Creek is approximately 4 km south of the main channel of the River. The creek is an overflow channel for the Murrumbidgee River during large rainfall events and flooding. During the site inspection in August 1999, the water level was very low in the channel and no flows were observed however, at times of high flow, the entire floodplain area would be inundated.

Due to its situation on the floodplain, the area has little relief and has been extensively cleared for grazing and crop growing (see Aerial Photo in Appendix B). The creek line, however, is still lined with trees which provide a woodland corridor (see photographs in Appendix C). Beyond this, pasture grasses are the dominant vegetation types.

Gum Creek Bridge was constructed in 1956, and is a five-span, reinforced concrete structure (see Photo 3 in Appendix C and the design drawing in Appendix D). The overall length of the bridge is approximately 30.5 metres and the width is 6.7 metres between kerbs with one lane of traffic in either direction. It has a concrete deck which is supported on four internal concrete piers with two "spill-through" abutments. Each of the piers and abutments consists of a headstock supported on three rectangular reinforced piles driven approximately 5 to 6 metres below the surface. Steel "W" beam barrier fencing (guardrail) is present on both sides of the bridge. The barrier fencing extends a short distance along the approaches.

The Highway approaches at both the eastern and western ends of the bridge are relatively straight and flat with no sight impediments and consist of one lane of traffic in either direction. The existing formation cross-section provides two 3.25 m lanes and a 0.5 m unsealed shoulder on both sides. The abutments to the bridge are raised by approximately 2 metres above the surrounding landscape to raise the road and bridge above the flood level and to give a level approach to the bridge. There are two property accesses immediately to the west of the bridge, the northern one leads to a private property called Kerarbury Run. The speed limit is currently 100 kph.

2.3 General Description of the Proposed Works

It is proposed to widen Gum Creek Bridge on the downstream, southern side of the existing bridge to a total of 12.3 metres which would provide a clear width of 11 metres between kerbs (see design drawing in Appendix D). To ensure safety of the bridge personnel, and to provide for traffic during construction, it is proposed to construct the widening work in stages. Traffic signal or flagman control would be used during periods of one lane traffic flow.

Two precast concrete piles would be driven at each pier and abutment location. They would be located in line with the existing piles to ensure that there is no impediment to the flows in the Creek. The piles would extend into the reinforced concrete headstock which would be cast on site. Temporary falsework (scaffolding) may be required to support the headstock formwork while it cures. Precast, prestressed concrete planks would be installed on top of the headstocks followed with a concrete deck which would be cast on site.

Additionally, the approaches to the bridge would be widened to suit the new bridge and to comply with current National Highway standards, and the existing pavement would be rehabilitated and strengthened. The pavement width would be increased to provide two 3.5 m lanes and a 2 m sealed shoulder on either side. The centre line would be shifted by up to 2 m at the bridge abutments to suit the bridge after widening on the one side. The approach work would extend for 240 m from the western abutment and 550 m on the eastern abutment to adjoin new work. It is proposed that RTA's Road Services would carry out the widening and rehabilitation of the approaches, while a Bridge Contractor would undertake the bridge works.

New kerbs and barrier fencing would be constructed on both sides of the bridge. Some earthworks would be required to extend the existing spill through abutments to the new width of the bridge.

Traffic would need to be slowed to 5-10 kph for a few days after the deck has been keyed into the existing bridge to minimise deflection while the deck is curing. This would be carried out with full time traffic controllers. More details of the works can be found at Section 6.1.

2.4 Costs and Funding

This proposal would be financed from Federal Funds and would be at a total project cost of approximately $975 000.

2.5 Timing

The construction works would be expected to commence in April 2000 if the environmental assessment procedure is satisfactorily completed. The works are estimated to take approximately 7 months and be completed by December 2000.

3 Specialist Studies and Community Involvement

3.1 Specialist Studies

Two specialist studies were required. A flora and fauna survey was undertaken by Terra Sciences. An Indigenous and Non-Indigenous Archaeological Study, which included the bridge, was undertaken by Robynne Mills & Associates. The findings of these studies are summarised in Section 6 of this report. Copies of the reports are also provided in Appendices E and F.

3.2 Community Involvement

Consultation by letter was undertaken with the following organisations for consideration under NSW legislation:

- NSW National Parks & Wildlife Service (NPWS)
- Murrumbidgee Shire Council
- Department of Land and Water Conservation (DLWC)
- NSW Fisheries
- Environment Protection Authority (EPA)
- Rural Lands Protection Board

Consultation was also undertaken with Environment Australia due to the use of Federal Funding for the project.

The Council and the Rural Lands Protection Board had no concerns or particular requirements with regard to the proposed works. The issues raised in the other responses are listed below and are dealt with in the applicable sections of this document. Copies of correspondence are provided in Appendix G.

3.2.1 Responses

Comments received and the RTA's responses to these and the relevant REF section numbers are summarised in the table below.

Table 1: Authority Comments and Responses

Comments	*Responses*	*REF Section*
DLWC		
Keep clearing of native vegetation to a minimum	Clearing of any vegetation would only be undertaken where required for the works.	6.7.3; 7.1
Strip and stockpile topsoil for later revegetation	Soil materials would be re-used where possible or stockpiled for use on other RTA projects.	
Prevent movement of silt into the watercourse using appropriate measures	A Soil and Water Management Plan (SWMP) would be undertaken as part of the EMP and these measures would be stipulated as part of the SWMP. These measures have been detailed in the Safeguards Section.	6.3.1; 7.1
Do not alter the current flow pattern or frequency of flow in the waterway	The flow pattern and frequency would not be altered as the piles would be placed in line with the existing piles.	6.4.1; 7.1
EPA		
EPA considers the following matters should be addressed in the REF:		
A site plan – proximity of waters - distances to any residences	Detailed in Figure 1	Appendix A
Details of sediment controls	Sediment controls have been addressed in the REF and an SWMP would be undertaken as part of the EMP.	6.3.1
Details of pollution control equipment to be used during construction to prevent contamination of water	These details have been included in the Safeguards section and would form part of the SWMP.	6.1.3; 7.1
Details of plans for rehabilitation of the site	These details have been included in the Safeguards section and would form part of the SWMP.	7.1
Schedule of the operating times of equipment	Equipment would be operated in normal working hours only and these details have been included in the Safeguards Section.	6.1.2; 7.1
Details of noise control measures	These details have been included in the Safeguards	6.10.1;

Comments	Responses	REF Section
	section.	7.1
Details of assessment of noise impacts on nearby residential premises	There are no nearby residential premises.	
Methods to prevent dust	Methods such as watering down would be implemented and have been detailed in the Safeguards section.	6.5.1; 7.1
Details of location and methods proposed for disposal of materials	These details have been included in the Safeguards section.	6.1.3; 7.1

NPWS		
Fully consider impacts on flora and fauna according to the guidelines	The impacts have been considered in the Flora & Fauna report	Appendix E
Fully consider impacts upon indigenous archaeological sites according to the guidelines	The impacts have been considered in the Indigenous & Non-indigenous Heritage report	Appendix F
NSW Fisheries		
Protection of fish habitat	Fish habitat would not be disturbed and this has been covered in the Safeguards section.	6.2.3; 7.1
Threatened species of fish	This has been addressed in the Aquatics study	Appendix E
Maintenance of fish passage during and after construction	Fish passage would be maintained as the new piles would be placed in line with the existing piles – maintenance of fish passage during construction has been covered in the Safeguards section.	6.7.3; 7.1
Minimal interference with snags	This has been addressed in the Safeguards section	6.7.3; 7.1
Timing of works to avoid floods and flows	The works would be undertaken at low flow.	
Ongoing control of sedimentation	Erosion and sediment controls would be undertaken as part of the SWMP.	6.3.1; 7.1
Rehabilitation and ongoing care of riparian vegetation	This would be undertaken as detailed in Safeguards.	7.1
Maintenance of creek-bed morphology	The creek bed would not be changed and the piles would be placed in line with the existing piles.	6.3.1
Control of run-off from roads	Run-off would be controlled from roads where feasible.	
Appropriate guidance and control of contractors	Contractors would be required to produce a CEMP and detail the measures to be taken.	
Environment Australia		
A number of flora and fauna species listed under the Endangered Species Protection Act 1992 have been recorded within 10 km of the bridge. These species should be surveyed and mitigation measures implemented.	The species outlined in the letter have been investigated in the Flora and Fauna Study and relevant mitigation measures for their protection have been included in the REF.	6.6; 6.7; Appendix E
River Red Gum and Yellow Box should be retained if possible.	Only one small eucalypt sapling will be required to be removed for the widening.	
Removal of riparian vegetation would necessitate the carrying out of vegetation surveys prior to construction and the careful design of a riparian vegetation rehabilitation program.	The Flora Survey has identified that only pasture grasses would be removed near the river. Any bare areas would be revegetated.	Appendix E
Trout cod and Macquarie Perch have also been recorded in the Murrumbidgee River near Narrandera and would suffer adverse impacts if mitigative measures fail to impede erosion and increased sediment	Standard erosion and sediment control measures would be undertaken as part of the construction works. Gum Creek is a small, intermittent waterway and the works would be located 4 km from the Murrumbidgee River.	6.2.2

Comments	Responses	REF Section
loads.		
Surveys should be carried out to determine if the structure is being used by bats and birds to roost.	The Fauna Survey has determined that no bats or birds are currently roosting on the bridge.	Appendix E

4 Strategic Stage

4.1 General

The Sturt Highway forms an integral component of the transportation corridor between Sydney and Adelaide and services the rural communities including the towns of Narrandera and Hay. The area is dependent upon a safe and efficient road system for the transportation of produce and other goods to and from the area. A high standard route is therefore essential to meet these demands.

The proposed widening activities are part of a program of works to upgrade the whole of the Sturt Highway to National Highway Standards. The Standards require minimum lane and bridge widths to ensure the safety of road users at high speeds. These activities are undertaken in accordance with the RTA's responsibilities for ensuring a minimum level of service to bridge users and are in line with the RTA's mission to:

> *manage road related transport infrastructure and provide safe and efficient access to the road network for the people of NSW.*

4.2 Justification and Need for the Works

The work is required to upgrade the bridge to National Highway Standards in line with the rest of the Sturt Highway in this area. The width and alignment of the Highway is generally of a high standard. This encourages high speed travel and an expectation of a consistent, safe standard ahead. The isolated narrow bridge is unexpected and, as such, is a safety hazard, particularly when heavy vehicles meet and pass within the area of the width restriction.

Justification of the work is based upon compliance with Standards and the elimination of a traffic safety hazard from the Highway.

5 Concept Stage

5.1 Objectives of the Proposal

The major objectives of the proposed work would be to:

- Widen the bridge on the southern side.
- Ensure the bridge is a safe structure for the volume of traffic on the Highway.

- Ensure efficient transport of goods and services along the Highway.

Other objectives during and after construction would be to:

- Minimise the adverse effects of the works on the environment and ecology of the areas around the bridge.
- Protect the waterway from any adverse effects of the works.
- Ensure traffic flow remains unhindered as far as possible.

5.2 Options Considered

A number of options for widening the Bridge have been considered. The options are briefly examined here.

5.2.1 Do Nothing

No widening would be undertaken and the bridge would be left in its current state. This would not be a favourable option, as it would not achieve the necessary improvements to ensure the bridge is of a high enough standard to conform to National Highway Standards.

5.2.2 Option 1 – Widen bridge on northern side

The bridge could be widened on the northern side instead of the southern. This would require more disturbance to the surrounding environment due to the presence of more trees and the need to realign the bridge approaches.

5.2.3 Option 2 – Build a separate bridge

A separate bridge could be built near the existing bridge and the road would be realigned to meet the new structure. This option would use more materials and require a larger area to be disturbed. It would also be an expensive option as it would not take advantage of the existing structure.

5.2.4 Option 3 – Use another route

This is a National Highway and is the only major route between Sydney and Adelaide, therefore there is no other route which could be used.

Therefore the preferred option for the RTA would be to widen the existing bridge on the southern side. This is the most efficient, cost-effective and environmentally sound option which requires the least amount of materials and provides a safe route for transportation.

5.3 Statutory Requirements

5.3.1 Local Environmental Plan

The environmental planning instrument which controls development in the area of the proposed work site is the Murrumbidgee Shire Council's Local Environmental Plan. In this plan the zoning of the road and bridge reflects that of the surrounding land uses which are zoned 1(a) – rural.

Under the Plan, road works are permitted with council consent. However as the Proposal comes under the definition of "roads" in the *Roads Act 1984*, State Environmental Planning Policy No. 4 (SEPP 4), Clause 11c allows the RTA to undertake the proposed works without the consent of Council.

5.3.2 Regional Environmental Plans

The area is not subject to the provisions of any Regional Environmental Plans.

5.3.3 State Environmental Planning Policies

The area is not subject to the provisions of any State Environmental Planning Policy, apart from SEPP 4 as described above.

5.3.4 Rivers and Foreshores Improvement Act

The Rivers and Foreshores Improvement Act, 1948 aims to protect the riverine environment by minimising the detrimental impacts of activities or works conducted in and/or adjacent to watercourses. As a part of the Act, any works conducted within 40 m of a "River" as defined in the Act may require a permit under Part 3A of the Act. Similarly the NSW Governments Rivers and Estuaries Policy aims to encourage the sustainable development of the natural resources of the State's rivers, estuaries, wetlands and adjacent riverine plains.

As the proposed works would be undertaken by a statutory body, and soil and water management would be in consultation with the DLWC, the RTA is exempt from the need for a permit. However, the works would be carried out in accordance with the requirements of the Rivers and Foreshores Improvement Act and the State Rivers and Estuaries Policy.

5.3.5 Protection of the Environment Operations Act, 1997

Under the Act, 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.

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.

If repair activities are likely to cause pollution of the water in Gum Creek, a licence would be obtained for the works.

5.3.6 Other Legislation & Licences

Other environmental legislation, which may pertain to the works, is listed below together with a list of licences and permits which may be required. This list is not comprehensive and is only meant to give an indication as to the types of legislation and licences which are applicable. A fuller account would be given in the Environmental Management Plan if the proposal is approved.

- Waste Minimisation and Management Act 1995
- Fisheries Management Act 1994
- Native Vegetation and Conservation Act 1997
- Threatened Species Conservation Act 1995.
- Heritage Act 1977
- Water Act 1912

It should be noted that the Protection of the Environment Operations (POEO) Act 1997 has repealed the following five Acts:

- Clean Air Act 1961
- Clean Waters Act 1970
- Pollution Control Act 1970
- Noise Control Act 1975
- Environmental Offences and Penalties Act 1989

The licences required would depend on the activities undertaken. Under the POEO Act, licences would be required for pollution of the creek, excess noise and any impacts on air quality. A pollution control approval would need to be obtained from the EPA for the construction of any temporary or permanent sediment ponds. It is not anticipated that there would be any noise or air quality impacts for the proposed works.

Under the Water Act, a permit would be required from DLWC for any extraction of water from the creek.

6 Detailed Assessment Stage

6.1 Design Considerations and Construction Process

The works would mainly be on the southern side of the bridge and activity would be confined to this area, as well as to the existing road and the bridge as much as possible. The works would be carried out with only one lane of the bridge closed at any one time. Some slowing of the traffic during the curing and keying in of the two bridges, and short delays of up to 15 minutes at a time would be expected. However, no sidetracks would be required and traffic would not be required to be diverted onto other roads.

6.1.1 Existing and forecast traffic

Figure 1 shows the traffic volumes for the Sturt Highway as Average Annual Daily Traffic (AADT) figures. At present the Sturt Highway is experiencing a growth rate of 3.2% per annum of traffic, which has been used to predict future traffic volumes as it is expected to continue. The growth rate is slightly higher for heavy vehicles than for other vehicles. This growth rate is in line with average State rates.

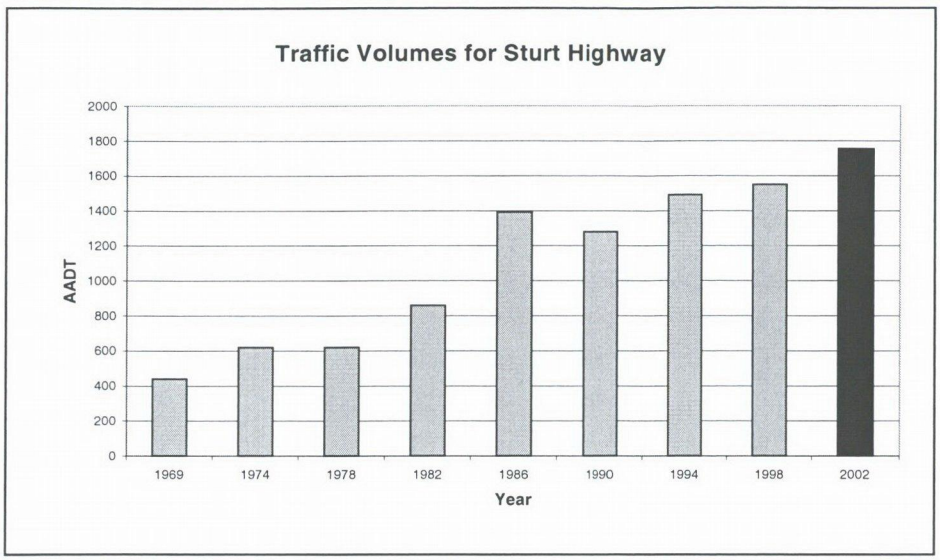


Figure 1: Traffic volumes for Sturt Highway (actual and forecast)

6.1.2 Construction Activities

Plant and equipment which would be used during the works are likely to include:

- generators
- jackhammers
- air compressors
- falsework
- chain saws
- crane
- trucks and other vehicles
- hand held tools
- concrete trucks and pump trucks
- bitumen laying equipment
- line painting equipment

The proposed sequence of the works would be:

1. Set up site compound
2. Place sediment and erosion controls
3. Restrict bridge use to northern lane only, ensure safety
4. Demolish existing kerbs and railing
5. Remove vegetation where necessary
6. Import and shape fill to widen abutments
7. Drive precast piles
8. Place deck and other elements and key into existing bridge deck
9. Realign road approaches for 50 m
10. Cover deck with variable layer of AC overlay to ensure correct slope and seal new road areas
11. Repaint lines, fix barrier railing and kerb and open to traffic

The road realignment would require importation of approximately 2,000 m^3 of fill for the approaches and other material for the road base. This would then be covered with a bitumen surfaced gravel overlay to give a continuous surface with the bridge. The surface level of the road would be raised by approximately 200 mm, tapering to nil at the ends connected to the existing pavement and bridge. The piles would be driven using pile driving equipment located in the creek bed. Where practicable, only equipment necessary for pile driving would be located in the creek bed. All stockpiles would be stored at existing RTA stockpile areas.

The Contractor would not be permitted to establish site facilities, office buildings, amenities, and storage areas etc within:

- any area subject to inundation;
- 20 m of the edge of Gum Creek;
- 15 m of the scarred tree at Gum Creek Bridge site.

Site facilities would be constructed in the road reserve either on the east or west approaches of Gum Creek Bridge on the southern side, or an area of similar or less environmental sensitivity. If storage of fuels, oils and chemicals is proposed within the site facilities area, the storage area shall be surrounded by impervious bund walls to contain any spillage and shall not be:

- within 50 m of any areas of concentrated water flows, floods and poorly drained areas;
- on slopes greater than 10%, or
- near areas of native vegetation.

The works would require approximately three to six personnel and would be undertaken by contractors. The personnel would be accommodated in nearby Narrandera. Fuel would be sourced from Narrandera, Hay or Griffith.

The materials required for the proposed works are concrete, steel reinforcing, bitumen, road base and safety railings. Fill material in the form of clay would also be required to extend the abutments, and would be obtained from an established quarry. Topsoil would also need to be stripped back on areas directly affected by the works which would include approximately 500 to 1000 m^2. The topsoil would be stockpiled and reused where applicable at the end of the construction works. Any excess material would be used in the road reserve (spread and revegetated) or used at other RTA sites, where possible.

Working hours would be:

- Monday to Friday 7 am to 6 pm
- Saturday 7 am to 1 pm
- Sunday & Public Holidays – no work.

Any work which is necessary outside these hours would only be with prior notification of the EPA via their hotline (131555).

6.1.3 Waste Minimisation and Management

Waste associated with the works would include cleared vegetation, soil and rock material, concrete, general litter, and sewage waste from toilets and washroom facilities.

A waste management plan would be prepared and implemented and would include relevant mitigation measures.

6.1.4 Proposed Mitigation Measures

- Traffic management measures would meet the requirements of the Contract Documents, the RTA's *Traffic Control at Worksites Manual* (Version 2) and any other directive of the RTA's Project Manager.
- Traffic management measures would be implemented to ensure minimum delays to traffic.
- At least one lane of the bridge would be open to traffic at all times.

- Construction work would not be undertaken during periods of heavy rain or during winds exceeding 30 km/hr.
- The Contractor would be required to meet all workplace safety legislation.
- Only equipment necessary for pile driving would be located in the creek bed.
- The waste management plan would include the following:
  - Where feasible, waste suitable for recycling such as any of the metal would be sent to a licensed recycling facility and in accordance with the NSW Government's Waste Reduction and Purchasing Policy.
  - Waste oil would be sent to approved recyclers.
  - Concrete trucks and other plant would not be permitted to wash-out on site or in the road reserve and would be directed to return to their depots to be washed out.
  - 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 such as waste concrete would be collected and disposed of at a licensed landfill or other disposal site in the area.
  - The eucalypt sapling to be cleared, would be left in an unobtrusive place in the road reserve.
  - Secure rubbish bins would be provided within site compounds. These would be regularly emptied.
  - Chemicals would be stored in secure compounds with an impermeable floor and appropriate bund walls.
  - The worksite would be left in a tidy and rubbish free state upon completion of the Proposal.

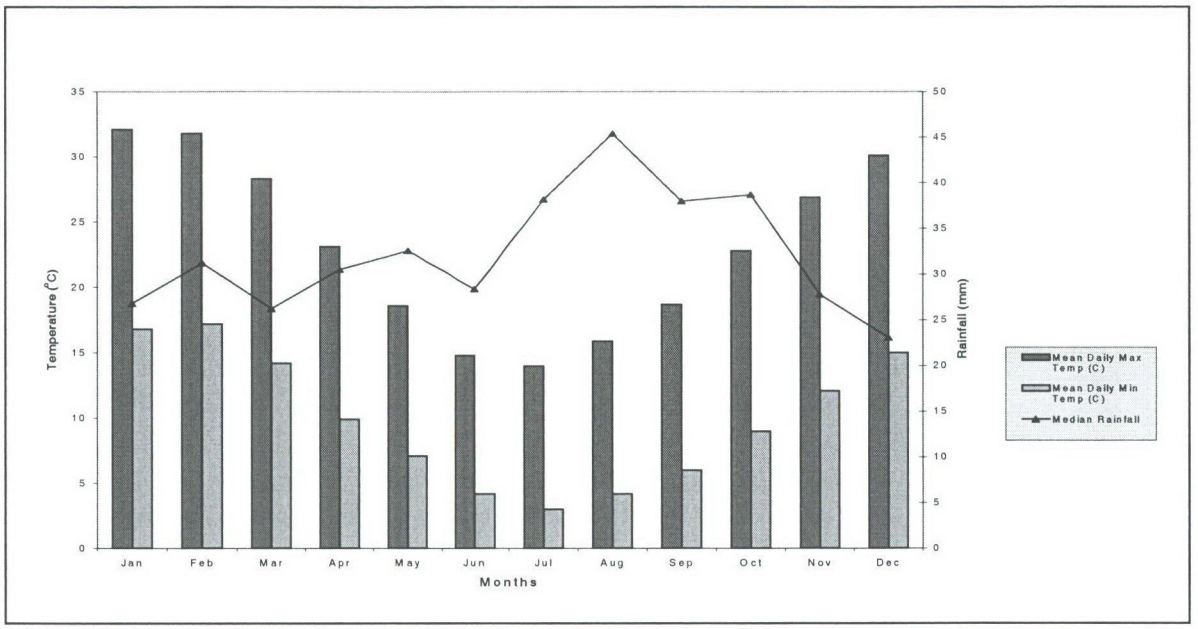
No toxic waste as defined by the *Environmentally Hazardous Chemicals Act 1985*, or the *Waste Disposal Act 1970*, and requiring specialised handling would be generated during the works.

6.2 Landforms, Climate, Geology and Soils

The site is located in the western Riverina area of NSW and is part of the Murrumbidgee River floodplain. The area is characterised by very flat, open country (it varies between 110 and 120 m AHD) with few topographical features apart from the water ways and wetlands.

The climate of the area is typical of the hot, dry conditions of the western area of the Riverina, as depicted in Figure 2 of the climate at nearby Narrandera. The hottest month is January, while July experiences the lowest temperatures. The driest month is usually March, with mostly spring rains occurring and a median annual rainfall of 501.6 mm.

Figure 2: Climate averages for Narrandera



(Source: Bureau of Meteorology 1999)

The 1:250 000 Geological Series sheet for Narrandera shows the site to be underlain by Quarternary sediments of the Murrumbidgee floodplain. These probably overlay rocks of Devonian Age (RTA 1996).

Data on soils of the area are not comprehensive and have not been mapped. However the following information has been provided by DLWC's Narrandera Office (P. Beal pers.com.). In general terms, the soils would most likely be Grey Cracking Clay of the Riverine Plain. These soils are usually associated with low dunes and levees of brown and red crusty duplex soils (desert loams) and sandy rises of deep siliceous sands. The plains are dominated by calcareous red earths and brown calcareous earths (solenised brown soils). It would also be likely that the Gum Creek area might have sand aquifers from old Prior Streams that are commonly found on the Murrumbidgee floodplain.

A Geotechnical Investigation of the area around the bridge (RTA 1996) has also revealed mixed alluvial sediments which were mostly interbedded clays and sands. The Grey Cracking Clays are highly resistant to wind and water erosion due to their blocky structure (Charman & Murphy 1991).

6.2.1 Erosion and Sediment Control

Due to the moderate erosive potential of the soils, standard erosion and sediment control measures should mitigate any effects of the proposal (discussed below in Section 6.3). They would, however, be designed to filter sediment-laden runoff water from the road drainage system before it enters natural waterways for any earthworks required.

6.2.2 Proposed Mitigation Measures

The broad erosion and sedimentation control measures to be implemented would include, but would not be limited to, the following:

- An Erosion and Sedimentation Control Plan would be prepared in consultation with DLWC and implemented in accordance with Department of Housing *Managing Urban Stormwater* Guidelines (DoH 1998) – also known as the Blue Book - as part of the Soil and Water Management Plan for the site.
- All earthworks would be promptly completed once commenced to minimise the exposure period of disturbed areas.
- Soil, rocks, concrete and other material would be swept from the road pavement and removed from the roadside and either incorporated in the work or transported to a designated RTA stockpile site (approved by the RTA) or landfill site at the end of each period of work.
- Erosion and sedimentation control measures would be erected prior to commencement of works and maintained regularly and after rainfall events in accordance with the Blue Book.
- Work would not occur during periods of heavy rainfall or high flows in the creek and would preferably be undertaken during dry conditions where possible.
- Straw bales and sediment fences would be used where applicable and the effectiveness of these measures would be checked daily and would be maintained during the period of the works. If any of the sediment barriers are damaged or otherwise made ineffective during the works, they would be repaired or replaced.
- Sediment would be cleared from behind barriers when they have collected 50-60% of their capacity.
- The sediment barriers and any sediment trapped behind the barriers would be removed at the completion of the work.
- All bare areas would be reseeded and kept vegetated where possible. Hydroseeding or equivalent would be undertaken on batters or steep slopes to establish and maintain a good ground cover, during and after the period of the works.

6.3 Water Flows and Quality

Gum Creek is a small, ephemeral creek which is part of the lagoon system of the Murrumbidgee River floodplain and is an overflow channel for the Murrumbidgee River in times of high flow and flood. It is normally dry or has a small amount of water held between rainfall events. It would only flow during and immediately after most rainfall events unless the event was a large one in which case there would be flooding in the area. During the site visit, the water was relatively low and turbid.

6.3.1 Potential Effects on Flows

The widening of the bridge would not affect the flows of the creek nor flooding regimes. During construction, bed morphology would not be changed as the piles would simply be driven into the substrate. The piles would be in line with the piles of the existing bridge which would ensure there would be no impediment to flows in the Creek.

The increased width of the abutments and the raising of the road by 200 mm may cause very minor backup of floodwaters, but not to a significant degree when compared with the area of the floodplain. High flood levels are significantly lower than the surface of the existing road, thus the road and bridge are not subject to flooding either. No construction material or plant would be left in the creek bed which may interfere with unexpected flows and most of the work would be undertaken from the road and abutments where possible. Water usage for the road works is estimated at 700 kL which would need to be obtained from the Murrumbidgee River. DLWC would be contacted and approvals obtained for any water to be taken from the River.

Where practical, the works in the Creek bed would be undertaken during periods of low water levels. Levels are usually high in spring due to rain. If water was flowing in the creek, diversions would not be required as the piles would be driven straight into the substrate.

6.3.2 Potential Effects on Water Quality

The proposal has the potential to impact on the water quality of Gum Creek through the input of concrete, sediment contained in site runoff, pollutants from hydraulic fluid and fuel leaks or spills, and general litter.

Increased pH levels of the creek may occur in the area surrounding the bridge as a result of concrete in the runoff having a pH as high as twelve. However, the concrete for the piers would be pre-cast prior to delivery to site, limiting the amount of fresh concrete to contaminate the water. The concrete for the deck and other elements would be formed up so there would be very minimal drip from these elements. The most likely source of any concrete contamination would be spills during the pouring or in transfer around the site, and cleaning of trucks and machinery. To minimise any impacts from spills and to prevent them from occurring where possible, a spill management plan would be drawn up prior to commencement of works and would be explained to the on-site workers. To minimise contamination from cleaning of trucks, they would be directed back to their depots to be washed out.

Spills during the refuelling of plant and equipment have the potential to cause localised contamination of waterways. To prevent this, a bunded refuelling site would be provided at the works compound which would be clear of the waterway area.

The potential for any significant amounts of pollutants to enter Gum Creek is very low given the scale of the works, the use of erosion and sedimentation control measures, and the strict maintenance and mechanical standards which would be required of the contractor's plant and equipment. If there was a spill which had the potential to significantly affect the water quality of the Creek, containment measures would be implemented and the EPA would be notified.

The potential for any of the pollutants to reach the Murrumbidgee River through overland or groundwater flow is even lower given the following parameters:

- the distance of the site to the River (approximately 4 km),
- the flow direction of Gum Creek is away from the River.

6.3.3 Proposed Mitigation Measures

In addition to the erosion and sediment controls outlined in Section 6.4.1, the following measures would also be implemented.

- A spill management plan would be produced prior to the commencement of works and implemented on site with instructions given to the workers on minimising the risk of a spill.
- Concrete trucks and other machinery would not be permitted to wash out at the site and would be directed to return to their depots for washing out.
- In the event of a spill containment measures would be undertaken and if the spill had the potential to significantly affect the Creek water quality, the EPA would be notified.
- All plant and equipment would be refuelled in the bunded area at the compound site.

6.4 Air Quality

Air quality at the site is good due to the rural nature of the area. Due to the clay type soils of the area, there could be some dust generated in times of dry weather or if the vegetative cover is removed.

Local or regional air quality would not be decreased by the proposed works. The abutments would be progressively revegetated to minimise the amount of bare areas. Most of the works would be accessed by the existing road which is sealed, however where unsealed accessways are used, water trucks would water the road to suppress any dust generation. Although diesel plant and equipment would be used, there would not be any activities which would produce significant amounts of air pollutants. There are no nearby residences which would be affected by any air pollutants or dust.

6.4.1 Proposed Mitigation Measures

- A water cart would be used to suppress dust generated during the works or from the compound site, that pose a threat to the safety of motorists or to the site personnel.
- The abutments would be progressively revegetated as soon as possible to minimise any bare areas.
- The loads of all trucks carrying material that may produce dust or odours would be covered during transportation and no work would be carried out under high wind conditions.

6.5 Vegetation

A flora survey of the site and surrounding areas was undertaken by Terra Sciences Pty Ltd on 6 August 1999. The key findings of this report are summarised below, and the full report can be found in Appendix E.

All vegetation potentially affected by the proposed work was surveyed on foot. The survey assessed the vegetation directly and potentially affected by the proposed work. The survey area included 100 metres either side of the bridge upstream and downstream along Gum creek and 150 metres along the Sturt Highway.

The conservation status of plant species and communities was assessed with reference to the *Threatened Species Conservation Act 1995* and the national Rare or Threatened Australian Plants (ROTAP) list by Briggs and Leigh (1996). The schedules of the *Endangered Species Protection Act* as well as known wetlands listed under RAMSAR were also referenced due to the use of Federal Funding.

6.5.1 Vegetation Communities and Plant Species

Two vegetation communities occur in the study area and adjacent areas – open riparian woodland along the Gum Creek channel and open pasturelands which make up the rest of the area. Generally the open woodland is dominated by River Red Gum and Black Box associations, while the pasturelands have grasses and saltbush due to grazing practices in the area. The observed flora species at the site is given in Table 2. A full description of the structure and floristics of the communities is given in the Flora and Fauna Report in Appendix D.

Table 2: Observed Flora Species

Family Name	*Botanical Name*	*Common Name*
Chenopodiaceae	*Atriplex suberecta*	Lagoon Saltbush
	Einadia nutans	Climbing Saltbush
	Maireana sp.	Bluebush
	Sclerolaena birchii	Galvanised Burr
Brassicaceae	*Lepidium pseudohyssopifolium*	Peppercress
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum
	Eucalyptus largiflorens	Black Box
Mimosoideae	*Acacia stenophylla*	River Cooba
Faboideae	*Medicago polymorpha*	Burr Medic
Asteraceae	*Vittadinia cuneata*	Fuzzweed
	Sonchus oleraceus	Common Sowthistle
Boraginaceae	*Echium plantagineum*	Patterson's Curse
Cyperaceae	*Cyperus sp.*	Sedge
Poaceae	*Lolium rigidum*	Rye Grass
	Paspalum distichum	Water Couch
	Panicum sp.	Panic
	chloris sp.	Windmill Grass
	Danthonia sp.	Wallaby Grass
	Avena fatua	Wild Oats
	Hordeum leporinum	Barley Grass

A search of the NPWS ROTAP database revealed the possibility of Slender Darling Pea in the area, however the closest recording of the species was in 1961 and was approximately 7 km north-west. This, together with the findings of the site survey which could not establish any evidence of the plant, nor found any suitable habitat for it, means it is very unlikely to occur in the area. An 8 part test for the Pea has been undertaken in the Flora and Fauna Report and is included in Appendix D. The test has found that preparation of a Species Impact Statement for the proposed works is not required.

6.5.2 Potential Impacts

- Disturbance to less than 1000 m^2 of vegetation which consists mostly of ground species and no woody vegetation.
- The removal of one eucalypt sapling which is growing in the way of the proposed widening.
- Potential invasion of common pasture related ground species and problem weed species along worked areas.

6.5.3 Proposed Mitigation Measures

- The removal or damage of native vegetation, especially mature trees would be avoided.
- The eucalypt sapling to be cleared, would be left in an unobtrusive place in the road reserve to act as habitat.
- Cleared areas would be kept to the minimum necessary for safe and effective construction of the works and would be vegetated progressively with groundcover as soon as possible. The mix for the groundcover would be prepared in consultation with DLWC.
- The work area would be defined in some manner to restrict construction to these areas.
- All site offices, work compounds and stockpiles would be located in areas already disturbed. These areas would be located away from drainage lines.
- Local, native tree species recommended by DLWC, would be planted where practical on the new approaches.

6.6 Fauna and Habitat

A Fauna Survey was also undertaken by Terra Sciences on the same day as the Flora Survey and is attached in Appendix E. The weather conditions experienced during the field investigation were considered appropriate for the detection of most of the resident fauna species likely to be present.

The fauna survey was taken over the same area as the flora survey and was based on identification of habitat type, quality and potential. By the completion of the field survey, approximately five (5) hours of active searches had been accumulated. A review of previous studies undertaken in the area was also carried out to identify additional fauna species known to occur in the study region – these are listed in the report.

The Aquatic Survey was undertaken at the same time and involved identification of aquatic vegetation, creek bed characteristics and available aquatic habitat in order to assess the likely occurrence of aquatic fauna species.

6.6.1 Habitat Types and Species Recorded

Terrestrial Species

The species which were observed during the site visit are shown in Table 3.

Table 3: Observed Fauna Species

Type	*Scientific Name*	*Common Name*
Mammals	*Vulpes vulpes*	Fox
Birds	*Cacatua roseicapilla*	Galah
	Melopsittacus undulatus	Budgerigar
	Hirundo neoxena	Welcome Swallow
	Coracina novaehollandiae	Black-faced Cuckoo-shrike
	Myiagra inquieta	Restless Flycatcher
	Lichenostomus leucotis	White-eared Honeyeater
	Corcorax malanorhamphos	White-winged Chough
	Struthidea cinerea	Apostlebird
	Cracticus nigrogularis	Pied Butcherbird
	Gymnorhina tibicen	Australian Magpie
	Corvus coronoides	Australian Raven

Based on the results of both the field investigation, and the NPWS Atlas of NSW Wildlife database review, the following threatened species may occur in the area:

- *Pedionomus torquatus* (Plains Wanderer)
- *Burhinus magnirostris* (Bush thick-knee)
- *Polytelis swainsonii* (Superb Parrot)

These birds use open riparian woodland corridors for breeding, foraging or movement. It is likely, however, that competition is high in the study area from other more common species better able to utilise the habitat given the levels of disturbance present.

Aquatic Species

Based on bioclimatic data, habitat assessment and field survey, no significant or favoured habitat for any threatened or significant aquatic species was detected or identified in the study area.

The Trout Cod (*Maccullochella macquariensis*) occurs in parts of the Murrumbidgee River near Narrandera. The Macquarie Perch (*Macquaria australasica*) has also been recorded from the Murrumbidgee system, however it occurs naturally in the cooler middle and upper reaches of the River system. The report has found that it is highly unlikely that the two species would be directly or indirectly impacted upon by the Proposal due to the distance of suitable habitat.

An 8 part test is included in the Flora, Fauna and Aquatics Report for the three terrestrial birds and the Trout Cod. The test has found that preparation of a Species Impact Statement for the proposed works is not required.

6.6.2 Potential Impacts

- Increased human presence and vehicular noise and movement during the construction period may discourage species from using the study area during this time.
- No impacts would occur to the aquatic species if the proposed works are carried out during a period of no flow when the creek is mostly or entirely dry.

6.6.3 Proposed Mitigation Measures

- Sedimentation fencing would be installed prior to the commencement of works, along the creek bank and along the downslope side of the construction compound. The fences would be regularly maintained throughout the construction phase and would not be removed until all disturbed surfaces are stabilised.
- No polluted or sediment laden runoff from any works areas would be allowed to flow straight into the creek without first being treated.
- All contaminants would be collected and removed from the construction area after the completion of the work.
- During construction, if the Creek is flowing, there would not be any impediment to fish movements under the bridge.
- Works required in the creek bed would be limited to some earthworks necessary for widening the abutments and pile driving.
- The works would not affect the bed of the creek or contribute to aquatic habitat loss, and the structure of the creek bed would remain unchanged at the completion of the works. Piles would be placed in line with the existing bridge piles.

6.7 Archaeological and Heritage Assessment

An Indigenous and Non-Indigenous Heritage Assessment was undertaken of the area and of Gum Creek Bridge by Robynne Mills of Robynne Mills & Associates. A site assessment was made on 20 August 1999, with John Simpson who represented the Griffith Local Aboriginal Land Council (LALC). The site survey covered approximately 1.6 ha where approximately 60% was visible. A full report on the findings is provided in Appendix F and a summary of the results is presented here.

Prior to the site visit, a search of the National Parks and Wildlife Service's Aboriginal Sites Register was made, however no sites were found to be recorded near Gum Creek Bridge. Searches were also conducted with the following organisations for non-indigenous heritage items:

- Australian Heritage Commission, Canberra
- NSW Heritage Council
- National Trust of Australia (NSW)
- Murrumbidgee Shire Council (LEP - Heritage Schedules).

No items were listed on any of the Registers or Schedules which would be impacted by the proposed works. An extensive literature search was also carried out on the Indigenous and Non-indigenous history of the area to provide other useful information.

The site investigation, however, revealed the presence of a scarred tree at the south-western end of the bridge realignment area. This tree would be outside the area of direct impact from the proposed bridge widening.

No non-indigenous sites were identified during the survey and it was concluded from the field assessment and archival investigations that the Gum Creek bridge is not a heritage item.

The survey has concluded that there is no archaeological reason why the widening of the bridge and approach roads should not proceed as planned.

6.7.1 Proposed Mitigation Measures

- Prior to work commencing at Gum Creek Bridge, the RTA and a representative of Griffith LALC would visit the site to identify the location of the scarred tree and advise on installation of fencing around the tree to protect the tree during works at the site. This buffer zone would maintain a distance of 15m from the scarred tree.

6.8 Socio-Economic Considerations

The motoring community may experience some short delays and inconvenience whilst the works are in progress, however they would ultimately benefit from the works due to the provision of a safer route. Only one side of the bridge would be closed to traffic at any one time, thus the route would not be completely blocked to traffic for any time.

No significant adverse socio-economic effects are likely to occur as a result of the works. The works would not disrupt business activities or hinder access to the residence, or cause other social, recreational or economic pursuits. No land acquisitions or property adjustments are required for the works. If access for the residents was impeded, they would be notified of the details of the scheduled works and suitable arrangements would be made to maintain property access.

6.9 Noise and Vibration Effects

There would be little to no effects from noise or vibration from the works. No blasting would be used during the works. The machinery which would be used would not emit any unduly loud noise and there are no nearby residences

6.9.1 Proposed Mitigation Measures

Despite minimal disturbance, generation of noise during the construction period would be minimised wherever possible which would include the following measures:

- Mufflers would be fitted to all plant and machinery used during the works.
- The Contractor would be required to minimise noise outputs through the use of best practice, and high quality plant and equipment.

6.10 Cumulative Environmental Effects

The proposed works would have a cumulative effect with other proposed or current works on the Sturt Highway to bring it into line with National Highway Standards.

Any cumulative ecological effects are likely to be minor and very isolated, and would not result in the extinction of a species from any locality as a result of the current or on-going works.

7 Implementation Stage

7.1 Summary of Proposed Safeguards

The safeguards listed below would be undertaken to ensure minimal environmental impacts on the area in which the activities would be performed. An addendum to this table would be attached to account for any recommendations made by the specialist consultants in regard to flora and fauna habitat and heritage artefacts.

Table 4: Summary of Proposed Safeguards

Potential Impact	Safeguards
General construction and operation impacts	• Preparation of an Environmental Management Plan.
Traffic Management and Construction	• Traffic management measures would meet the requirements of the Contract Documents, the RTA's *Traffic Control at Worksites Manual* (Version 2) and any other directive of the RTA's Project Manager. • Traffic management measures would be implemented to ensure minimum delays to traffic. • At least one lane of the bridge would be open to traffic at all times. • Construction work would not be undertaken during periods of heavy rain or during winds exceeding 30 km/hr. • The Contractor would be required to meet all workplace safety legislation. • Only equipment necessary for pile driving would be located in the creek bed.
Works Compound and Storage	• Site facilities, office buildings, amenities, and storage areas etc would not be established within: ▪ any area subject to inundation; ▪ 20 m of the edge of Gum Creek; ▪ 15 m of the scarred tree at Gum Creek Bridge site. • Site facilities would be constructed in the road reserve either on the east or west approaches of Gum Creek Bridge on the southern side, or an area of similar or less environmental sensitivity. • Chemicals would be stored in secure compounds with an impermeable floor and appropriate bund walls to contain any spillage. Storage shall not be: ▪ within 50 m of any areas of concentrated water flows, floods and poorly drained areas; ▪ on slopes greater than 10%, or ▪ near areas of native vegetation. • Plant and equipment, liquid fuels or other chemicals would be stored off site or at the work site compound.
Waste Management & Minimisation	• A waste management plan would be prepared and implemented and would include the following points. • Where feasible, waste suitable for recycling such as any of the metal would be sent to a licensed recycling facility and in accordance with the NSW Government's Waste Reduction and Purchasing Policy.

Potential Impact	Safeguards
	• Waste oil would be sent to approved recyclers. • Putrescible and other waste not able to be recycled such as the waste concrete would be collected and disposed of at a properly licensed landfill or other disposal site in the area. • Excavated soil and rock would be stockpiled at a site within the road reserve and used in other road works in the district. • Concrete trucks would not be permitted to wash-out on site or in the road reserve and would be directed to return to their depots to be washed out. • Portable, self-contained toilet and washroom facilities would be provided at the work site and would be regularly emptied and serviced by the Contractor providing them, and disposed of off-site in accordance with relevant regulations • Cleared vegetation or other materials would not be burned. • Secure rubbish bins would be provided within site compounds. These would be regularly emptied. • The worksite would be left in a tidy and rubbish free state upon completion of the works.
Erosion and sediment control	• An Erosion and Sedimentation Control Plan would be prepared in consultation with DLWC and implemented in accordance with the Department of Housing's *Managing Urban Stormwater* Guidelines (Blue Book) as part of the Soil and Water Management Plan (SWMP) for the site. • To minimise the exposure period of disturbed areas all works would be promptly completed once commenced. • Soil, rocks, concrete and other material would be swept from the road pavement and removed from the roadside and either incorporated in the work or transported to a designated RTA stockpile site (approved by the RTA) or landfill site at the end of each period of work. • Erosion and sedimentation control measures would be erected prior to commencement of works and maintained regularly and after rainfall events in accordance with the "Blue Book" • Work would not occur during periods of heavy rainfall or high flows in the creek and would preferably be undertaken during dry conditions where possible. • Straw bales and filter fabric sediment barriers would be used where applicable and the effectiveness of these measures would be checked daily and would be maintained during the period of the works. If any of the sediment barriers are damaged or otherwise made ineffective during the works they would be repaired or replaced. • Sediment would be cleared from behind barriers when they have collected 50-60% of their capacity. • The sediment barriers and any sediment trapped behind the barriers would be removed at the completion of the work. • All bare areas would be reseeded and kept vegetated where possible. Hydroseeding or equivalent would be undertaken on batters or steep slopes to establish and maintain a good ground cover, during and after the period of the works.
Water Quality	• Water quality monitoring before and during the works would be undertaken if water is present in the creek. • Where practical, the works in the Creek bed would be undertaken during periods of low water level.

Potential Impact	Safeguards
	• A spill management plan would be produced prior to the commencement of works and implemented on site with instructions given to the workers on minimising the risk of a spill. • All plant and equipment would be refuelled at the works compound site. • Concrete trucks would not be permitted to wash out at the site and would be directed to return to their depots for washing out. • In the event of a spill, containment measures would be undertaken and if the spill had the potential to significantly affect the Creek water quality, the EPA would be notified.
Air quality	• A water cart would be used to suppress dust generated during the works or from the compound site, that pose a threat to the safety of motorists or to the site personnel. • The loads of all trucks carrying material that may produce dust or odours would be covered during transportation. • Works would not be undertaken during periods of high winds which exceed 30 km/h.
Vegetation and Fauna Habitat	• The removal of or damage to native vegetation, especially trees would be avoided. • Sedimentation fencing would be installed prior to the commencement of works, along the creek bank and along the downslope side of the construction compound. The fences would be regularly maintained throughout the construction phase and would not be removed until all disturbed surfaces are stabilised. • No polluted or sediment laden runoff from any works areas would be allowed to flow straight into the creek without first being treated. • Cleared areas would be kept to the minimum necessary for safe and effective construction of the works and would be vegetated progressively with groundcover as soon as possible. The mix for the groundcover would be prepared in consultation with DLWC. • The eucalypt sapling to be cleared, would be left in an unobtrusive place in the road reserve to act as habitat. • All site offices, work compounds and stockpiles would be located in areas already disturbed. These areas would be located away from drainage lines. • All contaminants would be collected and removed from the construction area after the completion of the work. • During construction, if the Creek is flowing, there would not be any impediment to fish movements under the bridge. • Works required in the creek bed would be limited to some earthworks necessary for widening the abutments and pile driving. • The works would not affect the bed of the creek or contribute to aquatic habitat loss, and the structure of the creek bed would remain unchanged at the completion of the works. Piles would be placed in line with the existing bridge piles. • Local, native tree species would be planted where possible in the area of the works.
Indigenous Heritage	• Prior to work commencing at Gum Creek Bridge, the RTA and a representative of Griffith LALC would visit the site to identify the location of the scarred tree and advise on installation of fencing around the tree to protect the tree during works at the site. This buffer zone would maintain a distance of 15m from the scarred tree.

Potential Impact	Safeguards
	• If material suspected of being of Aboriginal origin is uncovered during construction, work in that area would cease immediately and the RTA's Aboriginal Liaison Officer and NPWS would be notified.
Noise	• Mufflers would be fitted to all plant and machinery used during the works.
	• The Contractor would be required to minimise noise outputs through the use of best practice, and quality plant and equipment.

This list would be expanded in the EMP.

7.2 Implementation Process

Environmental safeguards outlined in this document would be incorporated into the detailed design phase of the project and as part of its construction and operation. These safeguards would reduce any potential adverse impact arising from the proposed works on the surrounding environment. All of the safeguards described throughout this REF and the Assessment Report would be incorporated into the Project's Environmental Management Plan (EMP).

The EMP would also identify the requirements for compliance with relevant legislation, requirements for ensuring implementation of the environmental safeguards and development of self-assessment and auditing schedules.

The EMP would provide a checklist of actions to ensure that the environment is adequately protected during the pre construction, construction and post construction phases of the Proposal.

Work would be undertaken by Contractors under the supervision of the RTA.

8 Summary of Key Issues

8.1 Summary of Beneficial Effects

The major beneficial effects would be :

- widening of the bridge
- improved safety for all road users
- upgrade of the Sturt Highway
- protection of the environment while the works are in progress.

8.2 Summary of Adverse Effects

No major adverse effects are expected however, there would be some ground disturbance during the earthworks and some traffic delays due to the need to close one lane at certain times.

9 Consideration of Environmental Factors

The factors listed in Clause 82 of the *Environmental Planning and Assessment Regulation* are considered here in summary of the likely environmental impacts of the proposed works.

FACTOR	IMPACTS
a. *Any environmental impact on a community.* The Proposal would cause some short term impacts on the traffic flow due to only half the bridge being open during construction. However the widening would benefit the community and road users in the long term by providing safe and efficient travelling conditions.	positive
b. *Any transformation of a locality.* There would be a very slight transformation of the locality due to the widening of the bridge. One eucalypt sapling and some ground vegetation would be removed and the road would be slightly realigned.	negative
c. *Any environmental impact on the ecosystems of the locality.* Minor impacts on very localised areas under the bridge would occur due to the works. These impacts would include some removal of vegetation (mainly pasture grasses and sedges) and soil disturbance to increase the width of the abutments. These impacts would be mitigated by erosion and sediment control measures and revegetation of bare areas. There may also be minor impacts on the Creek bed such as disturbance of bottom sediments and removal of vegetation, due to the need to drive the piles. However these would also be mitigated by limiting works to times of low flow and only allowing pile driving equipment into the Creek bed.	negative
d. *Any diminution of the aesthetic, recreational, scientific or other environmental quality or value of a locality.* There would not be a reduction in the aesthetic, recreational, scientific or other environmental qualities of the area.	nil
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 works would have a very minor effect on the form of the bridge due to the widening. They would not have any effect on the archaeological item (scarred tree) due to the mitigation measures which have been proposed.	negative

FACTOR	IMPACTS
f. *Any impact on the habitat of any protected or endangered fauna.* No impact on the habitat of any protected or endangered fauna would occur within the vicinity of the site. The proposed works would have no direct or indirect effects on any habitat of any protected or endangered fauna that may still occur in the locality. There would be very little to no habitat loss or changes.	nil
g. *Any endangering of any species of animal, plant, or other form of life whether living on land, in water or in the air.* No species would be placed in danger by the proposed works.	nil
h. *Any long term effects on the environment.* No long term negative ecological effects would occur. The works would improve the safety for bridge users and would allow vehicles to travel at a constant speed on the Highway.	positive
i. *Any degradation of the quality of the environment.* The proposed works would not degrade the quality of the natural environment due to mitigation measures which would be used and would enhance the safety of the built environment as outlined in Section 7.1.	positive
j. *Any risk to the safety of the environment.* The proposed works would enhance the safety of the built environment.	positive
k. *Any reduction in the range of beneficial uses of the environment.* The proposed works would not cause any reduction in the beneficial uses of the natural or built environment.	nil
l. *Any pollution of the environment.* With the implementation of the required safeguards, the proposed works would not cause any increased pollution of the environment and is likely to decrease pollution by allowing vehicles to travel at a constant speed.	nil
m. *Any environmental problems associated with the disposal of waste.* No toxic or hazardous waste would be generated by the works and no problems would be associated with waste disposal. Where possible, materials such as soil and rock would be recycled for use on other RTA projects.	nil

FACTOR	IMPACTS
n. *Any increased demands on resources, natural or otherwise which are, or likely to become in short supply.* There would be no significant increases in the demands of any resources that are currently or likely to become in short supply. Fuel would be sourced from Narrandera, Hay or Griffith.	nil
o. *Any cumulative environmental effect with other existing or likely future activities.* The works would have a positive cumulative effect on the safety and efficiency of the current use of the bridge and highway. No other existing or likely future uses or activities on the existing highway would be disadvantaged by the proposed works.	positive

10 References

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DoH 1998 *Managing Urban Stormwater: Soils and Construction*. NSW Department of Housing, Sydney.

RTA 1996 *Foundation Investigation: SH14 Shire of Murrumbidgee. Widening of Bridge at Gum Creek, Approximately 75 km West of Narrandera. Report No. G2744*. NSW Roads & Traffic Authority, Scientific Services Branch.

11 Declaration

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

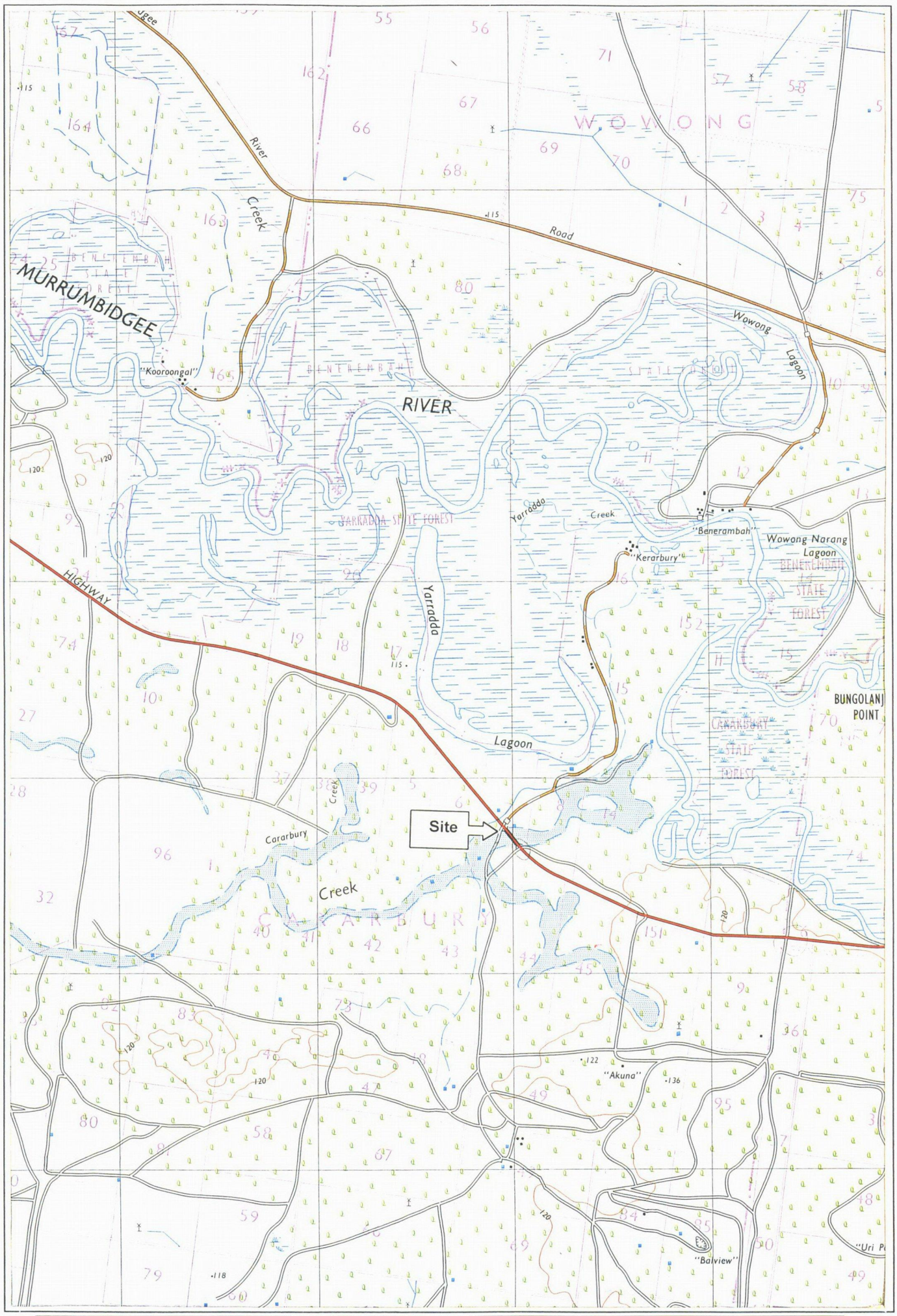
Andréa Zambolt
Environmental Officer
10 February 2000

Brian Hanson
Project Manager
Date:

Appendix A

Figure 1: Site Location Map

Figure 1 Site Location



Topographic Map	Location
Scale 1:50 000	Gum Creek Bridge SH14 Sturt Hwy 75 km west of Narrandera

(Source: Map extract courtesy of Surveyor-General's Department 8028-I & IV Darlington Pt)

Appendix B

Figure 2: Aerial Photo


UAG 1083 152.12
2961
Site
NSW 3105
2961
NSW 3105
SH 14 STURT HIGHWAY
WAGGA WAGGA TO HAY
RUN ABY 13
152.12mm
2940-2966
2015mASL
30.11.92
COPYRIGHT RTA
APPROX. PHOTO
SCALE 1:12,500

Appendix C

Photographs

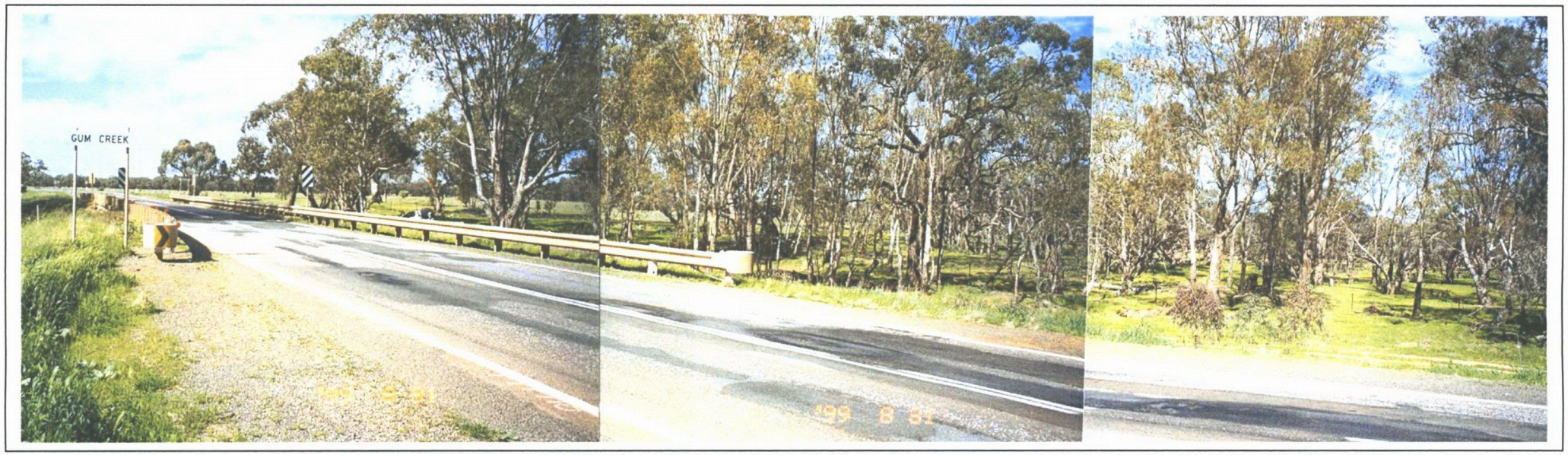


Photo 1: Gum Creek Bridge looking east from north west side of the bridge.

Photo 2: View west on upstream side – far side of bridge is proposed to be widened. Most of these trees would be untouched.

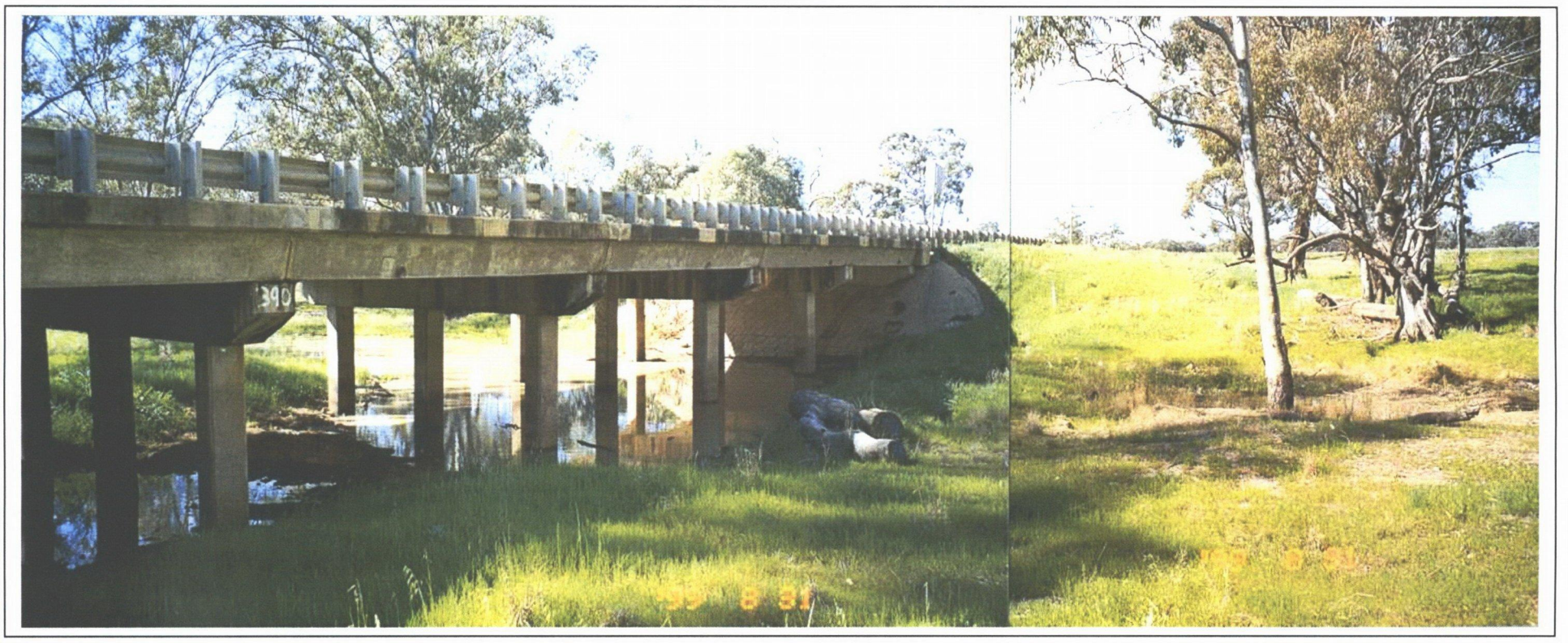


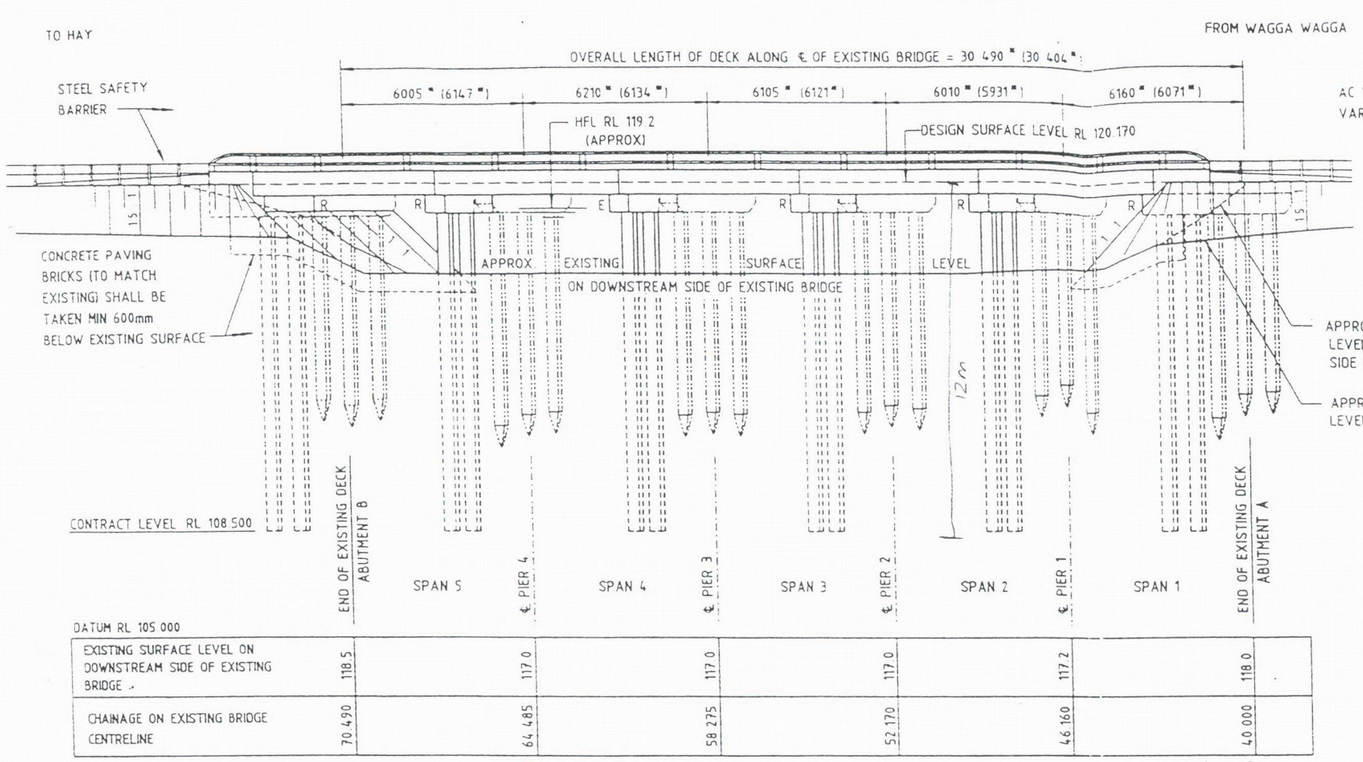
Photo 3: Looking east at the creek channel on the upstream side which would be the side affected by the bridge widening. The small sapling on the right of the photo will need to be removed, however the other trees can all be left. The water level can be seen to be low and the water turbid at the time of the site inspection.

Photo 4: View of the accessway to the south of the Highway.

Photo 5: Access to Kerarbury Run.

Appendix D

Figure 3: Design Drawing



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GENERAL NOTES

SCALE 0 1 2 3 4 5m (1 0.5) OR AS SHOWN.

DIMENSIONS ARE IN MILLIMETRES.

CHAINAGES AND REDUCED LEVELS ARE IN METRES.

REDUCED LEVELS ARE RELATED TO AUSTRALIAN HEIGHT DATUM.

THE BRIDGE CONTRACT DOES NOT INCLUDE CONCRETE PAVING BRICKS BATTER PROTECTION, ASPHALTIC CONCRETE WEARING SURFACE, APPROACH STEEL SAFETY BARRIERS OR ANY WORK IN APPROACHES OTHER THAN TEMPORARY TRAFFIC BARRIERS.

THE BRIDGE CONTRACT DOES INCLUDE DEMOLITION OF EXISTING KERBS AND BRICKS BATTER PROTECTION.

CHAINAGES, DIMENSIONS AND REDUCED LEVELS OF EXISITING BRIDGE AND THOSE DEPENDANT ON EXISTING BRIDGE SHALL BE VERIFIED ON SITE AND NEW WORK ADJUSTED ACCORDINGLY.

DETAILS OF EXISTING BRIDGE HAVE BEEN TAKEN FROM EXISTING BRIDGE WAE DRAWINGS REGISTRATION No 0014 300 BC 0115

E DENOTES EXPANSION BEARING.

R DENOTES RESTRAINED BEARING.

" DIMENSIONS ARE DIRECT CONVERSIONS FROM WAE DRAWINGS AND SHALL BE CONFIRMED ON SITE.

QA RECORDS COMPLETED
MANAGER, BRIDGE DESIGN PROJECTS
DATE 23.1.98

APPROVED
SENIOR BRIDGE ENGINEER
DATE 15.1.98

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

STATE HIGHWAY NO 14 — SHIRE OF MURRUMBIDGEE

BRIDGE OVER GUM CREEK
AT 75.1km WEST OF NARRANDERA
WIDENING

GENERAL ARRANGEMENT

RTA TECHNOLOGY

PREPARED BY
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52 ROTHSCHILD AVENUE
ROSEBERY NSW 2018
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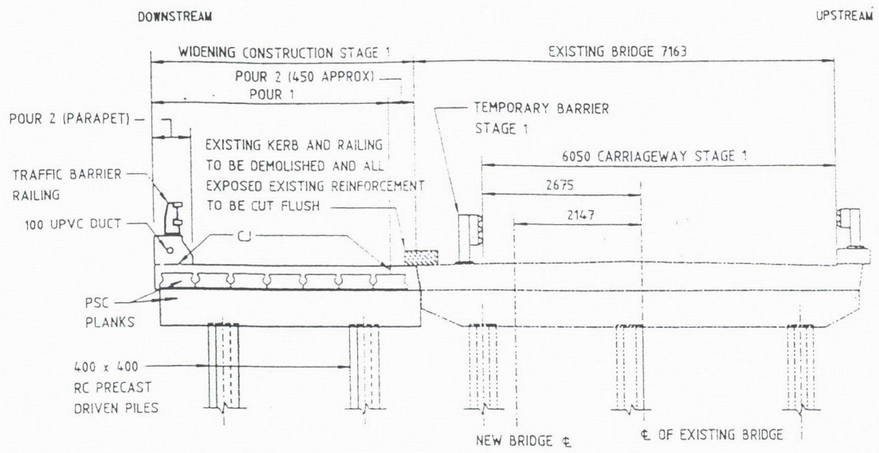
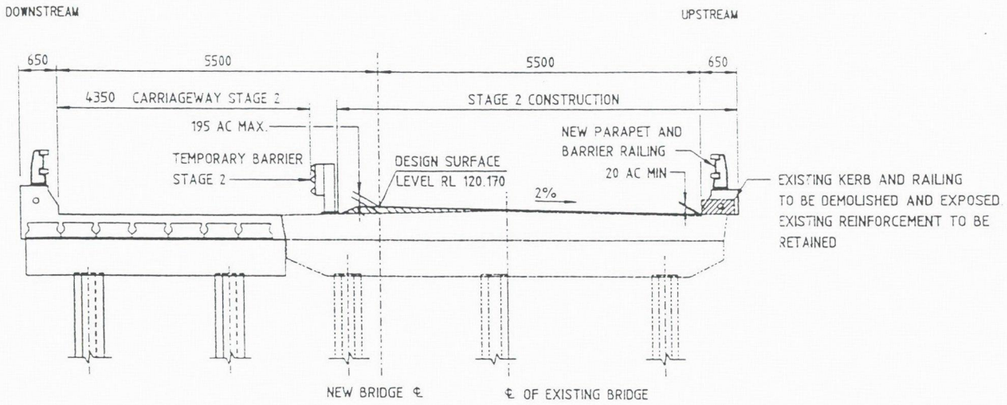
PREPARED	CHECKED	REGISTRATION No OF PLANS
DESIGN D.A.Dring	S.FAYERS	0014 300 BC 4517
DRAWING C.DANIELS	D.A.Dring	
MANAGER, BRIDGE DESIGN PROJECTS 15/1/98		SHEET No 2 — No OF SHEETS 18

A1 ISO A1/A3



STAGE 1



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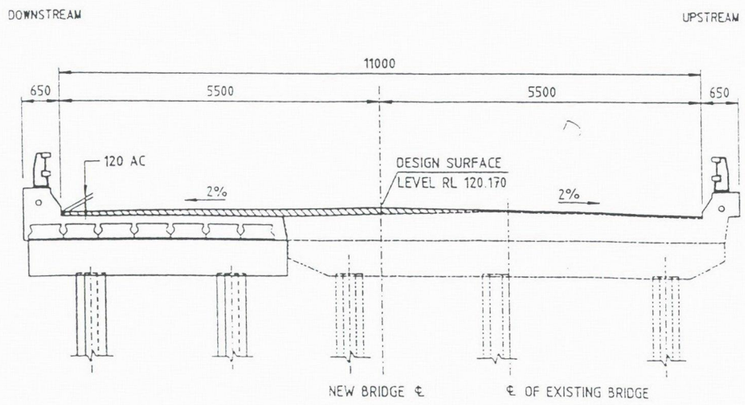

STAGE 3

CONSTRUCTION SEQUENCE

UNCONTROLLED COPY

STAGE1

1 ERECT TEMPORARY BARRIER ON EXISTING BRIDGE AND PROVIDE AN APPROXIMATE 6.05m TWO LANE CARRIAGEWAY
* 2 IMPOSE A 60 km/hr SPEED RESTRICTION ZONE FOR GENERAL SITE SAFETY.
* 3 CARRY OUT EARTHWORKS FOR UPSTREAM WIDENING OF APPROACHES
4 DEMOLISH DOWNSTREAM EXISTING KERB AND RAILING AND ALL EXPOSED EXISTING REINFORCEMENT SHALL BE CUT FLUSH AND SEALED WTIH EPOXY RESIN.
5 CONSTRUCT DOWNSTREAM SIDE STAGE 1 STRUCTURE.
6 THE PLACING OF DECK CONCRETE FOR POUR 2 SHALL NOT BE SOONER THAN 3 DAYS AFTER THE PLACING OF POUR 1 CONCRETE
7 DECK POUR 2 SHALL BE COMPLETED WITHIN ONE DAY
* 8 IMPOSE 10km/hr SPEED RESTRICTION ON THE BRIDGE AND 45km/hr SPEED RESTRICTION ZONE ON THE APPROACHES DURING DECK POUR 2 AND FOR A MINIMUM OF 3 DAYS AFTER COMPLETION OF DECK POUR 2.
* 9 IMPOSE 25km/hr SPEED RESTRICTION ON THE BRIDGE AND 60km/hr SPEED RESTRICTION ZONE ON THE APPROACHES 3 DAYS AFTER COMPLETION OF DECK POUR 2.
10 COMPLETE THE WIDENED STRUCTURE.
* 11 COMPLETE WIDENING OF APPROACHES

STAGE 2

1. ERECT TEMPORARY BARRIER TO PROVIDE AN APPROXIMATE 4.35m ONE LANE CARRIAGEWAY. (DONE BY RELOCATING THRIE BEAM TO OPPOSITE SIDE OF POST).
2. ENSURE LAST CONCRETE POURED ON NEW BRIDGE DECK IS AGED 28 DAYS BEFORE BEING SUBJECTED TO TRAFFIC.
3. SHIFT TRAFFIC ONTO NEW BRIDGE DECK AND PROVIDE TRAFFIC CONTROL.
4. TRAFFIC LOADING ON NEW BRIDGE DECK SHALL BE LIMITED TO T44-TRUCK. NO HEAVY CONSTRUCTION VEHICLE OR HLP 320 LOADING IS PERMITTED.
* 5. IMPOSE 25 km/hr SPEED RESTRICTION ON THE BRIDGE AND 60 km/hr SPEED RESTRICTION ZONE ON THE APPROACHES.
6. DEMOLISH UPSTREAM EXISTING KERB AND RAILING AND RETAIN EXPOSED EXISTING REINFORCEMENT.
7. CONSTRUCT NEW UPSTREAM PARAPET AND ERECT NEW RAILINGS.
* 8. LAY ASPHALTIC CONCRETE WITH VARIABLE THICKNESS ON EXISTING BRIDGE DECK AREA.

STAGE 3

1 REMOVE TEMPORARY BARRIER
* 2 LAY ASPHALTIC CONCRETE ON NEW WIDENED BRIDGE DECK AREA AND APPLY LINEMARKINGS.
* 3 REMOVE SPEED RESTRICTION AND TRAFFIC CONTROL.

* DENOTES NOT IN BRIDGE CONTRACT.

GENERAL NOTES

SCALE: 0 1000 2000 3000mm
1000 500

ISSUE	DATE	REVISION	PREP	CHECK	AUTH

ROADS AND TRAFFIC AUTHORITY OF NSW

STATE HIGHWAY NO 14 — SHIRE OF MURRUMBIDGEE

BRIDGE OVER GUM CREEK
AT 75.1km WEST OF NARRANDERA
WIDENING

CONSTRUCTION SEQUENCE

RTA TECHNOLOGY

PREPARED BY
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LOCKED BAG 30 NEWCASTLE NSW 2300
PHONE (02) 4924-0248
FACSIMILE (02) 4924-0344

PREPARED	CHECKED	REGISTRATION No. OF PLANS
DESIGN ~~D. O. Dirf~~	S. Fyfe	0014 300 BC 4517
DRAWING C.DANIELS	~~D. O. Dirf~~	
MANAGER, BRIDGE DESIGN PROJECTS		SHEET No 3 — No OF SHEETS 18

DS No DN4CSEQ

Appendix E

Flora, Fauna and Aquatics Report

Ecological Assessment

GUM CREEK BRIDGE

Prepared for

RTA TECHNOLOGY

DECEMBER 1999

by

Terra Sciences Pty Ltd ACN 075 657 359

ECOLOGICAL ASSESSMENT

GUM CREEK BRIDGE

DECEMBER 1999

Prepared for

RTA TECHNOLOGY

by

Terra Sciences Pty Ltd

Surveying Civil Engineering, Town Planning & Environmental Consultants

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COLOUR PLATES

FIGURES

TABLES

Section 1.0
Introduction

1.1 PURPOSE OF REPORT

This assessment has been prepared as part of the Review of Environmental Factors for the widening works of Gum Creek Bridge (**Figure 1.1**). It should be read in conjunction with the Review of Environmental Factors.

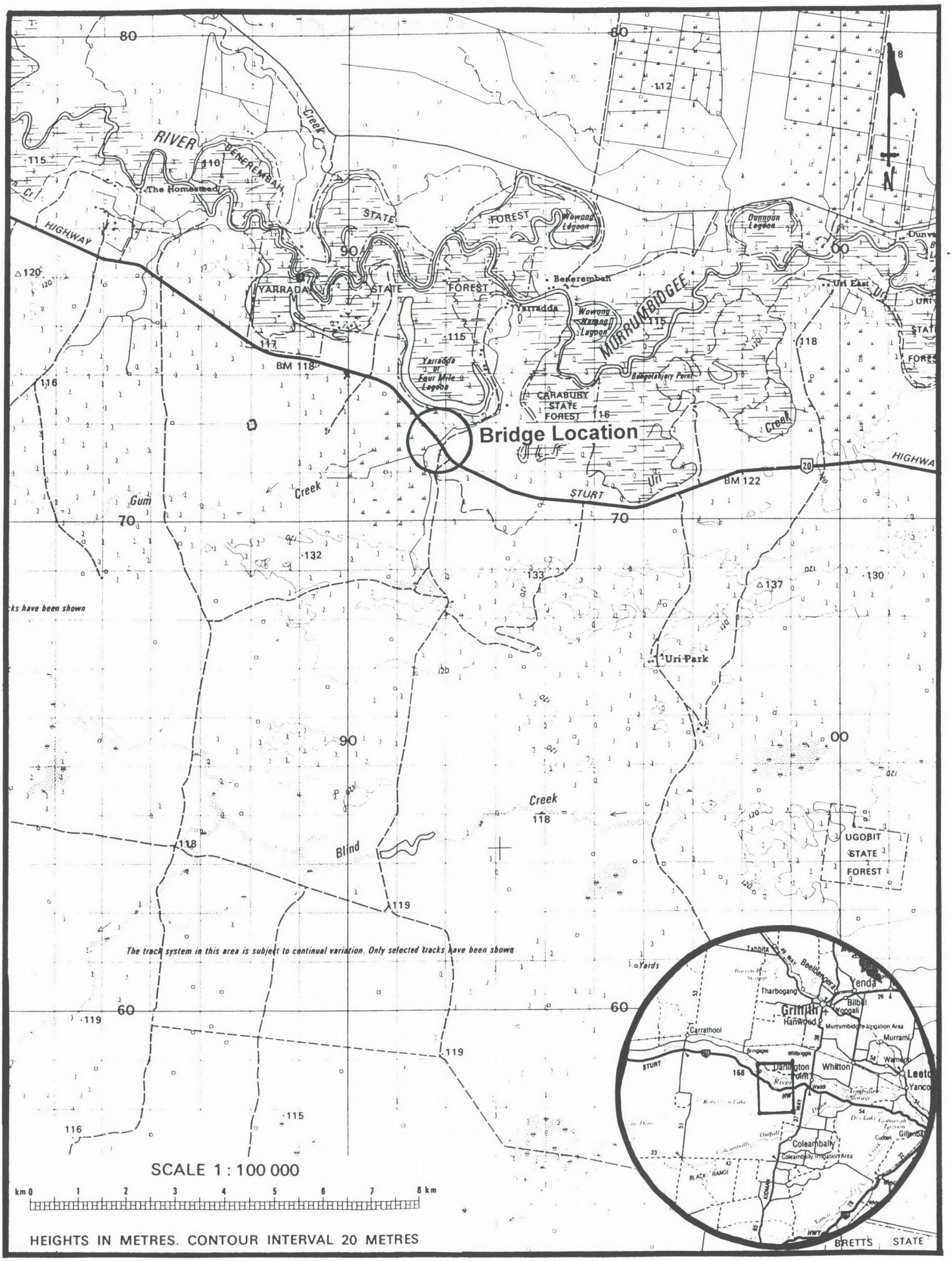
The assessment function is to identify the effects of the proposed bridge widening and associated roadwork activities on all flora and fauna species (including fish and aquatic vegetation species), populations, ecological communities and their habitats. This includes an assessment of whether threatened species are likely to be affected.

Specifically, this ecological assessment considers the implications of the *Threatened Species Conservation Act, 1995* and the *Fisheries Management (Amendment) Act, 1997.*

1.2 REPORT FORMAT

This ecological assessment has been structured into seven sections;

- **Section 1** — explains the purpose and structure of the report.
- **Section 2** — details the desktop and field survey study methodology.
- **Section 3** — presents results of the survey.
- **Section 4** — clarifies impacts.
- **Section 5** — assesses significance of impacts.
- **Section 6** — identifies mitigative measures.
- **Section 7** — provides conclusions.



Crown Copyright © Commonwealth of Australia

Terra

FIGURE 1.1
Site Location

Section 2.0

Study Methodology

2.1 DATA COLLECTION

Prior to the field survey a search was conducted of the National Parks and Wildlife Services' *Atlas of NSW Wildlife* database for the Colleambally 8028 map sheet.

Available literature detailing the distribution of threatened species (*National Parks and Wildlife Service 1996; Briggs and Leigh {'ROTAP'; Rare or Threatened Australian Plants} 1996; Strahan 1995*) was also reviewed to identify threatened species that may occur in the region.

Mr Bob Roach, Planner for Murrumbidgee Shire Council was contacted with regards to any relevant issues which may be contained in the State of the Environment Report. There were no flora or fauna issues for the locality of the study area.

2.2 SITE INSPECTION

The field investigation was conducted on 6 August 1999. The survey was conducted by Dean Lavers (Ba. Ap Sci, Env Tech), ecologist for Terra Sciences.

The survey site is located at Gum Creek Bridge approximately 75 kilometres west of Narrandera. The study area (**Figure 2.1**) took into account the area of the existing bridge, abutments, approximately 100 metres either side of the bridge along the drainage-line (ie. upstream and downstream), as well as vegetation flanking the Sturt highway (approximately 150 metres either side of the bridge along the road alignment). Habitat within this area has the potential to be directly or indirectly impacted by the proposed works.

The highway easement is fenced either side of the road alignment (approximately 50 metres from the centre-line). Both the road easement and fenced paddocks show evidence of grazing by cattle. A gravel sidetrack detours around the bridge to the southern side of the highway. Old earthworks suggest that a sidetrack may have once existed to the northern side of the bridge as well.

At the time of the survey weather conditions were mild and sunny, skies were clear with gentle breezes from the south-west. Air temperature averaged 17 degrees Celsius during the survey. No precipitation had been recorded for the seven day period before the survey.

Terra

FIGURE 2.1
Study Area

2.2.1 Terrestrial Survey

The survey was conducted over a period of five hours between early morning and mid-day. This survey period was sufficient to obtain data to adequately interpret the study area.

A general reconnaissance by foot of the study area was initially carried out with landform and vegetation units located and correlated with survey plans, aerial photos and topographic map details. Any sites, appearing to be more diverse or unusual, were investigated in order to obtain an overview of community diversity. The undersides of the bridges were also inspected for the presence of bird and bat species. The quality, availability and levels of past disturbances remained consistent within the habitat of all existing communities. This level of variance between each habitat type was assessed as being relatively low over the study area.

Due to the relatively small size of the study area, vegetation survey was carried out by conducting random sample transects into representations of each vegetation community. Along this straight line transect, data including existing vegetation species, community composition and potential habitat was compiled. Floristic samples were taken of unknown species and identified after the survey. Habitat assessment included consideration of flora of conservation significance and potential habitat of the threatened flora species that may occur in the locality.

The main guides used in the field to assist the flora survey included Cunningham, Mulham, Milthorpe and Leigh (1981), Costermans (1994), Brooker and Kleinig (1993) and Auld and Medd (1996). Harden (1990) was primarily used for exact keying of sampled flora specimens.

The fauna assessment was based on identification of habitat type, quality and potential. This entailed opportunistic observations of scats, tracks and diggings, nesting sites, remains and species observations and call identification. Habitat assessment included consideration of fauna of conservation significance and the potential habitat of threatened fauna species that may occur in the locality.

The main guides used in the field to assist the fauna survey included Strahan (1995), Slater(1994), Swan (1990), Robinson (1994), Triggs (1996) and Wilson and Knowles (1992).

Nocturnal survey was not considered essential to reach a conclusion for the survey. Available habitat data obtained from the site survey was considered sufficient to assess the potential for the occurrence of significant fauna species. The small size and limited habitat availability on the subject site, the level of existing disturbances, the extent of proposed impacts by bridge works and the composition of habitat surrounding the study area would likely make any information obtained through a 'snap-shot'nocturnal survey, inconclusive.

2.2.2 Aquatic Survey

Qualitative sampling was limited by absence of long standing water within the creek. Determination of which species may use the site, and in what proportions, could only be made based on the quality and availability of potential habitat within the creek bed and existing pools.

Based on the above, the aquatic survey involved identification of aquatic vegetation, creek bed characteristics and available aquatic habitat.

2.3 SURVEY LIMITATIONS

Climatic conditions were not considered to have impacted on the survey's effectiveness. Adequate vegetation and accessible water provided potentially suitable conditions for many terrestrial fauna species. Further, climatic conditions were not considered to be significant as the study has primarily assessed habitat quality and quantity rather than the occurrence or non occurrence of species.

Aquatic survey was not compromised by the absence of flowing water and significant pools within the study area. Aquatic survey primarily took into account available habitat and typical flow regimes for the creek.

Many flora species were in good health or retained seeds at the time of the survey. This assisted in precise identification.

Section 3.0

Results

3.1 FLORA

The study area encompassed two vegetation communities. These communities include an **open (riparian) woodland** (Specht, 1981) which extends along the Gum Creek channel and the **open grasslands** (Specht, 1981)which flank the creek course. This community is typical of the secondary creek channel corridors of the locality. All species identified during the survey area listed within **TABLE 3.1**

TABLE 3.1
OBSERVED FLORA LIST

FAMILY NAME	BOTANICAL NAME	COMMON NAME
CHENOPODIACEAE	*Atriplex suberecta*	Lagoon Saltbush
	Einadia nutans	Climbing Saltbush
	Maireana sp.	Bluebush
	Sclerolaena birchii	Galvanised Burr
BRASSICACEAE	*Lepidium pseudohyssopifolium*	Peppercress
MYRTACEAE	*Eucalyptus camaldulensis*	River Red Gum
	Eucalyptus largiflorens	Black Box
MIMOSOIDEAE	*Acacia stenophylla*	River Cooba
FABOIDEAE	*Medicago polymorpha*	Burr Medic
ASTERACEAE	*Vittadinia cuneata*	Fuzzweed
	Sonchus oleraceus *	Common Sowthistle
BORAGINACEAE	*Echium plantagineum* *	Patterson's Curse
CYPERACEAE	*Cyperus sp.*	Sedge
POACEAE	*Lolium rigidum* *	Rye Grass
	Paspalum distichum	Water Couch
	Panicum sp.	Panic
	Chloris sp.	Windmill Grass
	Danthonia sp.	Wallaby Grass
	Avena fatua *	Wild Oats
	Hordeum leporinum *	Barley Grass

* denotes Introduced Species

The study area extends through a section of open woodland (riparian sub-type) flanking the meandering Gum Creek. The Sturt Highway crosses the shallow creek depression of the Gum Creek channel approximately four kilometres south of the Murrumbidgee River. The riparian open woodland and woodland corridor of this river system and its associated lagoons are located less than one kilometre to the north as can be seen in **Figure 1.1**.

The Gum Creek course is defined by a woodland corridor. From aerial photographic information, the woodland corridor becomes more defined downstream to the south west. The broader locality consists of large open grasslands, pasture and cropping areas intersected by the denser timbered corridors of creek-lines. The dominant feature of the locality is the meandering Murrumbidgee channel to the north.

3.1.1 Terrestrial

Open (Riparian) Woodland

The open riparian woodland of the Gum Creek channel is almost exclusively dominated by a River Red Gum (*Eucalyptus camaldulensis*) and Black Box (*Eucalyptus largiflorens*) association. These species are restricted to the deeper, periodically inundated alluvial soils of the creek channel and its associated drainage lines. The community composition is open in structure becoming more scattered over flood-out areas and secondary channels located to the south-east of the study area. The boundaries of this community are clearly defined and terminate abruptly with the edges of the drainage channels. The community consists of a high proportion of young (approximately 25 to 40 years old) to young-mature (approximately 60 to 100 years old) aged trees scattered with infrequent mature and old aged individuals. These older trees become more common closer to the broader woodland associated with Yarradda Lagoon, located approximately one kilometre to the north. Older trees also tend to be located in the bottom of the creek depression rather than on the more elevated bank shoulders.

The bridge alignment presents a gap of approximately 20 metres in the woodland canopy. Trees have been previously cleared from the southern side of the bridge to form a gap of approximately eight metres. Trees are growing closer to the northern side, however open areas within the creek course indicate that trees may have once been cleared for a sidetrack. The sidetrack located on the southern side of the bridge does not cause a break in the woodland continuity.

The upper storey of the riparian community is dominated by River Red Gum and Black Box. Only one other tree species was present within the study area. This species was River Cooba (*Acacia stenophylla*) which was uncommon throughout the community. No mid or lower storey species exist apart from River Red Gum saplings. Recruitment by tree species is low, reflecting impacts from grazing stock.

Most species identified during the vegetation component included more robust and common native species. Other species included introduced pasture related species. These species are defined by a '*' within **TABLE 3.1**.

Many understorey species at the time of the survey were lush due to a favourable season. Grass species including Rye Grass (*Lolium rigidum*), Water Couch (*Paspalum distichum*) and Wallaby Grass (*Danthonia sp.*) made up a significant proportion of the ground cover in the creek depression. On the more elevated banks, ground cover became more sparse and contained a higher proportion of introduced pasture related weed species (eg. Patterson's Curse (*Echium plantagineum*). Barley Grass (*Hordeum leporinum*) and Common Sowthistle (Sonchus oleraceus)). Native species such as Burr Medic (*Medicago polymorpha*). Galvanised Burr (*Sclerolaena birchii*) and other *Chenopodiaceae* species were also present on better drained areas.

Sedge species were uncommon within the study area. Scattered sedges were present around the perimeter of the small ephemeral pool under the bridge. These *Cyperus* species did not have flower heads or nuts at the time of the survey. It is unlikely that the sedge species found on the survey area would be either of the two listed threatened species. (*C. aquatilis* grows in ephemerally wet sites, north of Evans Head area (Northern NSW Coast). *C. conicus* grows in open woodland on sandy soil. It is known from the north-western plains, being rare from the Pilliga area).

Some evidence of timber cutting exists within the fenced paddocks either side of the bridge and the high proportion of multi-stemmed young-mature trees provides evidence of past clearing practices.

Ground litter is sparse throughout the riparian woodland with only occasional large logs present throughout the community.

The floristic diversity of the community is low, reflecting impacts from grazing practices and ingression from pasture related vegetation species.

No unusual, rare or threatened species were identified in the study area.

Open Grassland

The open riparian woodland community is bounded by broad open grassland which has been strongly induced by grazing practices. Agricultural practices in the locality include grazing and cropping.

Vegetation species in these open areas include many species commonly associated with these agricultural practices. The flats immediately adjacent to the creek and road alignment are dominated by low grazed pasture associated species. These include Lagoon Saltbush (*Atriplex suberecta*), Bluebush (*Maireana sp.*), Burr Medic (*Medicago polymorpha*), Fuzzweed (*Vittadinia cuneata*), Windmill Grass (*Chloris sp.*), Wallaby Grass (*Danthonia sp.*) and Barley Grass (*Hordeum leporinum*).

The grassland community is very open. Trees which occur throughout the community are isolated with timber areas existing exclusively along drainage-lines.

3.1.2 Aquatic Flora

Gum Creek is an ephemeral waterway which is likely to flow for only short periods of time after heavy localised rainfall. Given the elevation of the creek, the fall of surrounding lands and mapped creek details it is likely that the creek is otherwise inundated by flooding events of the Murrumbidgee River. Most flow events would be attributed to localised rainfall and storms occurring within the creek catchment or from possible overflow events of the Murrumbidgee River to the north.

Sedge and reed communities within the bed of Gum Creek are sparse and lack diversity. This low diversity is likely to be attributed to grazing impacts and to the infrequent flow events of the creek. Only occasional plants exist around prior water holding depressions or as isolated clumps along the creek bed.

No submerged aquatic vegetation species were present in the water holding pool in the creek bed. It is considered unlikely that flow events continue long enough to support aquatic vegetation communities.

3.2 FAUNA

3.2.1 Terrestrial

Observed fauna at the site was low (as shown in **TABLE 3.2**). This reflects disturbances arising from the highway and from the history of agricultural practices in the surrounding area. Habitat quality improves and species diversity increases with distance away from the Sturt Highway alignment, particularly towards the woodland associated with the Cararbury State Forest to the north-east and Yarradda Lagoon to the north.

TABLE 3.2
OBSERVED FAUNA LIST

MAMMALS	
Scientific Name	**Common Name**
Vulpes vulpes *	Fox
BIRDS	
Scientific Name	**Common Name**
Cacatua roseicapilla	Galah
Melopsittacus undulatus	Budgerigar
Hirundo neoxena	Welcome Swallow
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Myiagra inquieta	Restless Flycatcher
Lichenostomus leucotis	White-eared Honeyeater
Corcorax melanorhamphos	White-winged Chough
Struthidea cinerea	Apostlebird
Cracticus nigrogularis	Pied Butcherbird

TABLE 3.2 OBSERVED FAUNA LIST	
Gymnorhina tibicen	Australian Magpie
Corvus coronoides	Australian Raven
* Denotes Introduced Species	

The timbered riparian corridor potentially provides shelter, foraging and movement habitat. In a broader regional context the Gum Creek corridor passes through broad open agricultural areas, linking with important alternative habitat and refuge such as the Yarradda and Cararbury State Forests and the timbered Murrumbidgee River corridor.

The dominant habitat type of the study area is arboreal habitat. The largest group of fauna species observed over the study area were avian species typical to riparian corridors passing through an agriculturally dominated landscape. Observed species included the Galah, Red-rumped Parrot, Australian Raven, Restless Fly catcher, Chough, Apostle Bird, and Welcome Swallow. All species observed are common to this locality and are not rare or of any conservation significance. These species are likely to utilise the corridor as refuge, foraging and as a timbered movement corridor. The underside of the bridge deck was inspected, revealing several broken Swallow mud nests. It is unlikely that any other species uses the bridge structure for roosting or nesting.

It is considered that a general lack of undisturbed and quality ground habitat, neighbouring agricultural practices and consistent vehicular disturbances inhibits the potential for terrestrial species diversity in the study area. Native mammal species diversity is likely to be very low in the study area due to the high levels of impact caused by neighbouring grazing activities (which have reduced ground vegetation), lack of alternative terrestrial habitat (ie. stony outcrops and hollow logs) and levels of roadside disturbances. Fox tracks were also observed in the study area. No traces of native mammal species were detected.

Reptilian habitat is also limited due to a lack of habitat diversity. Litter levels on the study area are generally shallow with no rocky outcrops or dense vegetation present. No reptilian species or important reptilian habitat was detected on the study area. Less disturbed and broader areas of habitat are likely to exist for reptilian and mammalian species to the north within the State Forest areas associated with the river channel.

Old aged River Red Gum trees containing large tree hollows and cavities may potentially provide significant wintering or maternal roost sites for bat species within the riparian corridor. Trees with hollows suitable for bat roosts are present within the study area and tend to be located away from the road verges and bridge alignment. The tall mature riparian woodland present on and around the study area is likely to provide suitable refuge, foraging and movement habitat for bat species. However, no features were observed over the study area which indicate that this site may provide more important habitat resources for bat species than broader neighbouring riparian woodlands.

3.2.2 Aquatic Fauna

At the time of the survey, only a small waterhole was present in the study area, beneath Gum Creek Bridge. There was no evidence of the history of past flow events. Stock have been watering in the pool, resulting in fouling of the water and disturbing the edges.

It is unlikely that significant native fin-fish habitat exists in the creek even during flow events. The bed of the creek does not have the characteristics for good native fish habitat. It is relatively uniform and does not contain any deeper water-holes or snags.

The creek channel bed may provide potential habitat for amphibian species during periods of flow or inundation. No amphibian species were identified on the site. A specific survey was carried out in and around the waterhole remaining under the bridge. Lack of tall vegetation around and within ephemeral water holding depressions also limits available amphibian habitat.

3.3 THREATENED SPECIES

3.3.1 Threatened Flora

An assessment was made on the likely presence of threatened species based upon bioclimatic range-data, the National Parks and Wildlife Service's Atlas of NSW Wildlife data base, habitat assessment and field survey. Species which could potentially use available habitat in the study area are listed include Mossgiel Daisy (*Brachycome papillosa*) *and* Slender Darling Pea (*Swainsona murrayana*)

Based on records from the database, a specific survey was carried out for the Slender Darling Pea (*Swainsona murrayana*). Based upon database records, this species may occur in the area. The closest recording of this species comes from scattered forest, located approximately seven kilometres to the north-west taken in 1961.

The Slender Darling Pea is known from grasslands, on inland plains and discharge areas, and also in eucalypt forests. The species is threatened by grazing by stock, rabbits and kangaroos and by competition from weed species (*NPWS, 1996*).

A specific survey was undertaken in order to identify this species in the survey area. No plants were found and no evidence of its existence in the study area was identified. The field survey has established that no ROTAP (Rare or Threatened Australian Plants) or regionally significant flora species are likely to be present in the study area. It is unlikely that the site provides suitable habitat for any threatened flora species. Vegetation of road verges and in the vicinity of the bridge has been modified from its original structure by vehicular and stock disturbances, past earth works and neighbouring pasture species.

The other flora species, *Brachycome papillosa* was not specifically searched for due to the dissimilarity between the study area and the species known habitat, soil types and associated vegetation. *Brachycome papillosa* is known to occur in the south-western plains of NSW from Mossgiel to Urana. The species is known from annual *chenopod* shrublands occurring on red-brown cracking clays and also fine white puffy clay. The species has been recorded from a located approximately 30 kilometre east of the study area. This recording was taken in 1950 on an area which is now used for irrigated cropping.

3.3.2 Threatened Fauna

Based upon bioclimatic range-data, the National Parks and Wildlife Service's Atlas of NSW Wildlife data base, habitat assessment and field survey, the following threatened fauna species may occur in the area. These include:

- Plains Wanderer (*Pedionomus torquatus*)
- Bush Thick-knee (*Burhinus magnirostris*)
- Superb Parrot (*Polytelis swainsonii)*

These are considered the only threatened species that may occur in the area. These species use open riparian woodland corridors for breeding, foraging or movement. Specific habitat requirements are listed within Part (a) of the 8 Part Test (**Section 5.2**).

It is likely, however, that competition is high in the study area from other more common species better able to utilise the habitat given the levels of disturbance present.

3.3.3 Threatened Aquatic Fauna

Based upon bioclimatic range-data, habitat assessment and field survey, no significant or favoured habitat for any threatened or significant aquatic species was detected or identified in the study area.

Indicators that the aquatic habitat values in the vicinity of Gum Creek Bridge are low, include the following:

- Based on the characteristics of the waterway the aquatic habitat classification in the vicinity of Gum Creek Bridge is considered "Class 3 – Minimal fish habitat" (NSW Fisheries, 1999). The basis for this classification being that Gum Creek has a defined channel with ephemeral flows and has the potential (albeit very limited) to provide refuge and feeding areas for some aquatic fauna.

- Vegetation which is present in the drainage course is representative of a very ephemeral aquatic system. Most flora species include species which are tolerant of long dry periods.

- There are no established wetlands in the locality.

- There is no gravel or rock substrate in the study area. The value of the locality as a spawning area is considered minimal due to the ephemeral nature of flows.

The Trout Cod (*Maccullochella macquariensis*) is listed as an endangered species in the *Fisheries Management Amendment Act*, 1997. It occurs in parts of the Murrumbidgee River near Narrandera (*Douglas et al 1994, Reed 1993)*. An eight part test has been carried out on this species.

The Macquarie Perch (*Macquaria australasica*) is listed as endangered on the ANZECC Threatened Australian Fauna List (Environment Australia, 1999) and has also been recorded from the Murrumbidgee system. The species natural habitat of well shaded streams with deep rock pools to provide shelter, and shallow riffles for food and spawning sites is not present on or in the locality of the study site. The species occurs naturally in the cooler middle and upper reaches of the Murray-Murrumbidgee River System. It is highly unlikely that the species will be directly or indirectly impacted upon by the proposed development with correct mitigative measures in place.

Section 4.0

Impacts

4.1 GENERAL

The proposed bridge widening and associated road works carried out on, or as close to the existing alignment as possible, will minimise ecological impacts. Impacts will primarily be associated with the widening of the immediate approaches to the bridges and the actual works carried out for bridge widening.

4.2 FLORA IMPACTS

- Disturbance to less than 1000 square metres of vegetation. This vegetation consists mostly of ground species with the proposed works potentially removing less than ten multi-stemmed trees or saplings less than 30 years old. None of these younger trees are hollow bearing. Three older Black Box trees are also present approximately 10 metres from the southern side of the bridge alignment. One of these trees is dead. These trees contain no significant hollows.

- The potential ingression of common pasture related ground species and problem weed species along worked areas.

4.3 FAUNA IMPACTS

- Increased human presence and vehicular noise and movement during the construction period may discourage species from using the study area during this time.

4.4 AQUATIC IMPACTS

- It is unlikely that any aquatic impacts will occur if proposed bridge works are carried out during a period where the creek depression has no flow and is mostly or entirely dry.

Section 5.0

Significance of Impacts

5.1 INTRODUCTION

On the basis of the field survey and a review of available data, it is considered that no threatened flora, fauna or aquatic species are likely to by impacted by the proposed bridge widening and associated road works. No threatened or uncommon species were identified within the study area and impacts resulting from past clearing, grazing and roadside disturbances limit the potential of their occurrence.

The following species are considered the only threatened species that could potentially use available habitat in the study area. Inclusions are based on bio-climatic considerations, known data records and sightings, and available habitat in the study area. Threatened species considered include:

TABLE 5.1
Basis for Inclusion

Species	Bio Climatic	Habitat Assessment	NPWS Database
Mossgiel Daisy (*Brachycome papillosa*)	✓		✓
Slender Darling Pea (*Swainsona murrayana*)	✓	✓	✓
Bush Thick-knee (Burhinus magnirostris)	✓	✓	✓
Plains-wanderer (*Pedionomus torquatus*)	✓		✓
Superb Parrot (*Polytelis swainsonii*)	✓	✓	✓

Accordingly, an eight part test of significance for these species has been undertaken.

NSW Fisheries has also requested that the Trout Cod (*Maccullochella macquariensis*) be assessed under an 8 Part Test. A separate 8 Part Test has been prepared for this species.

5.2 TERRESTRIAL FAUNA SPECIES

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

Bush Thick-Knee, *Burhinus magnirostris*

Habitat includes lightly timbered open forest/woodland with ground litter, short sparse grass, and few or no shrubs. Habitat also includes riparian vegetation

around permanent water (riparian, woodland and mallee). This species is widely distributed except in closely settled areas. It prefers less arid areas and is known from river flat and Belah-rosewood-mallee areas around Buronga-Mildura.

This species eats a wide range of invertebrates and vertebrates as well as seeds and fruit when available. A ground dwelling bird mostly affected by habitat removal and urban encroachment. This species can continue to live in slightly disturbed areas.

This species may occur within the riparian corridor and in surrounding agricultural flats. Preferred habitat for this species on the study area is likely to be variable due to grazing impacts and vehicular disturbances. Similar or better quality habitat is available to the north of the study area, where broader areas of grassy open woodlands exist. The broader woodlands of Yarradda and Cararbury State Forests are likely to provide favoured habitat for this species. The proposed works would not create a significant break within the Gum Creek open woodland corridor, nor would it impact upon the distribution or composition of open woodlands in the broader locality.

Plains-wanderer, *Pedionomus torquatus*

This is a ground dwelling bird species which displays very cryptic behavior and is sedentary in pockets of permanent habitat where there is sufficient food. The Plains-wanderer occurs within short, flat and sparsely grassed plains, steppes, fallow and stubble fields in southeastern Australian inland of the Great Dividing Range and through-out the Murray-Darling. Its preferred habitats consist of approximately 50% bare ground, 10% fallen litter, and the remainder cover with low (<5 cm) vegetation with a smaller amount of taller vegetation (important for concealment), but no trees.

This species tolerates some forms of agriculture, including broad-acre grazing on unimproved pasture and cropping on a long rotation. Threats to this species include intensive agriculture, habitat alteration, fire, competition, predation, pesticides and hunting.

Preferred habitat is scarce across the study area. In favourable seasons the species may opportunistically visit the locality and forage on neighbouring open grassland and pasture areas. It is likely that roadside and agricultural disturbances in the area would discourage this species from using the site for habitat other than opportunistic visitation. Similar or better quality habitat is available to the north of the study area, where broader areas of grassy open woodlands exist. The broader woodlands of Yarradda and Cararbury State Forests are likely to provide favoured habitat for this species.

Superb Parrot, *Polytelis swainsonii*

The Superb Parrot is a common inhabitant of open woodland and riverine forests of inland NSW. It has been recorded in riparian woodland and makes use of the woodland links of the river and its tributaries for movement between nesting and feeding areas. The Parrot nests in large mature River Red Gum and several Box species with nesting frequently occurring in dead trees.

An assessment of habitat indicate that the Gum Creek corridor may potentially provide habitat for this species. Scattered large mature Red Gums or Box trees are present within the corridor, however these are uncommon adjacent to the highway alignment. No preferred nesting trees would be removed by the proposed works. While nesting habitat and potential feed trees are available in the immediate locality, the preferred White Box and Bimble Box species are absent. It is more likely that the species would use quieter and broader areas of the riparian corridor away from the highway alignment for breeding and foraging activities than the habitat which is available in the study area. Similar or better quality habitat is available to the north of the study area, where broader areas of grassy open woodlands exist. The broader woodlands of Yarradda and Cararbury State Forests are likely to provide favoured habitat for this species.

The proposed works would not create a significant break within the Gum Creek corridor which would inhibit movement of the species.

Survey concluded that the occurrence of populations of the above listed threatened species in the study area is unlikely. There is the possibility that some of the listed species may potentially use the site from time to time for opportunistic foraging, however their life cycles are unlikely to be disrupted. The proposed development would not be likely to disrupt the life cycle of the species such that a viable local population 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.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act,* 1995. None of these species are listed as an endangered population. Therefore, the proposed bridge widenings and associated road works would not significantly compromise the viability of any endangered population.

(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.

Bush Thick-Knee, *Burhinus magnirostris*

The regional distribution of preferred habitat for this species extends through much of NSW with the exception more settled areas, the arid northern inland and the more elevated areas of the Great Dividing Range including the alpine areas. Habitat for this species includes lightly timbered open forest/woodland with ground litter, short sparse grass, and few or no shrubs. Habitat also includes riparian vegetation around permanent water (riparian, woodland and mallee).

The proposed works would not modify or remove a significant area of known habitat which in either a local or regional context is unique or important for the conservation of the listed threatened species. The proposed works would not create a significant break within the Gum Creek corridor or between corridors and woodland which may inhibit movement of the Bush Thick Knee.

Plains-wanderer, *Pedionomus torquatus*

The regional distribution of habitat for the Plains Wanderer throughout most of the Central, Northern and Southern tablelands and plains and also areas of the Western plains. Habitat for the Plains-wanderer occurs within short, flat and sparsely grassed plains, steppes, fallow and stubble fields in south-eastern Australian inland of the Great Dividing Range and through-out the Murray-Darling. Its preferred habitats consist of approximately 50% bare ground, 10% fallen litter, and the remainder cover with low (<5 cm) vegetation with a smaller amount of taller vegetation (important for concealment), but no trees.

The proposed works would not modify or remove a significant area of known habitat which in either a local or regional context is unique or important for the conservation of the Plains-wanderer. The proposed works would not effect the availability of open grasslands suitable for the Bush Thick Knee in the locality of the bridge.

Superb Parrot, *Polytelis swainsonii*

The regional distribution for the Superb Parrot is located primarily on the upper and middle reaches of the Murray, Murrumbidgee and Lachlan Rivers. Its winter range extends into central-northern NSW. It is a common inhabitant of open woodland and riverine forests of inland NSW and makes use of the woodland links of the south-western river systems for movement between nesting and feeding areas.

The proposed bridge works would not modify or remove a significant area of known habitat, which in either a local or regional context is unique or important for the conservation of the species. The proposed works would not create a significant break within the Gum Creek corridor or between this

riparian corridor and adjoining areas of woodland, which may inhibit the movement of the species.

(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.

Bush Thick-Knee, *Burhinus magnirostris*

An area of lightly timbered open forest/woodland with ground litter, short sparse grass, with few or no shrubs including riparian vegetation around permanent water (riparian, woodland and mallee) will not become isolated from interconnecting or proximate areas of similar habitat for this species.

Plains-wanderer, *Pedionomus torquatus*

An area of short, flat and sparsely grassed plains, steppes, fallow and stubble fields consisting of approximately 50% bare ground, 10% fallen with low (<5 cm) covering vegetation will not become isolated from interconnecting or proximate areas of similar habitat for this species.

Superb Parrot, *Polytelis swainsonii*

An area of open woodland and riverine forest habitat is not likely to become isolated from interconnecting or proximate areas of similar habitat for this species

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act, 1995*, defines critical habitat as habitat declared under Part 3 of the Act. No critical habitat was identified on site, therefore no critical habitat will be affected.

(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 study area is located in the NSW Riverina region. This region comprises an ancient riverine plain and alluvial fans extending from lower central NSW to northern Victoria. *Thackway and Creswell (1995)* have identified this region as being poorly conserved with less than one percent of the region dedicated to conservation areas.

No National Parks and Wildlife Service conservation area occurs within a 50 kilometre radius of the study area, however several State Forests are within close proximity to the site. Some of these State Forests include; Yarradda State Forest, Benerembah State Forest, Cararbury State Forest, Uri State Forest,

Bretts State Forest, Dunnoon Lagoon State Forest, Boona State Forest, Willbriggie State Forest and Luba State Forest. It is likely that areas such as these would provide a broader and generally better representation of habitat for the listed species.

As well as these areas, scattered riparian woodland corridors, roadside reserves and Travelling Stock Routes provide potential habitat for species.

There is insufficient information available on individual threatened species to determine whether these species are 'adequately represented in conservation areas'. The proposed works are not considered to represent a potential threat to the conservation of any of the listed species.

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

The proposed bridge widenings and associated road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of these species. Works would not contribute to any of the threatening processes listed in the *Threatened Species Conservation Act*, 1995.

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

The study area does not provide resources or features of significance with regard to the distributional limits or habitat requirements of any of the listed species. Further, each of the listed species' limits of known distribution extend outside the study area.

5.3 AQUATIC SPECIES

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

Trout Cod, *Maccullochella macquariensis*

In NSW little is known about the physicochemical requirements of Trout Cod. Habitat in the Murray River consists of deep, slow flowing waters with mud or sand sub-strata with abundant snags and woody debris. Habitat within Victoria includes deep pools separated by sections of fast flowing water with steep drops and rocky chutes. The sub-strata consists mostly of bedrock, boulders, gravel and sand. Instream cover is in the form of woody snags and overhanging banks. The species are often found in deeper pools but smaller fish have been found amongst boulders, under logs and other cover in shallower waters.

Angling, introduction of trout, and activities that damage rivers (sedimentation, dams, removal of riparian vegetation and instream habitat, changed flow or water temperature) and river improvement works (de-snagging and channel modification) have contributed to the decline of the species.

Although Trout Cod have been collected from the Murrumbidgee River near Narrandera, these fish are considered escapees from the Inland Fisheries Research Station at Narrandera and are not considered to be part of a self-maintaining population at present (*Douglas, et al. 1994*).

Given the ephemeral nature of Gum Creek and the absence of any large pools, snags and other preferred habitat it is considered highly unlikely that this species would occur within the creek system. It is therefore highly unlikely that a local population of this species would be placed at risk.

(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.

An endangered population is defined as a population specified in Schedule 4 of the *Fisheries Management Amendment Act*, 1997. The proposed bridge widenings and associated road works would not significantly compromise the viability of any endangered population.

(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 development would not modify or remove a significant area of known habitat which in either a local or regional context is unique or important for the conservation of the Trout Cod. Due to the use of an existing side tracks and retaining the same bridge alignment the proposed works would not significantly alter the creek system. A significant area of known habitat would not be removed or modified as a result of the proposed works.

(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.

An area of known habitat is not likely to become isolated from interconnecting or proximate areas of habitat for the Trout Cod. The proposed works would not isolate any area of known interconnecting habitat or proximate areas of habitat.

(e) Whether critical habitat will be affected.

No critical habitat is listed under Schedule 4 of the *Fisheries Management Amendment Act*, 1997. No critical habitat was identified on site, therefore no critical habitat will be affected

(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.

Currently there are no conservation areas in place for the Trout Cod. Some protected areas both within NSW and Victoria have restrictions to help prevent the removal of this species. These include bans and closed seasons on anglers exist within the two known self-maintaining populations areas.

By 1994 over 130,000 hatchery-bred juvenile Trout Cod had been released. Surveys (*by Endangered Species Unit of NPWS, from 1990 to 1993*) have shown that some fish had survived, but it was too early to determine whether self-maintaining populations will become established. NSW Fisheries has also released juvenile Trout Cod into private dams in the Burrumbuttock area (near Albury, NSW) to establish a protected population (*Douglas, JW, Gooley GJ and Ingram, BW, 1994*). There has also been a stocking site of hatchery-bred Trout Cod within the upper Murrumbidgee at Gundagai (*Douglas, et al. 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 bridge widenings and associated road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of these species. Works would not contribute to any of the threatening processes listed in the *Fisheries Amendment Act*, 1997.

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

The study area does not provide resources or features of significance with regard to the distributional limits or habitat requirements of this species. Only two self-maintaining populations are recognised within the presently known distribution for this species. These are located within the Murray River below Yarrawonga Weir and in Victoria in Seven Creeks below Polly McQuinns Weir.

5.4 TERRESTRIAL FLORA SPECIES

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

Slender Darling Pea, *Swainsona murrayana*

This species is a semi-erect sparsely downy forb, which is probably annual, and produces winter-spring growth and dies back after flowering. In NSW collections of this species have been made between Silverton and east Tambar Springs and near Jerilderie.

This species grows in grasslands, on inland floodplains and discharge areas, and also in eucalypt forests. Known threats to this plant are grazing, clearing, competition from weeds and habitat disturbance.

The timing of the survey coincided with the winter-spring growing period of this species, however, this species was not detected during field survey. Whilst potential habitat is available within the creek course and flood-out zones it is likely that grazing regimes have excluded this species from the existing communities. Earth works and vehicular disturbances closer to the bridge and highway alignments have altered native plant composition which are dominated by more common and robust species.

Survey and study concluded that the occurrence of populations of *Swainsona murrayana* in the study area is unlikely. The proposed development would not be likely to disrupt the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Mossgiel Daisy, *Brachycome papillosa.*

This species is known to occur in the south-western plains of NSW from Mossgiel to Urana. The species is known from annual *chenopod* shrublands occurring on red-brown cracking clays and also fine white puffy clay. The species has been recorded from a located approximately 30 kilometre east of the study area. This recording was taken in 1950 on an area which is now used for irrigated cropping.

The timing of the survey coincided with the winter-spring growing and flowering period of this species, however, this species was not detected during field survey. While known associated chenopod species were present on the study area, the structure of the ground community is likely to have been highly disturbed and modified by the grazing history of the site and surrounds. Further, the soil-type and vegetation community of the study area are dissimilar to the known or recorded habitat for this species.

Survey and study concluded that the occurrence of populations of *Brachycome papillosa* in the study area is unlikely. The proposed development would not be likely to disrupt the life cycle of the species such that a viable local population 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.

An endangered population is defined as a population specified in Part 2 of Schedule 1 of the *Threatened Species Conservation Act,* 1995. These species are not listed as an endangered population. Therefore, the proposed bridge development and associated road works would not significantly compromise the viability of any endangered population.

(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.

Swainsona murrayana

The regional habitat distribution for *Swainsona murrayana* occurs on the north and central slopes, north, south and far south western plains of NSW and Queensland, Victoria and South Australia. In NSW collections of the species have been made between Silverton and east of Tambar Springs and also near Jerilderie

The proposed bridge works would not modify or remove a significant area of known habitat, which in either a local or regional context is unique or important for the conservation of the species. The proposed works would not impact upon, modify or remove a significant area of grasslands, inland floodplains, discharge areas or eucalypt forest.

Brachycome papillosa

The regional habitat distribution for *Brachycome papillosa* occurs on the south-western plains and south far-western plains of NSW from Mossgiel to Urana. The majority of NPWS Atlas recordings come from further south-west of the study area.

The proposed bridge works would not modify or remove a significant area of known habitat, which in either a local or regional context is unique or important for the conservation of the species. The proposed works would not impact upon, modify or remove a significant area of annual chenopod shrublands or grasslands

(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.

Swainsona murrayana

An area of grasslands, inland floodplains, discharge areas, or eucalypt forests will not become isolated from interconnecting or proximate areas of similar habitat for this species.

Brachycome papillosa

An area of annual chenopod shrublands or grasslands will not become isolated from interconnecting or proximate areas of similar habitat for this species.

(e) Whether critical habitat will be affected.

The *Threatened Species Conservation Act, 1995*, defines critical habitat as habitat declared under Part 3 of the Act. No critical habitat was identified on site, therefore no critical habitat will be affected.

(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 study area is located in the NSW Riverina region. This region comprises an ancient riverine plain and alluvial fans extending from lower central NSW to northern Victoria. *Thackway and Creswell (1995)* have identified this region as being poorly conserved with less than one percent of the region dedicated to conservation areas.

No National Parks and Wildlife Service conservation area occurs within a 50 kilometre radius of the study area, however several State Forests are within close proximity to the site. Some of these State Forests include; Yarradda State Forest, Benerembah State Forest, Cararbury State Forest, Uri State Forest, Bretts State Forest, Dunnoon Lagoon State Forest, Boona State Forest, Willbriggie State Forest and Luba State Forest. It is likely that areas such as these would provide a broader and generally better representation of habitat for the species.

As well as these areas, scattered riparian woodland, roadside reserves and Travelling Stock Routes provide potential habitat for the species.

There is insufficient information available on individual threatened species to determine whether these species are 'adequately represented in conservation areas'. The proposed works are not considered to represent a potential threat to the conservation of the species.

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

The proposed bridge widenings and associated road works are unlikely to constitute a threatening process as the activity would not threaten the survival or evolutionary development of *Swainsona murrayana or Brachycome papillosa.* Works would not contribute to any of the threatening processes listed in the *Threatened Species Conservation Act*, 1995.

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

The study area does not provide resources or features of significance with regard to the distributional limits or habitat requirements of the listed species. Further, the limits of known distribution for *Swainsonia. murrayana* and *Brachycome papillosa* both extend outside the study area.

Section 6.0

Mitigation Measures

The following measures would assist in minimising the impacts on flora, fauna and associated habitat.

- The removal or damage of any mature trees should be avoided. This includes the larger River Red Gums located on the north-eastern side of the bridge, in and along the Gum Creek depression.

- Areas to be cleared should be kept to the minimum necessary for safe and effective construction of the works. This area should be clearly defined and construction machinery and other vehicles be restricted to these areas.

- The works compound site should be established in an area already disturbed. Stock pile sites exist to the east of the bridge with broad open flats located near property gateways to the north-west. Both these areas would provide suitable compound sites.

- Works should be scheduled to occur during seasons when the creek is least likely to have flow or flooding events.

- Throughout construction sediment and erosion control structures should be installed and maintained to minimise any potential downstream effects on aquatic species.

- Following construction a planting of groundcover should be undertaken to stabilise the exposed surfaces. The species mix should be prepared in consultation with the Department of Land and Water Conservation's Catchment Manager.

- Tree planting should be considered to replace any trees removed. These trees should be maintained until they become established

- Care must be taken to avoid spreading problem weeds such as Bathurst and Noogoora Burr through machinery operations. Both these species were identified on the survey area and are listed as Noxious weeds for the Local Government area. Mature plants or plants with burr must be removed before operations to prevent spread from tyres and clothing.

- On completion of works weed inspection and follow-up weed spaying should take place to remove problem weed species growing on the works area.

Section 7.0

Conclusion

The study area is located within the open riparian corridor of Gum Creek. This corridor links to broader woodland associated with the Murrumbidgee River located approximately four kilometres to the north. The study area is in a locality dominated by broad areas of cleared agricultural land. The corridor is comparatively narrow to the surrounding agricultural lands, providing mobile species with a route for movement between foraging sites and broader areas of habitat such as the nearby Cararbury and Yarradda State Forests.

The proposed bridge widening and associated road works are unlikely to significantly widen the existing gap within the Gum Creek open riparian woodland corridor. Mobility by species potentially using the corridor is unlikely to be impacted.

Native vegetation diversity over the study area is low and is retarded by grazing practices and a strong influence by surrounding pasturelands. The community structure indicates that the vegetation within the woodland of the study area has a history of clearing and grazing.

The field survey has established that no ROTAP or regionally significant flora species are likely to be present in the study area. Consideration of bio-climatic range forecast data, a search of NPWS Atlas of NSW Wildlife data base and an assessment of potential habitat indicates that five threatened species (including aquatic) could occur in the locality. These would not, however, be significantly impacted.

This ecological assessment concludes that the proposed bridge widening and road works are unlikely to result in a significant effect on threatened species, populations or ecological communities, or their habitats. Accordingly, a Species Impact Statement is not required.

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Colour Plates

PLATE 1

Gum Creek Bridge facing north west. The gap between the woodland and downstream side of the bridge deck can be seen. The woodland in the centre-distance is part of the Yarradda Lagoon (approximately 1km to the north).

PLATE 2

Gum Creek Bridge facing south west. Note the open vegetation structure of the creek bed, compared to the other side of the bridge. This may potentially be the result of clearing for a prior side track.

Appendix F

Heritage Report

An Archaeological Survey Of The Proposed Gum Creek Bridge widening, 75 Kilometres West of Narrandera on the Sturt Highway.

A report to Roads and Traffic Authority
Asset Performance Technology Branch

by

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August 1999

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Executive Summary

The NSW Roads and Traffic Authority (RTA) commissioned Robynne Mills through Jim Kelton of Central West Archaeological and Heritage Services, to conduct an archaeological survey of the proposed widening of Gum Creek Bridge on the Sturt Highway 75.1km west of Narrandera. The heritage assessment was designed to identify potential impacts of the proposed development on Aboriginal relics ('relics' as defined by the New South Wales National Parks and Wildlife Act 1974) and non-indigenous heritage items as defined by the NSW Heritage Act and the Environmental Planning and Assessment Acts of 1975 and 1979 respectively.

The field component of the study was conducted by Robynne Mills, archaeological consultant on Friday 20th August, 1999. The Griffith Local Aboriginal Land Council (LALC) was represented during the survey by John Simpson. A *Statement of Involvement in the field survey* from Griffith LALC is included as Appendix 5.

This report provides details of local environmental observations relevant to the archaeological sensitivity of the study area. It identifies all known archaeological sites in the vicinity of the study area as recorded in the site registers of the Australian Heritage Commission, NSW Heritage Council, NSW National Trust, NSW National Parks and Wildlife Service (NPWS), Heritage schedules of Murrumbidgee Shire Council and the RTA S170 Heritage lists for the South-Western Region. Survey methods, results and significance assessments are made according to NPWS and DUAP guidelines. Where appropriate, the report recommends site management options to minimise impact on areas of heritage sensitivity and items within the study area.

No non-indigenous sites were identified during the survey and it was concluded from the field assessment and archival investigations that the Gum Creek bridge was not a heritage item.

One indigenous site was identified by the survey. This was a scarred tree at the south-western end of the bridge realignment area. This tree is outside the area of direct impact from the proposed bridge widening. However it is recommended that a protective buffer zone of 15m around the tree be fenced prior to work commencing on the bridge so that there is no indirect damage to this heritage item.

This archaeological survey concludes that there is no archaeological reason why the widening of the bridge and approach roads should not proceed as planned.

1. Details of the Development Proposal and Consultancy Brief.

1.1 Development Proposal

The RTA proposes to widen the Gum Creek Bridge on the Sturt Highway 75.1km west of Narrandera. The proposed work involves the widening of Gum Creek Bridge by 4.5m on the southern side and minor adjustments to the approach roads for a distance of approximately 50m at each end of the bridge (Maps 1, 2, Sketch 1).

1.2 Consultancy Brief

The consultant was commissioned to:

- consult with Griffith LALC prior to the survey, to identify any areas of special significance to the Aboriginal community eg sacred or ceremonial areas and identify issues of Community concern.
- arrange for a representative of Griffith LALC to participate in the field work to ensure that the Aboriginal community was included in all discussions relating to the significance, protection and management of relics and archaeologically sensitive areas identified in the survey.
- examine the proposed route for evidence of indigenous and non-indigenous heritage items, sites and places which could be impacted, either directly or indirectly by the bridge widening program.
- assess the heritage significance of Gum Creek Bridge
- assess the significance of heritage sites/items/places recorded and make recommendations for the protection and management of these items.
- prepare a report on the heritage investigation which meets the requirements of the NPWS and DUAP

1.3 Impacts

The proposed widening of the bridge and adjustment of the approach road will impact directly on an area approximately 10m wide and extending for a distance of approximately 100m on the southern side of the current roadway. The area over which the proposed widening is to take place has been heavily impacted by previous and current road and bridge construction activities which include:

- The construction of 4m wide earthen embankments along the full length of both the eastern and western approaches to the bridge. The construction of these embankments which raise the bridge above the surrounding floodplain, has impacted severely on the area adjacent to these embankment areas (Sketch 1 Photos 1, 5, 8)
- A side track which extends the full length of the embankment is located on the southern side of the embankment.
- The entire road easement area to the north and south of the raised roadway and from the roadway to the fence line, shows evidence of having suffered damage from flooding (eg top soil to a depth of approximately 800m has been removed from the base of many of the large trees, and alluvial gravels and sandy deposit, were noted across the area.
- An area approximately 30m x 40m on the south western side of the bridge approach has been heavily impacted by an access track and also appears to have been used in the past as a storage area for road base and heavy vehicles (Sketch 1). A similar area on the north-eastern side of the bridge is currently being used as a road base storage area.

2. Aboriginal Community Consultation

The survey area is located within the area administered by Griffith LALC. Initial consultation was undertaken with Robert Carroll, Office Manager of the LALC and details of the proposed work, maps and survey dates were faxed to the LALC. A request was also made that at the conclusion of the field survey, a *Statement of Involvement* would be completed by the LALC (Appendix 5). The statement would include LALC views on how the survey was conducted, comments on the level of LALC consultation and issues of concern to the LALC associated with the proposed development. John Simpson represented the LALC in the field assessment.

3. Study Area.

3.1 Location

The Gum Creek Bridge is located 75.1km west of Narrandera on the Sturt Highway. The bridge crosses Gum Creek which forms part of a complex series of lagoons and creeks within the Murrumbidgee River flood plain (Map 2).

3.2 Environmental Observations

The study area is located approximately 1.5km south of the main channel of the Murrumbidgee River which at this point flows in an east-west direction. Gum Creek, together with Yarradda Lagoon and Uri Creek, form a system of overflow channels within the Murrumbidgee floodplain. At the time of the survey, Gum Creek was dry but at times of high water the entire floodplain area would be inundated. The Darlington Point 1:50 000 topographic map indicated less than a 1m variation in the natural topography across this floodplain area. Gum Creek has no definite "creek bank" areas as the water course appeared to extend across the entire survey area. Evidence of the strength and extent of the flow of the water at peak times is indicated by the fact that approximately 80cm of soil has been removed from the base of a large gum on the north-western side of the bridge (Photo 10).

The soil within the survey area is grey, cracked, alluvial floodplain soil which is prone to compaction and wind and water erosion. Although Gilgai soil formations have been identified in the vicinity, none were identified in the Gum Creek Bridge area. Gilgais are relatively shallow 'pot-hole' depressions in the floodplain surface which collect and hold water for considerable periods. These formations are known to have been exploited by Aboriginal people in areas distant from the permanent water sources (Kelton 1997).

Survey area vegetation is dominated by a ground cover of native and introduced grasses and eucalypts which grow both along and within the creek bed area.

A. Indigenous Heritage Assessment

4. Archaeological Context

4.1 Aboriginal Ethnography

According to Tindale (1974) and White (1986), the Aboriginal people who originally inhabited the Gum Creek study area, at least at the time of European settlement, were speakers of the Wiradjuri language.

Witter (1982a) discussed the economies of the prehistoric riverine groups who inhabited the region. He postulated that whilst occupation along the Murrumbidgee River was 'continuous' for at least several months of the year, movement away from the river occurred during the cooler autumn and winter months when fish and shellfish were less easily obtained along the river and when ephemeral water sources were relatively abundant, i.e. from prior streams, gilgai formations and soaks. Witter (1982a:3) also argued that movement away from more reliable water sources was not a regular occurrence or seasonal, but was more in response as an 'optimiser strategy' to cyclical but seasonally unreliable hydrological regimes on the Riverina floodplain and irregular seasonal 'overbank' flooding. Witter saw Gum Creek as possibly a 'forward base' from which the riverine groups periodically exploited the plains resources.

Whilst little is known of pre-historic Aboriginal occupation, there are numerous accounts of Aboriginal lifestyles in the Darlington Point area, at the time of European settlement (e.g. Read 1988, Kabaila, 1995, Mathews, 1896-1901). Read (1988) clearly states the extreme pressures which the new settlers placed upon the original Aboriginal custodians of the land along the Murrumbidgee by the 1840's and the phases of dispossession of their traditional lands and their culture which occurred. According to Read (1988:24) by the early 1840's the Wiradjuri near Narrandera, had fought a bitter and probably their final campaign against European settlement. During this period of the country's history numerous rumours of atrocities against Aboriginal people occurred and were even occasionally published.

During this early period of Aboriginal and white contact in the region, whilst many of the new settlers attempted to establish good relations with local Aboriginal clans or individuals mainly in the interests of self preservation, many of these alliances were superficial and their success varied depending upon the needs of the new settlers, i.e. what staff were required on their holdings and how rapidly the push to open up 'new' lands occurred.

Read (1988:25) states that by the 1860's it was common throughout the region that at best only one or two Aboriginal men and women might have found employment on stations as either station hands or as domestic staff at the homesteads. Casual employment on stations as sheepwashers or trackers still occurred but usually the extended families of Aboriginal station staff tended to live on the stations some distance from the homesteads. River and creek banks and groundwater bore and tank sites were favoured locations for these 'fringe' campsite locations. By the 1880's Mathews (1896-1897, 1901) found that most aspects of ceremonial life had ceased throughout the region and only male initiation ceremonies still occurred although with rapidly decreasing frequency. According to Read (1988:29) the period around the 1870's was very bleak with regard to black - white relations along the Murrumbidgee River.

During the 1870s and 1880s socio-economic conditions of the Aboriginal community along the Murrumbidgee were in decline and missionaries such as Mathews and Gribble pushed for the establishment of the Warrangesda Mission, 3.5km south of Darlington Point. This was set aside as an Aboriginal reserve in 1880 "*... for the present comfort and eternal good of the Riverina Aborigines.*" (Read,1988:30) The Great Depression of the 1920's and 1930's forced many white people into a lifestyle which resembled closely a way of life to which many Aboriginal people had already become accustomed. However, the Wiradjuri of the Riverina maintained links with their country which meant they could travel throughout the Murrumbidgee River region within a vast family network whereas non-Aboriginal people often became more isolated from the rest of the community. Some non-Aboriginal families found a semblance of security in associating with Aboriginal community groups living on unofficial mission or reserve sites.

Whilst mission stations such as Warrangesda no doubt had their bad points, and their management particularly during their earlier period was instrumental in effecting considerable losses to Aboriginal traditional culture, they did provide a safe haven to many Aboriginal people where no stability or peace could be found in the surrounding environment.

By the turn of the century much of the Aboriginal traditional lifestyle had ceased and the majority of Aboriginal families throughout the region were drawn into a work for rations situation and a dependence on welfare (White 1986:86).

4.2 Previous Archaeological investigations

4.2.1 National Parks and Wildlife Service Site Search results

According to the results of a NPWS site data base search there are no known Aboriginal sites located within the immediate vicinity of the Gum Creek Bridge survey area. However, 6 sites are recorded on Gum Creek approximately 14km to the south-west (Map 3). These include

- NPWS sites 48-6-1: a mound site
- Site 48-4-4: a scarred tree site located on the banks of Gum Creek
- Site 49-4-12, an open campsite located on the edge of Robertsons Dry Lake
- Site 49-4-13, an open campsite
- Site 50-5-21, an open campsite
- A known scarred tree site located 1.2km west of Waddaduri Swamp did not appear on the NPWS data base search however, it is known that Twynams applied for Consent to Destroy the site during 1996 or 1997 and that the application was rejected by NPWS - therefore it is assumed that the site is located on some official NPWS data base somewhere.

All known sites occur upon alluvial floodplain landscapes similar to those encountered in the Gum Creek Bridge area.

The NPWS data base report search indicated that whilst no systematic archaeological surveys had been carried out over the immediate survey area, a number of studies had been conducted in the vicinity and the broader region over similar landforms.

4.2.2 Australian Heritage Commission Data Base

This data base identified two indigenous places in the Darlington Point Area. These are the old Warrangesda Mission and Waddi Creek Scarred Trees. Neither of these is within the proposed development area. These two sites are also listed in the NSW Heritage Inventory.

4.3 Previous investigations in the Darlington Point Area.

Witter (1982a) conducted a survey for a proposed electricity transmission line between Darlington Point and Hay. Witter recorded hearth sites of varying sizes comprising baked clay 'balls'. These sites were generally associated with open campsite locations and stone artefact scatters. According to Witter, scarred tree sites were also a common occurrence along water courses in the Darlington Point - Hay survey area (where old-growth native timber stands occurred, particularly black box). Witter observed a pronounced anomaly in the size of stone tool material at sites found during the Darlington Point - Hay study, with the greatest proportion of artefacts measuring less than 3 cm, and that other artefacts including

axes and 'grindstones' were of manuport origin, with their sources well away from the survey area (1982:2).

Witter (1982b) and Thompson (1982) carried out separate archaeological assessments of a proposed 132kV electricity transmission line between Darlington Point and Yanco Weir (over similar landforms to the current study area). These surveys identified a total of 30 Aboriginal sites including scarred trees, 1 open campsite, 4 isolated artefacts and 12 mound/ oven/ hearth sites.

A number of studies have been carried out in the broader region between Narrandera (on the Murrumbidgee River) and the Murray River (approximately 180km to the south of the current survey area). These studies have been conducted, in part, over landforms similar to the current field survey.

Archaeological material recorded at a site recorded on the shores of Lake Cullival, approximately 100km south-east of the current survey area (NPWS site no. 55-2-0001) was apparently only a fraction of the actual relics observed around the lake by Bindon (cited in NPWS site card, n.d.). Unrecorded material included *"... Some skeletons .... Hundreds of ovens and many middens. Artefacts are on all the creek banks middens etc."* In addition to the relics described along the shores of Lake Cullival (and nearby Lake Airlie) by Bindon, extensive evidence of past Aboriginal occupation in the area also occurred in the Rand area, to the south of the current survey area, as described by a Mr. Robert Miller to Victorian Archaeological Survey and NSW NPWS, in 1982. Miller described a vast array of artefacts which he had removed for 'safe keeping' from a ploughed paddock in the Rand area. The list of artefacts included *"... hammerstones, axes, grinding stones etc."* (Miller 1982, cited in NPWS site card).

Brayshaw and Dallas (1985) conducted an archaeological survey over the site of a proposed coal mine and associated electricity power station, near Oaklands, approximately 100 kilometres south-east of the current study area. This field survey located a total of 4 Aboriginal sites, an isolated artefact find and a single historic site. Recorded Aboriginal sites consisted of 3 open campsites and a single scarred tree.

The results of Brayshaw and Dallas' Oaklands survey correspond with and support an occupation model and sensitivity map developed by Lance (1984) for the adjacent Coorabin area of the southern Riverina. Brayshaw and Dallas' Oaklands study located two open campsites in close proximity to water sources, the first site located along the adjacent lower hill slope of a wetland area and the second site on a gentle hill slope adjacent to the banks of a watercourse. Both of these landform units were assessed by Lance (1984) to be areas of high archaeological sensitivity. The third open campsite was located on a hill slope area assessed to be moderately sensitive, presumably being located further away from reliable water sources, or at a greater elevation. The fourth site located during the Oaklands survey was a scarred tree. This site was located on an area assessed to be low in sensitivity, well away from water sources. The presence of a scarred tree a considerable distance from water sources is not out of the ordinary, and would reflect a level of transient movement across the landscape by Aboriginal inhabitants, and the opportunistic removal of a section of bark from a tree trunk for use as a food container, shield or other similar sized artefact.

Open campsites recorded by Brayshaw and Dallas (1985) were relatively large in extent, with stone artefactual material dominated by milky white coloured quartz. Quartz comprised around 80% of total stone tool assemblages recorded by Brayshaw and Dallas, whilst silcrete was the next most common stone tool material. Flaked pieces and flakes were the most common stone artefact types present. Fragments of baked clay were also scattered

over the surface of at least one of the sites, possibly indicating the presence (although heavily eroded) of cooking fire hearths, ovens or mound sites.

Lance (1984) conducted a survey over the site of a proposed kaolin mine at Coorabin. The Coorabin study area was relatively small, approximately 640 metres x 540 metres. Lance found no sites during his study, and attributed the absence of archaeological material to the distance of the Coorabin study area from reliable water sources. He compared the relatively resource poor Coorabin study area with what he believed would have been rich resource zones and more densely populated areas of past Aboriginal occupation located adjacent to the Coorabin study area.

Lance indicated that he believed a vast amount of archaeological material has been observed (although apparently not recorded on NPWS records) along the shores of Lake Urana. In conclusion, Lance considered that had archaeological evidence of past Aboriginal occupation been located within the Coorabin study area it would have tended to represent only 'sporadic' occupation of the area.

Included in the Coorabin survey report, Lance (1984) developed a predictive model for past Aboriginal occupation throughout the general Riverina region, including locations as far south as Oaklands. This model was based upon observations throughout the region, and on the documented occurrence of sites in the NPWS data base. Lance included a map of archaeological sensitivity in his report, which indicated that the availability of water was a major determining factor in the presence of sites and in the density and extent of those sites, all the while taking into account the significant variable of differing resource zones.

Witter (1980) carried out an archaeological survey along the route of a proposed 134 kilometre pipeline between Wagga Wagga and Young. Witter located 15 Aboriginal sites, including 13 open campsites, 1 possible rock well, and 1 scarred tree. The largest site, an open campsite measuring 500 metres x 30 metres, was recorded along the alluvial flats of Muttama Creek, east of Cootamundra. The exact location of this site is not clear from NPWS records. Witter found that all sites were associated with water courses, however, site context varied considerably. Open campsites occurred on a number of varying landforms, including alluvial flats, low ridges and gentle slopes. Witter found that sites occurred with the greatest frequency on adjacent slopes and spurs away from major water courses, but always in association with water sources including springs and soaks. The dominant stone material at all sites recorded by Witter was quartz (90%), and he noted the absence of identifiable tool types, with the majority of stone artefacts comprised of unmodified flaked material. Some tool types observed included a considerable number of quartz cores as well as two quartzite cores, at least one silcrete backed blade, two quartzite pebble 'choppers' (axes), a number of 'hand grinding stones', hammerstones and an anvil stone.

Hiscock (cited in Brayshaw and Dallas 1985) conducted a survey for a proposed electricity transmission line between Wagga Wagga and Darlington Point. Hiscock located 18 scarred trees and 13 isolated artefact locations. Artefacst included 11 unmodified flakes, 2 cores, 2 flaked pieces, 1 retouched flake, a hammerstone, and a piece of broken millstone. Hiscock found quartz to be the dominant stone material. He was apparently unable to identify a correlation between artefact location and environment, with the majority of artefacts located a considerable distance from reliable water sources - contrary to that which would be expected (Brayshaw and Dallas 1985:9).

Smith (1992) conducted a desk top archaeological predictive study along the route of a proposed fibre optic cable route between Albury and Cootamundra. Smith based her prediction on the distribution of previously recorded sites in the study area, previous site

prediction, the views of local Aboriginal land councils and the levels of past disturbance and potential disturbance from the proposed cable route.

Kelton (1998) conducted a survey of a proposed irrigation development at Gunderline, between Darlington Point and Hay. This survey recorded a total of 13 Aboriginal sites which included 6 hearth sites, 3 open camp sites and 4 scarred trees. Kelton concluded from his survey that the two major factors determining site distribution and frequency over the study area were landform and availability of water. The proximity of the Murrumbidgee River, Gum Creek and Dow Creek was significant in Aboriginal site distribution throughout floodplain landscape areas. Evidence of such occupation can still be anticipated throughout the survey area despite disturbance from recent grazing and agricultural activities (such as commercial crop cultivation). Only the integrity of deposits as intact archaeological sites is expected to be reduced. The absence of sites over vast expanses of floodplain landform areas was anticipated as was the presence of sites over the same landscape where gilgai formations occur.

4.4 Predictive Models

4.4.1 Previous models

Brayshaw and Dallas (1985), suggested that a range of site types including artefact scatters, hearth sites and mound sites could be encountered throughout the general area. All site types were predicted to occur in close association with wetland/swamp areas. Scarred tree sites were also predicted to occur throughout the region, and Brayshaw and Dallas indicated that these particular site types might be encountered across the broad range of landform units. Brayshaw and Dallas also predicted that burial sites may be encountered in dune formations, presumably in association with freshwater lake systems.

Lance (1984) developed a predictive model for past Aboriginal occupation for the region. This model was based upon past observations throughout the region, and on the documented occurrence of sites in the NPWS data base. Lance included a map of archaeological sensitivity in his report which indicated that the availability of water was a major determining factor in the presence of sites and in the density and extent of those sites, all the while taking into account the significant variable of differing resource zones.

4.4.2 Predictive model for the current survey.

Based on previous archaeological studies and predictive models it was concluded that the following sites type may occur in the vicinity of Gum Creek Bridge:

- open campsites,
- burials,
- scarred tree sites
- mound sites

A significant factor in the potential distribution of Aboriginal archaeological relics and sites within the study area is the close proximity to the Murrumbidgee River. Statistically, more than 95% of all recorded open campsites located within a 50 kilometre radius of the study area occur within 500 metres of significant drainage lines, (i.e. the Murrumbidgee River, perennial and ephemeral creeks, ephemeral lakes and other ephemeral water sources).

Pearson (1981), in research for his Ph.D. thesis, established the following criteria for campsite location throughout his study of Aboriginal occupation in the Macquarie River region of the central tablelands and western slopes and plains (north of the current survey area). The criteria developed by Pearson can be applied to almost any

western NSW region, allowing for locally distinct environmental factors. The following is a summary of Pearson's criteria:

- Accessibility to water;
- Level ground with good drainage;
- Elevation above cold air currents and lingering frost prone valley systems with good views of the river flats and water courses;
- Shelter from cold winter winds and with adequate summer cooling breezes; and,
- Adequate fuel supplies.

Whilst only six Aboriginal sites have been previously recorded on the NPWS site data base in the vicinity of the survey area, it is assumed, based upon the known archaeology of the area, that archaeologically significant water courses, i.e. ephemeral creeklines and prior streams would have provided, at the very least, seasonally reliable supplies of fresh drinking water to past Aboriginal groups inhabiting the region, and that the absence of previously recorded sites in association with these particular water sources may reflect a lack of site recording programs throughout the local area rather than being an accurate indication of the region's archaeology or archaeological potential.

5. Field Survey Methods

5.1 Pre-field Survey Investigation

Initial investigations carried out prior to commencement of the field survey included site and archival searches of the NPWS site data base, and the Register of the National Estate, Canberra. Consultation also took place with Robert Carroll, Manager of the Griffith LALC.

5.2 Pre-Field Survey Assessment

Prior to the commencement of the field survey, a desk top study of the survey area landform and archaeological land systems was conducted. As a result of this assessment, a model of site prediction and sensitivity was developed (Section 4.4) in conjunction with a strategy for survey area coverage (Section 5.4).

5.3 Landscape Classification

Within the survey area there is one micro-landform unit, a flat flood plain. There are no distinct "creek bed" or "creek bank" areas as it appears from the nature of the deposited alluvial soils in the creek line area, that when the water flows, it spreads across the entire area to the raised road embankments. Archaeological land systems correspond to these landform units.

5.4 Field Survey Strategy

A 'total coverage' survey strategy was adopted for the entire bridge and approach realignment area (Sketch 1). This involved on-foot transects of approximately 5m wide across the entire area.

5.5 Field Recording Methods

The field survey was conducted using the Darlington Point 1:50,000 topographic map sheet and maps and aerial photographs of the proposed development supplied by RTA. Where sites were present, site details, landform and environmental conditions relating to the detectability of sites were recorded on data sheets developed for the survey. Where appropriate, copies of site/artefact recording forms are provided and copies of NPWS site forms with relevant field notes attached. Photographs were taken of all sites and PADs.

5.6 Surface visibility

Surface visibility within an archaeological context generally refers to the degree of impediments on the surface which might obstruct surface observation of archaeological material. The main factor to affect visibility is vegetation cover, although features such as rock outcrops and other natural or man-made obstructions on the landscape can also affect surface visibility. Surface visibility can be expressed as a percentage of the surface which is visible (Bonhomme 1986:11 Table 1, Sketch 2)

Table 1: Surface Visibility Criteria

a	Nil soil visibility	0-5%
b	Occasional glimpses of bare ground	5-10%
c	Frequent patches of bare ground	10-50%
d	Approximately 50% bare surface	50-70%
e	>70% bare surface	70-100%

Surface visibility varied across the floodplain area however there were tracks, and cleared areas across the survey area which enabled a comprehensive survey to be conducted of the area.

○ Field Survey Methods and Coverage Data

The total survey area has been assessed from plans supplied by the RTA to be approximately 200m x 80m or 1.6ha. It is important to attempt to quantify the effectiveness of coverage of these varying impact zones (Sketch 3). *'Effective coverage'* for the area surveyed using a total coverage strategy is shown in Table 2 below.

Table 2: Effective Coverage

Landform Unit	Sample unit Dimensions (LxB)m approx)	Sample Unit area Area in hectares	Coverage method % of Sample Unit Vehicle/Foot	% visib-ility	Effective Coverage of Total survey area	% area effect surveyed
Creekline/ floodplains	200m x 80m	1.6	100% on foot	60%	0.9ha	60%

Site detectability varied over the survey area and was determined by factors such as surface visibility (see Table 1), geomorphology and the type of sites present. The measurement of site detectability is difficult given the range of factors which may influence site detection, some of which are mentioned above. Effective coverage assessment can be determined by the interpreted accuracy of a field investigation (Witter pers. com) For the current study, a method of coverage analysis where effective coverage can be reasonably accurately calculated, was adapted from Witter (cited Bonhomme 1993:50) where the following applies:

Survey Coverage Assessment formula (Boot 1996 pers Com)
L x W x % of visible ground surface = effective survey coverage
where L is the length of the of the survey area/unit/transect in metres, W is the width of the survey unit/area/transect in metres. Therefore the total survey area was approximately 1.6ha of which 0.9ha or 60%% were effectively surveyed.

5.8 Surface Exposure

Surface exposure of archaeological sites is linked with visibility but should not be confused with surface visibility, in that exposure usually refers to the results or the effects of geomorphic processes on archaeological deposits. For example, a level of exposure of archaeological materials may occur due to wind, rain or other erosive agents. There were several significant areas of surface exposure over the survey area. These included three areas where visibility was 100% (Sketch 1) and included vehicle tracks which extended the full length of both sides of the bridge (400m x 5m); a large eroded access area to an adjacent property on the south-western side of the road (60m x 40m) and an RTA storage area (80m x 15m) on the north-eastern side of the road.

5.9 Definition of Sites and establishing site boundaries

For the purposes of surface archaeological surveys, site boundaries are most frequently determined by the presence of Aboriginal cultural material. NPWS report writing guidelines indicate that a site may be determined by the presence of two artefacts located within 50m of each other. However, Witter (pers coms 16/5/96) describes a cultural site as ...*"a place identified as such by an observer (including someone listening to oral accounts)...a site should be a unit of management*". This statement infers that an archaeological 'site' may be a place where physical evidence of past Aboriginal occupation has occurred eg open camp sites, stone arrangement, whilst other site types may be determined by the presence of a single artefact (eg a scarred tree) or even by the presence of a recognised significant area based upon anecdotal information and often occurring with no visible artefacts (eg places of ceremonial or religious significance such as natural geological formations).

6. Aboriginal Scarred trees: An Origin Assessment

Scarred tree sites present a range of assessment, interpretation and management problems. Because a number of both natural and man made effects impacted upon old - growth timber in the past, one of the most difficult problems in scarred tree assessment is that of determining the origin of scars, whether particular scars on trees have an Aboriginal origin or else stem from one of a range of natural impacts.

Aboriginal scars can be found on a number of tree species within the region and study area, however, the most apparent and in most cases conclusive Aboriginal scars in the region occur on either old - growth black box or river red gum trees, with a lesser number occurring on grey box and white cypress pine. Black box is the dominant tree species in the study area.

Scars can occur on trees for a number of reasons, not all relating to human cultural activities, and where scars are the result of human cultural activity, not all scars necessarily relate to Aboriginal culture. They may be the result of Aboriginal people employed during the early 'post - contact' period as European station workers, involved in station related activities. Scars can occur from a number of 'non traditional' causes including bark removal from bird attack, fire, flooding, European introduced stock rubbing and eating bark, European land clearing and ring - barking, fencing, rabbiting, farm and other machinery damage, 'bridle track' markers, and survey markers, to name some of the more obvious impacts. The following criteria have been used in the assessment of the potential original of scarred trees:

"Possible" Aboriginal Scarred Trees: This category includes all scars which are 'more than likely' a result of human cultural activities, but which are very difficult to distinguish from scars of non - Aboriginal or European origin. While the shape of scars in this category are generally irregular, the shape of these scars can often resemble the shape of more definite Aboriginal scarring, although bark regrowth patterns may confuse the recorder. Scars in this category may often be found in association with scars of a more definite Aboriginal origin or other Aboriginal site types. 'Possible' Aboriginal scars may or may not have axe marks visible and where axe marks are visible, they may be the results of either a stone or steel axe. Where axe marks are visible, they are generally not consistent with recognisable Aboriginal bark removal patterns or stone axe scarring, and quite often the height of these scars is inconsistent with a height (or shape) which it is considered would have facilitated easy and comfortable removal of the scarred section. Prior to observation, there should be no ethno-historical account of the tree in relation to the local Aboriginal community. Generally, the recorder would have considerable doubt as to the Aboriginal origin of the scar. The over-riding factor for inclusion in the survey would be the scarred tree's association with other more positive Aboriginal scarred trees (although this may not necessarily be the only determining factor for inclusion in a report).

"Probable" Aboriginal Scarred Trees: 'Probable' Aboriginal scarred trees are often found in association with other more definite Aboriginal scarred trees or in association with other Aboriginal site types. These scars are generally more easily identifiable with regular scar shapes and patterns in the region, and quite often, although not necessarily, they may display axe marks. Axe marks on these scars need not necessarily resemble or be consistent with observed 'normal' bark / cambium removal in the region, but will often be the results of stone axe scarring, although steel axe removal is not uncommon. Scars in this category also fit within height parameters which would have been conducive to comfortable bark removal, although multiple scars may be found in areas at heights which may be otherwise considered outside the normal 'comfort range' for removal. The local Aboriginal community would have no knowledge of the particular site. Generally, the recorder may have some doubt as to the Aboriginal origin of the scar due to an absence of some of the above characteristics or for other tangible reasons.

"Definite" Aboriginal Scarred Trees: These scars fit the regular scar shape patterns of the area and their removal patterns can often be immediately identified with the removal of bark and/or outer cambium layers for the production of certain artefacts. Scars in this category may or may not display axe marks, but where axe marks occur, they conform to normal bark and cambium removal patterns observed in the region. Axe scarring can be either the result of Aboriginal stone axe use or from steel axe removal. The height of scars usually fits within a 'normal' comfort range for removal. Quite often 'definite' Aboriginal scars will have a known ethno-history within the local Aboriginal community. Generally the observer should have no doubt from an informed, experienced view point that the scar is of Aboriginal origin.

7. Significance Assessment Criteria

The assessment of an individual site's significance is determined by a number of criteria, which in their broadest terms, and under NPWS Guidelines consider the site's scientific and educational values, as well as the value of a site to the Aboriginal community. These broad criteria can be further broken down into more specific criteria which are used in significance assessment.

Witter (1995) has identified a range of significance assessment criteria which can be applied to sites during the process of significance assessment. Witter describes these criteria as "*objectifiable*" and they are intended to supersede the existing criteria of scientific, educational and Aboriginal value assessment or at least for the present, complement them.

The broad terms of reference (or criteria) listed by Witter (1995) for the significance assessment of Aboriginal sites include the following:

- Identification and reconstruction of behaviour;
- Cultural patterning; and,
- Prehistories.

Witter's criteria tend to fall within the Scientific Value assessment criteria previously recommended for use by NPWS in significance assessment. For the purposes of this report, both sets of criteria will be considered and where appropriate, applied.
When applying the original NPWS criteria of scientific value, educational value, and Aboriginal value for site significance assessment, the first two can be readily assessed by an experienced archaeologist. However, the only way in which the Aboriginal value can be effectively assessed is with input from the local Aboriginal community, presumably to whom the material or site(s) relate. Significance assessment in this part of the report has been on the basis of three assessment criteria developed for significance assessment by NPWS, and incorporating those developed by Witter (1995):

Scientific Value Sites are assessed for their scientific value, using sub - criteria of site integrity, preservation, contents, location, uniqueness or representativeness and potential for future scientific research. Witter (1995) uses additional criteria within a largely scientific framework. Headings used by Witter include '*identification and reconstruction of behaviour*', '*cultural patterning*' and '*prehistories*' relating to past Aboriginal occupation of an area. The 'new' criteria adapted by Witter can be applied as supplementary levels of assessment when assessing a site's scientific value.

Educational Value This area of assessment can be closely linked with a site's scientific value, but it can also reflect a site's integrity and value as a learning tool through its visual 'appeal' as an example of a certain site type, and as clear evidence of past Aboriginal occupation over an area. The educational value of sites can vary considerably depending upon the condition of the site (site integrity), representativeness and location, to name several of the aspects upon which it would be assessed. Sections of the community which may place educational value on a site include tertiary education institutions and the general education system, Aboriginal communities, the general public, etc.

Aboriginal Value The Aboriginal community places a range of values on sites. Aboriginal values can often vary from those held by the non-Aboriginal community. In some instances, the archaeological significance of a site is considered by an Aboriginal community to be a secondary consideration when assessing a site's significance. The Aboriginal community may place greater emphasis on the socio - cultural significance of a site, for its educational value, particularly for teaching community members about the lifestyles of their ancestors, or its value in providing a 'link' between living community members and their ancestors. Whilst assessment of Aboriginal sites for their significance to the Aboriginal community is conducted in this report by the archaeological consultant following consultation with representatives of the local Aboriginal land council, the local Aboriginal community is also invited to develop its own significance assessment for sites found during the field survey for inclusion in the survey report.

8. Survey Results and Significance assessment

This survey identified one scarred tree site (GC-ST-1). No areas of potential archaeological deposit were identified in the survey area which was a low lying flood plain which had been heavily disturbed by the construction of the elevated earthen embankments for the bridge approaches and the effects of previous flooding episodes.

8.1 Site Name: GC-ST-1 (Sketch 3, Photo 3, 4)

Location: Grid Ref: 39025E 6171576N
This general location of the site is on the Sturt Highway approximately 75km west of Narrandera. The tree is approximately 67m west of the bridge (Sketch 3, Photos 3, 4).

Potential for Development Related Impact:
This site is outside the area of direct impact from the proposed bridge widening. However the site should be protected during the construction phase by creating a 15m buffer zone around the site.

Site Description
The scar is on a grey box tree which is living but has been badly affected by die back. The circumference of the tree is 3200mm. The scar is elongated in shape and is 1500mm long by 600mm wide and is located 800mm from the ground. The scar is in poor condition as the heart wood in the upper section of the scar has collapsed. Therefore it was not possible to determine whether or not axe marks were present. The scar is oriented to the north.

Site Context
The site occurs within the flood plain of Gum Creek on an old growth box tree. Box trees were a tree species preferred by Aboriginal people for bark removal. A majority of scarred trees area within 100m of permanent or ephemeral creeklines. Therefore this site occurs in a landform which was predicted to be archaeologically sensitive.

Significance Assessment
The scar has been identified as a "probable" scar of Aboriginal origin. This assessment is based on the shape of the scar, which is similar to other known scars in the area, its location on the trunk (ie within the "comfort zone" for bark removal), and the fact that there are many scarred trees along the Murrumbidgee River and its associated watercourses in the vicinity of Gum Creek.

The site has been assessed as having **a low level of significance assessment.** This assessment is based upon the site's low scientific value which results from the large number of similar sites within the area, its low-moderate educational value and its assessed moderate to high value to the Aboriginal community, offset by the slight level of uncertainty as to the site's 'Probable' Aboriginal origin. The site assessment by the Aboriginal community is presented as Appendix 5.

B. Non-Indigenous Heritage Assessment

9. Non-indigenous Heritage Context.

9.1 Archival Research and Results

Review of Registers

This research involved the review of heritage records held by heritage bodies which have responsibility for the care and protection of non-indigenous heritage items and places to identify all known heritage items within the study area.

- **Australian Heritage Commission Canberra**

The Australian Heritage Commission maintains the Register of the National Estate. This register lists both indigenous and non-indigenous heritage sites and is organised by both Local Government Area and Locality. Places on this list are classified as:

"Indicative Places": not on the register, but identified as important
"Interim Places": currently being evaluated for inclusion on the Register
"Registered Places": listed

The Register of the National Estate has 4 listed heritage items in the Darlington Point Area (Table 3). None is in the vicinity of the Gum Creek Bridge study area.

- **Register of the NSW Heritage Council.**

The Heritage Council of NSW includes on its list only items under Conservation Instruments. These Instruments are Interim Conservation Orders (ICO's) and Permanent Conservation Orders (PCO's). These lists are organised by Local Government Area.

There are 5 items listed in the Darlington Point area. (Table 3) No items are within the vicinity of the Gum Creek Bridge.

- **Register of the National Trust**

The National Trust of Australia (NSW) is a non-government, community organisation which promotes the conservation of both built and natural heritage. The Trust maintains a register of landscapes, townscapes, buildings, industrial sites, cemeteries and other items or places which the Trust determines have heritage significance and are worthy of conservation. Items listed in the Trust's Register are said to be classified. The listing of a place in the Trust's Register has no legal force, however the Trust does encourage owners of listed places to respect their heritage significance.

The National Trust has 4 items listed in the Darlington Point district (Table 3). One of these, Kerarbury Station Homestead is approximately 2km north of Gum Creek Bridge. The entrance to the property is at the north-western end of the bridge (Sketch 1)

- **Murrumbidgee Shire Council Heritage Schedules**

The heritage schedules compiled by Murrumbidgee Shire Council were examined. Under the NSW Environmental Planning and Assessment Act (1979) local Councils and the Department of Urban Affairs and Planning (DUAP) prepare local and regional environmental planning instruments (LEPs and REPs), to give statutory force to planning

controls. These plans incorporate provisions for the conservation and management of archaeological sites and Heritage items. There are no items listed in the vicinity of the Gum Creek Bridge.

9.2 Results of Archival Searches

There are no non-indigenous heritage sites listed on the registers of any Heritage Bodies listed above which will be impacted by the works proposed.

Table 3: Summary of Non-indigenous Heritage sites identified from archival searches

Heritage listing				Item Description	Location	Impact from proposed development
AHC	NT	NSW H.C.	LEP			
*		*		Courthouse Group	Darlington Point	Nil
*		*		Mission	Darlington Point	Nil
*		*		Waddi Scarred trees	Darlington Point	Nil
*	*	*		Tubbo Station	Sturt Highway	Nil
	*	*		Kerarbury Station	West of Darlington Point	Nil
	*			Kooba Station	Leeton Rd Darlington Point	Nil
	*			Horizontal Windmill	Coonong Creek	Nil

9.3 Brief Summary of the History of the Darlington Point Area.

The utilisation of the water from the Murrumbidgee River and a means of transport across it have been a vital elements in the history of the settlement of the Murrumbidgee River district. The first white man to experience the area was John Oxley in 1817 when he and his party experienced the harsh dry, windswept plains to the north and were unaware of the fertile corridor which surrounded the river. It was not until Sturt's journey down the river in 1829 that the rich farmland on the banks of the Murray and Murrumbidgee rivers was reported. Settlement of the river area followed swiftly and by the end of 1833, large tracts of land with river frontages had been occupied from Barbylara in the Gundagai area to Buckinbong near Narrandera. From 1838 – 1844 runs with extensive river frontages were taken up, down river from the site of the township of Narrandera. By the close of 1844, all river frontages in the Darlington Point District had been completely occupied.

Early references are made to Kerarbury Run which is now accessed from the Sturt Highway immediately west of the Gum Creek Bridge. The run was described at its sale in 1888 as 120,000 acres of freehold land, 16,000 leasehold and 16,700 under occupational licences with an 18.5 mile frontage to the Murrumbidgee from which it extends back for 22 miles. It carries 86,000 sheep, 600 cattle and 120 horses.

Because of the size of the runs, traditional fencing was not a viable option and shepherds and hutkeepers were employed to tend the sheep and stock and to keep them on their respective runs and grazing areas. Shepherds and hutkeepers were considered the pioneers of the outback.

The water supply provided by the river was not always reliable and it was reported in 1839 that the Murrumbidgee ceased to flow and for a 12 year period no water from the Murrumbidgee ran into the Yanco Creek. During these dry years, stock was brought to the river waterholes to drink. It was also reported during this extended drought that native

groups also came to the river from the east and west. Pitched battles were witnessed between two groups each about 400 strong who advanced on each other armed with spears and boomerangs. Several natives were killed before the eastern tribes retreated.

The stability of an adequate water supply was achieved In the early 1850's when a series of wells were sunk to depths of between 90 to 150 feet. The well walls were timbered with gum or pine slabs with sections cut out of them to all the "runners" on the square or oblong galvanised iron buckets to slide in them. A pulley and shaft was erected at a height to allow the buckets to be raised.

The route down the Northern side of the Murrumbidgee, pioneered by Sturt, was used by drovers, coachmen and travellers as the main road through the area from Wagga to Hay until the turn of the century. In 1852 a weekly coach service was operating from Wagga to Balranald. River steamers were increasing in number on the Murrumbidgee, supplying the needs of the landholders and townspeople along the river. Woodpiles were set up near the river at Darlington Point to supply the steamers with wood for the boilers.

The discovery of gold in Victoria in the 1850's and the opening of the Burra Burra copper mines in South Australia attracted thousands of people through the district and created a demand for goods, food and services. This need was to a degree met by the growth of the township of Darlington Point which was located at the main crossing point of the Murrumbidgee River and been established initially in response to the overland stock trade to Victoria which began in the late 1840's. It continued to the 1860's and saw thousands of head of cattle and hundreds of thousands of sheep pass through the town annually.

The Government decided in 1878, to extend the railway line from Wagga to Hay to secure the rich Riverina trade for Sydney. Work for the line between Narrandera to Hay began in 1880. Railway camps were constructed along the railway route. The need for railway sleepers resulted in the setting up of saw mills near Kerarbury station where 40 men were employed cutting railway sleepers and other building materials. The Railway Station at Darlington Point was opened in 1881 and included telegraph facilities. The opening of the railway line resulted in the loss of steamer trade which had always been reliant on high water levels in the river to supply a reliable service.

Access to the southern side of the river had been a constant source of frustration to residents of the area. The earliest attempt at bridging the river was undertaken by the proprietor of the Punt Hotel who purchased a pontoon bridge which was transported to the site by steamer from Echuca in 1880. The bridge was constructed from 8 pontoon sections, however it was not successful and appears from the records never to have carried traffic.

In 1881 the private ferry which had operated to give access to the southern side of the river was proclaimed a Public Ferry on which tolls and dues would be demanded at the following rates: 2d per foot passenger, 6d per horse, mule, ass 1/- per dray or other four wheeled carriage; 1/2d per lamb, pig, sheep or goat; school children free.

In the severe floods of 1891 the ferry went out of commission, several small bridges and built up road approaches to river crossings were destroyed, the Chinaman's garden was flooded and houses and public buildings were inundated. Water spread over the countryside and boats were the only means of transport.

In stark contrast, 1900 ushered in a severe drought with dust storms. The March copy of the Narrandera Ensign reported that the dust storm raged throughout the day and night. All business was suspended owing to the darkness and flying, blinding sand. Breathing was

difficult and the country was transformed, sand hillocks were swept form their old positions and deposited on new ones, hollows and depressions have been levelled and much of the soil from the western plains has been borne far to the east.

In 1902, after much community agitation, tenders were called for the construction of a bridge over the river at Darlington Point. The bridge was completed in 1905 and gave reliable access to the southern side of the river.

Drought, rabbits and debt defeated many of the small selectors. In 1905 the Narrandera District Irrigation Association was formed in an attempt to manage the distribution of water across the area so that prosperity would extend beyond the rivers edge. This was not a new concept as the Yanco creek cutting had been constructed in 1856 and other small canals on the southern side of the river had been constructed to provide water for both crops and animals. Major irrigation works were approved by the Barren Jack Dam and Murrumbidgee Canals Construction Act, passed in 1906. The Murrumbidgee Irrigation Area (MIA) was declared in June 1911 and in early 1912, 500 hectares had been acquired for irrigation and 206km of canals had been completed. By 1916 Leeton had a cannery and a butter factory and Yanco a bacon factory. A garden was being dug in the wilderness and progress was flowering in the Riverina. The MIA contains over 3700 farms and 2500 kilometres of channels.

10 Field Assessment

10.1 Field Investigations

The survey for indigenous and non-indigenous sites was carried out concurrently (see Section 5 of this report for details)

10.1.1 Survey Aims

This survey was designed to:

- identify areas of possible heritage significance in the vicinity of the bridge
- carry out an assessment of the bridge
- make a full assessment of the heritage significance of the bridge.
- recommend additional investigation if required.

10.1.2 Survey Methodology and Strategies

- A total on foot survey conducted of the entire area.
- The bridge was photographed and a sketch made of the surrounding environmental context.
- A preliminary heritage assessments of the bridge and the impact of the proposed upgrading of the bridge were made at the site
- At the conclusion of the survey, discussions were held with the Murrumbidgee Shire engineer to determine if there were any aspects of the social history of the bridge which were relevant to the local community.
- A visit was made to the local history section of the Griffith Library for source material relevant to the Gum Creek Bridge area and discussions were held with the Local Studies Librarian.

10.2 Results of non-indigenous heritage survey

- Kerarbury Station is located approximately 3km north of Gum Creek Bridge and the entrance to the property is at the north-western end of the approach road to Gum Creek Bridge. There were no heritage items associated with this property within the impact area of the proposed bridge upgrade.
- A large river gum on the northern side of the bridge is most likely to have given the bridge its name (Photo 10). As this tree appears to be one of the oldest surviving gums in the area, it would have historical significance to the local community as a landmark and may have floral significance. This item will not be affected by the proposed development.

11. Brief History of Concrete Slab and beam bridges in NSW.

"By 1914 the theory and practice of reinforced concrete in bending was well understood overseas and the bridge design engineers of the Public Works Department were ready to extend the application of reinforced structures from Monier arches to beam and slab constructions.

The first slab bridge, over American Creek near Fig Tree, Wollongong was completed in 1914 (replaced in 1985). In the same year a small slab bridge was built over Tooles Creek south of Wagga Wagga. This bridge has been widened using beam and slab construction techniques. There followed in quick succession a series of beam/slab bridges over Mullet Creek near Dapto in 1916, over Throsby Creek, Newcastle also in 1916 and over Shark Creek at McLean. These bridges have all been replaced.

With the success of these bridges and the end of World War 1, a whole new era of road bridge construction began, so much so that for the next fifty years reinforced concrete was the dominant form of bridge construction". (Fraser 1985 p 8)

Table 4: List of Council maintained Concrete bridges in Murrumbidgee and adjoining LGA areas.

Council	Bridges > 6m in length: Principally Concrete/Steel Construction					
	Urban Local Roads		Non-Urban Sealed Roads		Non-Urban unsealed	
	Number	Length (m)	Number	Length (m)	Number	Length (m)
Griffith (C)	6	57	3	60	4	57
Jerilderie (S)	1	58	6	82	6	133
Leeton (S)	1	21	1	27	-	-
Lockhart (S)	15	181	60	652	40	409
Murrumbidgee (S)	-	-	1	30	1	20
Narrandera (S)	-	-	5	150	10	301
Urana (S)	1	49	2	58	8	139
Wagga Wagga ©	18	674	108	1,615	29	593
Totals	42	1,041	186	2,675	98	1,652

12. Comparative data for RTA Slab Concrete Bridges in the South-Western Region.

Gum Creek Bridge is one of 16 slab concrete RTA bridges constructed in the South-Western Region prior to 1978. The bridge is 30.48m long and has 5 spans all of which are 6.21m in length.

12.1 Data base of RTA concrete slab bridges built before 1978

Table 5: RTA Bridge Data base

Bridge No.	Date Built	Sing Span	Multi Span	Total length	Span no.	Span laths	Comments
6283	1954		*	19.96	3	6.24, 7.46 6.24	
6284	1956		*	38.10	5	7.62	
5472	1967		*	24.38	4	6.09	
5495	1938		*	38.66	6	5.33 x 2 6.85 x 4	
3155	**1957**		*	**30.48**	**5**	**6.21**	Gum Creek
5114	1955		*	97.53	16	6.09	
5115	1955		*	36.58	6	6.09	
5116	1955		*	36.58	6	6.09	
6341	1934		*	15.54	2	7.31	
6340	1933		*	13.40	2	7.31	
5553	1969		*	46.33	8	5.79	
5554	1969		*	57.91	10	5.79	
3190	1969		*	43.28	4	10.66	
6419	1961		*	36.57	6	6.09	
6496	1966		*	28.95	5	5.79	
5689	1957		*	21.64	4	7.31 x 2 9.14 x 2	

12.2 Construction Dates of RTA concrete slab bridges in the South-Western Region built before 1978

Table 6: Construction dates

Construction dates	Bridge No	Totals	Comments
1933	6340	3	
1934	6341		
1938	5495		
1954	6283	7	
1955	5114		
	5115		
	5116		
1956	6284		
1957	5689		
	3155		**Gum Creek**
1961	6419	6	
1966	6496		
1967	5472		
1969	5553		
	5554		
	3190		

From this analysis of concrete slab bridge construction dates prior to 1978, it appears that the majority of concrete slab bridges were built in the South-Western Region in the 1950's which was a period of south-western history when increased population and density of agricultural settlement which resulted from the expansion of irrigation, created a demand for all weather roads and bridges which could carry increased load bearing vehicles transporting agricultural products, tourists and supplies through the area.

12.3 Analysis of relative overall lengths and average span lengths of RTA concrete slab bridges in the South-Western Region

Table 7: Bridge and span lengths

Total bridge lengths	Total bridges	Bridge Number	Number of Spans	Span Lengths
10 – 19m	3	6283	3	6.24 x 2 7.46
		6341	2	7.73
		6340	2	7.31
20-29	3	5472	4	6.09
		6496	5	5.79
		5689	4	7.31 x 2 9.14 x 2
30-39	6	6284	5	7.62
		5495	6	5.33 x 2 6.85 x 4
		3155 Gum Creek	5	6.21
		5115	6	6.09
		5116	6	6.09
		6419	6	6.09
40-49	2	5553	8	5.79
		3190	4	10.66
50-59	1	5554	10	5.79
61-90	0			
91-100	1	5114	16	6.09

12.4 Results of comparative analysis:

- Gum Creek Bridge appears to have been built in the middle period of concrete slab bridge construction
- The bridge is within average overall length of concrete slab bridges, and conforms to the average span lengths
- There do not appear to be any technical attributes which this bridge displays which are not duplicated in other RTA maintained Bridges in the South-Western Region.

13. Significance assessment of Gum Creek Bridge

13.1 Criteria for Heritage Assessment

"Heritage Significance" is a term used to describe the value or importance of an item or place to past present or future generations. Heritage significance is contained in the fabric of an item, its setting and relationship to other items and in the response that the item evokes in those who value it (Department of Urban Affairs and Planning 1995). Archaeological deposits and features provide evidence of the pre-history and history of the settlement of

NSW. It is through the potential for revealing information unavailable from other sources that archaeological significance occurs. An assessment of the significance of heritage sites located in this survey is based on the guidelines of the Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter). The terms of the Burra Charter define "a place" to have significance because of its cultural, social, educative, aesthetic, historic or archaeological and scientific value for past, present or future generations. This definition obviously includes places and items representative of the cultural histories of all racial groups who have contributed to the development of Australian society.

13.2 Assessment of Gum Creek Bridge

This statement has been developed from the assessment made by the consultant from statistics gathered from RTA bridge records and Local Government Grants Records for Bridges and a field assessment.

NSW State Heritage Inventory Evaluation Criteria for Heritage Items
To be classified as a heritage item, the item or place must meet :
At least one of the Nature Criteria (1-5)
AND
Meet at least one of the Comparative Criteria (6-7)
AND
Retain the integrity of its attributes.

Significance Criteria- Type

Criterion 1: Evolution and Association (Historic)
This concrete bridge was constructed in 1956. Although in the vicinity of one of the older historic homesteads in the Darlington Point District, it does not appear to have any historical significance for the region.

Criterion 2: Creative and Technical Accomplishment
Having compared data from Gum Creek Bridge with that of other concrete bridges in the South Western region, it does not appear that this bridge has any significant technical attributes which are not found in many other RTA bridges of similar construction.

Criterion 3: Community Esteem (Social)
This aspect of significance has not been fully investigated however in discussions with Murrumbidge Shire Council representatives and the Local History Librarian at Griffith City Library there does not appear to be any local community association with the bridge.

Criterion 4: Research Potential (Scientific)
This bridge has low potential for scientific research..

Criterion 5: Other/ Nil

B. Comparative Significance Criteria

Criterion 6: Rarity
There are 15 other RTA bridges of this type in the South-Western Region and a further 326 concrete bridges maintained by the Murrumbidgee and adjacent Shire Councils.

Criterion 7: Representativeness

Representativeness is an important aspect for consideration when assessing the significance of bridges. All bridges were built from standard designs and as such a single bridge has the ability to represent others. Although there will be obvious variations between bridges, the overall design will be constant. This bridge is representative of other concrete slab bridges, however there are many examples which represent this bridge type

Assessment:

This bridge is less than 50 years old therefore, in terms of the Heritage Act it is not a heritage item and not protected by the Act. This heritage assessment concludes that the bridge is not a heritage item.

14. Site Management Recommendations for both indigenous and non-indigenous heritage sites identified by the survey.

The RTA, as a developer, has an obligation under the National Parks and Wildlife Act 1974, the NSW Heritage Act 1975 and the EP& A Act 1979, to determine if their proposed bridge and approach road upgrade proposal will impact upon indigenous and non-indigenous heritage and where required, take ameliorative action. The following recommendations have been developed to minimise the potential impact of the development on indigenous and non-indigenous heritage items and places and ensure that the proposed development is accommodated within a management framework endorsed by DUAP and NPWS and includes consultation with the local community and Griffith LALC.

Recommendation 1: Indigenous Heritage

It is recommended that prior to work commencing at Gum Creek Bridge, the RTA and a representative of Griffith LALC should visit the site to identify the location of the scarred tree and to install fencing around the tree to protect the tree during works at the site. This buffer zone should maintain a distance of 15m from the scarred tree.

Recommendation 2: Non-indigenous Heritage

Gum Creek Bridge has been assessed using the NSW Heritage Council criteria and it has been concluded that the bridge is not a heritage item. Therefore it is recommended that there is no heritage reason why the proposal to widen the bridge and approach road should not proceed as planned.

15. Legal Obligations

RTA is reminded of its obligations under the NSW NPW Act 1974, where it is stated that all Aboriginal relics (sites and objects), other than those made for sale, are protected. Aboriginal archaeological sites are a non renewable resource, valued for the information they can provide on the lifestyles of Aboriginal people in the past, and are also valued by some Aboriginal communities who have maintained cultural links with specific sites in their 'country'. It is illegal to disturb, damage or destroy a site or relic without the prior consent of the Director-General of NSW NPWS. Any such disturbance requires a permit from the Director-General. The Act requires that relics recovered under such a permit come under the custody of the Australian Museum in Sydney.

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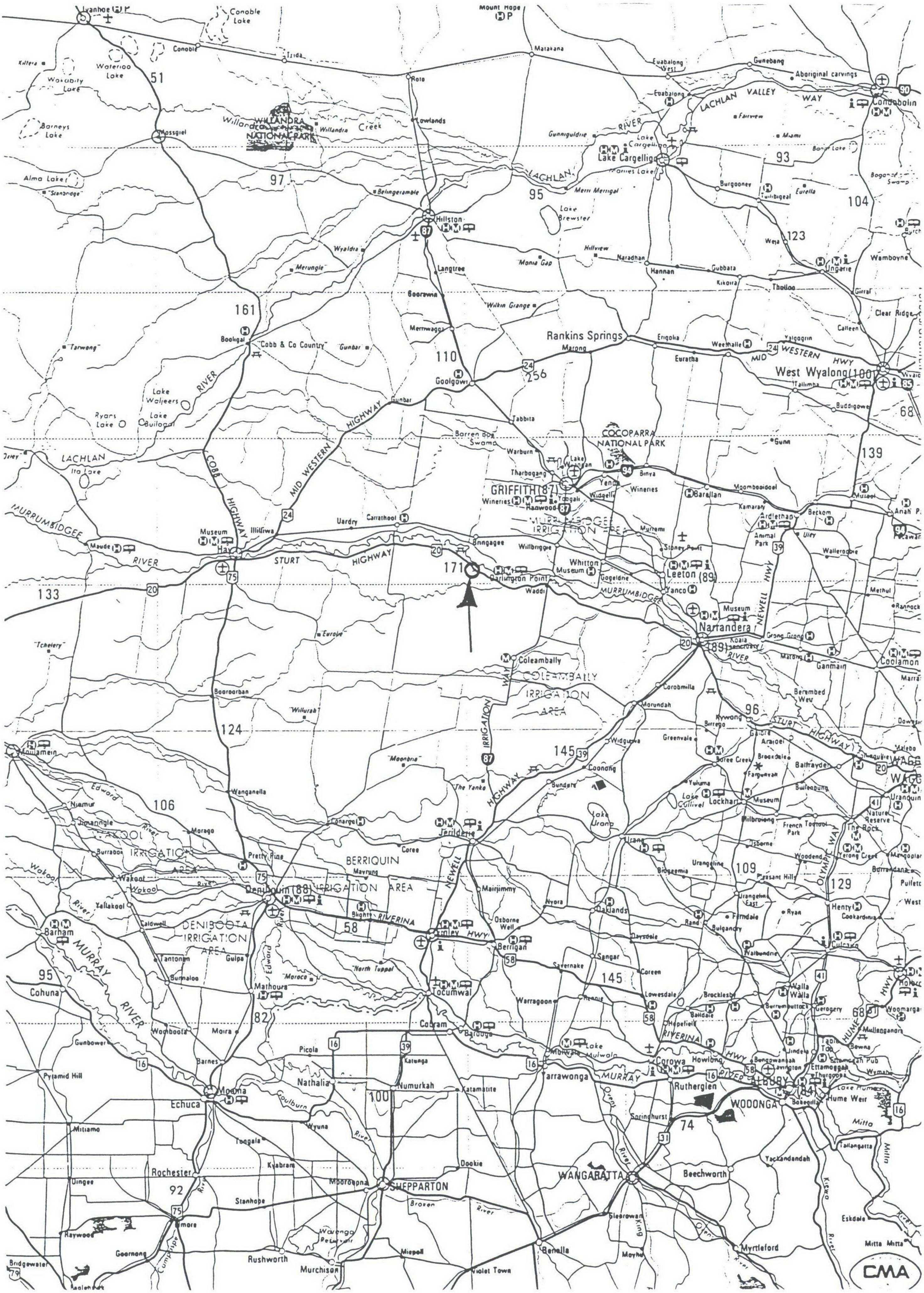
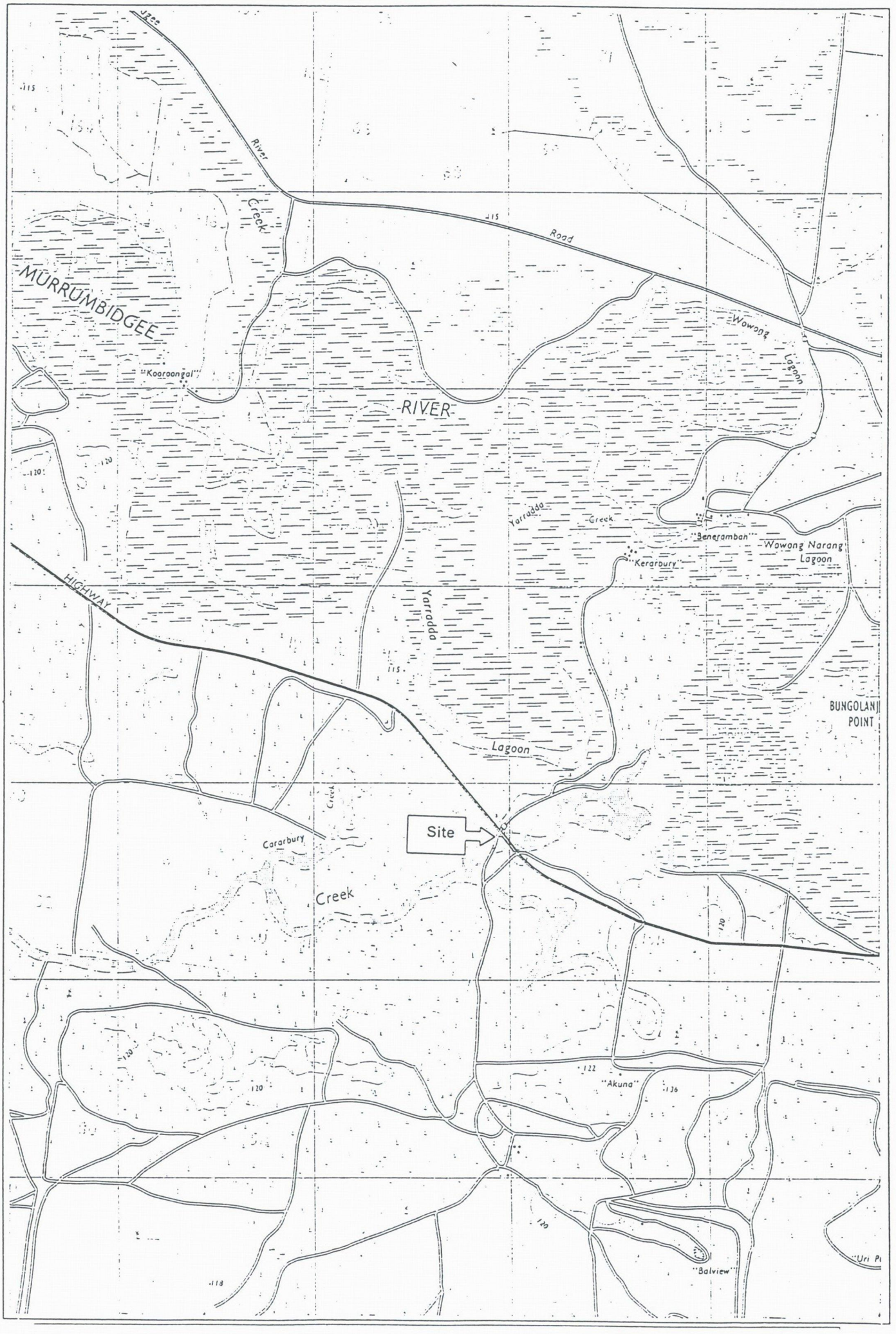
Appendix 1: Maps

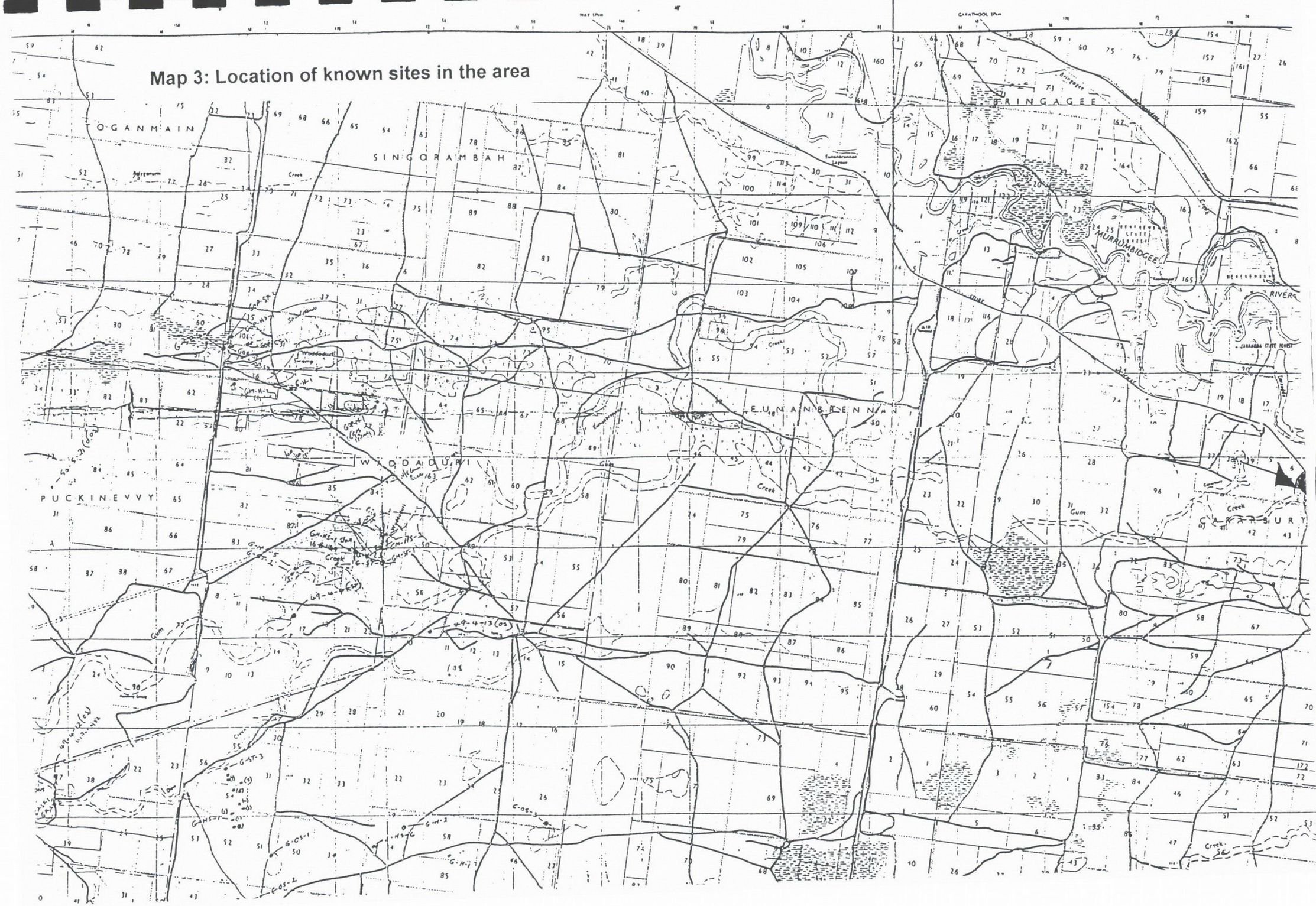
Map 1: General Location of Gum Creek Bridge



Map 2: Detailed site location

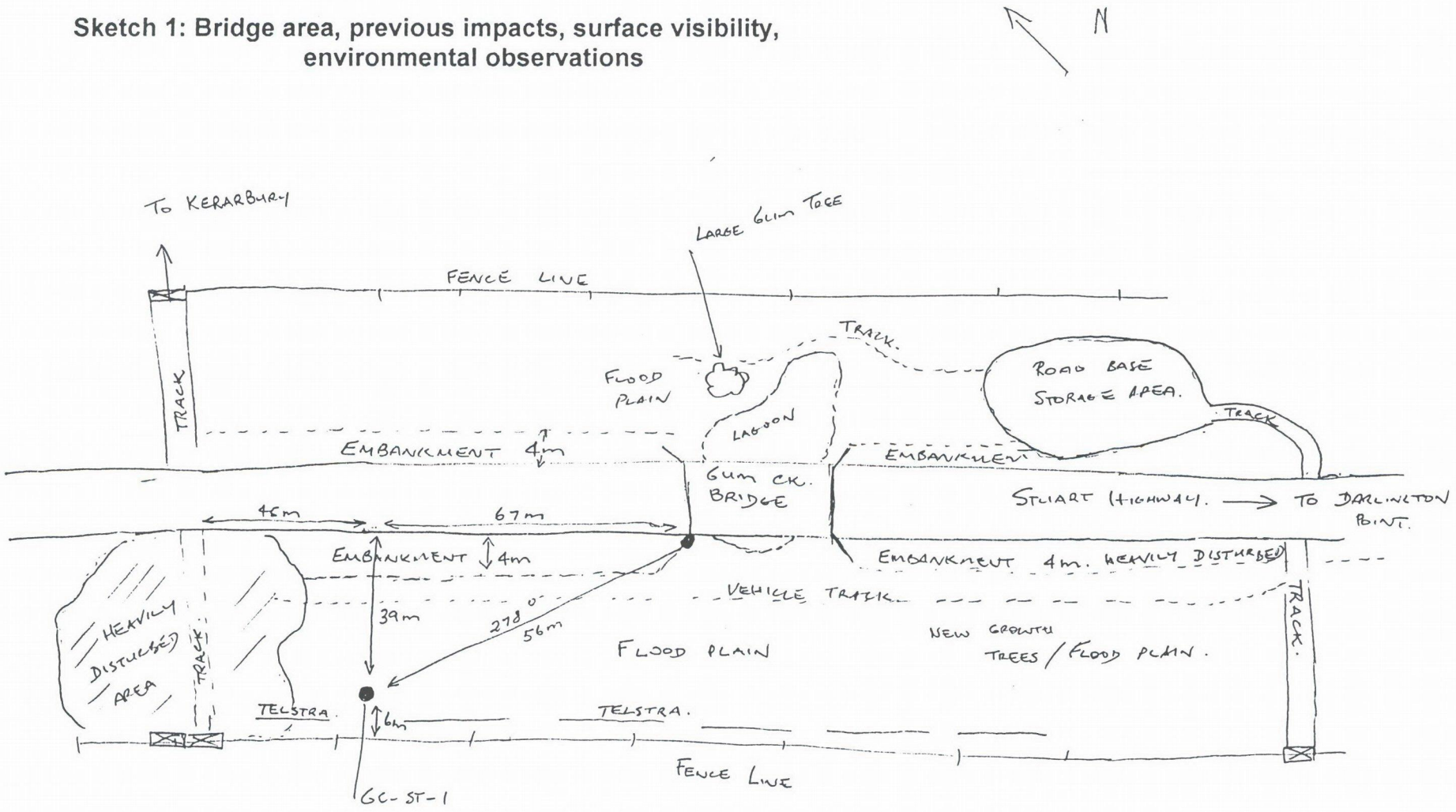


Appendix 2: Tables (all tables in text)

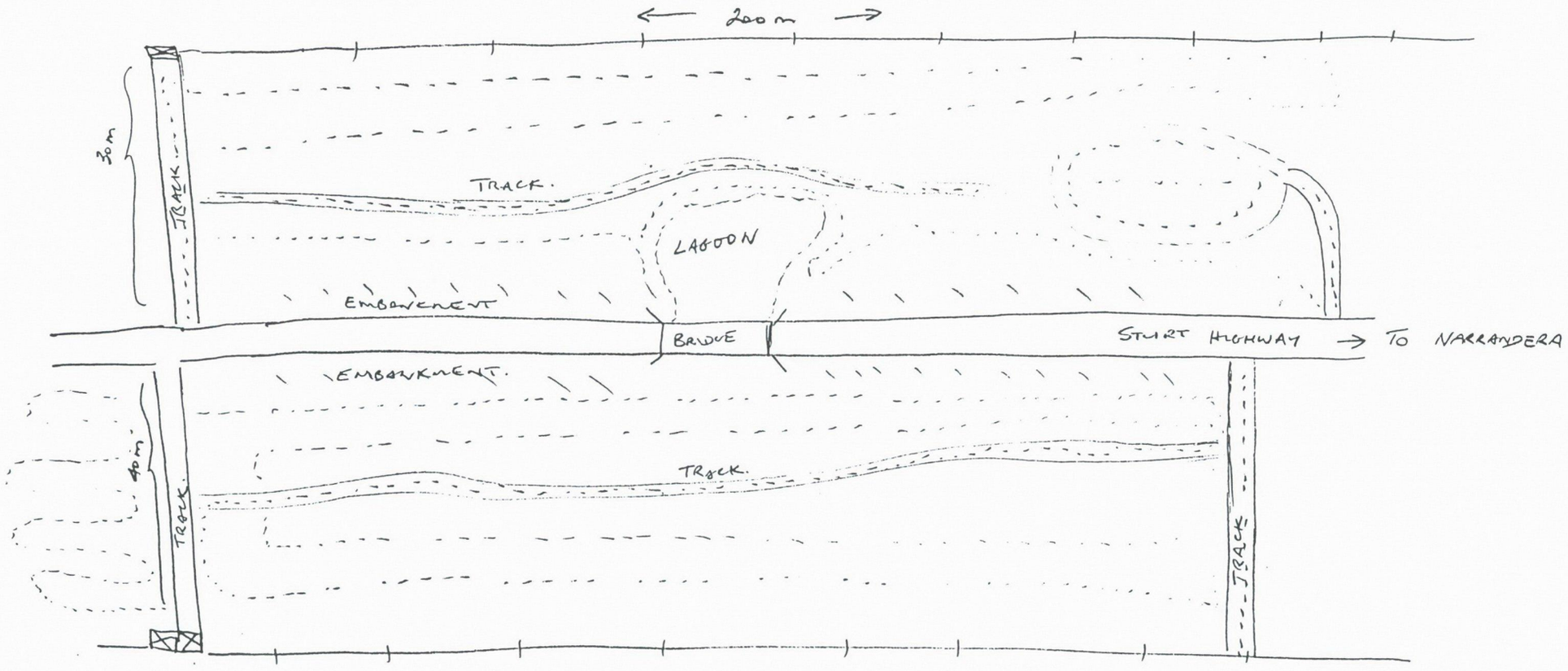

DARLINGTON POINT
Map 3: Location of known sites in the area
OGANMAIN
SINGORAMBAH
BRINGAGEE
MURRUMBIDGEE
RIVER
WIDDAIGURI
PUCKINEVVY
CARABURY
Creek
Swamp
Gum

Appendix 3: Sketches

Sketch 1: Bridge area, previous impacts, surface visibility, environmental observations



Sketch 2: Area surveyed

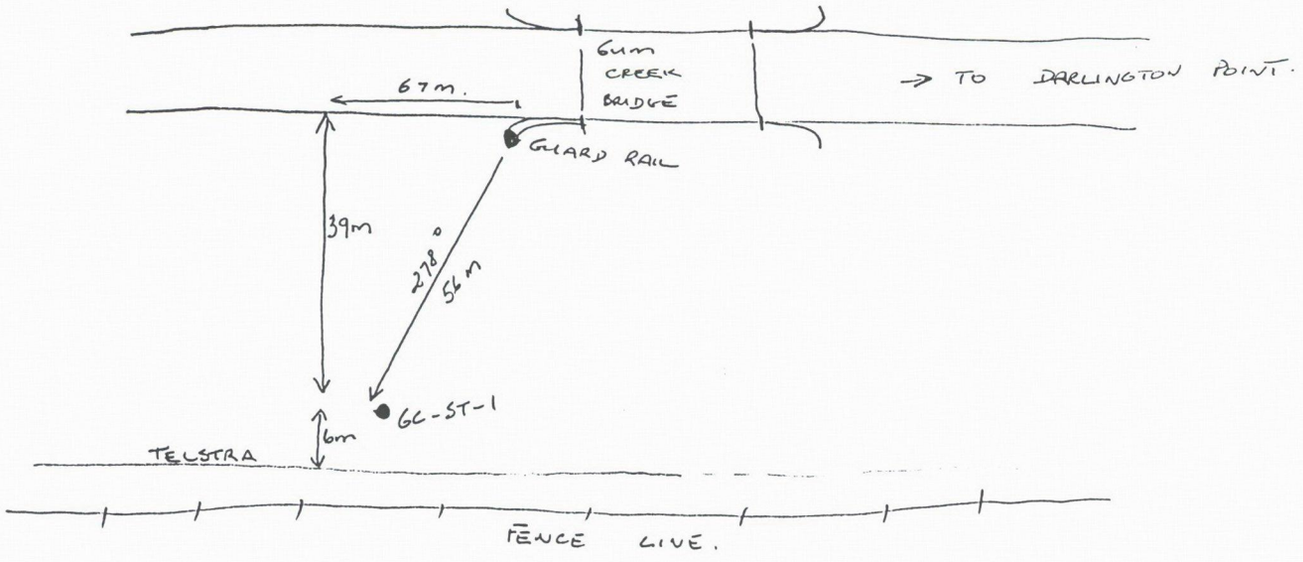


TOTAL AREA BETWEEN FENCE LINES WAS SURVEYED

----- SURVEY ROUTE.

Sketch 3: Location of site GC-ST-1

SITE GC-ST-1 - LOCATION SKETCH



Appendix 4: Photographs

Photo 1: Gum Creek Bridge looking west

Photo 2: Bridge plaque

Photo 3: Site GC-ST-1

Photo 4: GC-ST-1 location

Photo 5: Guard Rails

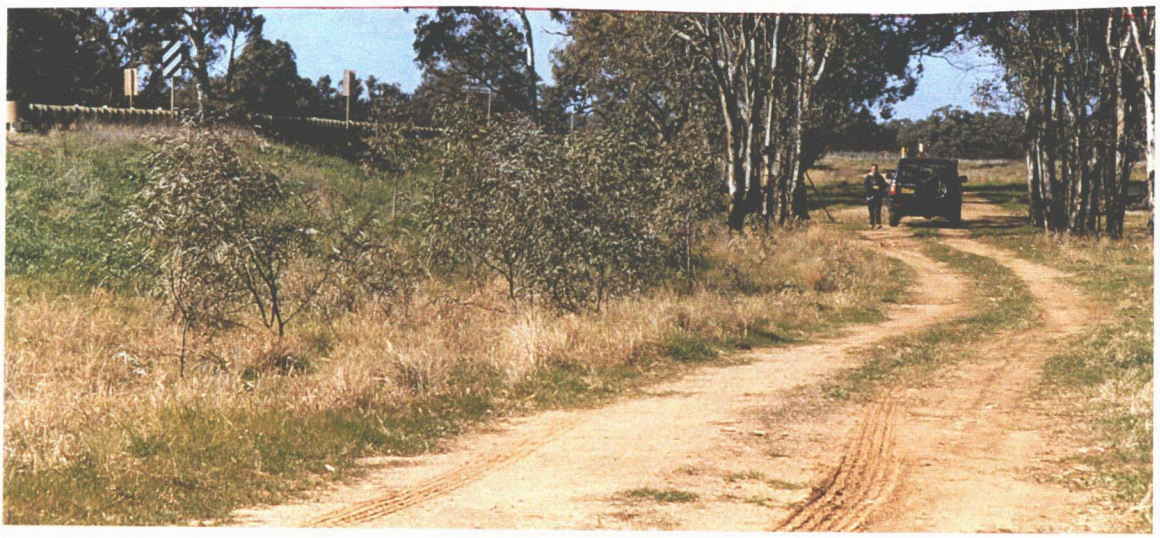
Photo 6: Bridge deck and piers

Photo 7: Bridge deck and piers

Photo 8: Northern side of the bridge

Photo 9: Southern side of the bridge western end

Southern side of the bridge central section



Southern side of the bridge eastern end

Photo 10: Northern side of the bridge western end

Northern side of the bridge central section

Northern side of the bridge western end

Appendix 5:

Correspondence with Griffith LALC and LALC heritage statement.

FAX

Robynne Mills
Archaeological and Heritage Services
60 Watkin Street
Newtown 2042

Ph: (02) 95171413
Fax: (02) 95179860

****

To: Griffith LALC
Attention: Sites Officer
Fax No: Date: 8th August, 1999

****

I have been asked by Jim Kelton to carry out a survey for him while he is on holidays. The survey has been commissioned by the RTA and involves an assessment of the bridge crossing of Gum Creek on the Stuart Highway approximately 8km west of Darling Point.

I would like to conduct the survey on Friday 20th August and request a representative of the LALC to participate in the survey. I would appreciate LALC confirming that the Gum Creek area is within the Griffith LALC area. I would also request that the LALC consult with members of the community to identify any issues related to the Gum Creek area which are important to individuals or community members so that these issues can be included in management recommendations made for the area.

At the conclusion of the survey I would appreciate a Statement of LALC involvement in the survey and a statement of cultural significance for any heritage items identified in the survey. Invoices should be sent to me at the above fax number and will be paid on receipt of an invoice and Statement of involvement in the survey.

I will confirm details of where to meet the LALC representative later in the week when availability of a representative has been confirmed. I would appreciate confirmation of these arrangement by Friday 13th August.

Many thanks,

Robynne

****

21/8/99.

GRIFFITH LOCAL ABORIGINAL LAND COUNCIL

P.O. Box 1424, 5 Wiradjuri Place, Griffith NSW 2680
Tel: (02) 6962 6711 Fax: (02) 6964 1477

10th August 1999

Ms Robynne Mills
Archaeological & Heritage Services
60 Watkin Street
NEWTOWN NSW 2042

Dear Robynne,

I write in relation to our telephone discussion which pertained to the survey of the bridge crossing of Gum Creek on the Sturt Highway, 8km west of Darlington Point.

Griffith Local Aboriginal Land Council advise that a representative of this organisation will be involved in the survey providing:

Firstly our representative performing the work is involved in all facets of the survey.

Secondly, this organisation is paid the following for being involved in the survey.

(1) $100 per hour.
(2) 53c per kilometres car allowance
(3) $75 administration fee.

If you agree to the above the organisation will have a representative at the site at 7.30 am on Friday 20th August 1999.

Yours in Unity

R CARROLL
OFFICE MANAGER

Appendix 6: Heritage data base print outs

Register of the National Estate Database

[RNE search | AHC Home | Disclaimer | ©]

Sites within or near 'Darlington Point'

Courthouse Group (former) , Darlington St , Darlington Point , NSW
Indigenous Place , Darlington Point , NSW (MISSION)
Indigenous Place , Darlington Point , NSW (SCARRED TREES)
Tubbo Station Group , Sturt Hwy , Darlington Point , NSW
Tubbo Station Homestead and Outbuildings , Sturt Hwy , Darlington Point , NSW
Tubbo Station Woolshed Complex , Sturt Hwy , Darlington Point , NSW

The Register of the National Estate has been compiled since 1976. The Commission is in the process of developing and/or upgrading official statements of significance for places listed prior to 1991.

Report produced : 30/7/1999
RNEDB URL : http://www.ahc.gov.au/net/rnedb.html

[RNE search | AHC Home | Disclaimer | ©]

Back

State Heritage Inventory Search Results

Statutory Listed Items

Item Name	Address	Suburb	LGA	State Heritage Register
Courthouse	William Street	Urana	Urana	No
Post Office	Anna Street	Urana	Urana	No
Returned Soldiers Hall	Anna Street	Urana	Urana	No
St Phillips Rectory (former)	Stephen Street	Urana	Urana	No

There were 4 records matching your search criteria.

Home Back

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Computer Power

Heritage Listings Back

State Heritage Inventory Search Results

Statutory Listed Items

Item Name	Address	Suburb	LGA	State Heritage Register
Courthouse Group (former)	Darlington Street	Darlington Point	Murrumbidgee	No
Old Warrangesda Mission		Darlington Point	Murrumbidgee	No
The Homestead formerly Kerarbury Station	Sturt Highway	Darlington Point	Murrumbidgee	No
Tubbo Station Group		10km SE of Darlington Point	Murrumbidgee	No
Waddi Creek Scarred Trees		Darlington Point	Murrumbidgee	No

There were 5 records matching your search criteria.

Home Back

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Database Constructed by Computer Power

Heritage Listings

State Heritage Inventory Listings

Old Warrangesda Mission

Item

Name of Item: Old Warrangesda Mission
Address: Darlington Point 2706
Local Government Area: Murrumbidgee

Description

Listings

Heritage Listing	Reference Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan	1994	30 Dec 94	177	7829
Register of the National Estate		15 May 90		

References

Conservation or Management Plan?: No
Bibliography: None

Source of information for this entry

Name: NSW Government Gazette
Email: watters@heritage.nsw.gov.au
Web Page: www.heritage.nsw.gov.au

Administration

Heritage Database Number: 11068
Central Registry Number:

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Heritage Listings

State Heritage Inventory Listings

The Homestead formerly Kerarbury Station

Item

Name of Item: The Homestead formerly Kerarbury Station
Address: Sturt Highway, Darlington Point 2706
Local Government Area: Murrumbidgee

Description

Listings

Heritage Listing	Reference Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan	1994	30 Dec 94	177	7829

References

Conservation or Management Plan?: No
Bibliography: None

Source of information for this entry

Name: NSW Government Gazette
Email: watters@heritage.nsw.gov.au
Web Page: www.heritage.nsw.gov.au

Administration

Heritage Database Number: 11074
Central Registry Number:

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Heritage Listings

State Heritage Inventory Listings

Tubbo Station Group

Item

Name of Item: Tubbo Station Group
Address: 10km SE of Darlington Point 2706
Local Government Area: Murrumbidgee

Description

Listings

Heritage Listing	Reference Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan		30 Dec 94		
Register of the National Estate		14 May 91		
Register of the National Estate		15 May 90		

References

Conservation or Management Plan?: No
Bibliography: None

Source of information for this entry

Name: NSW Government Gazette
Email: watters@heritage.nsw.gov.au
Web Page: www.heritage.nsw.gov.au

Administration

Heritage Database Number: 11075
Central Registry Number:

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State Heritage Inventory Listings

Waddi Creek Scarred Trees

Item

Name of Item: Waddi Creek Scarred Trees
Address: Darlington Point 2706
Local Government Area: Murrumbidgee

Description

Listings

Heritage Listing	Reference Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan	1994	30 Dec 94	177	7829
Register of the National Estate		15 May 90		

References

Conservation or Management Plan?: No
Bibliography: None

Source of information for this entry

Name: NSW Government Gazette
Email: watters@heritage.nsw.gov.au
Web Page: www.heritage.nsw.gov.au

Administration

Heritage Database Number: 11067
Central Registry Number:

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Appendix 7: Gum Creek Bridge Archival Records

PLEASE KEEP ON TOP OF FILE

BSICOE SHIRE COUNCIL
AREA
MUB | 14 | km ~~MILES~~ 40.35 ~~25.07~~

File No 14/300.1117

Bridge over GUM CREEK

Name of Bridge

Road No SH 14 SHIRE of MURRUMBIDGEE

Structure 5/20' R.C. Slab Deck 100' long, 22' K/K

Constructed 1957 Maintenance by Department

HISTORY

YEAR	SUMMARY-DETAILS OF WORK INSPECTIONS ETC.	EXP. $
1957/69	No maintenance reports	
Dec. 69	D.O. Inspection: minor repairs required	
Oct. 70	Expansion joint replaced	
Dec. 75	D.O. Inspection: abutments scoured	
May 77	D.O. Inspection: abutments scoured, cracks in handrails, deck uneven	
Jan.78	D.O. Inspection as above.	
Dec. 78	D.O. Inspection: satisfactory, repairs to abutments Handrail complete.	
Sept. 83	D.O. Inspection: Patching to handrail, wearing surface, Abutments a & B, Exp. joints to be replaced.	
June 84	D.O. Inspection: replace exp. joints with Megaprene.	

RTA Form No 17
'89
No 45060098

ROADS AND TRAFFIC AUTHORITY, NSW

H O Ref
D O Ref 14/300.1117 PRH:JM
W O Ref

TO		FROM	
	Chief Bridge Engineer		Mr Hurst
	HEAD OFFICE		DENILIQUIN DIVISIONAL OFFICE
		DATE	2 NOV 1990

STATE HIGHWAY NO 14. STURT HIGHWAY. SHIRE OF MURRUMBIDGEE. BRIDGE OVER GUM CREEK AT 75.1 KM WEST OF NARRANDERA.

The subject bridge has 5/6.096 m reinforced concrete slab spans and was constructed in 1957 (WAE Plans 0014 300 BC 0115 refer).

The road approaches to the bridge are currently programmed for rehabilitation under the 3x3 Program. The existing riding quality across the bridge is poor due to the development of a sag at midspan of each span together with some level variation between piers. Accordingly, a deck correction with asphalt, to be carried out in conjunction with the road rehabilitation, is currently under consideration.

Attached for your information is a graph of the deck profile at the road centreline and at the centre of each travel lane. As the road approaches are being designed with 4% two way crossfall (existing deck 1/48 two way crossfall) it would require a minimum depth of asphalt of approximately 85 mm at the piers to provide a similar cross section on the bridge deck (see attached sketch). The maximum depth of asphalt at midspan would increase to approximately 145 mm at midspan of span 1 (Narrandera end).

Based on the above, it has been calculated that it would require approximately 17 tonne (7.1 m^3) of asphalt to restore the original design profile and a further 26 tonne (10.7 m^3) to provide a new surface at 4% crossfall.

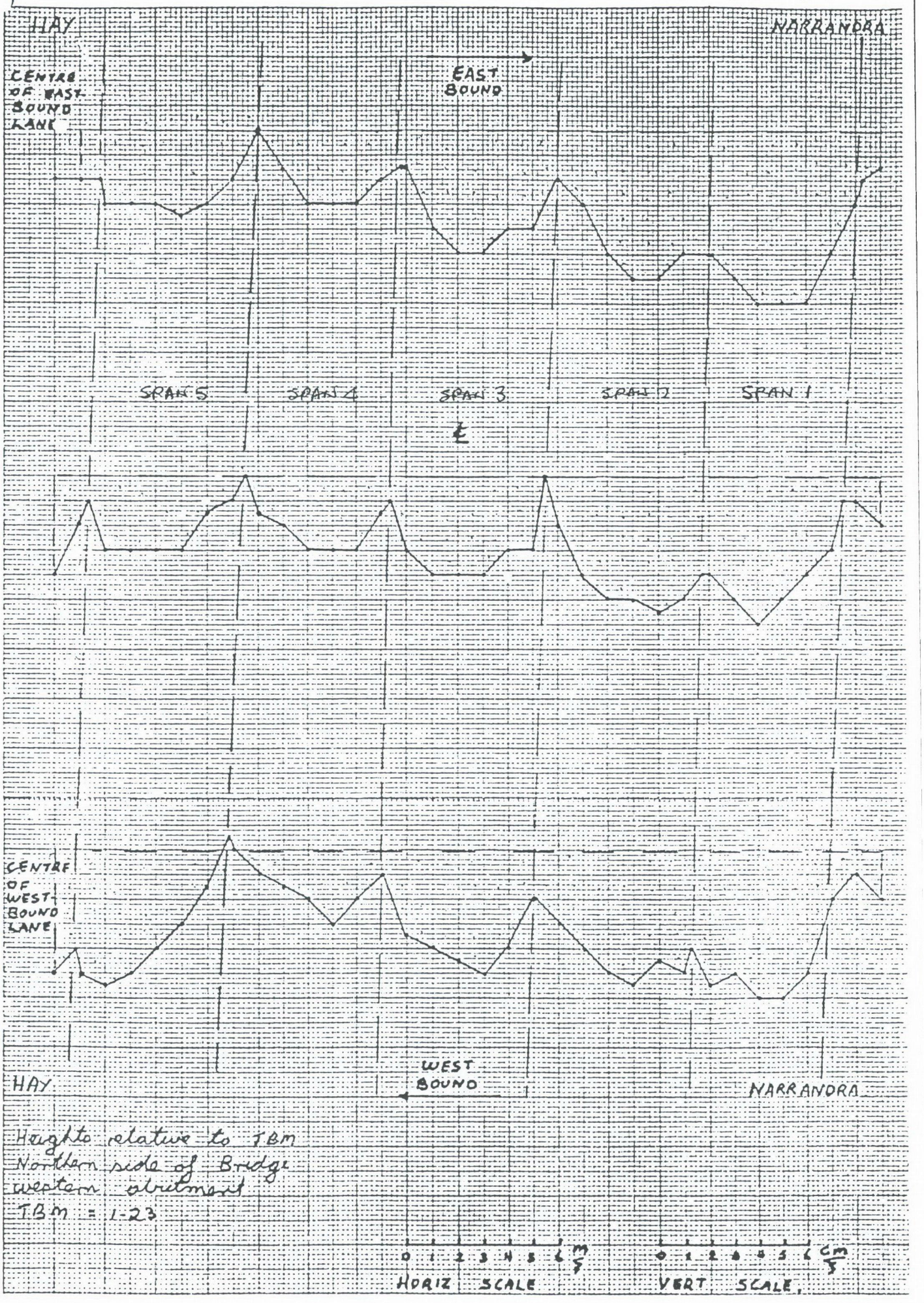
It would be appreciated if you could now carry out a structural check of the bridge to establish the feasibility of the proposal with regard to the additional asphalt loading. If necessary, the crossfall on the bridge may be reduced to 3%.

The account number to be charged for this work is 01/531/1251/00015.

C E Blomfield

C E Blomfield
Divisional Engineer

encl


HAY
NARRANDRA
CENTRE OF EAST BOUND LANE
EAST BOUND
SPAN 5
SPAN 4
SPAN 3
SPAN 2
SPAN 1
℄
CENTRE OF WEST BOUND LANE
WEST BOUND
HAY
NARRANDRA
Height relative to TBM
Northern side of Bridge
western abutment
TBM = 1-23
0 1 2 3 4 5 6 m/s
HORIZ SCALE
0 1 2 3 4 5 6 cm/s
VERT SCALE.

$A = (6.705 \times 0.065 \times 0.5) + (6.705 \times 0.020)\ m^2$

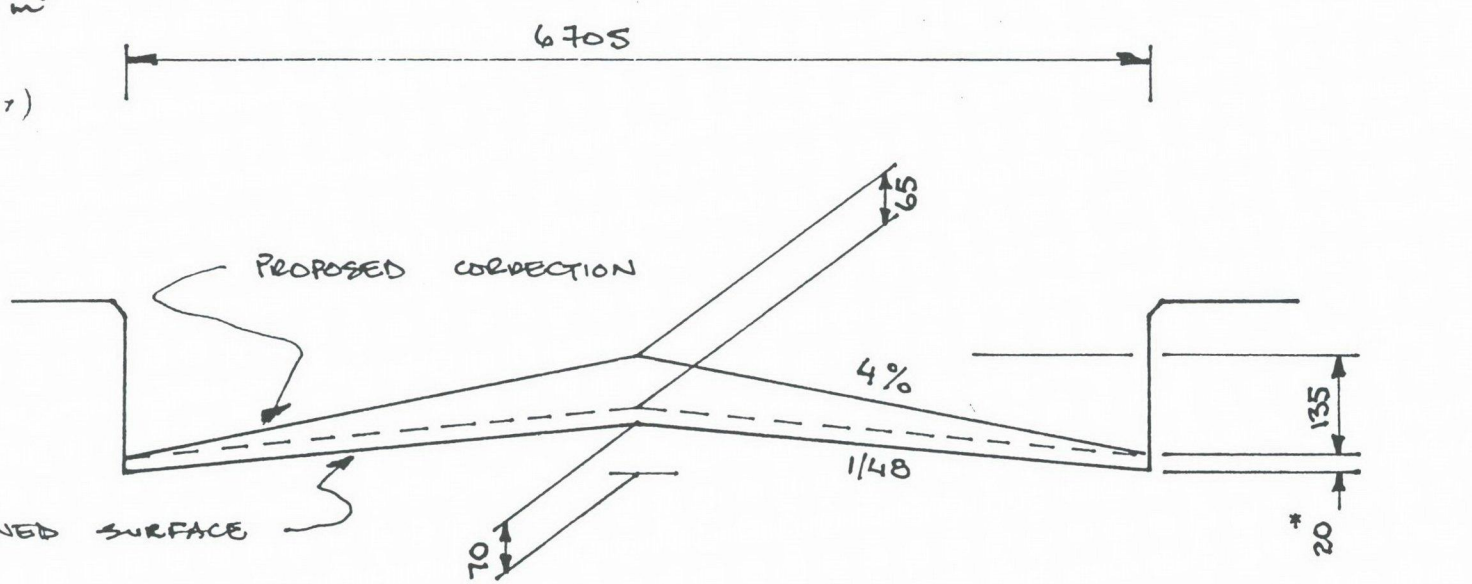
$= .352\ m$

∴ Volume asphalt

$= .352 \times 30.48\ m^3$

$= 10.7\ m^3$

$= 26T \quad (24^T)$



*Minimum asphalt depth

SCALE 1:50 HORIZ.
1:10 VERT.

SH14 - STURT HWY. SHIRE OF MURRUMBIDGEE

BRIDGE OVER GUM CREEK AT 75.1km WEST OF NARRANDERA

MR Form No 124

ROADS and TRAFFIC AUTHORITY of N.S.W.

INSTRUCTION

Road No State Highway No 14 — File No 14/300.168

Shire of Murrumbidgee — Instruction No CMY 393

Parish of Cararbury — Ref No N/A

County of Boyd — Dated... 5 OCT 1990

Site of Work : Rehabilitation of Approaches to bridge over Gum Creek at 75.05 km west of Narrandera.

Messrs Surveyors A H West & Co are requested at your earliest convenience to carry out an engineering survey to peg an offset road construction centreline. Following are details of the extent of the survey and particular requirements.

1. Limit of the Survey.

The construction centreline to be pegged extends from distance 74 km 475 to 75 km 450 on plans Reg No 0014.300.BA.3201 (copy handed to you).

2. Centreline.

The construction centreline as detailed above shall be pegged as an offset centreline 20 metres to either the left or right. Pegs shall be placed at chainage points scheduled on the plans (count 65).

3. Marking.

Chainage points on the offset centreline (count 64) are to be marked with pegs of sawn hardwood or cypress pine not less than 200 mm long, and 50 mm square driven flush with natural surface. Pegs are to be painted white on top.

Indicator stakes of sawn hardwood or cypress pine not less than 500 mm long by 50 mm wide and 20 mm thick are to be firmly driven about 300 mm beyond nominated pegs (count 24) on the offset centreline in the direction of travel. The broard face of the indicator is to be square to the centreline.

Indicators are to be painted white above ground. The distance in kilometres and metres is to be clearly marked in letters 30 mm high. The notation of SS, TS, TP and SC are also to be marked where appropriate.

Indicator stakes are required at start and finish distances, SS, TS, TP and SC points, the 75km00 point and even 100m distance points.

4. Datum.

It is not required to level the pegs placed.

5. Co-Ordinates.

Co-Ordinates shown on the plan are assumed. Calculations or information supplied shall use the same grid as shown on the plans.

6. Ground Model.

Additional ground model information is not required.

7. Property Information.

Adjoining property information is not required.

8. Submission of Survey.

Completion of the survey shall be notified in writing.

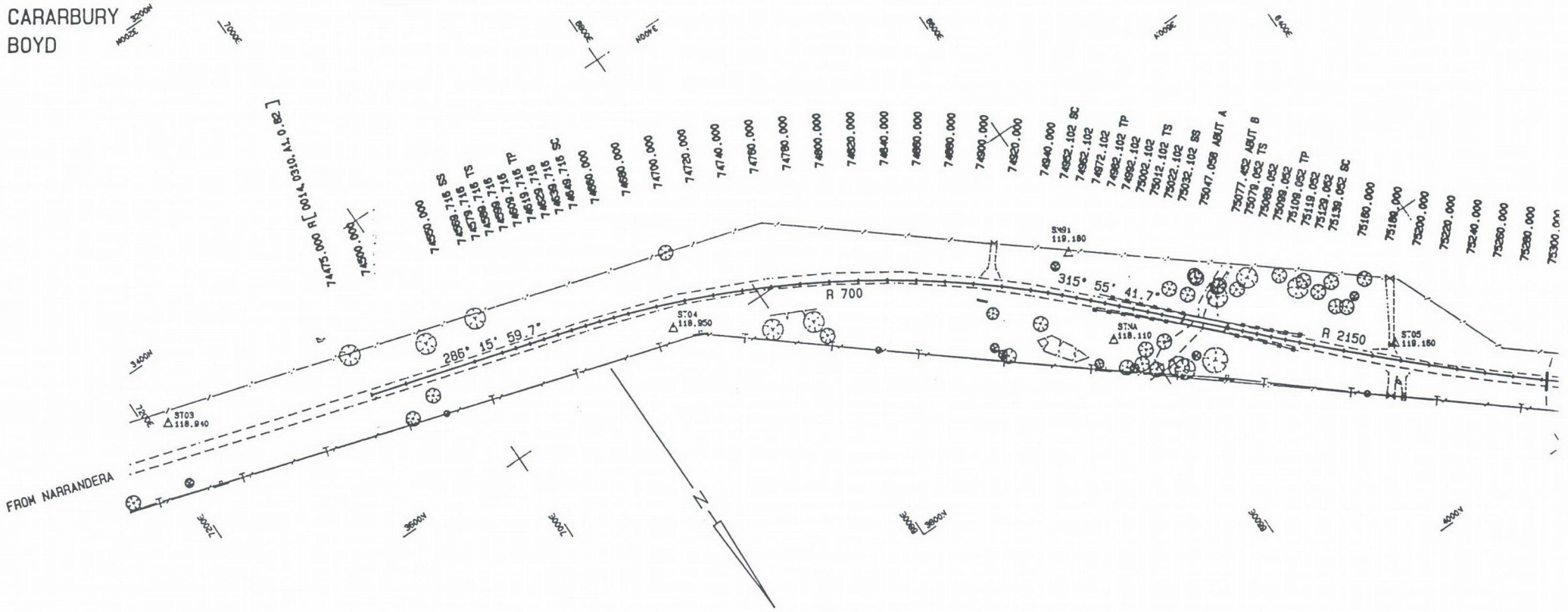
A copy of plan Reg No 0014.300.BA.3201 shall be marked to show the location of the pegs placed on the offset centreline, and shall be forwarded with advice of survey completion and account for payment.

9. Time of Completion of Survey.

The whole of the work shall be completed by 19 October 1990.

C E Blomfield
Divisional Engineer

ARISH OF CARARBURY
OUNTY OF BOYD



COORDINATES OF CENTRELINE POINTS

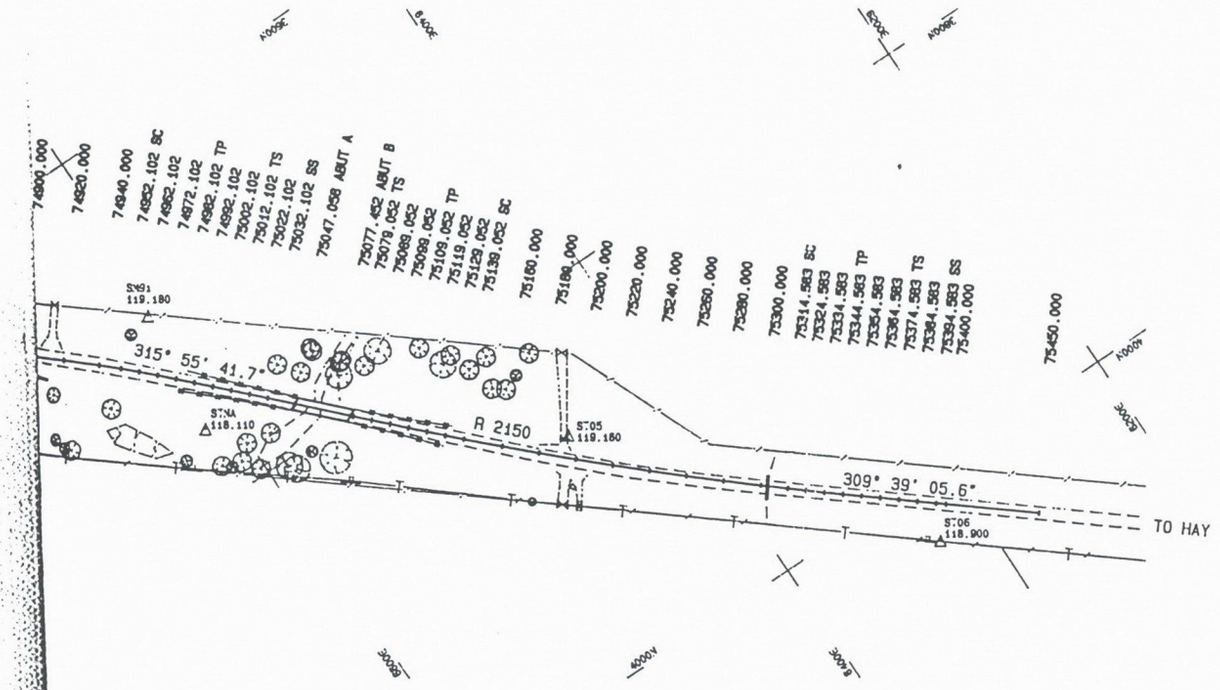
CHAINAGE	EASTING	NORTHING
74475.000	7059.101	3505.613
74500.000	7035.102	3512.615
74550.000	6987.103	3526.621
74569.716	6968.176	3532.143
74579.716	6958.577	3534.944
74589.716	6948.977	3537.745
74599.716	6939.377	3540.546
74609.716	6929.778	3543.347
74619.716	6920.178	3546.149
74629.716	6910.599	3549.018
74639.716	6901.061	3552.024
74649.716	6891.568	3555.166
74660.000	6881.853	3558.539
74680.000	6863.105	3565.504
74700.000	6844.565	3573.002
74720.000	6826.246	3581.027
74740.000	6808.164	3589.572

COORDINATES OF CENTRELINE POINTS

CHAINAGE	EASTING	NORTHING
74860.000	6705.455	3651.342
74880.000	6689.431	3663.309
74900.000	6673.755	3675.728
74920.000	6658.441	3688.591
74940.000	6643.500	3701.885
74952.102	6634.646	3710.135
74962.102	6627.439	3717.067
74972.102	6620.331	3724.101
74982.102	6613.324	3731.236
74992.102	6606.368	3738.421
75002.102	6599.413	3745.605
75012.102	6592.457	3752.790
75022.102	6585.502	3759.975
75032.102	6578.546	3767.159
75047.058	6568.143	3777.905
75077.452	6547.002	3799.742
75079.052	6545.890	3800.891
[redacted]	[redacted]	[redacted]

COORDINATES OF CENTRELINE POINTS

CHAINAGE	EASTING	NORTHING
75129.052	6511.045	3836.750
75139.052	6504.006	3843.853
75160.000	6489.155	3858.627
75180.000	6474.842	3872.596
75200.000	6460.400	3886.432
75220.000	6445.830	3900.132
75240.000	6431.133	3913.697
75260.000	6416.310	3927.124
75280.000	6401.363	3940.412
75300.000	6386.294	3953.562
75314.583	6375.229	3963.060
75324.583	6367.604	3969.531
75334.583	6359.949	3975.965
75344.583	6352.265	3982.364
75354.583	6344.565	3988.746
75364.583	6336.866	3995.127
75374.583	6329.167	4001.508
[redacted]	[redacted]	[redacted]

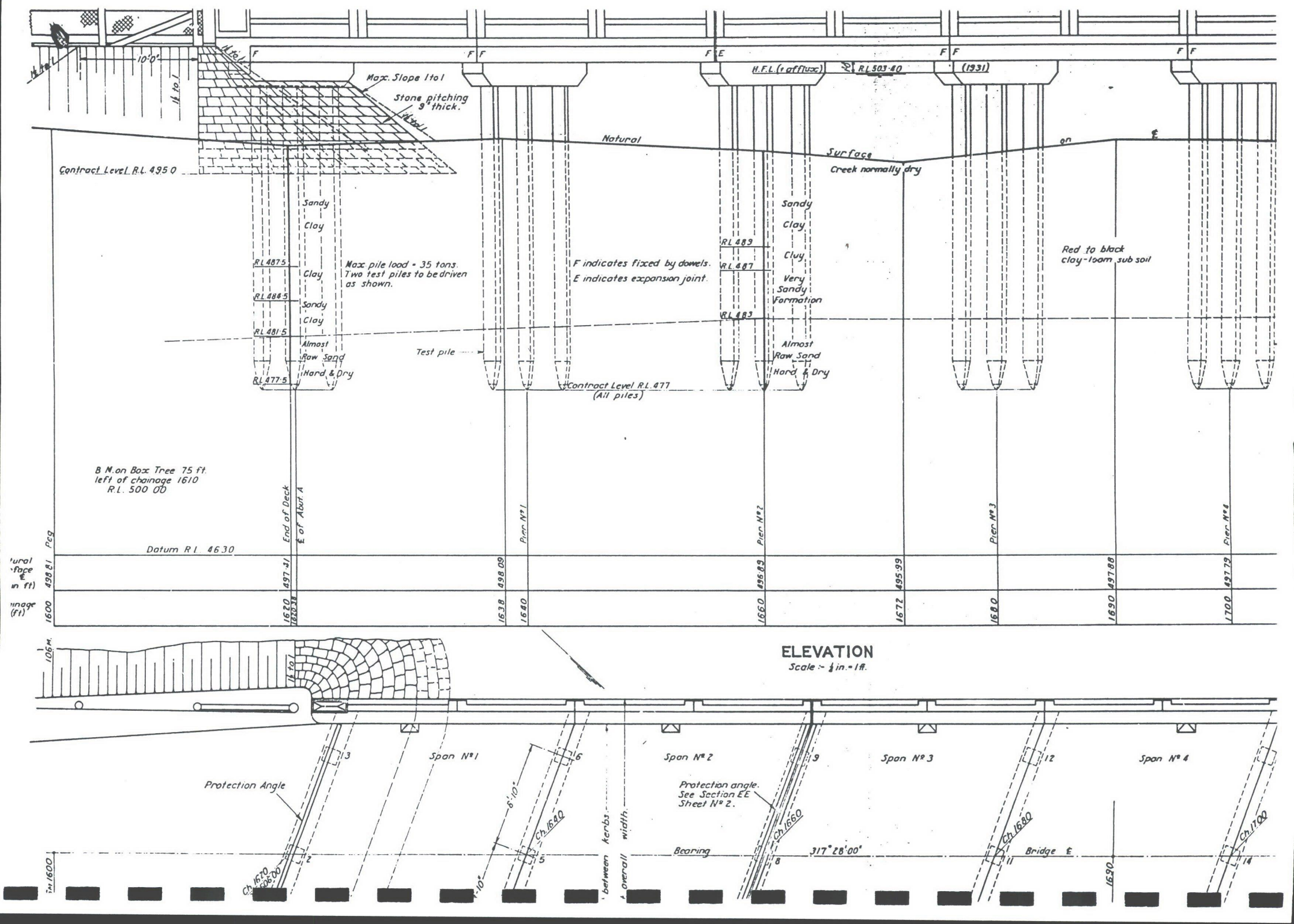


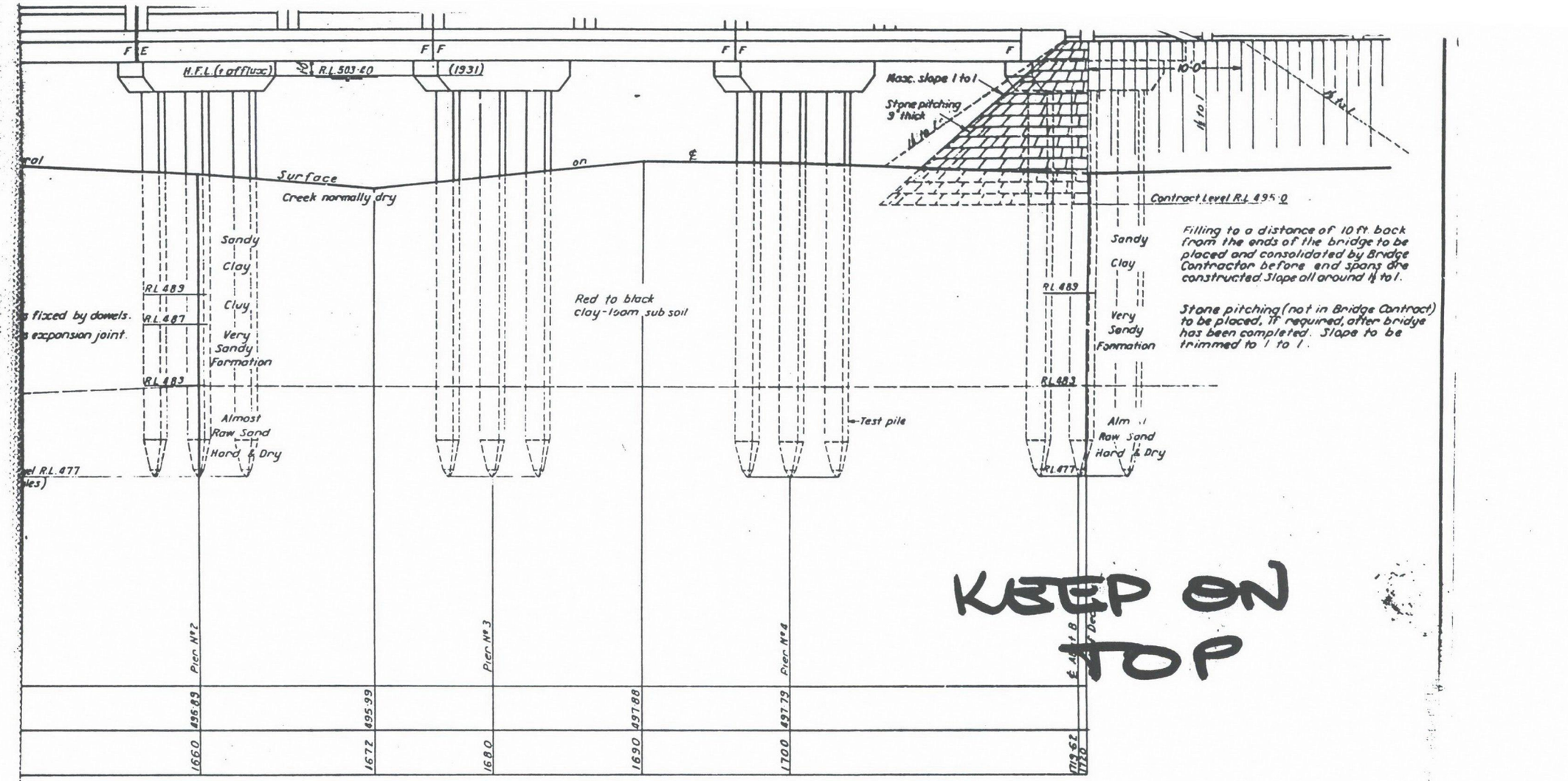
COORDINATES OF CENTRELINE POINTS

CHAINAGE	EASTING	NORTHING
75129.052	6511.045	3836.750
75139.052	6504.006	3843.853
75160.000	6489.155	3858.627
75180.000	6474.842	3872.596
75200.000	6460.400	3886.432
75220.000	6445.830	3900.132
75240.000	6431.133	3913.697
75260.000	6416.310	3927.124
75280.000	6401.363	3940.412
75300.000	6386.294	3953.562
75314.583	6375.229	3963.060
75324.583	6367.604	3969.531
75334.583	6359.949	3975.965
75344.583	6352.265	3982.364
75354.583	6344.565	3988.746
75364.583	6336.866	3995.127
75374.583	6329.167	4001.508
75384.583	6321.467	4007.889
75394	631	40

COORDINATES OF CONTROL STATIONS

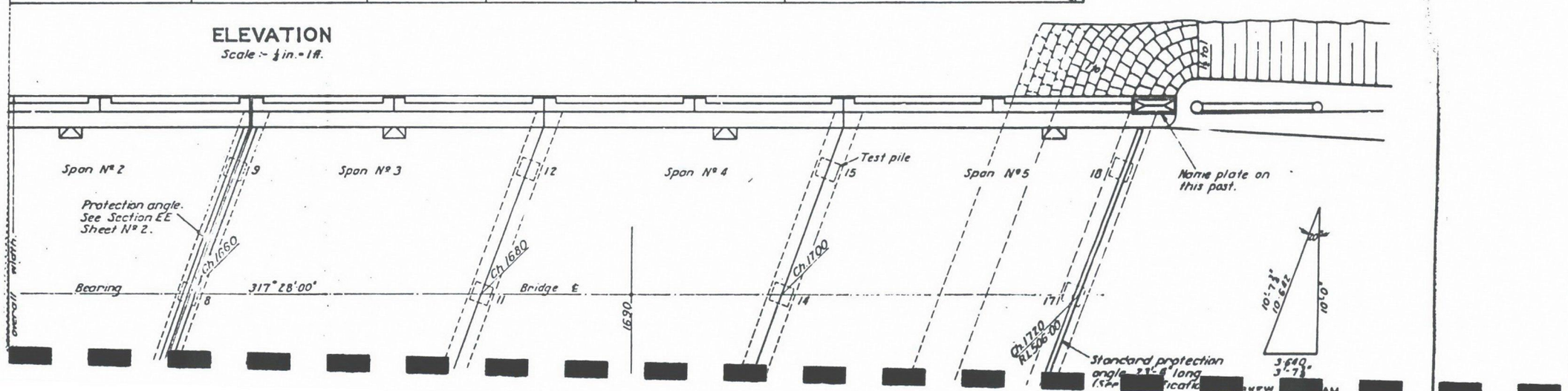
STATION	EASTING	NORTHING	R.L.
ST02	7485.39	3352.56	119.23
ST03	7185.23	3443.05	118.94
ST04	6861.41	3583.95	118.95
SM91	6606.99	3694.65	119.18
STNA	6615.43	3762.20	118.11
ST05	6456.68	3873.55	119.16
ST06	6323.07	4032.58	118.90
ST07	5965.97	4321.75	118.71
ST08	5621.72	4600.52	118.43
ST11	5384.11	4792.93	118.88
ST09	5268.54	4886.52	119.35
ST10	5000.00	5000.00	118.98
ST12	4687.50	5026.95	118.63


10'0"
1 to 1
Max. Slope 1 to 1
Stone pitching 9" thick.
F
E
H.F.L. (effluxe)
R.L 503·40
(1931)
Natural Surface on ℄
Creek normally dry
Contract Level R.L. 495 0
Sandy Clay
Clay
R.L 487·5
R.L 484·5
Sandy Clay
R.L 481·5
Almost Raw Sand Hard & Dry
R.L 477·5
Max pile load = 35 tons.
Two test piles to be driven as shown.
F indicates fixed by dowels.
E indicates expansion joint.
Test pile
Contract Level R.L. 477 (All piles)
R.L 489
R.L 487
R.L 483
Very Sandy Formation
Red to black clay-loam sub soil
B.M. on Box Tree 75 ft. left of chainage 1610 R.L. 500 00
Peg
End of Deck
℄ of Abut A
Pier N°1
Pier N°2
Pier N°3
Pier N°4
Datum R.L. 463·0
Natural Surface ℄ in ft)
498·81
497·41
498·09
496·89
495·99
497·88
497·79
Chainage (ft)
1600
1620
1638
1640
1660
1672
1680
1690
1700
ELEVATION
Scale :- ½ in. = 1 ft.
106 M.
1 to 1
Span N°1
Span N°2
Span N°3
Span N°4
Protection Angle
Protection angle. See Section EE Sheet N° 2.
6'·10"
Ch. 1640
Ch. 1660
Ch. 1680
Ch. 1700
Ch. 1670
Bearing 317°28'00"
Bridge ℄
between kerbs
overall width.
1690
1600



ELEVATION

Scale :- ½ in. = 1 ft.



M R & M N° 95

DEPARTMENT OF MAIN ROADS, N. S. W.

WW

H. O. FILE N° EB 14/300.~~148~~ 1117

D. O. FILE N° 14/300.148

W. O. FILE N°

MEMO. TO Engineer-in-Chief,

HEAD OFFICE.

MEMO. FROM DENILIQUIN. (DIVISIONAL OF

(D

SUBJECT State Highway No. 14 - Shire of Murrumbidgee - Bridge over Gum Creek 11M from Darlington Point - Repairs.

REFERENCE Your memorandum dated 29th January, 1970.

The rubber tubing in the expansion joints of the subject bridge were perished and in places had fallen out, accordingly under the 1970/71 Bridge and Ferry Maintenance Programme the following remedial measures were carried out.

1. The existing rubber tubing was removed and the expansion joint protection angles were sand blasted to remove the rust as far as practicable.

2. 28 ft. of 3" x 1¼" Spandex self expanding cork jointing was then placed in the grove between the protection angles, and fixed into place with expandite filler.

3. The top of the cork jointing was protected by means of masking tape applied to the top edge.

4. After hardening of the expandite filler and removal of the masking tape, the Spandex was then saturated with water and kept moist for four days.

L. R. James

(L.R. James)
Divisional Engineer.

...971
J Thompson
15.3.71

...MAR 1971
J Thompson
9.3.71

I. the Swimmer

DO. File No. 300.13

CENTRAL MURRAY DIVISION

DENILIQUIN

30 SEP 1963

The Shire Clerk,
Shire of Murrumbidgee,
DARLINGTON POINT. N.S.W.

SUBJECT: Shire of Murrumbidgee. Bridge over Gum Creek on Carrathool - Jerilderie Road. Longitudinal Running Planks.

Dear Sir,

In reply to your letter dated 14th August 1963, I have to advise that, although there are no comparative figures available as to the incidence of accidents on bridges with running planks as against those without, the provision of full width longitudinal sheeting is considered preferable to the provision of running planks on transverse timber deck bridges.

It has been the Department's policy during recent years to provide 2" thick longitudinal sheeting for the full width between kerbs on bridges under the control of the Department which were originally constructed with transverse timber decking.

Yours faithfully,

Divisional Engineer.

H.O. File No. ~~N.K~~/4/300.1117

Forwarded for your approval and despatch please.

A copy of Council's letter dated 14th August, 1963, is attached hereto.

Encl.

(Sgd.) L. Derrin
Divisional Engineer.

CHIEF ENGINEER,
HEAD OFFICE.

Approved and despatched.

T.M. COULTER
Chief Engineer.
PER
30 SEP 1963

DIVISIONAL ENGINEER,
DENILIQUIN.

14/300.14

D.O. File No. 300.13

AM

CENTRAL MURRAY DIVISION

DENILIQUIN.

The Shire Clerk,
Shire of Murrumbidgee,
DARLINGTON POINT. N.S.W.

SUBJECT: Shire of Murrumbidgee. Bridge over Gum Creek on Carrathool - Jerilderie Road. Longitudinal Running Planks.

Dear Sir,

Traffic Services Engineer. No figures available. [illegible] 1963

In reply to your letter dated 14th August 1963, I have to advise that, although there are no comparative figures available as to the incidence of accidents on bridges with running planks as against those without, the provision of full width longitudinal sheeting is considered preferable to the provisio of running planks on transverse timber deck bridges.

It has been the Department's policy during recent years to provide 2" thick longitudinal sheeting for the full width between kerbs on bridges under the control of the Department which were originally constructed with transverse timber decking.

Yours faithfully,

RECOMMENDED FOR APPROVAL
26 SEP 1963
ASST. BRIDGE ENGINEER MAINTENANCE

Divisional Engineer

H.O. File No. N.K.

Forwarded for your approval and despatch please.

A copy of Council's letter dated 14th August 1963, is attached hereto.

AUTHORISED FOR DESPATCH
27 SEP 1963
BRIDGE ENGINEER

Divisional Engineer
23 AUG 1963

Encl.

CHIEF ENGINEER,
HEAD OFFICE.

Approved and despatched.

DEPT. OF MAIN ROADS
AUG 1963

Chief Engineer

Order despatched [illegible]

Murrumbidgee Shire Council

Darlington Point

All Correspondence to be addressed to Shire Clerk, P.O. Box 5.

South-West Line N.S.W.

☆

Telephone 6, Darlington Point

14th August, 1963.

Divisional Engineer,
Central Murray Division,
Department of Main Roads,
DENILIQUIN.

SUBJECT: Longitudinal Bridge Running Planks

Dear Sir,

A recent accident on the bridge crossing the Gum Creek approximately 15 miles south of State Highway No. 14, has prompted Council to request your advice on the following matters:-

1. Does the incidence of accidents appear to be higher on bridges having running planks;

2. If so, would full width longitudinal decking decrease the danger hazard;

3. Does the Department have recent policy relating to this matter.

The particular bridge is 16ft. in width and has running planks constructed in a similar manner to the Departments standard A1216.

Yours faithfully,

(I. V. Crump)
SHIRE CLERK

Appendix 8: NPWS Site cards and field notes

[ ] New recording [ ] Additional Info

National Parks and Wildlife Service

Box 1967, Hurstville NSW 2220. Tel: (02) 9585 6444

Standard Site Recording Form Revised 5/88

NPWS Code

1:250,000 map sheet: _____

AMG Grid reference (Full reference - please include leading digits)

250K 3 9 0 2 5 0 mE (25K)

250K 6 1 7 1 5 7 0 mN (5/6 | 25K)

Scale of map used for grid reference (Please use largest scale available) [ ] 25K, 50K (preferred) [ ] 100K [ ] 250K

(1:25K) 50K, 100K map name: DARLINGTON POINT.

HEAD OFFICE USE ONLY:

NPWS Site no: _____

Site types:

Accessioned by: _____ Date: _____

Data entered by: _____ Date: _____

Owner/Manager:

Address:

Site name: GC-ST-1 Locality/property name.

NPWS District: SOUTH WESTERN Region:

Reason for investigation

WIDENING OF GUM CK. BRIDGE + APPROACH ROAD.

Portion no:

Parish:

Photos taken? ✓

How many attached? (1)

How to get to the site (refer to permanent features, give best approach to site eg. from above, below, along cliff. (Draw diagram on separate sheet.)

SITE IS ON STUART HIGHWAY 75 Km. WEST OF NARRANDERA

Other sites in locality? YES

Are sites in NPWS Register? YES

Site Types include: OPEN CAMPS MOUND.

Have artefacts been removed from site? NO

By whom?

When?

Deposited where? /

Is site important to local Aborigines?

Give contact(s) name(s) + address(es) GRIFFITH LALC

Contacted for this recording? ROBERT CARROLL

(Attach additional information separately) If not, why not?

Verbal/(written) reference sources (including full title of accompanying report)

NPWS Report Catalogue #

AN ARCHAEOLOGICAL SURVEY OF THE PROPOSED GUM CK BRIDGE WIDENING. 75 Km WEST OF NARRANDERA ON STUART HIGHWAY.

Checklist: surface visibility, damage/disturbance/ threat to site

Condition of site:

GOOD

Recommendations for management & protection (attach separate sheet if necessary) AVOID.

PROTECTION DURING BRIDGE WORKS BY 15m BUFFER AREA.

Site recorded by: Robynne Mills

Address/institution: 60 Watkin Street Newtown NSW 2042

Date: 10/9/99.

SITE POSITION & ENVIRONMENT | OFFICE USE ONLY: NPWS site no:

1. Land form a. beach/hill slope/ridge top, etc: CREEK LINE b. site aspect: NORTH. c. slope:

d. mark on diagram provided *or* on your own sketch the position of the site: e. Describe briefly:

f. Local rock type: NIL g. Land use/effect: ROAD EASEMENT

2. Distance from drinking water: 2 KM Source: MURRUMBIDGEE RIVER.

3. Resource Zone associated with site (estuarine, riverine, forest etc): FOREST (NOW CLEARED FOR FARMING)

4. Vegetation: ALL REGROWTH EUC.

5. Edible plants noted: NIL

6. Faunal resources (include shellfish): NIL

7. Other exploitable resources (river pebbles, ochre, etc): NIL

Site type:

SCARRED TREE.

Location: Grid Ref: 39025E 6171576N

This general location of the site is on the Sturt Highway approximately 75km west of Narrandera. The tree is approximately 67m west of the bridge (Sketch 3, Photos 3, 4).

Potential for Development Related Impact:

This site is outside the are of direct impact from the proposed bridge widening. However the site should be protected during the construction phase by crating a 15m buffer zone around the site.

Site Description

The scar is on a grey box tree which is living but has been badly affected by die back. The circumference of the tree is 3200mm. The scar is elongated in shape and is 1500mm long by 600mm wide and is located 800mm from the ground. The scar is in poor condition as the heart wood in the upper section of the scar had collapsed. Therefore it was not possible to determine whether of not axe marks were present. The scar is oriented to the north.

Site Context

The site occurs within the flood plain of Gum Creek on an old growth box tree. Box trees were a tree species preferred by Aboriginal people for bark removal. A majority of scarred trees are within 100m of permanent or ephemeral creeklines. Therefore this site occurs in a landform which was predicted

Attach sketches etc. eg. plan & section of shelter, show relation between site contents, indicate north, show scale.
Attach annotated photos (stereo where useful) showing scale, particularly for art sites.

Appendix G

Correspondence from Authorities

Ms Andrea Zambolt
Environmental Officer
RTA Operations
Environmental Technology
Level 3/52 Rothschild Avenue
Rosebery NSW 2018

LAND & WATER CONSERVATION

October 25 1999

Dear Andrea

RE: PROPOSED WIDENING OF GUM CREEK BRIDGE, STURT HIGHWAY VIA DARLINGTON POINT.

In reply to your e-mail of October 22, 1999 which sought comment on the above outline proposal.

This Department has a statutory obligation to ensure that developments and landuse do not result in land degradation or depletion of natural land and water resources. From the outline of proposed works you have provided, DLWC would have no objections to it providing measures are taken to:

- Keep necessary clearing of native vegetation to a minimum.
- Strip and stockpile topsoil from the site prior to construction works for later revegetation.
- Prevent the movement of silt into the watercourse using appropriate measures.
- Not in any way alter the current flow pattern or frequency of flow in the waterway.

The above points will no doubt be included in the ***Review of Environmental Factors*** document you compile and this Department will provide further comment.

In regard to your request for Soils information in the subject area, DLWC has not yet ***Landscape Mapped*** areas west of Wagga Wagga and therefore it is difficult to provide you with any specific information or references. To give a very general description of the soil type in the subject area, it would most likely be Grey Cracking Clay of the Riverine Plain. These soils are usually associated with low dunes and levees of brown and red crusty duplex soils (desert loams) and sandy rises of deep siliceous sands. The plains are dominated by calcareous red earths and brown calcareous earths (solenised brown soils). It would also be likely that the Gum Creek area might have sand aquifers as old Prior Streams that are commonly found on the Murrumbidgee FloodPlain. These have been mapped in the past, however the work has not been collated into any useable form. Some general soil survey work to determine suitability for rice growing and irrigated Agriculture on some farms has been undertaken in major irrigation areas but this has been confined to surveying mainly soil texture. Again this information is not readily available.

I would suggest that CSIRO at Griffith would be an additional information source for soil assessment information.

A reference book which provides some good general information on soil types in different zones of NSW is "Soils- Their Properties and Management" by Charman and Murphy, published by Sydney University Press 1991.

I you require any further assistance at this point of time I would be happy to assist.

Yours faithfully,

Peter Beal
Catchment Manager, Narrandera.

Murrumbidgee Shire Council

Council Chambers, Darlington Point, N.S.W. 2706

Telephone: (02) 6968 4166
Fax: (02) 6968 4252

All communications to be
addressed to the General Manager
Box 5 Post Office, Darlington Point, 2706

IN REPLY PLEASE QUOTE

RR/FD

20TH August, 1998

Mr B Hanson
Project Manager
Roads & Traffic Authority
PO Box 484
WAGGA WAGGA 2650

Dear Mr Hanson

BRIDGE OVER GUM CREEK – STURT HIGHWAY

Further to your enquiry I advise Council has no concerns or particular requirements with regard to the proposed works. The plans indicate there will be no impediment to the flow of gum Creek.

Yours faithfully

R D Roach
Director
Environmental Services

B H.

Rural Lands Protection Board
Narrandera

Communications to be addressed to:
THE ADMINISTRATIVE OFFICER
P.O. Box 11, Narrandera 2700
Telephone (02) 6959 2322
Fax (02) 6959 3077

BOARD OFFICE
8 Bolton Street,
NARRANDERA 2700

Roads & Traffic Authority
PO Box 484
WAGGA WAGGA NSW 2650

11th September, 1998

Dear Brian,

Re: Bridge over Gum Creek, 75.1 Km west of Narrandera

We refer to your letter of 13 8 98, which was tabled at our August Meeting, and advise that the Board has no objection to or concerns about the proposed widening of the above mentioned bridge.

Yours faithfully

Chris Wills
Administrative Officer

Roads & Traffic Authority
13 SEP 1998
Regional Office

BH

EPA

Environment
Protection
Authority
New South Wales

Suite 3 Level 1, 130-140 Banna Ave
Griffith City Plaza
P.O. Box 397 Griffith NSW 2680
Tel. 069. 64 1880 Fax. 069. 64 1885

The Zone Manager
Roads and Traffic Authority
PO Box 484
Wagga Wagga NSW 2650

Our Reference GF365

Your Reference 14/300.194

CC537
BH

Dear Mr Blomfield

RE GUM CREEK BRIDGE NARRANDERA

I refer to your letter dated 13 August 1998 to the Environment Protection Authority (EPA) requesting comments on the works proposed to widen Gum Creek bridge on the Sturt Highway, 75 kilometres west of Narrandera.

In response to your request I wish to submit that the EPA considers that the following matters should be addressed in the Review of Environmental Factors (REF) for the proposal.

1. A site plan showing the following in relation to the proposed works.

   (a) Any natural or artificial waters.

   (b) Distances between the construction site and any residences within likely area of impact.

2. Details of sediment control on site development and construction areas.

3. Details of any proposed pollution control equipment to be installed to prevent any contaminants associated with the construction activities from entering any watercourses.

4. Details of plans for rehabilitation of the construction site.

5. A schedule of the anticipated operating times of the plant and equipment.

6. Details of the noise control measures to contain or control noise from each major source.

7. Details of any assessment of the noise impact describing the effects of the predicted noise levels on people in any nearby residential premises.

8. Proposed methods of preventing or minimising air-borne or vehicle-borne dust.

9. Details of the location(s) and methods proposed for the disposal of timber and other materials will be replaced as a result of the works.

I hope this information is of assistance to you. Should you have any further enquiries about this matter please do not hesitate to contact Melissa Daniher by telephoning 02 6964 1880.

Yours faithfully

Craig Bretherton
Acting Head Regional Operations Unit South West
for **Director General**

NSW FISHERIES

Our Ref.: HS 94/48
Your Ref.: 14/300.194

Brian Hanson
Roads and Traffic Authority
PO Box 484
Wagga Wagga NSW 2650

28 October 1998

Re: State Highway No. 14 – Sturt Highway. LGA of Murrumbidgee.
Bridge over Gum Creek at 75.1 km West of Narrandera

Dear Brian.

Thank you for seeking comments from NSW Fisheries regarding this project. NSW Fisheries is responsible for the conservation of fish stocks, fish habitat, threatened fish species and aquatic biodiversity, with the term 'fish' including aquatic invertebrates. Inland waterways such as Gum Creek often contain valuable fish habitat, even if they are flood channels and/or they dry out intermittently. Thus, our overarching requirement for the REF is consideration of the quality of fish habitat in the region.

Bridges and other structures crossing waterways may significantly alter aquatic habitats by blocking fish passage, increasing sedimentation, changing water flow patterns, interfering with snags, removing riparian vegetation, and/or changing the bed of waterways. The major issues for the present project are blocking fish passage, increasing sedimentation, removing riparian vegetation and any general declines in water quality. Blocking fish passage may cause the local extinction of fish in large sections of streams as migrating adults and/or juveniles are denied access and local populations are not replenished. Increasing sedimentation can greatly affect fish habitat by filling deep holes that are used by many fish species, especially during droughts, and by smothering gravel beds which are important spawning sites for some fish species. Good water quality is a critical component of fish habitat and riparian vegetation helps to provide clean water, shelter and food for fish.

The trout cod (*Maccullochella macquariensis*) is listed as an endangered species under NSW Fisheries threatened species legislation. It occurs in parts of the Murrumbidgee River near Narrandera. Under the *Environmental Planning and Assessment Act* 1979, an 'eight part test' is

Regional Office
Received
30 OCT 1998

Shoalhaven Fisheries Offices
Telephone
Telephone
Office Facsimile

required and a species impact statement may be required. Please see the attachment to this letter which outlines threatened species provisions.

Thus the following issues must be considered for the present project, *both during and after construction*:

- protection of fish habitat;
- threatened species of fish;
- maintenance of fish passage during and after construction;
- minimal interference with snags;
- timing of works to avoid floods and flows;
- ongoing control of sedimentation, especially from the erosion of batters and table drains;
- rehabilitation and ongoing care of riparian vegetation;
- maintenance of creek-bed morphology, creek banks and water flow patterns;
- control of run-off from roads (e.g. oil and grease); and
- appropriate guidance and control of contractors.

Please do not hesitate to contact me for further discussion of the project.

Yours faithfully,

Rodney James
Conservation Manager

for Dr J. Glaister
Director of Fisheries

cc. Peter Angel, SFO, Narrandera

Attachment: Conservation of threatened aquatic species

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

Mr Brian Hanson
Project Manager
Roads and Trafic Authority
1 Simmons St
WAGGA WAGGA NSW 2650

Our reference: 1998/~~0318~~ 563
Your reference:

Enquiries: Gary Saunders
Phone: (02) 6883 5325

15 September, 1998

Dear Mr Hanson,

RE: State Highway No 14 Sturt Highway. Bridge over Gum Creek at 75.1 Km west of Narrandera

Thank you for inviting the National Parks and Wildlife Service (NPWS) to provide comments and advice on the above mentioned proposal. I would like to offer the following advice regarding the Service's concerns and interests surrounding widening of the bridge over Gum Creek on the Sturt Highway.

The Environmental Planning and Assessment Act (1979) requires that the Review of Environmental Factors (REF) fully describe the proposal, the existing environment and the likely impacts of the proposal. The NPWS will also need this information (particularly regarding fauna, flora, threatened species and cultural heritage) to comment fully on the impacts of the proposal, if required.

The following comments are the Service's generic requirements for an REF. The Service would like to emphasise that the intensity and scale of the development should dictate the level of detail required in the environmental assessment.

The Service has several areas of responsibility due to the provisions of both the National Parks and Wildlife Act 1974 and the Threatened Species Conservation Act 1995. The NPWS is responsible for the:

1. **National Parks and Wildlife Act 1974** - Under this Act, the Service is responsible for the protection and care of Aboriginal relics and places (Section 85), the protection and care of native fauna (Section 92), the protection of native plants (Section 114) and the protection and management of reserves (Part 4).

Western Zone
Level 1
48-52 Wingewarra St
Dubbo NSW
PO Box 1007
Dubbo NSW 2830
Fax: (02) 6884 9382
Tel: (02) 6883 5330

Head Office
43 Bridge Street
Hurstville NSW
Australia
PO Box 1967
Hurstville 2220
Fax: (02) 9585 6555
Tel: (02) 9585 6444

Received
18 SEP 1998
Rego No.
Officer BH.

Australian-made 100% recycled paper

2. **Threatened Species Conservation Act 1995** - This Act aims to conserve threatened species of fauna and flora, populations and ecological communities, to promote their recovery and to manage the processes that threaten them.

The Service understands that the RTA is the Determining Authority for this activity. For the RTA to form appropriate conclusions regarding the significance of impacts of the proposed works to native flora, fauna, threatened species and cultural heritage, the RTA will need to have the following issues addressed in the REF.

Whilst the Service understands that the proposed development site is disturbed by past activities, the impacts upon fauna, flora, and archaeology still need to be fully considered. The following attachments to this letter, are the Service's generic guidelines for environmental impact assessment:

Attachment 1: Flora and Fauna Environmental Assessment Guidelines

Attachment 2: Cultural Heritage Environmental Assessment Guidelines,

Attachment 3: Threatened Species Conservation Act (1995) Information Circular No. 1.

Attachment 4: Information Circular No. 2 - Threatened Species Assessment under the EP&A Act, The '8 Part Test' of Significance.

It should be noted that these attachments are only guidelines and it is up to the proponent (and later the determining authority after appropriate consultation) to determine the detail and comprehensiveness of the surveys and level of assessment required to form satisfactory conclusions regarding the impact of the proposal. The scale and intensity of the proposed activity should dictate the level of investigation. It is important that all conclusions are supported by adequate data.

If you require further information please contact Gary Saunders - Environmental Planning Officer on (02) 6883 5325.

Yours sincerely,

David Robson
Environmental Planning Manager
WESTERN ZONE

Environment Australia

Department of the Environment and Heritage

FILE NO 99/8625

CONTACT David Knobel
PHONE: +61 2 6274 1558
FAX: +61 2 6274 1620

Ms Andrea Zambolt
Asset Performance Technology Branch
52 Rothschild Avenue
ROSEBERY NSW 2018

Dear Ms Zambolt

PROPOSED WIDENING OF GUM CREEK BRIDGE, STURT HIGHWAY

I refer to your letter of 22 October 1999 regarding an invitation to comment on the Draft Review of Environmental Factors (DREF) for the proposed widening of Gum Creek Bridge on the Sturt Highway.

As the proposal has not been referred for assessment in accordance with the Administrative Procedures under the *Environment Protection (Impact of Proposals) Act 1974* (EPIP Act), these comments are for your information only and should not be regarded as an assessment under the EPIP Act.

The Biodiversity Group (BG) and the Australian Heritage Commission (AHC) have been consulted in relation to this proposal.

The BG has advised that there are a number of flora and fauna species listed under the *Endangered Species Protection Act 1992* (ESP Act) that have been recorded within 10 kilometres of the existing bridge:

SPECIES	COMMON NAME	ESP ACT STATUS
Swainsona murrayana	Plant	Vulnerable
Polytelis swainsonii	Superb Parrot	Vulnerable

There are additional records on Environment Australia's Endangered Species Database of another species of flora, *Brachyscome papillosa*, within 30 kilometres of the proposed development. This perennial herb does not appear to be present within any protected area. This species should be a potential subject for any survey or mitigation plan implemented by the proponent to lessen any adverse impacts.

As the Superb Parrot nests in hollows in River Red Gum, the retention of mature tree specimens would be critical for the survival and recovery of this parrot in the region. Clearance of River Red Gum and Yellow Box associations are cited as reasons for the decline of this species in the *Action Plan for Australian Birds 1992*. EA suggests that these species of trees should be retained if possible.

As we have only been presented with a very brief summary of the issues associated with this development we have not had access to any information concerning the existing vegetation of the development site, the extent of road construction or a projection of the amount of vegetation clearance required.

We would assume that widening of the bridge and road construction would involve the removal of riparian vegetation surrounding the bridge structure and the road approaches. Such activities would necessitate the carrying out of vegetation surveys prior to construction and the careful design of a riparian vegetation rehabilitation program. Such a revegetation program would be essential to avoid riparian erosion and river siltation.

The Trout Cod *(Maccullochella macquariensis)*, a fish listed as endangered under the ESP Act, has been recorded from the Murrumbidgee near Narranderra, historically and via a translocation program (commenced in 1987), and would suffer adverse impacts if mitigative measures fail to impede erosion and increased sediment loads. The Macquarie Perch *(Macquaria australasica)*, listed as endangered on the ANZECC Threatened Australian Fauna list (1999), has also been recorded from the Murrumbidgee system and may also suffer similar adverse impacts. Siltation and riparian degradation have been cited as threats to both species in a 1999 report to Environment Australia by Dr John Harris. These two species have not as yet been added to the EA database and therefore have not been included in the above threatened species table.

It should also be noted that bridge structures provide roost sites for some fauna species, such as birds and bats, as has previously been found at a bridge site in northern NSW. Preliminary surveys should be carried out to determine if the structure is being used and measures implemented to ensure that colonies are not destroyed. Although it is unlikely that species from this location are listed as threatened under the ESP Act, the colony may be locally or regionally important for the species.

The AHC has advised that Gum Creek Bridge is not entered in the Register of the National Estate and there appears to be no adverse impacts to known heritage values.

Thank you for the opportunity to comment on this proposal. If you have any questions please contact David Knobel on 02 6274 1558.

Yours sincerely

Gerry Morvell
Assistant Secretary
Environment Assessment Branch

23 November 1999