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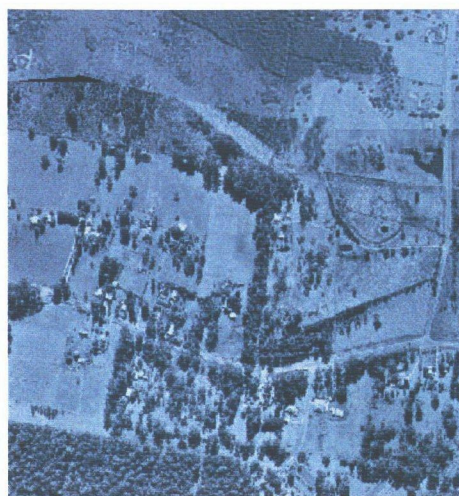
Oxley Highway Upgrade

Port Macquarie

REVIEW OF ENVIRONMENTAL FACTORS

VOLUME 1 OF 3

SEPTEMBER 2004



Summary

Purpose and Background

An upgrade of the Oxley Highway between Wrights Road and the Pacific Highway is proposed by the NSW Roads and Traffic Authority (RTA) to address road safety, traffic efficiency and residential amenity issues.

Following an extensive review of corridor options by the RTA, a decision to upgrade this 6km section of the highway was announced by the Minister for Roads in August 2002. Since this announcement, the RTA has undertaken a wide range of specialist studies to establish the engineering and financial feasibility of a highway upgrade, as well as a number of studies to identify the environmental impact of the Preferred Corridor and concept design (the Proposal). The study process has also involved substantial consultation with a wide range of stakeholders from government agencies and the local community.

This Review of Environmental Factors (REF) examines the environmental impact of the Proposal incorporating the Preferred Corridor and Detailed Concept Design.

Project Justification

The existing highway in its current form does not meet community expectations and there is a strong probability that it will continue to diminish in terms of road safety and travel conditions.

Future population growth and resulting traffic will further diminish road safety and travel conditions within the next ten years. As the traffic increases there would be additional demands on the existing Highway and the Level of Service would decrease markedly, particularly during holiday periods, resulting in increased delays and higher vehicle operating and travel time costs. The existing accident rates, which are high, would continue to rise to an unacceptable level.



Photomontage of Wrights Road roundabout on the Proposal looking east

In summary, justification for an upgrade to the Oxley Highway between Wrights Road and the Pacific Highway (the Proposal) is based on a combination of the following key elements:

- improved road safety
- improved road efficiency
- reduced impact on residential amenity
- improved gateway image
- scope for improved economic development
- economic feasibility (positive benefit / cost ratio).

Project Objectives

The objective of the project is to improve road safety and provide improved access between the Pacific Highway and Port Macquarie for all road users, including local community and tourists and provide a gateway to Port Macquarie.

The main issues relating to the upgrade of the Oxley Highway relate principally to road safety, travel time, community satisfaction, access and environmental protection. These issues have been translated into a series of **broad objectives** developed by the RTA and in consultation with the local community, as outlined below:

- reduce road accidents and injury rates
- be socially acceptable to the local and broader community
- support economic development
- improve traffic efficiency
- be managed in accordance with Ecologically Sustainable Development Principles
- achieve maximum effectiveness of expenditure.

Process

Since early 2003, the RTA has undertaken a two-stage process to define a preferred highway corridor and to undertake a preferred concept design for the project. The combination of these two stages has resulted in a Proposal that has been the subject of this REF assessment.

The first stage was a strategic planning process to place the highway upgrade in the context of regional transport, land use planning and environmental priorities, and to consider all feasible options for the Preferred Corridor. A broad environmental impact assessment was undertaken for each of the corridor options to help with the overall evaluation process.

After a short-listing process, three corridor options with several sub-options were considered at a Corridor Evaluation Workshop (CEW) which included representatives from the RTA, other government agencies and the community. This workshop recommended adoption of the Southern Deviation Corridor as the preferred alignment of the Oxley Highway Upgrade.

The Preferred Corridor was shown at a public display in October 2003 and received strong community support.

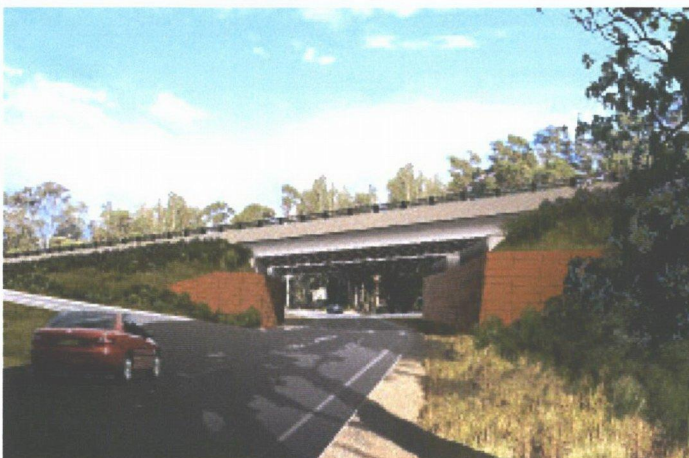
The second stage involved formulation of a Detailed Concept Design for the Proposal, based on a list of design objectives developed for the project as well as RTA technical specifications. The main engineering elements to be addressed included:

- the vertical and horizontal alignment within the Preferred Corridor
- the determination of intersection locations and designs
- the type of bridge structure to be built over the existing highway
- drainage structures
- environmental safeguards to minimise impact on fauna movement
- indicative landscape design
- the staging and construction schedule.

Throughout both stages of the process to date, the RTA has maintained close contact with local stakeholders. Consultation has taken a number of forms including:

- media releases and general media coverage
- Community Liaison Group (CLG)
- community updates (newsletters)
- community workshops
- public displays
- residents / landowner meetings
- display of REF and circulation of summary brochures for public comment.

The RTA has also maintained close liaison with a wide range of government agencies and public utility companies at both stages in the project.



Photomontage of central cross-over bridges looking east along existing highway

The main features of the Proposal are summarised as follows and described in detail in **Sections 5** and **6** of the REF:

- a 6km section of new highway standard road
- a four-lane dual carriageway highway with controlled access
- bridge over the current Oxley Highway near Philip Charley Drive
- 100 kph design speed, with signposted speeds of between 60 and 100kph along the Proposal
- major drainage structures
- two dedicated fauna underpasses in the central part of the corridor
- five intersections including:
 - Wrights Road roundabout
 - Lindfield Park Road (temporary full at grade intersection)
 - a left on/left off ramp at Phillip Charley Drive
 - a central overpass bridge (with provision for an eastbound on-load ramp at a future stage)
 - western service centre roundabout
- provision for on-road cycling
- lighting at major intersections
- landscaping throughout the corridor
- noise attenuation in the form of noise walls and mounds at selected locations, as well as architectural treatment of selected houses along the corridor.

There is no provision for additional access points along the Proposal. On completion of the Proposal, the existing Oxley Highway would be de-classified as a State Highway and would be transferred to Hastings Council.

Main Environmental Impacts

The environmental studies undertaken for the REF examined all aspects of the impact of the Proposal.

The Proposal would represent a substantial improvement over the existing Oxley Highway in terms of road safety, transport efficiency and improved residential amenity.

Whilst there is still land to be acquired for the Proposal, this would not have major impact on severance of local properties or adversely affect local agricultural production. The Proposal does not entail the acquisition of any additional residential dwellings.

Consideration of the potential impacts of the proposed road upgrade on threatened species and their habitats, pursuant to Section 5A of the *Environmental Planning & Assessment Act 1979* (the '8-part test') has concluded that the proposed activity is likely to impose a significant effect on three threatened fauna species (the Koala, Yellow-bellied Glider and Glossy Black Cockatoo). Whilst a number of environmental safeguards would be included in the Proposal to minimise the impact on these species, a Species Impact Statement (SIS) has been separately undertaken by the RTA in consultation with the Department of Environment and Conservation (DEC).



OXLEY HIGHWAY UPGRADE

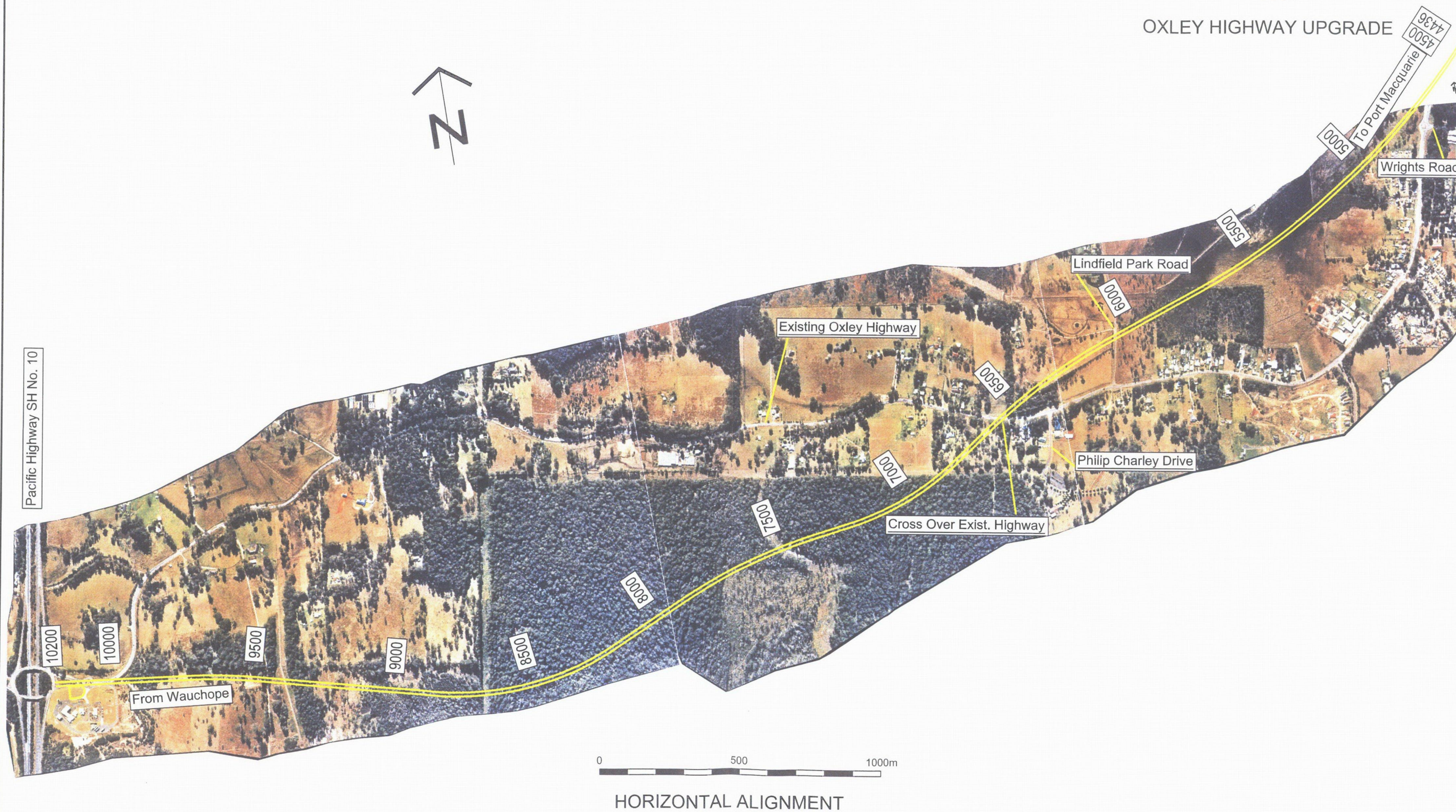


Fig. S1.0
Preferred Concept Design

Environmental Safeguards

The various environmental studies undertaken for the project identified a number of environmental safeguards that have been incorporated into the Detailed Concept Design. These cover several matters including:

- protection against contamination of water quality and soil erosion
- noise attenuation
- fauna underpasses and fauna fencing
- planting of food trees for Koalas and Glossy-Black Cockatoos
- avoidance, protection and/or salvage of indigenous sites along the Proposal.

Details of the environmental safeguards included in the Proposal are provided under relevant headings in **Section 7** of the REF, and are summarised in **Section 8**.

Next Steps

The REF will be made available for public comment over a four week period commencing early September 2004, and will be placed on display in a number of convenient locations within the local area as well as in RTA offices in Grafton and Sydney.

Copies of the main report and working papers will be available from the RTA for review., and a summary brochure has been prepared for general circulation

The documents will also be available on the RTA website at www.rta.nsw.gov.au.



Photomontage looking east from near the Service Centre at the western end of the Proposal

Any inquiries about the REF can be directed to Freecall 1800 800 342 or via email to michael_bulmer@rta.nsw.gov.au. Written comments on the REF should be sent to RTA Northern Region, PO Box 5234 Port Macquarie NSW 2444.

The REF and public comment will be considered by the RTA in coming to a decision on:

- whether an Environmental Impact Statement is required for the Proposal
- if an EIS is not required, whether the Proposal should proceed; and if so, subject to what modifications and/or conditions.

If it is decided that the Proposal can proceed, work would commence on the detailed engineering design for the project in anticipation of construction commencing during late 2005. Construction of the Proposal is estimated to take 18 months to complete.

The RTA wishes to place on record its appreciation for the cooperation and assistance provided by members of the Port Macquarie community in the preparation of studies and consultations associated with this REF.

RTA
September 2004



Photomontage of Oxley Highway Upgrade looking east to roundabout at intersection with existing highway

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14. Urban and Landscape Design
15. Noise and Vibration

1 Introduction and Methodology

1.1 Proposal Identification

The Oxley Highway Upgrade is part of State Highway 11, located within the Hastings Local Government Area in NSW.

The project is formally titled: Oxley Highway Upgrade, Port Macquarie (from Wrights Road to Pacific Highway), and the limit of work is between 4.65km to 10.75km west of Port Macquarie.

Throughout this report, the term “the Proposal” is used to describe the Preferred Corridor for the new highway alignment and the preferred concept design including all aspects of engineering, landscape and related design elements.

1.2 Introduction

The NSW Roads and Traffic Authority (RTA) proposes to carry out an upgrade of the Oxley Highway from Wrights Road to the Pacific Highway in Port Macquarie. The project involves construction of a four lane dual carriageway road on a new alignment running broadly parallel to the existing Oxley Highway. It is intended that, on completion of the Oxley Highway Upgrade, the existing alignment would be de-classified to local road status and become the sole responsibility of Hastings Council.

This Review of Environmental Factors (REF) has been prepared by Purdon Associates Pty Ltd on behalf of the RTA. This REF has been prepared in accordance with the RTA's Proforma 2 REF as presented in the RTA's *Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4* (RTA, April 2001).

For the purposes of these works, the RTA is the proponent and a determining authority under Part V of the *Environmental Planning and Assessment (EP&A) Act 1979*.

The purpose of this REF is to:

- describe the Proposal,
- document the likely impacts of the Proposal on the environment, and
- detail protective (or mitigating) measures to be implemented.

Volume One of the REF contains the main report and assessment. Working papers provided by the RTA are included in **Volumes Two and Three** of the REF. RTA specifications are available on www.rta.nsw.gov.au/doingbusinesswithus/specifications. In the case of any discrepancy between the REF and material contained in the Working Papers, the former takes precedence.

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

The findings of the REF would be considered when assessing:

- whether the Proposal is likely to have a significant impact on the environment and therefore the necessity for an Environmental Impact Statement (EIS) under Section 112 of the EP&A Act
- the significance of any impact on threatened species as defined by the TSC Act, in Section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS)
- the potential for the Proposal to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Commonwealth Environment Minister in accordance with the EPBC Act.

The Oxley Highway is one of the main links between the Pacific Highway and Port Macquarie. It is currently a two lane rural road between Wrights Road and the Pacific Highway catering for between 12,000 and 16,000 vehicles per day. East of Wrights Road, the highway becomes a dual carriageway four lane arterial road.

The planning and development process undertaken has investigated and assessed the best value for money alignment for the upgrade, to improve road safety and provide improved access as well as enhancing the overall entrance to Port Macquarie.

1.3 Background

In 1980, following representations by Hastings Council, the RTA (formerly Department of Main Roads) prepared a location proposal for the Oxley Highway between 4.3km and 14.7km west of Port Macquarie. A number of options were investigated. The then preferred option included an interchange with the Pacific Highway and was submitted to RTA Head Office for approval in February 1983. In September 1984 the location proposal was rejected and it was suggested that widening of the existing highway to four lanes would satisfy the requirements of the area for a number of years.

Following further investigation, a refined highway alignment was identified. This Corridor allowed for staging of the Proposal, and was submitted to RTA Head Office in January 1986. It was approximately half the cost of upgrading the existing highway alignment and included the interchange with the Pacific Highway. Approval for the concept was given in September 1986 for the purpose of developing the Corridor and obtaining a planning scheme reservation to preserve the land from adverse development. A detailed environmental impact assessment of this refined highway alignment was not undertaken at this time.

Over the ensuing years, approximately 15ha (35%) of land within the proposed reservation was purchased by the RTA, and the interchange with the Pacific Highway was constructed and opened to traffic in 1990.

In August 2002, the NSW Minister for Roads announced the upgrade of the Oxley Highway between Wrights Road and the Pacific Highway and the RTA commenced the development phase of the project.

Table I-1 summarises the main project milestones up to compilation of this REF.

Table I-1: Project Milestones - Oxley Highway Upgrade

Date	Activity
August 2002	Media Release N° 1 Announcement of Oxley Highway
September – December 2002	Preparation for engagement of project team Background information search
February 2003	Start-up workshop Commence specialist studies and investigations Community Update N° 1 Media Release N° 2
March 2003	Government Agencies workshop Develop Preliminary Corridor Options Letters to residents Community Liaison Group (CLG) Meeting N° 1 Community Workshops
April 2003	Shortlisting of Options Workshop
May 2003	Refine Corridor Options Letters to Residents CLG Meeting N° 2 Community Workshops
June 2003	Display Corridor Options Community Feedback on Corridor Options Community Update N° 2 Media Release N° 3
July 2003	Corridor Evaluation Workshop (CEW) Additional investigations arising from the CEW
August 2003	Finalise Preferred Corridor
September 2003	Preparation for Public Display
October 2003	Minister for Roads announces Southern Deviation Corridor as the Preferred Corridor Media Release N° 4 Community Update N° 3 CLG Meeting N° 3
November – 2003 January 2004	Stakeholder consultation Specialist studies
February 2004	Hastings Council releases of final draft Area 13 Structure Plan
April 2004	CLG meeting N° 4 Value Engineering Workshop (VEW) Finalisation of specialist studies
May 2004	Community Update N° 4 Public display N° 3 of refined concept design Media Release N° 5
June 2004	Review comments from public display of refined concept design Finalise REF
September 2004	Publish REF for public comment Public Display N° 4

1.4 Methodology Including Specialist Studies

Figure 1-1 summarises the main steps in the REF process leading up to and including preparation of the REF. The process has included a number of key elements involving:

- specialist studies of the study area
- corridor identification, evaluation and selection of Preferred Corridor
- concept design of the Preferred Corridor
- environmental assessment of the Preferred Corridor
- community consultation.

Commencing in February 2003, the RTA initiated a number of inter-disciplinary studies for the project, and as part of the environmental assessment. These studies are summarised and discussed in this REF, with detailed information contained in Working Papers (**Volumes Two and Three of the REF**).

Specialist investigation leading up to and during the REF development phase includes:

- land use
- planning and zoning
- geology
- hydrology
- ecology noise and vibration
- heritage
- visual impact
- social and economic impacts
- traffic

1.5 Project Need and Justification

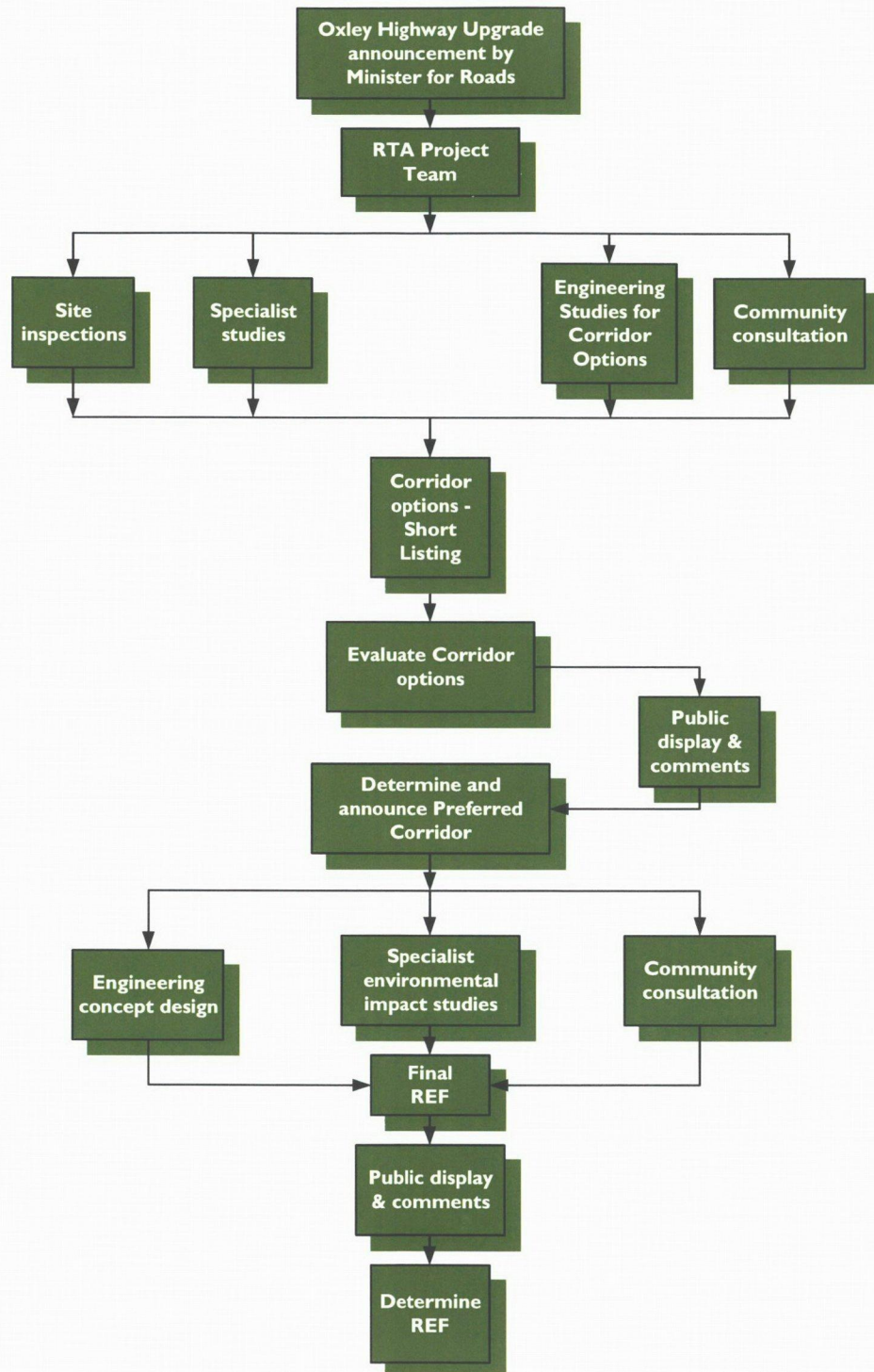
1.5.1 Existing Road Conditions

In its role as a state highway, the Oxley Highway provides an important arterial connection within the overall state road network. It connects the regional centre of Port Macquarie to the Pacific Highway, the most important north-south transport corridor in New South Wales. In this role, the Oxley Highway must provide a high standard of accessibility for heavy commercial vehicles as well as for light commercial and passenger traffic.

Port Macquarie is a major regional centre and as such attracts not only long distance traffic on the Oxley and Pacific Highways but also significant volumes of commuter, shopping and business traffic from villages and towns located on the Mid-North Coast of NSW. The Oxley Highway is one of the major east-west highways linking the coast to the Tablelands, and is the major regional link in the Hastings area. In this role, the Oxley Highway is required to provide adequate, reliable access to the remainder of the Hastings and adjoining areas for commercial and passenger traffic.

As a local transport link, the Oxley Highway serves as an essential means of collection and distribution of traffic generated by adjoining development. This flow accounts for a significant proportion of all traffic, is predominantly composed of passenger vehicles, and requires reliability of access.

Figure I-1: Oxley Highway - REF Process



The Oxley Highway between the Pacific Highway and Wrights Road, Port Macquarie, carries average daily traffic volumes of between 12,500 vehicles on the western end and 16,500 vehicles on the eastern end. These volumes are expected to grow rapidly with future urban development proposed in the locality.

Vehicle classification and speed surveys show the existing 85th percentile speeds as being close to the existing posted speed limits which include a 70kph speed zone extending from Wrights Road to immediately east of Lindfield Park Road, and an 80kph zone extending from there to the Pacific Highway.

Travel lanes on the existing section of highway are approximately 3.5m wide marked with a centre line and edge lines on a winding and undulating alignment. The alignment is of a poor standard (min 50kph) and this is exemplified by the many sub-standard curves. The shoulders are narrow, being approximately one metre. Large trees are adjacent to the table drain on sections. The narrow and winding road formation makes it difficult for vehicles to pass turning traffic on this section of Highway, and creates a sub-standard safety environment.

The extent of overtaking is severely limited along the full length of the existing highway, with approximately 80% of its length controlled by central barrier lines which do not permit general overtaking.

The existing pavement has deformation and the road is generally rougher than acceptable for an important transport link such as the Oxley Highway.

A total of 54 accidents (tow away or injury) occurred in the last 5 year period. The existing Highway has an accident rate of 135 accidents/100MVK on the eastern section and 125 on the western section. This rate is approximately three to four times higher than a modern dual carriageway road.

Extensive ribbon development has been permitted along the existing Oxley Highway, leading to the proliferation of uncontrolled access points. The development includes caravan parks, industrial bays, a service station, golf driving range and numerous houses.

As a result of progressive urban development, the existing highway corridor has been extensively used for public utility installations including telephone, power, lighting, water, sewer and, more recently, optical fibre. Any attempted improvement to this alignment would require significant departures from the existing road formation, disruption to utility services, and major property effects especially to existing houses.

There is also a history of strong community concern from various user groups about the current level of service provided by the existing Oxley Highway, including convenience of access and egress, amenity for residential dwellings adjacent to the highway, and the poor gateway image created for Port Macquarie.

1.5.2 Local and Regional Growth

The Hastings Urban Growth Strategy (HUGS) 2001 provides a framework for planning for future urban development in the Port Macquarie area. It outlines a strategy for development over the next 20 years (until 2021).

Port Macquarie is identified as an expanding regional centre with growth opportunities to the west of the current centre. Urban expansion is identified within the Oxley Highway corridor. These strategies have local and sub-regional traffic implications and will increase trip generation along the highway corridor.

The population of the Hastings is predicted to increase from the current population of 66,473 to between 90,000 and 104,700 in 2021. The strategy to accommodate this anticipated growth is three-fold:

- Consolidation of existing urban areas including redevelopment in older, central areas of the town and development in areas zoned residential but not yet to be subdivided. It is estimated that the population of Port Macquarie will increase from 40,288 to between 48,000 and 53,000.
- Expansion of Area 14 (Bonny Hills-Lake Cathie). It is estimated that the population of Area 14 will increase from 4,300 to between 8,700 and 11,000.
- Development of a new town in Area 13 (Thrumster area) between Port Macquarie and the Pacific Highway. It is estimated that the population will increase from the current rural residential population (not separately defined) to a population of between 3,800 to 11,000 in 20 years and an ultimate population of 20,000.

A substantial area of the remaining zoned but undeveloped residential land in Port Macquarie is located on the Innes Peninsula. This area extends south of the Oxley Highway and is bounded by the Lake Innes Nature Reserve to the south, east and west. The population of this area is likely to increase to 7,000 people when the area is fully developed. Access to the area is currently via Major Innes Drive and the Ruins Way. Both roads intersect with the Oxley Highway.

Hastings Council has prepared a draft Development Control Plan (DCP) for the Peninsula and of particular relevance to the Oxley Highway upgrade are the plans for neighbourhood shopping facilities, school sites and playing fields and access.

In 1999-2000 Hastings Council prepared an interim strategy for the release of land at West Lindfield pending the completion of HUGS. West Lindfield forms the eastern section of Area 13 and includes land immediately to the east and west of the crossover point of the existing highway alignment and the Proposal.

Hastings Council owns a substantial area of land in Area 13 and will determine opportunities for future use having regard to Hastings Council's obligations to provide a site for a sewerage treatment plant (STP) for Area 13. Other opportunities for use of Hastings Council's land holdings include:

- a new Council works depot
- industrial land use
- residential land use
- recreational land use
- a major north/south road link between Hastings River Drive and the Oxley Highway
- airport facilities extension.

Hastings Council is to identify the amount of land required to meet industrial development needs and to develop criteria for identifying suitable locations for industrial development. Approximately 100ha of industrial zoned land will be required to serve Port Macquarie and Area 13. Locations for industrial areas have yet to be determined. As proximity to population centres and access are important criteria, it will be necessary for the industrial area to be in close proximity to Port Macquarie and the Pacific Highway.

An additional area of land to the south west of West Lindfield is currently zoned for urban development but not developed.

The development of a new urban area in Area 13 would have major implications on the existing Oxley Highway. The highway upgrade and the timing of construction would also have an important relationship with the planning for Area 13. Urban development in the highway upgrade corridor would result in substantially increased sub-regional and local traffic.

1.5.3 Road User Benefit Cost Analysis

The overall economic efficiency of the Proposal has been examined. Refer Section 6.8 below. This is reflected in the Road User Benefit Cost Ratio (RUBCR) that indicates the Proposal would provide a good return to the community of more than four times the investment (RUBCR of 4.2 to 1) when a standard RTA discount rate of 7% is used in the financial analysis.

1.5.4 Summary

The existing highway in its current form does not meet community expectations and there is a strong probability that it will continue to diminish in terms of road safety and travel conditions.

Future population growth and resulting traffic will further diminish road safety and travel conditions to an unacceptable level within the next ten years. As the traffic increases there would be additional demands on the existing Highway and the Level of Service would decrease markedly, particularly during holiday periods, resulting in increased delays and higher vehicle operating and travel time costs. The existing accident rates, which are high, would continue to rise to an unacceptable level.

In summary, the need for an upgrade to the Oxley Highway between Wrights Road and the Pacific Highway (the Proposal) is based on a combination of the following key elements:

- current and projected road safety problems
- current and projected inefficiencies in road transport
- addressing the deterioration in residential amenity for dwellings along the existing Oxley Highway
- scope for improvement in the gateway image to Port Macquarie
- improvements in economic development arising from improved transport links.

2 Description of the Proposal

2.1 Location

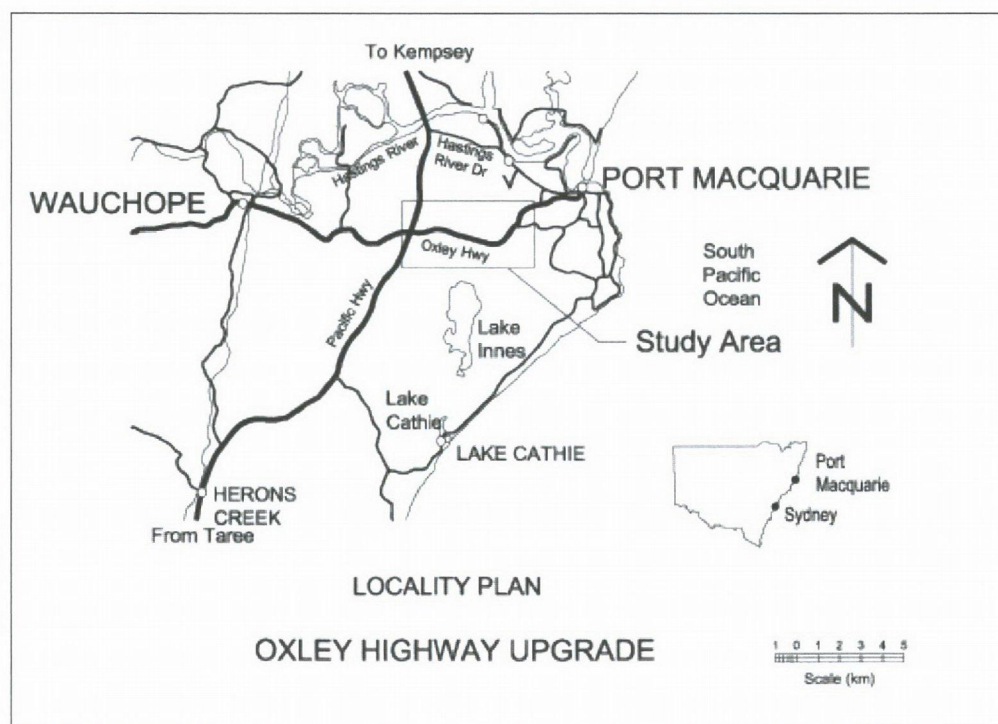
Figure 2-1 and **Figure 2-2** show the location of the Proposal within NSW, the Hastings Region, and the western part of Port Macquarie.

2.2 General Description of Proposal Site and Surroundings

The study area is located on either side of the existing Oxley Highway from Wrights Road west to the Pacific Highway, and covers an area of approximately 7kms by 2kms (1,400ha). The Proposal would occupy approximately 45ha or 3% of the study area as defined.

The study area has an undulating topography, ranging in height from a low elevation of 1m above sea level at the eastern end to approximately 40m near the western end. The study area drains into two separate catchments, but there are no major watercourses contained within the corridor.

Figure 2-1: NSW and Regional Context



The study area contains a variety of land uses as described in **REF Volume Two, Working Paper 1**.

Existing land uses consist primarily of rural smallholdings and residential development with some commercial and tourist uses, including two caravan parks and a motel in the eastern section of the study area. Residential development in the form of ribbon development exists along a section of the existing highway with a number of relatively small lots, each having direct access to the existing highway. There are a number of community uses including the Port Macquarie Base Hospital, St Columbia School and the Crematorium that also have access from the existing highway.

The commercial land provides a mix of uses with direct access to the existing highway, including smash repairs, rural supplies, landscape supplies, manufacturing and a golf driving range. There is also a number of smaller commercial/home businesses located along the existing alignment.

In the south of the study area is a large, heavily timbered rural property. The south eastern part of this land is zoned 2(a1) Residential, and is identified for future urban development.

2.3 Description of the Proposal

2.3.1 General Description of the Proposal

The Proposal covers a distance of approximately 6kms, starting east of the Wrights Road roundabout, and traversing low lying land to the north of the existing Oxley Highway. It crosses Lindfield Park Road before passing over the existing Oxley Highway just west of Philip Charley Drive. The Proposal then passes through timbered and cleared pastureland, rejoining the existing highway at the roundabout near the Pacific Highway.

2.3.2 Objectives for the Oxley Highway Upgrade

The purpose of the project is to improve road safety and provide improved access between the Pacific Highway and Port Macquarie for all road users, including local community and tourists, and to provide a gateway to Port Macquarie.

The main issues relating to the upgrade of the Oxley Highway relate principally to road safety, travel time, community satisfaction, access and environmental protection. These issues have been translated into a series of **broad objectives** developed by the RTA and in consultation with the local community, as outlined below:

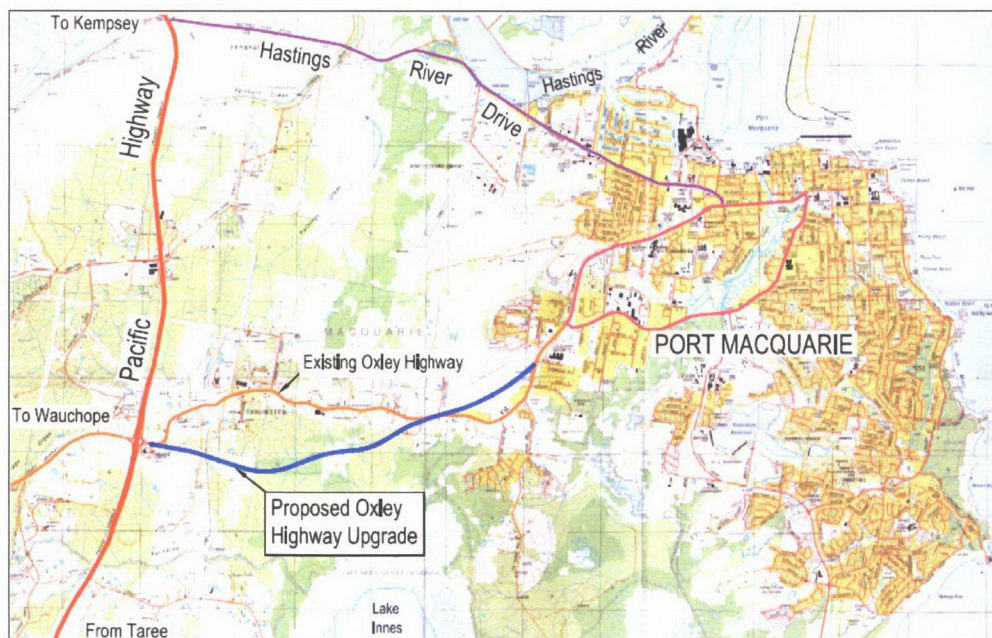
- reduce road accidents and injury rates
- be socially acceptable to the local and broader community
- support economic development
- improve traffic efficiency
- be managed in accordance with Ecologically Sustainable Development Principles
- achieve maximum effectiveness of expenditure.

2.3.3 Summary of Main Features

The main features of the Proposal are summarised as follows (refer **Sections 5 and 6** below):

- a four-lane dual carriageway highway with controlled access
- bridge over the current Oxley Highway near Philip Charley Drive
- a 100kph design speed, with signposted speeds of between 60 and 100kph
- major drainage structures
- two dedicated fauna underpasses in the central part of the corridor
- five intersections including:
 - Wrights Road roundabout
 - Lindfield Park Road (temporary full at grade intersection)
 - a central overpass (bridge) with an eastbound on-load ramp (future stage)
 - a left on/left off ramp at Phillip Charley Drive
 - western service centre roundabout
- provision for on-road cycling
- lighting at major intersections
- landscaping throughout the corridor
- noise attenuation in the form of noise walls and mounds at selected locations, as well as architectural treatment of selected houses along the Proposal.

Figure 2-2: Port Macquarie Locality



There is no provision for additional access points along the Proposal. However, the RTA may consider future development that provides connectivity for the areas north and south of the Proposal (with no direct connection) at a later stage if these are justified, and funded by the applicant (Hastings Council or private developer). Separate environmental assessment for these items would also have to be undertaken by the proponent at the time of consideration.

2.3.4 Proposal Timing, Cost and Source of Funds

The Proposal has an estimated total project cost of approximately \$67 million in current dollars and is a State Government funded project from the State Development Program. If The Proposal proceeds, it is anticipated that works would be completed approximately 18 months after commencement date of December 2005.



View from the existing Wrights Road roundabout looking west, with Gateway Tourist Park on right. This section of the existing highway would be de-gazetted.

3 Statutory Position

This section is based on extracts from a detailed report by ERM on planning and zoning issues contained in **REF Volume Two, Working Paper 2**. It describes the legislative framework at the Local Government, State and Commonwealth levels within which the Oxley Highway Upgrade has to be considered, and implications for the Proposal.

3.1 Hastings Local Environmental Plan 2001

Development on land within the Hastings Local Government Area (LGA) is controlled by Hastings Council under the *Hastings Local Environmental Plan 2001* (Hastings LEP).

Zonings along and adjacent to the Proposal are shown in **Figure 3.1, REF Working Paper 2**.

The Hastings LEP applies to all land within the Hastings LGA, except land identified on the zoning map as "deferred matter", where land remains unzoned pending further investigation.

The eastern section of the Proposal is defined as a "deferred matter" pursuant to Hastings LEP 2001 pending resolution of the Oxley Highway Upgrade. Consequently, the provisions of *Hastings LEP 1987* still apply to the defined Corridor, and the relevant zoning for the Proposal is 1(a1) and 9(b).

The western section of the Corridor is shown on the Hastings LEP 2001 as 1(a1) which is a rural zoning.

Roads are permissible with the consent of Hastings Council in all zones in the Corridor. However, State Environmental Planning Policy (SEPP) 4 is applicable to the Proposal. **Section 3.3.1** below refers. This allows for public authorities (including the RTA) to undertake certain types of development without the need for development consent from Council. The Proposal may therefore be assessed and determined as a Part 5 *Environmental Planning and Assessment Act* (EP&A Act) activity.

3.2 State Environmental Planning Policies

There are a number of State Planning requirements relevant to the Proposal and related matters that have to be addressed.

3.2.1 SEPP 4 – Development without Consent and Miscellaneous Complying Development

Clause 11c(2) of the *EP&A Act 1979* states "where, in the absence of this clause, development for the purposes of a classified road or toll work, or a proposed classified road or toll work, may be carried out only with development consent being obtained therefore, that development may be carried out without that consent".

SEPP No. 4 applies to the Proposal, as the intended works are for the purposes of a classified road (State Highway 11, the Oxley Highway) as defined by the *Roads Act 1993*. Therefore the RTA would not require consent from Hastings Council prior to undertaking the Proposal. This activity has therefore been assessed under *Part 5 of the EP&A Act 1979*.

3.2.2 SEPP 14 – Coastal Wetlands

SEPP 14 Wetlands are sensitive ecosystems that have been given special protection under NSW legislation. Although there are SEPP 14 wetlands located to the north and south of the Proposal, these areas are not traversed directly by the Proposal. **Figure 6-2** refers.

In preparation of the concept design for the Proposal, a number of issues with potential impact on wetlands including drainage, stormwater management and run-off, and other potential impacts have been considered by the RTA. The REF has concluded that the Proposal would not have any adverse impacts on SEPP 14 wetlands.

3.2.3 SEPP 44 – Koala Habitat Protection

The Hastings Council area is identified within the Schedules of SEPP No. 44 (Koala Habitat Protection) as a Local Government Area in which Koalas are known to occur. While the requirements of the SEPP do not technically apply to this Proposal, as it is not subject to Council consent, it is the RTA's practice to consider SEPP 44 criteria in its EIA process. These criteria relate to the percentages of feed tree cover listed under Schedule 2 – Known Feed Trees.

The assessment criteria consider the percentage cover of known feed trees, and whether these are greater or less than 15% of the total tree canopy. **Section 7.6** of the REF considers the environmental impact of the Proposal on koala habitat and migratory patterns. The Proposal will have an impact on core koala habitat.

3.2.4 North Coast Regional Environmental Plan 1988

The *North Coast Regional Environmental Plan 1988* (NCREP) provides local government with regional policy guidelines for the preparation of local environmental plans and for the assessment of certain types of development. The plan sets the basis for new urban development and rural development. The emphasis is on progress coupled with careful management.

Clause 28 of NCREP lists the following objectives in relation to the natural environment:

- to protect areas of natural vegetation and wildlife from destruction and to provide corridors between significant areas
- to protect the scenic quality of the region, including natural areas, attractive rural areas and areas adjacent to water bodies, headlands, skylines and escarpments
- to protect water quality, particularly within water catchment areas.

Clause 52 states that the objectives of the NCREP in relation to transport are to:

- safeguard the role and efficiency of the main road system of the region, particularly by recognising the importance of primary arterial roads
- facilitate maintenance and improvement of transport in the region.

There are no licences or approvals required under the NCREP. The Proposal has achieved the objectives of the NCREP in relation to the natural environment by undertaking detailed assessment of environmental impacts and identifying appropriate environmental safeguards to ameliorate any adverse impacts. In relation to transport, the Proposal would achieve the objectives by improving road transport facilities within the region.

3.3 Other NSW Statutory Requirements

There are a number of other Statutory Requirements relevant to the Proposal as summarised below.

Protection of the Environment Operations Act 1997

The PoEO Act provides an integrated system of licensing whereby a single schedule of activities requiring an environment protection licence regulates all forms of pollution. Relevant activities include:

- bitumen pre-mix or hot mix
- concrete batching
- crushing, grinding or separating works
- discharge to water
- mobile plant activities.

It is not anticipated that an environmental protection licence would be required for the Proposal.

NSW Heritage Act 1977

There are no items listed on the State Heritage Register or State Heritage Inventory within the study area. The closest State Heritage Item to the study area is the Lake Innes House Ruins and Environs, which is located approximately 5km south of the study area.

In addition, the cultural heritage assessment (**REF Volume Three, Working Paper 11**) concluded that the study area had experienced very little historical development. No non-Indigenous heritage items were detected in the field.

The *Heritage Act 1977* has no known implications for this project.

Threatened Species Conservation Act 1996

Developments requiring approval from a Council or statutory authority of the NSW Government are required to be assessed in accordance with the (EP&A Act) as amended by the *Threatened Species Conservation Act 1995* (TSC Act).

Section 111(4) of the EP&A Act requires a determining authority to consider the effects of an activity on the following:

- critical habitat
- in the case of a threatened species, population or ecological community, or their habitats, whether there is likely to be a significant effect on those species, populations or ecological communities, or their habitats
- any other protected fauna or protected native plants within the meaning of the *National Parks and Wildlife Act 1974*.

Section 5A of the EP&A Act outlines eight points that must be considered in order to determine the significance of the impact of a proposed activity on threatened species, populations or ecological communities or their habitats, known or considered likely to occur in the study area. This assessment is commonly referred to as an 'eight part test'.

Where the proposed activity is likely to significantly affect the habitat of a threatened species, population, or ecological community, or is located within an area of critical habitat, as defined by Part 3 of the TSC Act, a Species Impact Statement (SIS) must be prepared for assessment by the Director-General of the Department of Environment and Conservation (DEC). The Department would make recommendations to the determining authority via the Minister for the Environment.

An 8-part test has been undertaken for the Proposal as part of this REF. **Section 7.6** and **REF Volume 3, Working Paper 10** refer. **Working Paper 10** determines that the Proposal would result in a significant impact on three threatened species.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) defines the powers, duties and functions of the DEC relating to all areas reserved as national parks, historic sites, nature reserves, Aboriginal areas, state recreation areas and regional parks. This Act also guides the protection of native vegetation and native fauna.

In areas that artefacts have been identified or are likely to be identified, a *Section 87* permit would be required to disturb or excavate this land. If any relics or places are found during the construction of the new alignment, prior to destroying or disturbing these sites, the RTA would be required to obtain a permit from the Director-General of DEC pursuant to *Section 90* of the NP&W Act.

Native Vegetation Conservation Act 1997

The Native Vegetation Conservation Act 1997 (NVCA) repealed State Environmental Planning Policy 46 – Protection and Management of Native Vegetation. The principal aim of the NVCA is to streamline approvals and to regulate the clearing of native vegetation in NSW by making it subject to development consent. The legislation requires the assessment of proposals to remove native vegetation for the purpose of ensuring that native vegetation is protected and managed in the environmental, social and economic interests of the State (DLWC 1997).

Certain types of clearing are excluded from the NVC Act. These include:

- Any clearing that involves the removal or lopping of any tree or other vegetation, in accordance with *Section 88* of the Roads Act 1993. *Section 88* of the Roads Act states:
“...A roads authority may, despite any other Act or law to the contrary, remove or lop any tree or other native vegetation that is on or overhanging a public road, if in its opinion, it is necessary to do so for the purposes of carrying out road work.”
- Clearing associated with road works is exempt from the operations of the Native Vegetation Conservation Act, 1997. Therefore, the RTA would not be required to obtain consent from DIPNR for clearing of native vegetation associated with the upgrade of the Oxley Highway.

Native Vegetation Act 2003

The *Native Vegetation Act 2003* is due to come into effect in 2004 and will repeal the *Native Vegetation Conservation Act 1997*. The aims of the NV Act 2003 are to encourage and promote the management of native vegetation, prevent broad scale clearing, improve the condition of existing native vegetation and encourage revegetation of land. The legislation requires the assessment of proposals to remove native vegetation for the purpose of ensuring that native vegetation is protected and managed in the environmental, social and economic interests of the State and having regard to the contribution to water quality, biodiversity and the prevention of salinity or land degradation.

Clearing associated with road works and Part 5 activities (EP&A Act) would be exempt from the operations of the *Native Vegetation Act, 2003*. Under this legislation the RTA would not be required to obtain consent from DIPNR for clearing of native vegetation associated with the upgrade of the Oxley Highway. However, until the new NV Act 2003 is implemented, the relevant legislation is the *Native Vegetation Conservation Act 1997*.

Rural Fires Act 1997

It is the responsibility of the RTA, as the occupier of land related to the Oxley Highway, to take the relevant steps to prevent bush fires on that land. The provisions of the *Rural Fires Act 1997* (RF Act) outline the responsibilities of the RTA.

The RTA and its contractors are not required to obtain a permit to light fires, however they are required, under Clause 95(2) to advise the Fire Control Officer for the district, and the Officer in Charge of the nearest fire station before lighting a fire, and must observe bushfire danger periods in the district.

3.3.1 Licences and Approvals

Based on consideration of the statutory requirements presented above, the approvals or licences listed in Table 3-1 may be required to enable the construction and/or operation of the Proposal.

Table 3-1: Summary of Other NSW Statutory Requirements

Act	Authority	Requirements
<i>Protection of the Environment Operations Act 1997</i>	DEC	An Environment Protection Licence (EPL) is required for scheduled activities, including: <ul style="list-style-type: none"> • Bitumen pre-mix or hot-mix industries • Concrete works • Crushing, grinding or separating works • Miscellaneous licence for discharge to water • Discharge of pollutant • Pre-mix or hot-mix plant (licence not required if operating for less than 12 months) output criteria. It is not anticipated that an EPL would be required for the Proposal.
<i>Heritage Act 1977</i>	NSW Heritage Office	There would be no impact on State heritage items. No permits are required, and the provisions of the Heritage Act are not applicable to this project although excavation permits for pits would be required.
<i>Threatened Species Conservation Act 1995</i>	DEC	Based on findings of the 8 part test undertaken as part of the REF, the RTA has decided to prepare a Statement of Significance (SIS) in consultation with DEC
<i>National Parks and Wildlife Act 1974</i>	DEC	A Section 87 permit is required to excavate or disturb land where Aboriginal artefacts potentially occur. If any archaeological items are identified during construction, a permit would be required under Section 90 of the NP&W Act prior to destroying or disturbing Aboriginal relics or places.
<i>Native Vegetation Act 2003</i>	DIPNR	Clearing associated with road works and Part 5 approved activities are exempt from this Act.
<i>Rural Fires Act 1997</i>	NSW Rural Fires Services	Permits to light fires are not required, but bushfire danger periods must be observed.

Source: REF Volume Two, Working Paper 2

3.4 Commonwealth Legislation

The most relevant Commonwealth legislation that applies to the Proposal is the *Environment Protection and Biodiversity Conservation Act 1999*. This legislation was amended in 2003 to include a number of amendments relating to Environment and Heritage Legislation and the Australian Heritage Council.

Matters of National Environmental Significance under the *EPBC Act* are discussed in **Section 9** of the REF below.

There are no items listed on the Register of the National estate Database within the locality of the Preferred Corridor. The Cultural Heritage Assessment concluded that the study area had experienced very little historical development. Although Indigenous heritage items and potential archaeological deposits were detected in the field, provisions of the Commonwealth *Environment and Heritage Legislation Amendment Act (No.1) 2003* have no implications for this project.

In terms of the *Native Title Act*, the Proposal affects only one area of Crown Land located to the west of Lot 2 DP 244442 and Part Lot 2 DP 773237. This is an unconstructed Crown Public Road Reserve. Native Title legislation would not apply to this land, as it is identified as a Crown Public Road Reserve. Native Title legislation only applies to vacant Crown Land.

3.5 Summary

This section has outlined Commonwealth, State, Regional and Local planning requirements, as well as other statutory requirements, which would need to be considered for the proposed upgrade of the Oxley Highway, and identifies potential implications for the Proposal.

SEPP 4 allows public authorities (including the RTA) to undertake certain activities, which include classified roads, without the need to obtain development consent from Council. Therefore, this activity can be assessed as a Part 5 Activity under the *EP&A Act 1979*. An EIS is not required for the proposal.

There are no Commonwealth legislative requirements applicable to the Proposal.

NSW legislation that relates specifically to this project includes:

- Protection of the *Environment Operations Act 1997* – A license would be required for any Scheduled Activities;
- *Threatened Species Conservation Act 1995* – An SIS is being undertaken by the RTA because it has been determined that there is likely to be a significant impact on threatened species, populations or ecological communities within the Preferred Corridor.; and
- *National Parks and Wildlife Act 1994* – A permit would be required under Section 87 to disturb or excavate areas where aboriginal artefacts are likely to be identified. A Section 90 permit would be required prior to removal or destruction of relics

4 Stakeholder Consultation

4.1 Agency Liaison

All relevant government agencies and utility service providers were briefed on the Proposal during the inception phase (March 2003) and were requested to provide written comments.

The initial set of issues raised by agencies, and the relevant section of this REF where the issues have been addressed, are outlined in **Table 4-1**. A full description of agency issues and copies of all correspondence from agencies are provided in **REF Volume Two, Working Paper 3**.

4.2 Community Consultation

Consultation with the local community including land owners, residents, community organisations and business establishments has been an important part of the overall Corridor selection process, as well as the concept design phase of the Oxley Highway Upgrade.

The public display of the REF will also provide an opportunity for further consultation with these stakeholders and the wider community.

Details of the community consultation process for the Proposal up to preparation of the REF are provided in **REF Volume Two, Working Paper 3**.

Table 4-1: Agency Liaison and Issues

Agency	Issue	Relevant Section in REF
Hastings Council	Future urban development; project timing; intersection numbers; design and location; RTA noise policy	7.7
Department of Infrastructure, Planning and Natural Resources (DIPNR)	Impact on planning for Area 13; impact on koala habitat	7.6
Department of Environment and Conservation (formerly NPWS)	Impact on wildlife and heritage	7.6
Emergency Services (Ambulance; Rural Fire Service and Fire Brigade; Police)	Road design; median breaks; emergency access	6.0
NSW Fisheries	Impact on water course and fish	7.0
Telstra	Impact on infrastructure	6.0
Optus	Impact on infrastructure	6.0
Country Energy	Impact on infrastructure	6.0
Electricity	Impact on infrastructure	6.0
Department of Lands	Existing land in study area	7.7

Consultation has taken a number of forms including:

- media releases and general media coverage
- Community Liaison Group (CLG)
- community updates (newsletters)
- community workshops
- public displays
- residents / landowner meetings.

4.2.1 Media Coverage

In August 2002, the Minister for Roads announced that the NSW Government anticipated that construction of the Oxley Highway Upgrade would begin in 2005, subject to environmental investigations and planning approvals. In October 2003, the Independent Member for Port Macquarie announced that the Southern Deviation Corridor was the Preferred Corridor for the highway upgrade, and that a detailed environmental impact assessment under the requirements of relevant NSW legislation would be undertaken for this alignment.

In May 2004, the Minister opened a public display of preferred intersection layouts as part of the refined concept design for the Proposal.

The local media have carried regular articles regarding the Oxley Highway Upgrade since commencement of the study, and these have helped keep local residents and businesses informed of the progress of the project.

4.2.2 Community Liaison Group

A Community Liaison Group (CLG) was established by the RTA in March 2003 to assist with on-going community contact and feedback on the project. The CLG currently consists of 18 individuals drawn from a wide range of interest groups including (Table 4-2 refers):

- local land owners
- developers
- business representatives
- community organisations
- environmental groups
- indigenous community.

The CLG met on five occasions during the development of the Proposal since March 2003 and completion of the REF in 2004. The RTA acknowledges the time and input made by CLG members to this study.

Members of the CLG also attended a Corridor Evaluation Workshop (CEW) workshop over two days in July 2003 at which the corridor options were evaluated and a preferred corridor recommended.

4.2.3 Community Updates

The RTA has prepared and circulated four Community Updates as newsletters for the Proposal. These documents were delivered to all houses and businesses in the study area and were circulated widely in the local community. Community Updates were also available at the public displays, RTA offices and Hastings Council.

A colour brochure summarising the REF will be made available by the RTA to coincide with the public notification of the REF.

4.2.4 Community Workshops

Two separate sets of community workshops were held for the project in March 2003 and May 2003. These workshops were publicly notified and well attended. They provided an opportunity for information exchange on the Proposal and input to the RTA planning process.

The first group of workshops was held in the Hastings Council Chambers in March 2003 and attracted a total of 30 participants. It provided an initial project briefing and identified key issues of concern. The second group of workshops was also held at Hastings Council Chambers in May 2003 and attracted a total of 50 participants. The main purpose of this round was to invite community input to the corridor options for consideration by the RTA, including the Northern, Southern and Existing corridor options. (Refer to **Section 5.2** below).

The main outcome from the second round of workshops was a decision by the RTA to delete the eastern end of the existing Oxley Highway (Wrights Road to Philip Charley Drive) from further consideration as an upgrade option in the current corridor study. This decision was based on the adverse safety, property, amenity and cost implications of upgrading this section of the existing Oxley alignment into a new four lane highway standard road whilst still maintaining access/egress to existing residential and commercial properties along the road.

The workshops also agreed that the Northern Deviation Corridor would be included in the corridor options display.

Table 4-2: Oxley Highway CLG Members

Name	Organisation
Mr Phil Brown	Port Macquarie Chamber of Commerce
Mr Bob Charley	Charley Bros
Mr Barry Cook	Retreat Village
Mr Rob Drew	Hastings Council
Mr Edward Fowler	Landowner
Mr Reg Hall	Port Gateway Caravan Park
Mr Joe Hampton	Birpai Land Council
Mr Maurice Higgins	Maurice Higgins & Assoc
Mr Chris Pitt	St Colombia Anglican School
Mr Cameron Price	Forest Watch
Mr John Ross	Sherwood Estate Wines
Mr Chris Rowland	Koala Preservation Society
Mr Ken Tanswell	Land owner
Mr George Vaughan	Landowner
Mr Bob Walsh	Port Macquarie Base Hospital
Mr Peter Ypatidis	Landowner

4.2.5 Information Displays

The RTA has organised three separate community information displays up to the public display of the REF for public comment. A fourth display is planned during notification period of the REF to assist community comment.

The main displays have been held at Settlement City retail centre in Port Macquarie, as well as at the Hastings Administrative Centre in Port Macquarie and the RTA Motor Registries in Port Macquarie and Wauchope. These venues were chosen to maximise public exposure at convenient locations. A small display was also mounted at the general store on the corner of the Oxley Highway and Major Innes Drive within the study area.

The first public display was held over the period 14 to 21 June 2003 (8 days) to inform the local community about corridor options, constraints and other considerations. Coloured plans and photo-montages were used in the display. Three RTA representatives staffed the main display over four days (2 weekends) during the exhibition. Participants at the display were asked to complete a written survey as part of the process.

The overwhelming response from participants during the staffed display time expressed a strong preference for the Southern Deviation Corridor option based on the following views:

- simplest “straight forward” corridor
- least impact on property acquisition
- the Corridor has “been around” for a long time
- “nice” entry to Port Macquarie.

The second display was held in August 2003 to display the Preferred Corridor announced by the Minister for Roads.

The third display was launched by the Minister for Roads and held over the period 29 May to 20 June 2004. The display showed the Proposal with refined concept designs for all intersections, noise attenuation and other features.

A fourth public display will be organised by the RTA in Port Macquarie, Wauchope, Grafton and Sydney to coincide with public notification of the REF.

4.2.6 Community Survey

A written survey was completed by over 600 respondents during the corridor options display in June 2003. About one third of respondents lived within the corridor study area. The results of this survey were overwhelmingly in support of the Southern Deviation Corridor as the preferred option in relation to the community’s assessment of stated project aims. This community attitude was conveyed to participants at the Corridor Evaluation Workshop in July 2003, and used as part of the decision making process.

4.2.7 Corridor Evaluation Workshop

An independently facilitated Corridor Evaluation Workshop was held in July 2003, with representatives of the RTA study team, Agencies and representatives from the Community Liaison Group, to review all inputs to the corridor studies and evaluate options.

The main outcome of this workshop was a recommendation to the RTA to endorse the Southern Deviation Corridor as the Proposal.

4.2.8 Liaison with Stakeholders on Intersection Treatments

Several meetings were held on-site between December 2003 and February 2004 with the RTA and affected stakeholders regarding design options for each of the main intersections in the Proposal. These consultations assisted in the evaluation process resulting in the proposed outcomes described in **Section 6.5.4** below.

Discussions have also been held with landowners affected by the proposed Compound site.



RTA displays at Settlement City attracted strong interest

4.2.9 Summary of Main Issues Arising from Community Consultation

The main issues raised during the corridor selection and concept design stages of the Proposal included the following:

- strong concerns about the level of traffic congestion, safety, inconvenience, noise and air pollution on the existing highway, and the prospect of substantial land acquisition if the existing highway alignment was selected as the preferred option
- the need for an upgraded highway as a matter of priority
- a strong preference for selection of the Southern Deviation Corridor as being the Corridor previously announced and causing the least disruption to accepted community expectations. An upgrade along the existing alignment was strongly rejected by a large majority of local residents, especially those living between Wrights Road and Phillip Charley Drive
- the need for a new attractive gateway entrance into Port Macquarie
- concerns about increased noise levels associated with the Proposal

- adverse impacts on existing habitat, especially koala habitat and wildlife corridors that would be affected if the Southern Deviation Corridor were selected
- potential impact on indigenous heritage sites along the Proposal
- the need for provision of effective wildlife habitat protection in the form of fauna underpasses and possibly compensatory habitat if the Southern Deviation Corridor was selected
- the impact of heavy vehicle movements during the construction period (noise, dust, road safety).

All of the above issues have been addressed by the RTA study team during the corridor assessment and detailed concept stages of the project, and are discussed further in this REF.

5 Strategic Stage

This section briefly describes the strategic planning context for the Oxley Highway Upgrade, and outlines the planning process undertaken by RTA in selecting the Preferred Corridor for the Proposal. Refer **REF Volume Two, Working Papers 2, 4 and 6**.

5.1 Strategic Overview

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

The Proposal also fits within a series of transport planning initiatives and regional development strategies initiated by the State Government and Hastings Council.

The Pacific Highway is the main transport link between Sydney and Brisbane, and intersects with the Oxley Highway immediately west of Port Macquarie. Under the Strategic Transport Plan for NSW, the Pacific Highway has been undergoing major improvements over recent years and there is an on-going program of investment in the Proposal upgrade.

The Oxley Highway is an important arterial connection within the overall state network. It connects the important provincial centre of Port Macquarie to the Pacific Highway as the most important of the north-south transport corridors in NSW. In this role, the Oxley Highway must provide a high standard of accessibility for heavy commercial vehicles as well as for light commercial and passenger traffic.

The Oxley Highway provides an east west link from Port Macquarie to the Pacific Highway, Wauchope and inland NSW. This is the main transport connection into Port Macquarie, supported by other secondary connections from the Pacific Highway to the north and south.

The Oxley Highway Upgrade is also consistent with the broad objectives of the North Coast Urban development strategy and the Hastings Urban Growth Strategy.

The North Coast Urban Planning Strategy (1995) was developed to provide an overview of development in the north coast region, extending from the Hastings Local Government Area to the Tweed. The strategy envisages a regional settlement pattern having regard to the capacity of each centre to accommodate growth. The strategy recognises the potential for the urban expansion of Port Macquarie, particularly in the Thrumster area. A number of centres including Port Macquarie are identified as subregional centres that would be the focus of higher order services such as major hospitals, specialist medical facilities, tertiary education and regional entertainment and sporting facilities.

Port Macquarie is identified as an expanding regional centre with growth opportunities to the west of the current centre. This strategy has local and sub-regional traffic implications and will increase trip generation along the highway corridor which passes through the proposed urban growth area.

Hastings Council is currently preparing a Structure Plan for Area 13 (west Port Macquarie) as part of the **Hastings Urban Growth Strategy**. At the time of completion of this REF, this Structure Plan was in Draft Stage and has not yet been adopted by Hastings Council. **The Area 13 Structure Plan** identifies western Port Macquarie for substantial urban development. Area 13 forms a large part of the study area and the medium population prediction from HUGS is 6,200 by the year 2021. This projection has been adopted by the

RTA as a reasonable expectation about growth prospects for future planning, and does not include unapproved developments and population projections by land developers in the western area.

Much of the constraint-free rural land in this area will be transformed into urban development over the next 20 years and beyond.

In addition there are large areas of undeveloped residential zoned land in the Lake Innes Peninsula and plans for additional, playing fields, industrial areas and neighbourhood shopping facilities.

5.2 Corridor Option Selection

Following the announcement by the Minister for Roads in August 2002 the planning and development process commenced for the Oxley Highway Upgrade to investigate and assess the best value for money alignment for the upgrade, which will improve road safety and provide improved access as well as enhancing the overall entrance to Port Macquarie.

5.2.1 Short Listing of Corridor Options

The RTA is required to look at a “do nothing” option as part of any corridor selection study for the Proposal.

The preliminary assessment of the project compared the original Southern Deviation Corridor with the existing Oxley Highway corridor to confirm that the previous decision (approved in 1986) to proceed with the Southern Deviation Corridor was correct.

The “do nothing” option involved retention of the existing highway alignment. Since problems of road safety, traffic efficiency, inconvenience and adverse residential amenity were major factors influencing the need for an Oxley Highway Upgrade, the “do nothing” option was not regarded as an acceptable solution and was discarded from further consideration in the project.

Since the original design for the Oxley Highway was developed in the 1980s, some further constraints have arisen which relate to considerations of corridor options, namely:

- changes in environmental legislation
- construction of the Oxley Highway interchange with the Pacific Highway
- optical fibre installations
- construction of Ruins Way intersection
- residential subdivision adjacent to Major Innes Way
- development of a crematorium in Philip Charley Drive
- Hastings Council’s plans for further urban expansion in the Innes Lake and Thrumster areas.

Consideration of the original Proposal did not advance as far as a formal environmental impact assessment.

As a result, a decision was made to undertake further analysis of all feasible corridor options within the study area to determine those options that best met the main project objectives. **Figure 5-1** refers.



OXLEY HIGHWAY UPGRADE



LEGEND

- Study Area
- Property Boundaries
- Indicative Boundaries
- SOUTHERN DEVIATION CORRIDOR
- EXISTING CORRIDOR
- NORTHERN DEVIATION CORRIDOR

FIGURE 5.1
ROUTE SELECTION OPTIONS

The resulting corridors were examined at an Options Shortlisting Workshop held at Port Macquarie in April, 2003. (Refer to **REF Volume Two, Working Paper 4**. The purpose of the workshop was to shortlist corridor options that best met the project objectives to move forward for further investigations. The shortlisting workshop concluded that three main corridors were to be carried forward for further investigation, with a further two combination corridors being developed from these main corridors. These were:

- a **Southern Deviation Corridor** from Wrights Road to the Pacific Highway
- a **Northern Deviation Corridor** from Wrights Road to the Pacific Highway
- an **upgrade of the Existing Highway Corridor** from Philip Charley Drive west to the Pacific Highway including the eastern section of the Southern Deviation Corridor (Note: It was recommended that the existing highway east from Philip Charley Drive to Wrights Road be eliminated from further investigations subject to community consultation)
- combinations of these three corridors, including a Northern Combination and a Central Combination.



Existing highway looking west from central cross-over.

5.2.2 Description of Corridor Options

Following the Options Shortlisting Workshop further investigations were undertaken on the three main corridor options and the two combination options. The following paragraphs describe the main features of each of the corridors considered for further investigation.

Upgrade Existing Highway Corridor

The corridor followed along the Southern Deviation Corridor from Wrights Road towards Lindfield Park Road and then deviated from this corridor onto the existing highway alignment. The corridor generally followed the existing alignment until it reached the roundabout with the Pacific Highway, where it finished.

This corridor was designed to 80kph design speed. Major access points were considered at Wrights Road, Thrumster Street, Bestglen Place and at the western end near the Pacific Highway. A highway crossover point was located where the corridor crossed over Lindfield Park Road.

Southern Deviation Corridor

This corridor was approved by the then Department of Main Roads in 1986 and the eastern section was included in Hastings Council's Local Environmental Plan. Consideration of the corridor did not advance to an environmental impact assessment.

The corridor started just east of the Wrights Road roundabout and departed from the current alignment crossing low-lying land to the north. It passed over Lindfield Park Road before crossing the existing Oxley Highway just west of Philip Charley Drive. The corridor then passed through timbered and cleared pastureland, rejoining the existing highway at the roundabout with the Pacific Highway.

This corridor was designed to 100kph design speed. Access points were considered at Wrights Road and at the western end. In addition a highway crossover point was located where the Southern Deviation Corridor crossed Lindfield Park Road and also the existing highway west of Philip Charley Drive.

Areas of acquisition had occurred along this corridor since its approval in 1986 with the result that all but 8 properties have been acquired, wholly or partially.

Northern Deviation Corridor

This corridor followed along the Southern Deviation Corridor from Wrights Road towards Lindfield Park Road where it deviated to the north. It traversed mainly low lying land with pockets of vegetation running generally along the northern boundary of the study area. It crossed the existing Oxley Highway east of Thrumster Street, and from there it traversed hilly partially vegetated terrain until it reached the roundabout with the Pacific Highway.

This corridor was designed to 100kph design speed, with access points at Wrights Road and the western end.

Northern Combination Corridor

This corridor followed the Northern Corridor from Wrights Road to Thrumster Street. It then connected to the western section of the Existing Corridor until it reached the Pacific Highway. This corridor was designed to 100kph design speed on the sections of the Northern Deviation, and 80kph on the existing Oxley Highway corridor. Access points were considered at Wrights Road, Thrumster Street, Bestglen Place and at the western end. A highway crossover point was located where the corridor crossed Lindfield Park Road.

Central Combination Corridor

This corridor followed the Southern Deviation Corridor from Wrights Road to just west of Philip Charley Drive, where it combined with the central section of the Existing Corridor. It followed the existing Oxley Highway corridor until it connected with the Northern Deviation Corridor just east of Thrumster Street, continuing along the Northern Deviation Corridor until it reached the roundabout with the Pacific Highway.

This corridor was designed to 100kph design speed on the Southern Deviation and Northern Deviation Corridors and 80kph on the existing Oxley Highway corridor. Access points were considered at Wrights Road, Thrumster Street and at the western end. A highway crossover point was located where the corridor crossed Lindfield Park Road.

5.2.3 Assessment Criteria

The draft assessment criteria for assessment of the corridors were categorised under the streams of Functional Performance, Social Impacts and Environmental Impacts (i.e. an examination of a “triple bottom line” approach) to comply with requirements under the EP&A Act. The criteria are listed below:

Functional Criteria

- meet design speed standards
- minimise access points
- support economic development
- can be staged
- maximise the use of road corridors.

Social Impact Criteria

- minimise social impacts on the local community
- minimise adverse impacts on (or enhance) businesses
- compatible with future urban development opportunities
- cater for future local traffic needs
- minimise adverse impacts during construction.

Environmental Impact Criteria

- minimise impacts on potential habitat of threatened and endangered species
- minimise severance impacts on wildlife corridors
- minimise impacts on Aboriginal heritage
- minimise road traffic noise on existing residences
- enhance Port Macquarie / region in terms of visual quality, urban design and landscape.

5.2.4 Options Evaluation and Preferred Corridor Option

Background Papers were developed from the corridor selection investigations as input to a Corridor Evaluation Workshop (CEW). The five corridor options were analysed at the CEW on how each corridor performed under the selection criteria.

The CEW was held in July 2003, with representatives from the RTA project team, Government agencies and Community Liaison Group members. Its purpose was to review all aspects of the project to date and make recommendations on the Proposal.

The CEW undertook a thorough assessment in qualitative and quantitative terms of the advantages and disadvantages of each corridor option, including a comparison of road user benefit cost ratios and strategic project costs. The details of this evaluation are provided in **REF Volume Two, Working Paper 4**.

The selection of the Preferred Corridor option was a culmination of the engineering and environmental investigations undertaken, community consultation and the recommendations of the CEW.

The CEW concluded that the Southern Deviation Corridor was considered, on balance, to be superior to the other corridor options and was recommended as the preferred option for the following reasons:

- most compatible with the project objectives
- ranked highest in relation to assessment criteria for functional performance, social impact, and road user benefit/cost ratio (RUBCR).
- best road safety outcome and lowest noise impact
- a straighter road that provides better access to Port Macquarie
- a longstanding option that was supported by the community.

However, the recommendation within the Workshop for the Southern Deviation Corridor was subject to:

- appropriate environmental safeguards being included in the Proposal
- noise amelioration measures being undertaken
- ongoing monitoring of the environment to assess the impact and take appropriate action as required
- examination of appropriate habitat compensation being examined
- the road design within the corridor to complement the planning of Area 13
- identification of a way to ensure environmental agreements are met in the long term.

The Northern Deviation was supported at the workshop as the fallback option should the Southern Deviation Corridor prove unsustainable. It was agreed by participants at the CEW that the process undertaken to reach these conclusions was robust and allowed consideration of the various perspectives represented in the workshop.

The matter regarding the environmental agreements was addressed in a subsequent meeting of representatives from the RTA, the then National Parks & Wildlife Service, Hastings Council, Department of Infrastructure, Planning & Natural Resources and Vilro Pty Ltd (landowners in the central section of the Southern Deviation Corridor). This meeting reached agreement-in-principle to broad strategies that would minimise the impact on the environment not only of the Southern Deviation Corridor but also future development adjacent to the Corridor.

Figure 5-2 shows the Preferred Corridor option that was presented at the public display in June 2003.

In October 2003, the Minister for Roads announced that the Southern Deviation Corridor was the Preferred Corridor for the highway upgrade, and that a detailed environmental impact assessment under the requirements of relevant NSW legislation would be undertaken of this alignment.



OXLEY HIGHWAY UPGRADE



FIGURE 5.2
PREFERRED CORRIDOR

6 Concept Stage

This section of the REF outlines the work undertaken by the RTA subsequent to selection to the Southern Deviation Corridor as the Preferred Corridor for the Oxley Highway Upgrade, and describes the Proposal.

In summary, the Concept Stage has involved additional concept road and bridge design, including detailed investigations on the Southern Deviation Corridor intersection refinement, as well as on-going liaison with community stakeholders along the corridor. A copy of the concept design report is contained in **REF Volume Two, Working Paper 5**.

6.1 Concept Design Objectives

In addition to the main project objectives for the Proposal, a number of more detailed objectives were adopted for the Detailed Concept Design in consultation with other government agencies and the local community:

- develop a dual carriageway road with potential to reduce crash rates to 20-30 crashes per 100MVK over the project length
- develop a Detailed Concept Design that meets B-Double requirements, including at intersections, where required
- maximise the use of the existing road corridors, where appropriate
- integrate input from local communities into development of the Proposal
- satisfy the technical procedures and standards of the RTA with respect to design of the Proposal
- provide transport solutions which are complementary with landuse and that take into account future development
- consider cyclists and public transport needs that take into account existing and future development
- allow for all connections, modifications and improvements (including streetscape) necessary to upgrade the existing highway where it is retained as part of the Project



Existing highway and central cross-over looking east.

- consider delay management strategies to minimise disruption to local and through traffic and maintain access to affected properties and land during construction
- provide flood immunity on at least one carriageway for a 1:100 year flood event
- provide controlled access along the project
- make provision for intersections to operate at no worse than Level of Service C 20 years after opening
- develop locations and design solutions for intersections in consultation with Hastings Council, local stakeholders and urban growth plans
- develop a Detailed Concept Design to give a desirable design speed of 100kph with an absolute minimum design speed of 80kph
- minimise the impact of the Proposal on the environment to “less than significant”
- maximise pollution control and water quality safeguards of the project
- minimise road traffic noise on existing residences
- allow for staged construction of the project.

6.2 Existing and Forecast Traffic

6.2.1 Introduction

The existing highway between the Pacific Highway and Wrights Road, Port Macquarie is a two lane rural road with narrow gravel shoulders for a distance of 6km. It carries average daily traffic volumes of between 12,500 on the western end and 16,500 on the eastern end. On current traffic projections the existing two-lane Highway will be at capacity by year 2009. Intersections with Give Way control on the eastern end of the Proposal will incur long delays due to inadequate gaps in the traffic stream for traffic to enter.

A traffic study was undertaken on the Proposal. Details of this study are contained in **REF Volume Two, Working Paper 6**. This traffic study contains traffic and transport data that is used to justify the project and to assist in the design of the road and intersections. The traffic volumes have been obtained from historical data and recent traffic counts. Traffic projections have been made on the basis of the medium projected population growth in the HUGS document.

6.2.2 Existing Traffic Volumes

Intersection Counts

Traffic counts were taken at Wrights Road/ Oxley Highway intersection in November 2003 for morning and evening peak hours.

Intersection traffic counts conducted in February 2001 at two Oxley Highway junctions, Major Innes Road and The Ruins Way indicated a large variation in the am peak hour eastbound flow between the two separate counts on different days. The counts were taken prior to the opening of St Columba Anglican School. Traffic volumes in Major Innes Drive have increased as a result of a new school development. Stage 1 of the school opened in 2002. A new roundabout at the intersection of Major Innes Road and the existing Oxley Highway is currently under construction to address local traffic issues.

Daily traffic volumes are shown on **Table 6-1**. Average daily volumes are larger in the eastern section of the route reflecting the greater urban development in this area. Traffic volumes on Friday are higher than other days of the week.

Table 6-1: Daily Traffic Volumes on Oxley Highway (March 2003)

Location		Sun	Mon	Tues	Wed	Thurs	Frid	Sat
Ruins Way	Eastbound	4,223	7,074	7,388	7,342	7,616	7,672	5,571
	Westbound	5,130	6,879	7,428	7,297	7,220	7,463	5,632
	Total	9,353	13,953	14,816	14,639	14,836	15,135	11,203
Thrumster St	Eastbound	4,015	5,479	5,408	4,443	4,870	6,356	4,652
	Westbound	4,169	5,332	5,978	4,299	5,199	6,217	4,541
	Total	8,184	10,811	11,386	8,742	10,069	12,573	9,193

Source: Roadnet (REF Volume Two, Working Paper 6)

Table 6-2 lists the mix of vehicle types including small and large trucks using the Oxley Highway. Passenger vehicles dominate traffic movement along both sections of the existing highway, with light and heavy vehicles marginally higher in percentage terms in the eastern section.

Table 6-2: Vehicle Types on Oxley Highway

Location	Type of vehicle	Percentage
Ruins Way	Cars	92.9%
	Light trucks	5.2%
	Heavy trucks	1.9%
Thrumster Street	Cars	93.8%
	Light trucks	4.5%
	Heavy Trucks	1.7%

Source: Roadnet (REF Volume Two, Working Paper 6)

Travel Speeds

The current average travel speeds in the eastern and western sections are currently 57kph and 71kph respectively.

B-Doubles

B-Doubles are currently permitted to operate on the section of Oxley Highway between the Pacific Highway and Lake Road. Lake Road leads into Port Macquarie industrial area.

Public Transport, Pedestrians and Cyclists

The existing Highway is narrow and winding and unsuitable for bicycle use.

Public transport currently uses the existing Oxley Highway for local and long distance bus trips.

Accident Analysis

A detailed analysis has been carried out of the traffic accident history of the section covering the five-year period from October 1997 to August 2002.

Analysis of existing accident data and consideration of the nature of the Proposal indicate that there will be a considerable improvement in the safety performance of the Preferred Corridor when compared with existing accident rates.

At present, there are 125 accidents per 100MVK on the western section and 135 accidents per 100MVK on the eastern section of the improvement length. There have been two fatalities along the existing highway during the period of analysis.

On the basis of comparison with similar roads carrying similar traffic volumes, it is predicted that accident rate on the Proposal will fall to 25 per 100MVK. The rate on the old road will also decline to 75 per 100MVK due to reduced traffic volumes and the prevalence of local travel.

6.2.3 Projected Traffic Volumes

Table 6-3 shows projections of future traffic volumes based on Hastings Council's HUGS document using the medium population projection of 6,2000 in the western part of Port Macquarie (Area 13). The projections are also based on the following access arrangements to/from the Proposal:

- westbound on-load ramp from Philip Charley Drive at the crossover in 2008
- eastbound on-load ramp at crossover 2018
- Seagull 'T' intersection at Lindfield Park Road
- roundabouts at the eastern and western ends.

Travel Times / Delays

Modelling of traffic flows on the existing highway indicates that:

- On the western section, current average travel speed is 71kph during peak traffic. This will drop to 52kph when saturation is reached in about 2028. At that stage, the peak period would need to extend to cater for additional traffic.
- On the eastern section, current average travel speed is 57kph during peak traffic. This will drop to 44kph when saturation is reached in about 2008. At that stage, the peak period would need to extend to cater for additional traffic. As an indicator of the need for upgrading, by 2033, the Oxley Highway would need to flow at peak capacity for 21 hours per day to permit the overall traffic flow predicted. This is clearly impractical and long delays would occur during the normal daily peaks.
- Delays at intersections with Give Way control are currently approaching unacceptable levels for example Major Innes Road. This intersection would reach capacity by 2008 at which time the delays will become intolerable and safety will decline. As a result the RTA has constructed a roundabout at the intersection of the existing Oxley Highway and Major Innes Road.

With the provision of dual carriageways and controlled access, travel speeds are not reduced by the traffic volumes predicted within the analysis period. Travel speed on the Proposal would be at or close to the posted speed limit. Travel time savings will be significant.

Table 6-3: Projected Traffic Volumes and Level of Service (LOS)

Year	Existing Hwy- western section, east of Thrumster St	Existing Hwy – eastern section west of Wrights Rd	Proposal – midpoint on western section east of Thrumster St	Proposal – eastern section west of Wrights Rd	Existing Hwy east of Wrights Rd
2008	2,964	11,154	16,635	15,844	28,590
LOS	B	C	A	A	B
2018	6,227	14,082	22,631	24,053	42,294
LOS	B	D	B	B	C
2021	7,290	15,928	26,024	27,697	47,988
LOS	C	D	B	B	D
2031	9,228	15,928	40,255	41,790	61,829
LOS	C	D	C	C	E

Source: Roadnet (REF Volume Two, Working Paper 6)

6.3 Design Standards

The following RTA design standards and considerations have been used as the basis for concept design. (Refer to www.rta.nsw.gov.au/doingbusinesswithus/specifications and REF Volume Two, Working Paper 5).

6.3.1 Design Standards

New Highway Alignment

- minimum 100kph horizontal alignment
- minimum 100kph vertical alignment
- dual carriageway with 2x3.5m Lanes, 2.5m outside shoulder and 0.5m median shoulder
- a desirable 7m wide depressed median
- provision of a 2.5m shoulder on carriageways to provide for cyclists.

Local / Service Roads

- minimum 60kph horizontal alignment
- minimum 60kph vertical alignment
- lane widths, parking lanes, road shoulders and footpaths to be in accordance with the RTA Road Design Guide
- medians where required to be in accordance with the RTA Road Design Guide
- a parking lane to be provided on the residential side of service roads (if required or provided) in accordance with the RTA Road Design Guide.

6.4 Design Constraints and Issues

A detailed analysis by the RTA of site characteristics, as well as other considerations including RTA road objectives for the Oxley Highway Upgrade, broader planning and environmental policy, enabled a detailed set of opportunities and constraints to be established for the Proposal.



Existing highway looking east has poor vertical and horizontal alignment.

6.4.1 Design Constraints

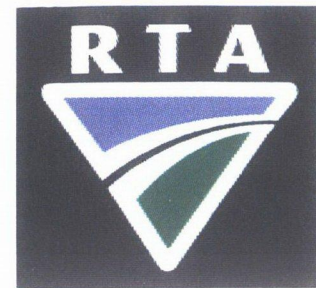
The following design constraints have been identified:

- existing LEP boundaries in the eastern section
- previous land acquisition
- heritage sites
- 5.3m clearance to proposed overbridge
- design standards (Refer **REF Volume Two, Working Paper 5**)
- limited access points / future urban growth
- noise sensitive developments
- identified fauna
- timbered area in central section
- SEPP I4 land adjacent to Preferred Corridor
- design to have potential for staging
- visual impact
- access to Base Hospital
- existing business requirements
- construction under traffic / pedestrian movements / impact on residences
- design schedule
- soft soils
- sources of pavement and bridging materials.

Figure 6-1 and **Figure 6-2** summarise the main physical and environmental constraints affecting road design.



*Looking east along
preferred corridor from
ridge.*



OXLEY HIGHWAY UPGRADE

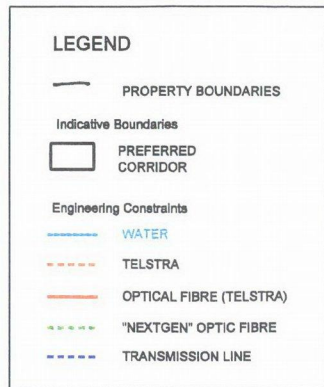
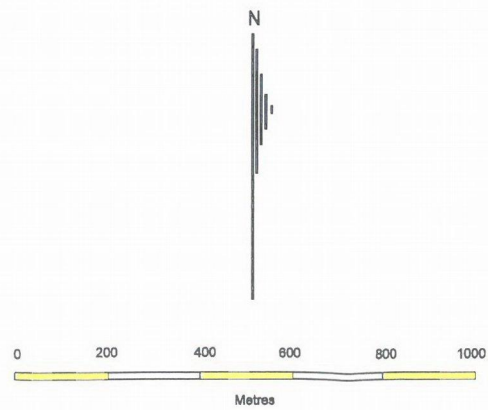


FIGURE 6.1
PHYSICAL CONSTRAINTS



OXLEY HIGHWAY UPGRADE

LEGEND

— Property Boundaries

Indicative Boundaries

□ PREFERRED CORRIDOR

Environmental Constraints

□ SENSITIVE WATERS

□ KOALA USE (MEDIUM)

□ KOALA USE (HIGH)

□ HASTINGS COUNCIL FUTURE DEVELOPMENT AREA 13

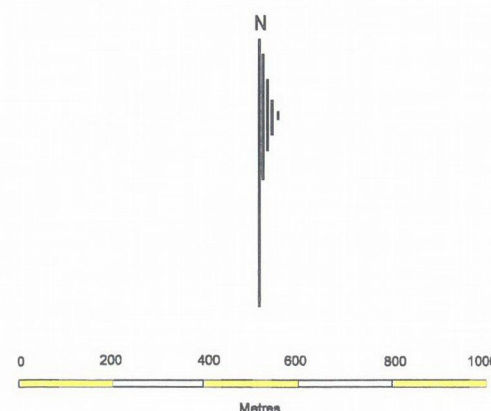


FIGURE 6.2
ENVIRONMENTAL CONSTRAINTS

6.4.2 Design Issues

There are a number of high risk design issues that have been addressed in the concept design of the Proposal and the main issues are detailed in the following sections. A full list of design issues is included in the Detailed Concept Design Report (**REF Volume Two, Working Paper 5**).

Road and Bridge Design

- a balance of cut and fill material along the Corridor
- minimum impacts on property acquisition
- minimum visual and environmental impacts
- minimum impacts on built form (eg. from noise attenuation structures)
- cost effective solution
- minimum affect on public utilities
- consider Area 13 Plan of Management
- minimum impact on timbered Vilro Land
- bridges to allow for noise wall attachment where required
- minimum vertical clearance of 5.3m for the bridge above existing Highway to cater for high vehicles during construction and operation.

Environment

- avoid both Indigenous and non-indigenous heritage sites where possible
- minimise effect on native flora and fauna including threatened fauna habitat, including Koala habitat
- consider requirement for fencing eg. fauna fence
- consider fauna movement / underpass design
- minimise noise impacts (noise attenuation features)
- address drainage issues with regard to nearby wetlands (sedimentation, spills etc)
- design bridge and culverts to be in accordance with Department of Fisheries requirements
- design road batter slopes to accommodate native plant species for rehabilitation
- provide narrow median between chainage 8km200 and 8km900 for glider movements (tree distance 35-40m)
- provide jumpdowns for Koalas at appropriate locations
- consider location of fauna fence (closer to road the better) / visual impact.
- incorporate feedback from community consultation, workshops and CLG where possible
- consider additional businesses and landowners requirements for access and acquisitions.

Urban Design

- minimising the visual impact of the Proposal
- existing and proposed land usage
- general assessment of noise walls and mediation measures
- access points (avoid gaps in noise walls)
- location of culverts in relation to sound attenuation measures
- bridge design
- minimising cuttings
- lighting of intersections
- consider action of cyclists
- integration with hydrology design
- integration with wildlife requirements
- public transport routes and stops.

Hydrology

- required road height to ensure design 1 in 100yr flood immunity
- sizing of culverts, etc. – acceptable impact
- reduction in flood storage due to road embankment to an acceptable impact
- operational stormwater management impact.
- Scour protection.

Occupation Health and Safety (OHS)

- working on unstable slopes
- investigation and construction under traffic
- noise walls on bridge
- wider shoulders – maintenance

Geotech

- consider sources of pavement materials
- asbestos – investigation and construction issues
- batter design (2H to 1V) maximum slope in cuts and fills, 4 to 1 in lower cuts and fills
- settlement stability – including at overbridge site and noise mounds at eastern end
- material sourcing, locations for bridging layers, cut floor treatments and locations of Upper Zone Formation thickness for vertical grading
- allowance for all fill areas to include imported bridging layer
- maximising utilisation of fill on-site for the Upper Zone formation to reduce material import
- foundations for bridges and conventional culverts
- foundations for noise walls – to be addressed in the final design stage
- drainage pipes and trenches – provide longitudinal drainage within median for reasons of slope stability.

Utilities

- affect of concept options on Telstra and Optus
- Country Energy, Hastings Water, Hastings Sewer.

Acquisition

- most acquisitions will be from predominantly rural 1A land
- boundaries to be set for possible future upgrades at access points

Construction

- tie-ins to existing infrastructure
- construction noise on existing residences
- asbestos materials.

6.5 Detailed Concept Design

This section describes the design considerations associated with the main roadworks along the corridor, including horizontal and vertical profiles, pavement treatments and medians. **Figure 6-3** shows the Preferred Detailed Concept Design for the Proposal.

Development of the concept design was an iterative process with the aim of minimising the impacts of the Proposal and including environmental safeguards and measures in the Proposal. Design issues and constraints were identified and the concept design was reviewed and modified on a number of occasions to minimise the impacts of the Proposal.

The issues and constraints identified have been outlined in **Sections 6.4** above.



OXLEY HIGHWAY UPGRADE

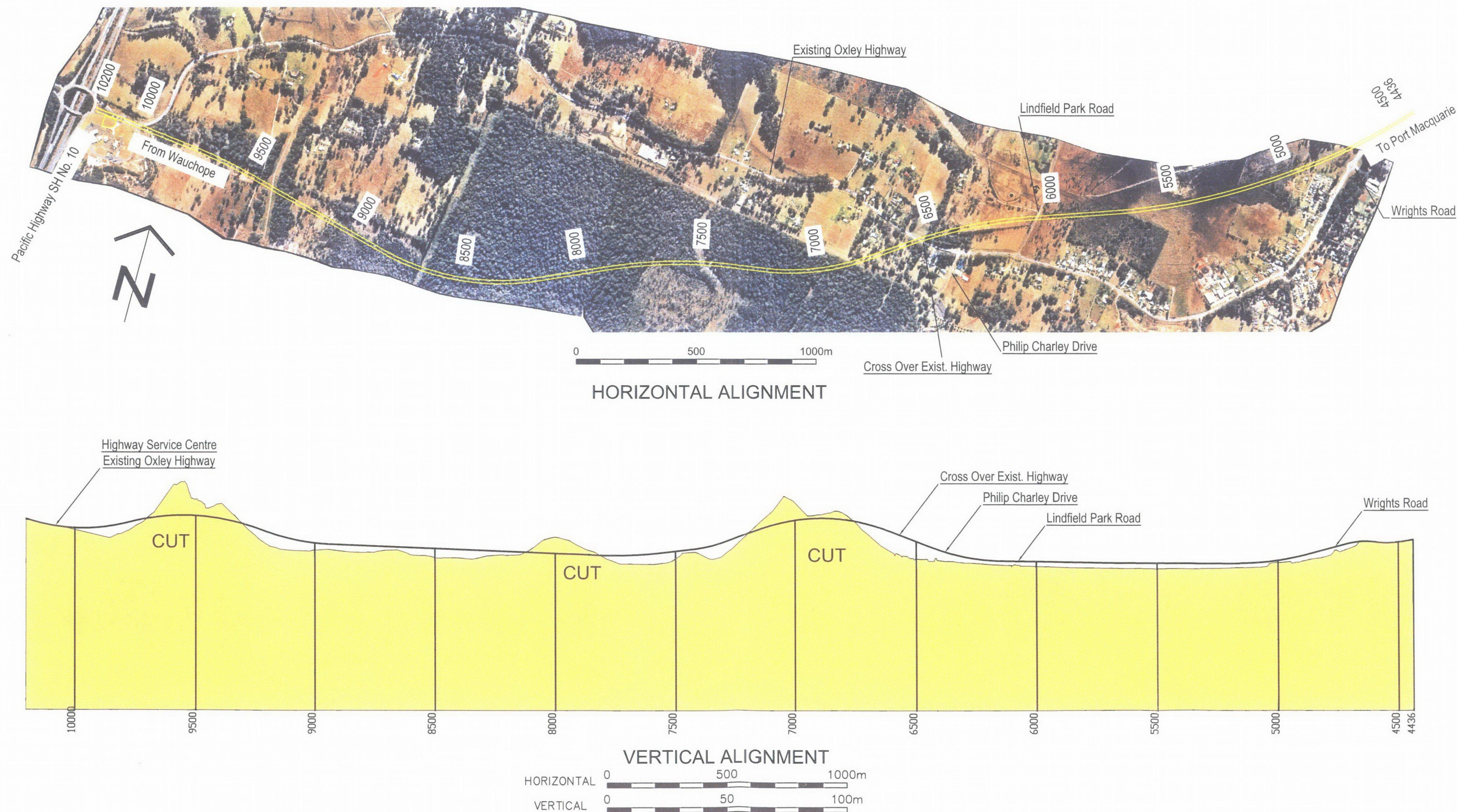


Figure 6.3
Preferred Concept Design

6.5.1 Horizontal Alignment

Figure 6-3 shows the horizontal alignment of the Proposal.

The horizontal alignment for the Proposal extends from approximately 150m east of Wrights Road from where it deviates to the north crossing the low-lying Partridge Creek floodplain. After traversing the floodplain the Proposal crosses Lindfield Park Road approximately 150m from its junction with the Oxley Highway and proceeds over the existing Oxley Highway just west of the Major Innes Motel. The Proposal then traverses undulating timbered land south of the Oxley Highway until it rejoins the Highway at the service centre.

The horizontal alignment meets the RTA standard for 100 kph with a minimum curve radius of 950m and a maximum curve radius of 2,800m. On curves larger than 2,000m radius crossfall sloping towards the outside shoulder has been adopted which meets design criteria and assists in improving drainage in the median.

6.5.2 Vertical Alignment

Figure 6-3 shows the vertical alignment of the Proposal.

The Proposal traverses the Partridge Creek Floodplain in the east where the road level has been designed above the 1 in 100 year flood of RL 3.3m. In the western section the Proposal traverses undulating terrain and Lake Innes catchment area. The new highway reaches a maximum height above sea level of RL 24.0m.

The vertical alignment meets the RTA standard for 100kph road with a maximum grade of 3.9% and a minimum grade of 0%.

6.5.3 Cross-Sections

Figure 6-4 shows typical engineering cross-sections for the Proposal.

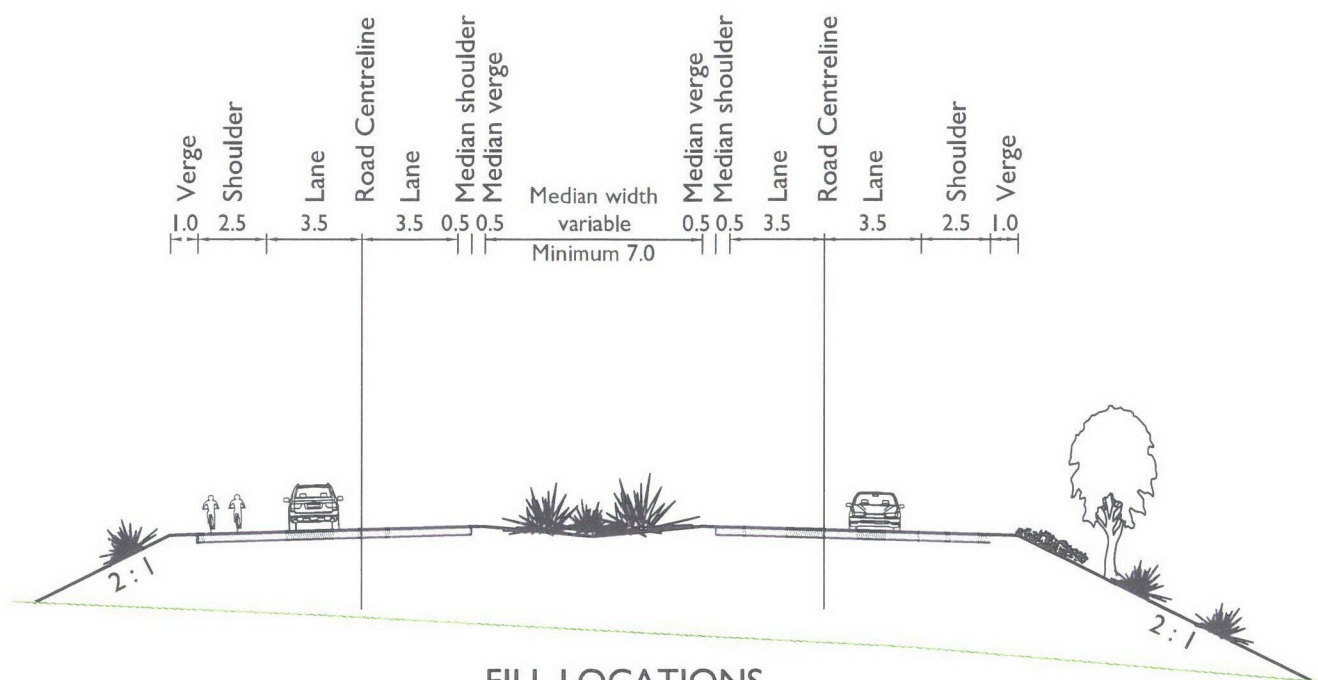
The basic configuration would feature 10m width of high strength pavement on each carriageway. This would be made up of 2 x 3.5m lanes, 2.5m outside shoulders, 0.5m median shoulders. The width of the median would be 7m between the edges of the travel lanes. Verges would typically be 1m for outer shoulders on fills and 0.5m in the median. Turning lanes would have a width of 3.5m.

Cyclists would be accommodated in the 2.5m outside shoulders.

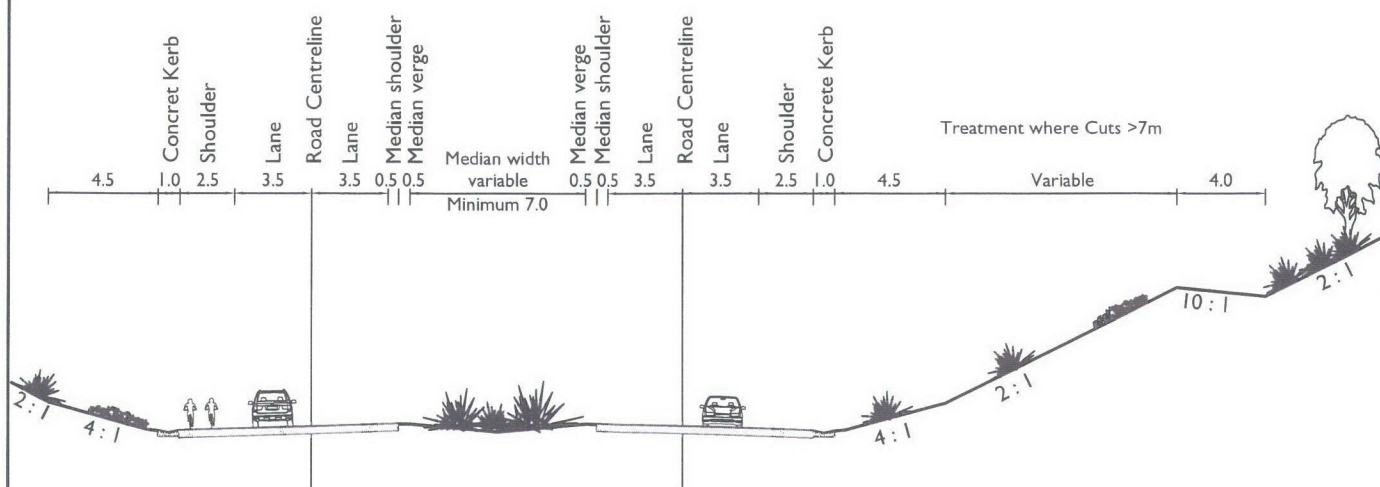
The crossfall on each carriageway would normally be 3% towards the outside shoulder. This crossfall would also be applied to curves larger than 2,000m as previously mentioned.

Crossfall on the larger roundabouts would be 3% crossfall sloping towards the outside shoulder, which improves drainage and assists the movement of larger vehicles through the exits from the roundabout.

OXLEY HIGHWAY UPGRADE



FILL LOCATIONS



CUT LOCATIONS

Fig. 6.4
TYPICAL CROSS SECTION

6.5.4 Intersections

Figure 6-5 and **Figure 6-6** show the preferred design concepts for each of the main intersections along the Proposal.

The Proposal has been designed as a controlled access highway, and the number of intersections has been minimised consistent with the need for traffic safety and access to the existing urban area.

Four intersections have been incorporated into the concept design at the following locations:

- Wrights Road
- Lindfield Park Road
- Central cross-over including an extension of Philip Charley Drive
- Western connection near the Shell service centre.

In arriving at the preferred concept designs for each of the intersections, a number of options were considered by the RTA in the context of projected traffic movement, traffic safety, efficiency, land acquisition and adjacent land uses. Options considered for each of the intersection concepts are summarised in the **REF Volume Two, Working Paper 5**.

Wrights Road

Wrights Road at the existing Highway is a T-junction currently controlled by a roundabout and forms the eastern extent of the project. This intersection is of high importance as it feeds into the Base Hospital to the south and also would be the connection to the deviated section of the existing Oxley Highway.

A number of options were considered including retaining the existing small roundabout, providing a dumb bell roundabout, traffic lights and a large roundabout.

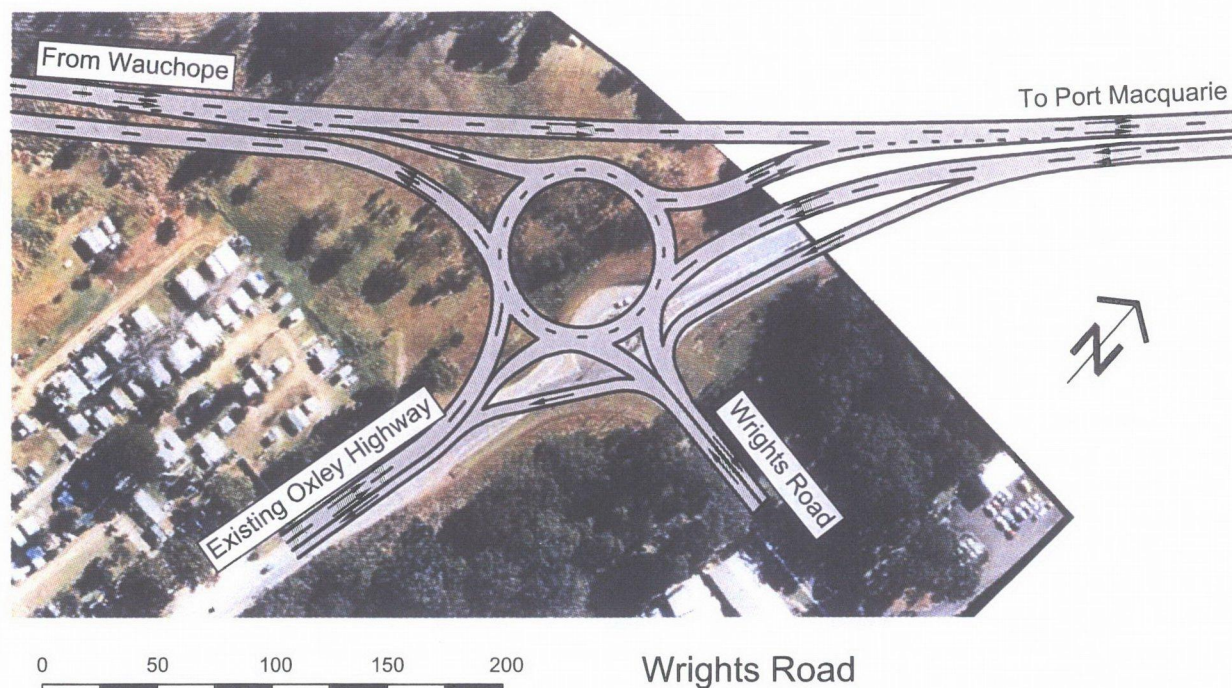
The preferred option provides a large roundabout offset to the north from the existing roundabout at the intersection Wrights Road and the existing Oxley Highway. **Figure 6-5** refers. This allows the existing highway pavement to be utilised to provide a separate slip lane into Wrights Road from the east and a separate slip lane from Wrights Road to the existing Oxley Highway to the west. Also a separate slip lane that would take traffic from the west would be provided on the northern side of the roundabout to avoid conflict with traffic using the roundabout.

Lindfield Park Road

A seagull 'T' intersection with a storage bay for westbound traffic has been considered as an interim measure and retained until Council finalise their development plans for the area. **Figure 6-5** refers.

This preferred option may include alternate access for Lindfield Park Road onto the current Oxley Highway, west of the proposed Highway crossover, once the latter area is developed and traffic volumes along the Proposal increase. At that stage, the junction would be converted to a left in/left out only, i.e. right turn movements for westbound traffic would be removed once a local road network is established.

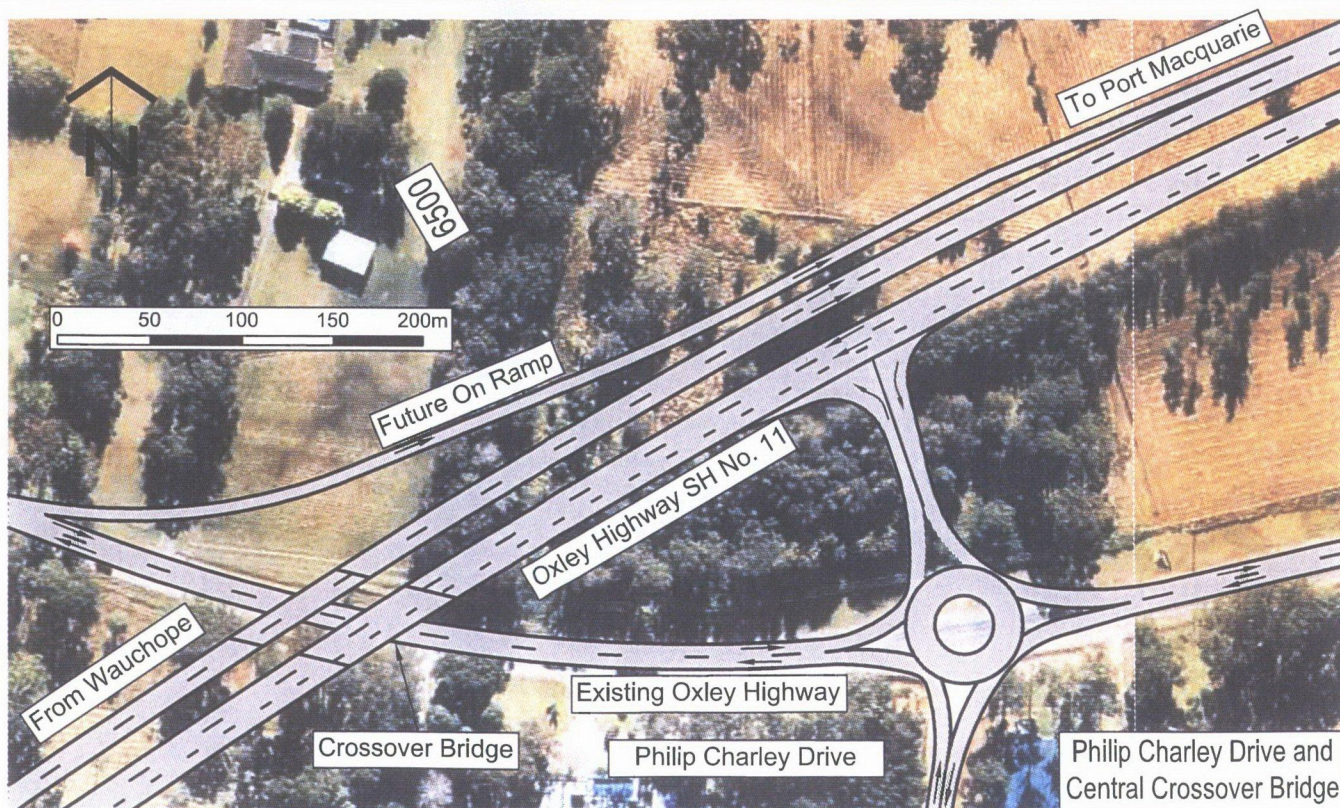
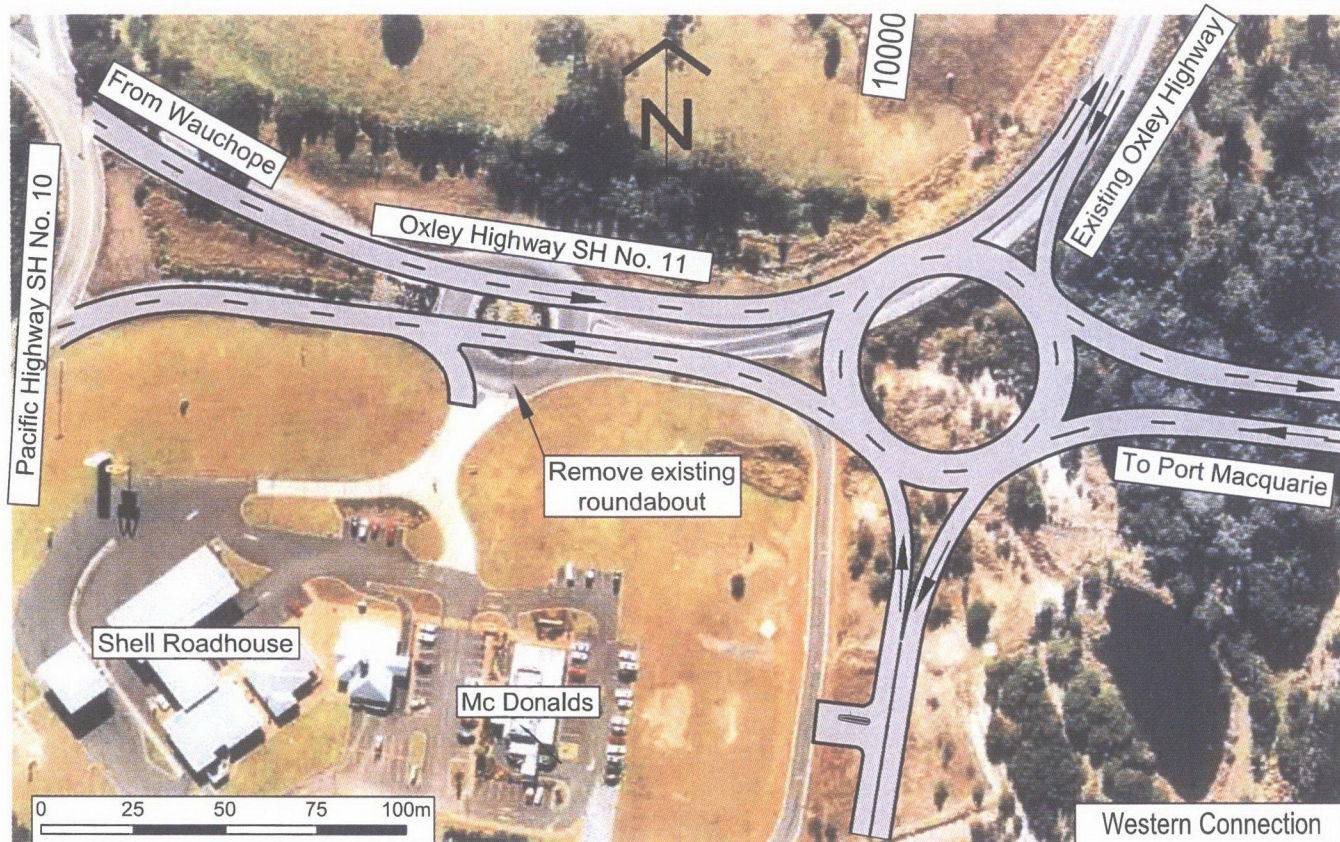
OXLEY HIGHWAY UPGRADE



SUBJECT TO COMMUNITY
CONSULTATION AND FINAL DESIGN

Fig. 6.5
Wrights Road and
Lindfield Park Road

OXLEY HIGHWAY UPGRADE



SUBJECT TO COMMUNITY
CONSULTATION AND FINAL DESIGN

Fig. 6.6
Western Connection, Philip Charley Drive
and Central Crossover Bridge

Central Cross-over including Philip Charley Drive

A number of options were considered at the crossover. The minimal option of no access at the crossover, with on-load ramps in the future, was proposed at the corridor selection stage to allow greater flexibility of refinement of the options during the Preferred Corridor stage. This option was discussed at the initial meeting with landowners to obtain community input. A full analysis of the options considered at the crossover is contained in the Detailed Concept Design Report attached in **REF Volume Two, Working Paper 5**.

The community acknowledged the RTA's objective of minimising access at this point but requested the RTA consider the on-load ramps to gain access to the Proposal. The owner of the Major Innes Motel, adjacent to the crossover, requested full access arrangements to his motel to retain future business viability.

For the preferred option, a roundabout is proposed on the current Oxley highway at Philip Charley Drive with a connection north to the Proposal. **Figure 6-6** refers. This is along an existing road reserve that was acquired by the DMR in 1986 for the original concept design. Therefore, this option does not require any additional acquisition. At the Proposal the left in/left out movement would be available. This access onto the Proposal would be in lieu of the westbound on-load ramp which would require an additional lane at the overbridge to provide merging for westbound traffic.

Western Connection near Service Centre

At the western connection a small roundabout on the Oxley Highway to the east of the Pacific Highway provides access to the service centre (service station; McDonalds; Sherwood Wine Embassy; and pie shop).

The preferred option provides a larger roundabout close to the service centre with alternate access provided to the service centre. **Figure 6-6** refers. This Proposal allows for the removal of the smaller roundabout with all access to the service centre being via the larger roundabout. Light and heavy vehicles using the service centre would be separated, with the heavy vehicles exiting via a left-out lane at the existing entrance.

The Proposal contains two major bridges located at the central crossover with the existing Oxley Highway, involving separate structures for west-bound and east-bound traffic contained by an earth filled vertical wall design.

There would be a west-bound on-load ramp from Philip Charley Drive included on the west-bound bridge in the initial stage with provision made for an east-bound on ramp from the existing highway, to be constructed at a later stage if traffic warrants. Land acquisition for the bridge and possible ramps would commence once the REF has been determined.

The bridges would each have a total span of 34.68m, with provision for continued use of the existing highway, together with pedestrian access on both sides and a bicycle lane to ensure continued connectivity with residential development to the east and west of the bridge. Sufficient width has been allowed under the new bridges to allow for future upgrading of the existing Highway by Hastings Council to four lanes as a consequence of future urban development.

6.5.5 Structures

Bridge

The major structure to be built is the proposed bridge over the existing Oxley Highway. The bridge would be a single span of precast PSC Super T-girders, with a 34.68 metre span simply supported on reinforced concrete sill beam over reinforced soil walls at each abutment. The cast in place RC deck would be composite with the precast girders. The design would provide a clear width between kerbs of 10 metres for the two lane eastbound bridge and 13.5 metres for the three lane westbound bridge.

There would be a minimum clearance above the existing Oxley Highway of 5.3 metres. Safety screens would not be warranted on the bridges, but a noise wall would be required on the outer kerb of the eastern bridge only (refer **Section 7.11** below). As the girders would be supported on sill beams, there would be no requirement for driven piles, therefore reducing construction noise on site.

Fauna Underpasses

Figure 6-7 shows the main fauna underpasses and culverts along the Proposal. Fauna underpasses would be located to maximise effective wildlife movement within identified corridors for north-south movement. The underpasses would have a dimension of 3m x 3m and 3m x 2.1m respectively and be designed according to best case RTA practice for fauna movement, including provision for Koalas in the vicinity of the Proposal. The underpasses would also contain appropriate “fauna furniture” and would be resolved at the detailed design stage. Fauna fencing would be provided adjacent to the underpasses to restrict animal movement (and reduce the potential for road kill) across the highway. Final location of the underpasses would be determined during final design.

Pedestrian Underpass

Discussions with Hastings Council have indicated a possible future pedestrian underpass requirement in the general location of 7km600. This is not part of the Proposal. It would be dependent upon the future use of the land either side of the highway in that location. Further consultation will be carried out with Hastings Council during their planning process and the environmental impact assessment, design and funding for an underpass would be the responsibility of Hastings Council.

Major Culverts

Box culverts of varying sizes would be provided over known watercourses along the Proposal to maintain natural surface water flow. The main locations include the eastern section in low lying land, and in depressions at several locations along the western section of the Proposal. As these culverts only carry water in times of rain they would also be utilised for fauna movement.

6.5.6 Noise Attenuation

A detailed noise study was undertaken by Renzo and Associates to establish existing noise levels, make recommendations about noise abatement and assess the impact of projected noise and vibration impacts of the Proposal. Refer to **REF Volume Three, Working Paper 14**.

A number of noise treatments have been identified and incorporated into the concept design stage of the Proposal, including:

- solid noise walls combined with sound mounding (max. 5m high)
- transparent noise wall on bridge (max. 1.5m high)
- architectural treatment of selected dwellings
- road surface treatment.

Table 6-4 as well as **Figure 6-8** and **Figure 6-9** refer.

In addition, it should be noted that a feature of the Proposal is the distance of the corridor from a large majority of dwellings in the study area, and the horizontal and vertical gradients adopted to minimise road traffic noise.

Noise environmental safeguards are mainly required between the central overpass and Wrights Road. **Table 6-4** describes the height and location of proposed noise walls.

Table 6-4: Location and Height of Noise Walls

Chainage	Side	Approx Length (m)	Nominal Height (m)
6700-6400	South	300m	1.5m
5450-4800	South	650m	5m
5500-4800	North	700m	2.5m
4800-4650	North	150m	1.5m

Source: Renzo & Assoc (REF Volume Three, Working Paper 14)

The treatment of noise walls would vary according to their location:

- Transparent noise walls are proposed at the overpass to allow views into the floodplain and to provide a lighter appearance to the bridge structure.
- Towards the eastern end, the walls are proposed in the form of a combined sound mound/noise wall. This would visually mitigate the overall height of the wall through the introduction of landscape measures. The wall would be slightly tilted towards the outside to provide a more dynamic and less static character. The mounding would be higher on the outer side (community side) to visually mitigate its prominence.

The surface treatment of the walls is proposed similar to the bridge abutment walls to create a unifying composition. Anti-graffiti coating is proposed versus painting the walls because it provides a visually more pleasing solution and the risk of the walls being subjected to graffiti is not considered high. Hence, the visual quality as part of the entrance sequence to Port Macquarie is considered more important.



OXLEY HIGHWAY UPGRADE

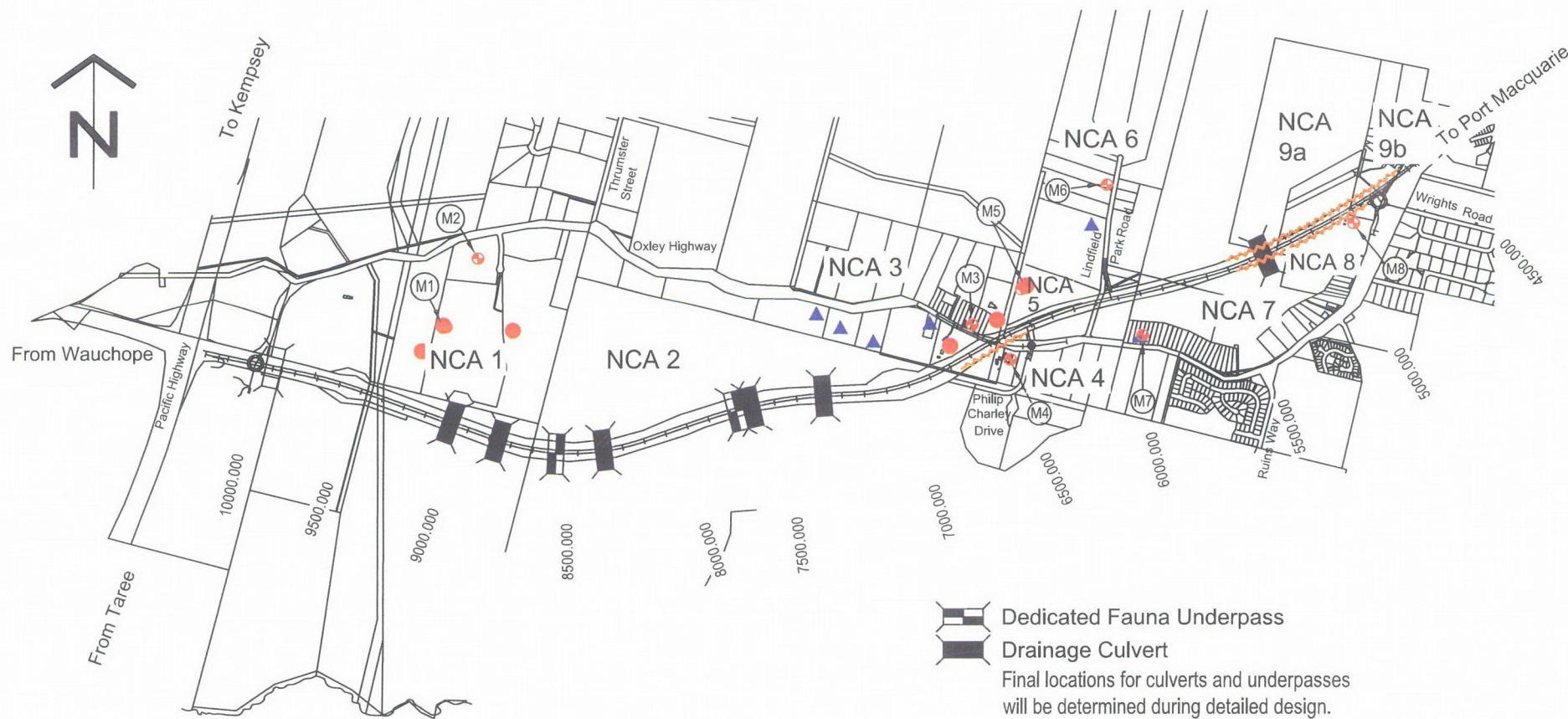


Fig. 6.7
Location of Fauna Underpass
and Major Culverts



OXLEY HIGHWAY UPGRADE



- Architectural Treatment of Residence
- ▲ Post Construction Monitor
- Noise Wall/Mound

Figure 6.8
Noise Environmental Safeguards
for Proposal



OXLEY HIGHWAY UPGRADE

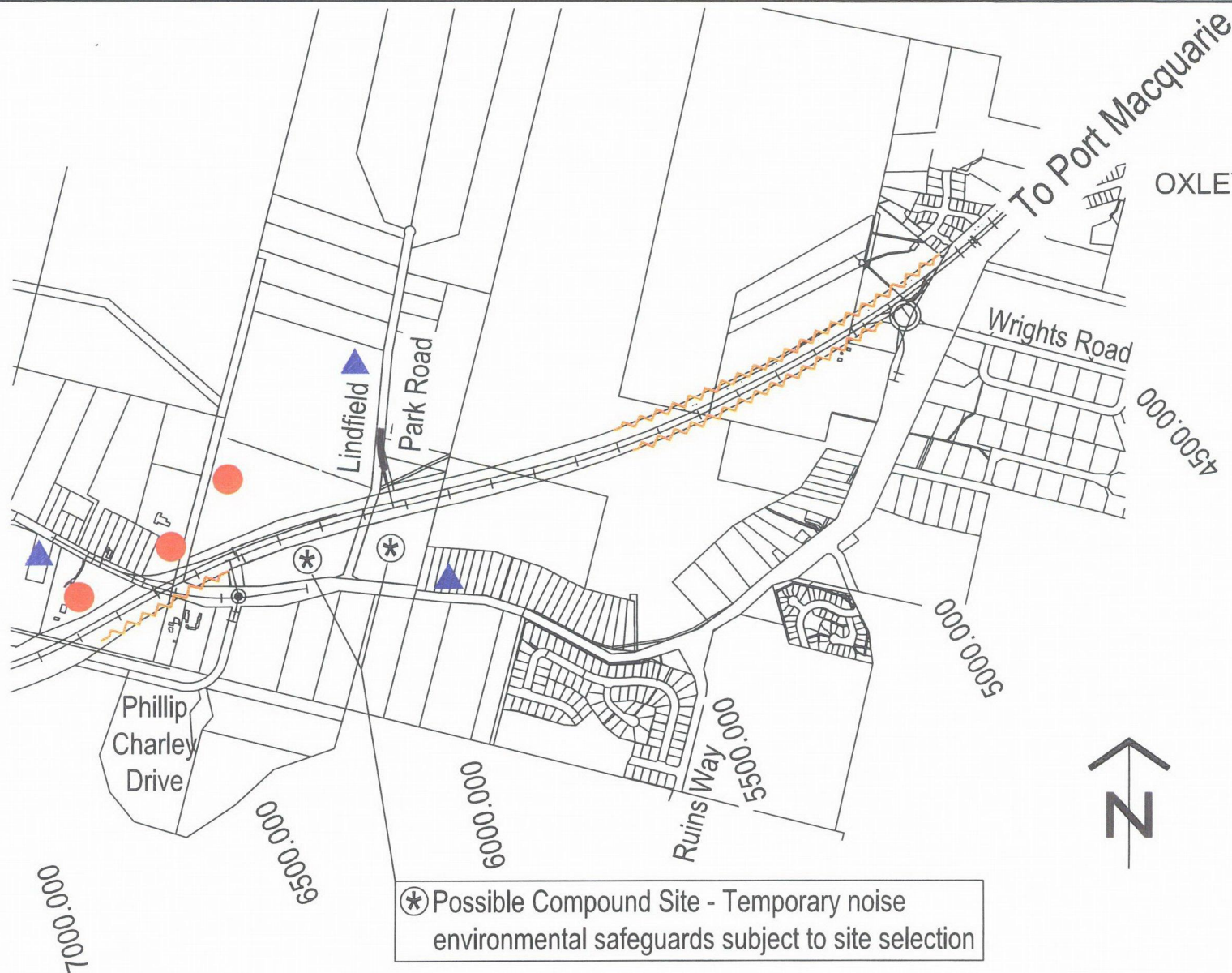


Figure 6.9
Noise Environmental Safeguards
Eastern Proposal

6.5.7 Drainage

The Proposal crosses the Partridge Creek flood plain and the upper part of the Lake Innes catchment area. The major culvert locations are detailed in **Section 6.5.5**. Details of the drainage are contained in **REF Volume Three, Working Paper 8**.

The Proposal would meet the following objectives in relation to drainage:

- runoff conveyed quickly off the pavement to prevent aquaplaning
- runoff dispersed to prevent flooding and erosion
- no ponding at low points on the pavement
- runoff water treated to reduce sediment and pollutant loads
- protection of SEPP14 wetlands to the south and north.

In cut locations, water would be collected in table drains and this would then be dispersed into the existing drainage environment. Similarly, water on embankments and in the median would be collected and dispersed into the existing drainage environment.

Sediment basins, pollution control ponds and vegetated swales would be utilised to minimise impact on the SEPP14 wetlands. The final location and size of these ponds would be determined during detailed design.

6.5.8 Local Access

A small number of private accesses need to be provided to those portions of properties severed by the construction of the new highway. These would be licensed points of access with left in/left out capabilities only. As future rezoning of these severed parcels occurs these licensed point of access would be reviewed.

6.5.9 Trucks, Bicycles and Public Transport

An objective of the project is to cater for efficient movement of freight. All vehicle types would be catered for including B-Doubles. The Proposal makes provision for use by B-Doubles, including adequate turning paths at intersections.

Provision is made in the concept design for the Proposal for cyclists to safely travel along the corridor by way of a 2.5m wide sealed shoulder. Squeeze points would be avoided in the detailed design (for example at drainage structures or bridges) unless suitable alternative arrangements are made for cyclists. Road crossing points would be limited to intersections at which provision would be made for safe pedestrian and cycle access.

Pedestrian and cycle facilities would be provided for safe linkage between the northern and southern development areas. The need for such facilities would be discussed with Hastings Council during the detailed design stage.

Pedestrian activity on the Proposal would be minimal due to limited access and no parking being permitted. Accordingly, there is no special provision made for pedestrians along the Proposal. However, a 2.5m wide sealed shoulder on outer lanes in both directions would be provided clear of the traffic for use by pedestrians and cyclists. Grass and vegetated verges would be provided beyond the shoulder.

Buses would travel along the Proposal but are unlikely to stop due to limited access to subdivisions. Existing bus routes that run along the Oxley Highway to and from Wauchope would extend into new subdivisions as they develop.

It is expected that all bus stops would be on the local road network with the exception of express buses to and from Wauchope. These buses may need stops at both ends of the Proposal.

6.5.10 Earthworks Quantities and Batter Slopes

Earthwork quantities are expected to be balanced for the project and have been derived adopting batter profiles shown in **Figure 6-4**. The expected earthwork figure is in the order of 330,000cu.m but this will be further refined in the final design.

It is proposed to provide a bridging layer in low-lying areas especially in the eastern section due to the high probability of having to work in wet areas.

As the quality of material within the site is poor for the bridging layer, selected material layer and pavement layers would all be imported, and may include clean rock and or bottom ash.

The majority of the earthworks would occur on the western section with cuts up to 17m in depth and fills up to 9m in height. Cut batters are generally at a 2 Horizontal to 1 Vertical (2H:1V) slope but are likely to be flattened at the ends of the cuttings during final design. Cut batters would also be provided with a 4m wide berm at 7m vertical interval. Fill batters would generally be flattened to 4 Horizontal to 1 Vertical below 3m in height.

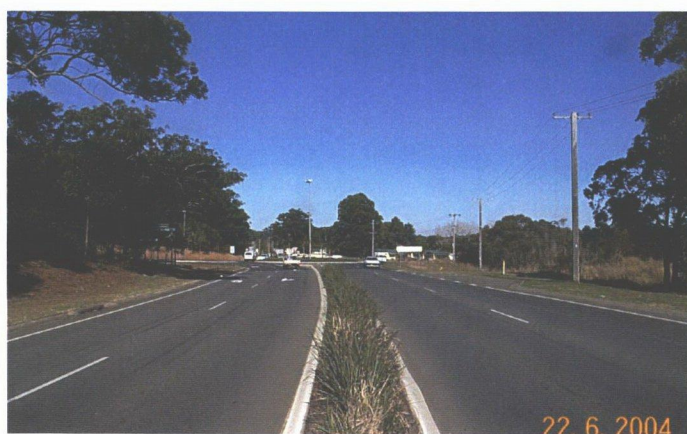
6.5.11 Roadside Furniture

Lighting

Lighting is currently provided for the roundabouts at Wrights Road and the service centre roundabouts, as well as the junction of Lindfield Park Road and the Oxley Highway.

It is proposed to light the new roundabouts at Wrights Road, Philip Charley Drive and the service centre as well as the new seagull intersection at Lindfield Park Road. The off-load and on-load ramps at Philip Charley Drive would also be lit to a suitable standard.

Lighting spill at intersections would be considered at the detailed design stage in consultation with adjacent residents and Council.



Looking west from existing highway towards Wrights Road roundabout.

Fencing

The proposed road would be declared a controlled access road upon completion and the entire road boundary would be fenced. Consultation with adjoining owners would be undertaken during the acquisition process to ensure acceptance of the type of fencing to be constructed.

In the environmentally sensitive areas to the west, the fencing would consist of wildlife exclusion fencing which would funnel wildlife to the dedicated fauna underpasses and other box culvert structures.

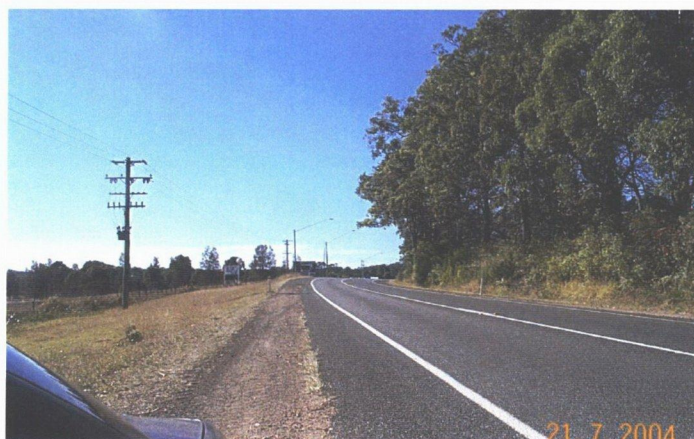
Signage

Signage along the Proposal would be in accordance with current RTA policy guidelines.

Consultation with Hastings Council as well as the CLG would be undertaken during the final design process to determine the extent and nature of any major signage requirements with a view to enhancing the entrance to Port Macquarie.

6.5.12 Public Utilities

Provision has been made in the Detailed Concept Design for adjustments to existing utility services (including fibre optic networks, minor power lines and water mains) that run along the road corridor.



*Existing Oxley Highway
looking East towards Lindfield
Park Road*

6.5.13 Landscape Design

The integrated Urban Design and Landscape Concept Plans show the proposed planting design with urban design elements such as noise walls and noise mounds, wire rope barrier and fauna fencing.

Figure 6-10 shows typical cross-sections of landscape design intended for the Proposal.

Details of the Landscape Concept Plan are contained in **REF Volume Three, Working Paper 13**, and shown in **Figure 6-11**.

The landscape design approach integrates earthworks, planting, drainage and wildlife corridor issues. Key issues considered were treatment of the large cuts, careful integration of filling over the floodplain and integrating wildlife movement across the corridor.

The planting design promotes the establishment of local indigenous native species (through natural regeneration, bushland regeneration and reintroduction) to develop plant communities which are better able to self-perpetuate under the modified site conditions.

Where possible, and practicality, all planting areas other than those at key intersections, would have mixes that reflect the local indigenous species in proportions and diversity which represent the original community (or a serial stage towards its development). The aim is to establish a self-perpetuating plant community representative of the original native plant community that existed on the site in which sufficient natural regeneration processes would occur to maintain species diversity and structure.

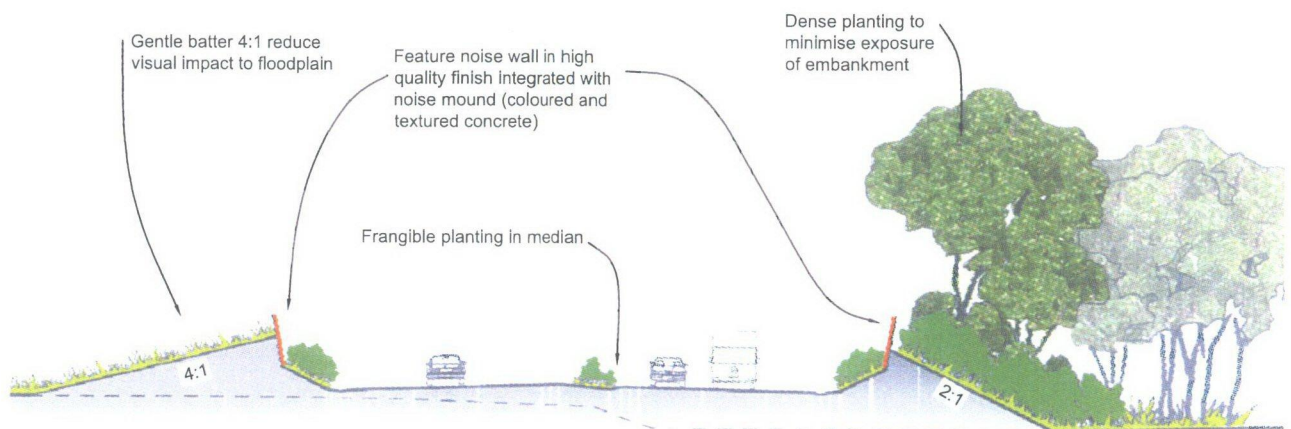
The specific details would be considered in a Landscape Management Plan compiled during the detailed final design.



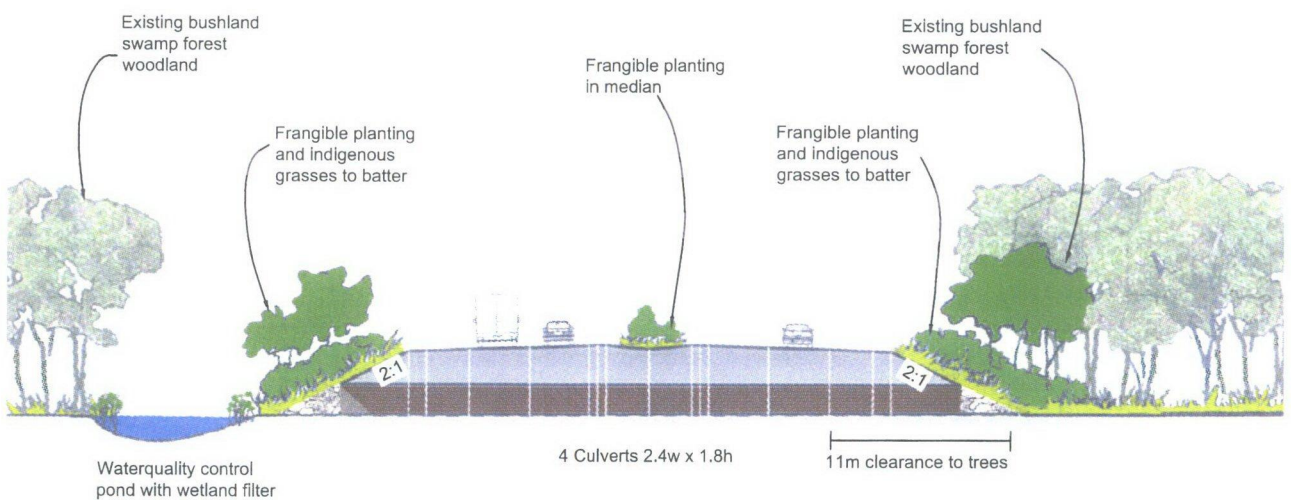
Photomontage of the Proposal in the Eastern Section between Lindfield Park Road and Wrights Road



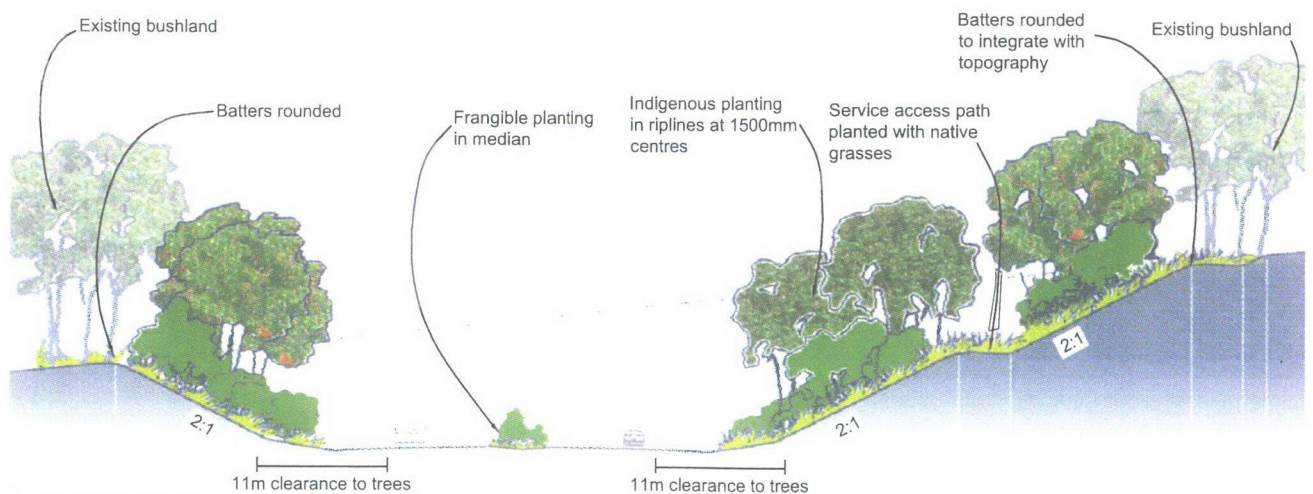
OXLEY HIGHWAY UPGRADE



EASTERN



CENTRAL



WESTERN

Figure 6.10
LANDSCAPE DESIGN CROSS SECTIONS



0 100 200 300 400 500m

Photo Source - Klah Infranet

6.6 Land Acquisition

The RTA has previously acquired approximately 15.2ha of land along the Preferred Corridor.

Figure 6-12 shows the land acquired and that to be acquired if the Proposal is approved.

Acquisition surveys have been completed previously from Wrights Road to the crossover and from the western extent of Charley Brothers land (Lot 3, DP 826241; Lot 32, DP 809231) to the service centre near the Pacific Highway.

Approximately 26ha of Rural 1A land is still required for acquisition. Most of this land is through Area 13, the future urban growth area of Port Macquarie. Two properties, which have previously been affected and acquired, would now have an additional effect on them due to design changes. These are located at the crossover and at the major cut east of the service centre.

Final acquisition boundaries would be set to cater for future upgrades of the major access points as urban development progresses.

6.7 Construction

6.7.1 Construction Staging

The Proposal is for the construction of the entire project over a period of up to 18 months. Following the clearing and grubbing and stripping of topsoil, the bridging layers for support of the formation and pavement would commence. This would also include the construction of drainage structures. Bulk earthworks would then commence in the western section.

The earthworks stage would allow fill material for the construction of the bridge over the existing Oxley Highway. During the construction of the bridge there would be an opportunity to complete the earthworks and pavement for the eastern section to allow this section to be opened to traffic earlier in the project. There would be a temporary connection to the existing Oxley Highway, west of the proposed overbridge.



Existing highway looking west
from central cross-over.

6.7.2 Typical Construction Sequence

The description of construction activities outlined in this section is typical for a project of this size. There may be variations to the activities described depending on the method of delivery of the project.

The main tasks in general order of sequence would include:

- Establishment of site compound
- Temporary barriers and signage
- Relocation of public utilities
- Pre-clearing and relocation of any significant fauna
- Clearing and grubbing of vegetation
- Installation of temporary erosion, sediment and water quality controls
- Fencing
- Stripping, stockpiling and management of topsoil
- Sedimentation basins
- Drainage structures
- Bridging layers
- General earthworks
- Construction of bridge over Oxley Highway
- Construction of noise walls/mounds
- Construction of roundabouts and road connections
- Pavement construction
- Progressive topsoiling and revegetation of batters and berms
- Landscaping
- Linemarking and signposting
- Intersection lighting
- Finishing works
- Site clean-up and removal of compounds

6.7.3 Construction Traffic

Table 6-5 shows RTA estimates of truck volumes during construction of the Proposal. The figures have been based on the full length of the project being constructed as a single stage of operation. Construction vehicles would be in operation between 7am and 6pm on weekdays and 8am to 1pm Saturdays, with no work to be undertaken on Sundays or public holidays.

Table 6-5: Construction Truck Movement

Description	Fill Stage	Pavement Stage
Trips per day	250	140
Duration	18 weeks	20 weeks

The construction period is estimated at 18 months. Material would be excavated from the western section and transported to the eastern section as fill material. This would involve up to 250 truck movements per day for up to 18 weeks.

Imported pavement material would be required for the Project and would arrive via the Pacific Highway. Pavement materials for the western section would enter at the western end of the project near the service centre. Haulage of the pavement material to the eastern section would be via the existing Oxley Highway. The pavement stage would require 140 truck movements per day for up to 20 weeks, 12 weeks for the western section and 8 weeks for the eastern section.

OXLEY HIGHWAY UPGRADE

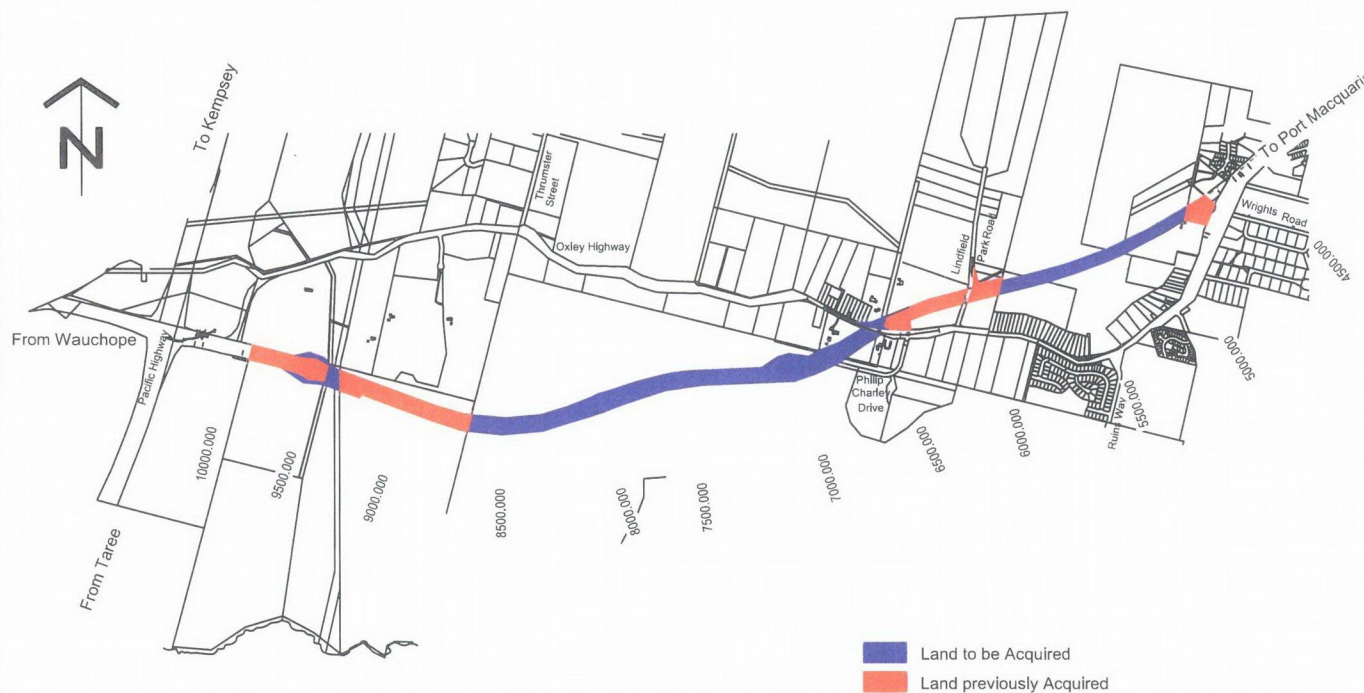


Fig. 6.12
Existing and Proposed
Land Acquisition

6.7.4 Temporary Access Arrangements

Access to all local roads and private entrances would be available throughout the duration of the construction works. The majority of the works would be clear of the existing highway and therefore existing access would be easily maintained. Access along Lindfield Park Road would need to consider construction traffic as it crosses Lindfield Park Road and this would be addressed in the detailed design.

The works would be undertaken by a Contractor selected after a competitive tendering process.

6.7.5 Construction Equipment

It is anticipated that equipment during construction of the Proposal would include:

- Light transport vehicles
- Rollers
- Backhoe
- Wood chippers
- Stump grinders
- Chainsaws
- Water tankers
- Excavation trucks
- Cranes
- Concrete pumps
- Cement trucks
- Service vehicles
- Excavators
- Bulldozers
- Graders
- Front-end loaders
- Compactors & compressors

Many of these items of equipment would be sources of noise and air pollution, as well as generators of potential Occupational Health and Safety (OHS) issues and other environmental impacts such as hazardous spills. The potential environmental impacts of this equipment are discussed in **Section 7** of the REF.

6.7.6 Additional Fill Material

Construction materials to be won from the bulk excavation of the proposed cuttings are as follows:

- residual silty clay
- extremely to highly weathered rock.

Laboratory testing has indicated that the above materials are likely to be suitable only for use as General Fill and Upper Zone of Formation (UZF) during construction. Pavement materials, select quality fill, drainage blanket and bridging layer material would need to be sourced outside the project area.

RTA records indicate that there are three commercial quarries in the Port Macquarie/Wauchope area that are capable of supplying the materials required for construction would include the following (**Figure 6-14** refers):

- Sancrox Quarry (CTK) – located along Sancrox Road, Wauchope
- Maxwell Bros Quarry (Rosewood) – located on the corner of Quarry Road and Rosewood Road, Wauchope
- Johns River Quarry (Boral Resources) – located on Bulleys Road at Johns River (South of Kew, approximately 35km south of the Oxley Highway).

6.7.7 Compound Sites

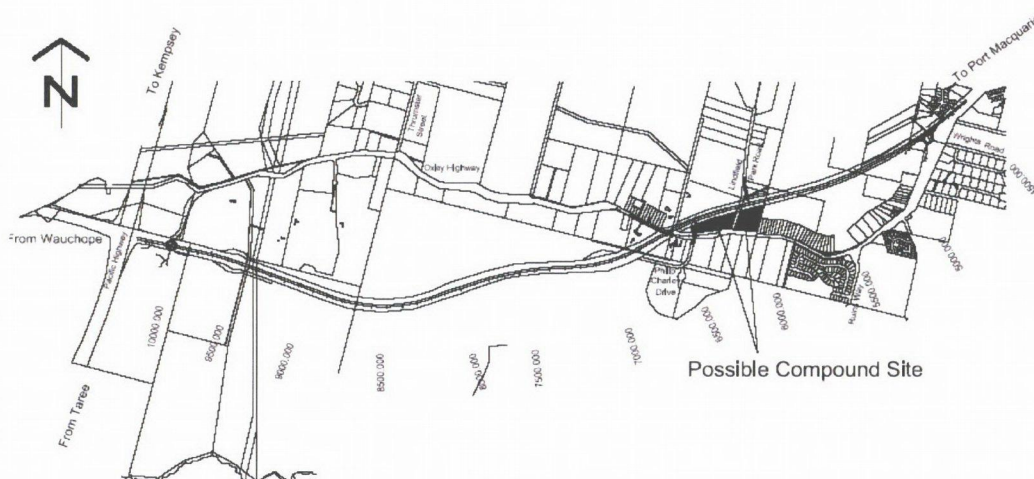
A possible location for the project compound site has been identified adjacent to the Proposal on the southern side, immediately east of the central crossover bridge. **Figure 6-13** refers.

The compound would have an area of approximately 4ha, and contain the following activities:

- site offices
- lunch rooms and worker facilities including toilets, showers, first aid
- vehicle and fuel storage.

The site would be fenced and treated as a secure area with night lighting and security patrols. The potential environmental impacts relating to the compound sites are discussed in **Section 7.13**.

Figure 6-13: Possible Compound Site



6.7.8 Stockpile Sites and Batching Plants

The actual sites used for stockpiling of materials and batching plants (concrete; asphalt) would be the responsibility of the ultimate road contractor, and it is possible that existing works sites away from the Oxley Highway would be used.

Both types of facilities, including associated truck movements, would be subject to individual environmental assessment as well as Hastings Council regulations for truck movements along local roads.

Figure 6-14 shows the location of possible material sources and batching plants in the district surrounding the study area.

Some material (eg. bridge girders) may require transport over long distances, depending on the location of manufacture, and truck movements associated with this material (expected to be relatively minor) would require consideration in a traffic plan of management for the site to be prepared by the Contractor prior to commencement of works.

Parameters that would be considered in the siting of the above facilities include:

- existing operations in the local area (eg. quarries, industrial sites)
- the need for environmental protection in terms of water quality, noise and visual impact
- cleared land on a relatively flat surface if a new site is to be used
- distance from the project site, and use of roads through urban areas.

The potential environmental impacts relating to the stockpile sites and batch plants are discussed in **Section 7.13**.

6.7.9 Workforce and Working Hours

A wide variety of employment would be created during various stages of the project, both on and off the site.

Although difficult to estimate accurately, the main stages of the project could generate a combined total of approximately 1,400 jobs on-site and off-site in support activities including material supplies, road design and related activities. Many of these jobs would be generated locally for the duration of the project.

The major construction components of the project are listed in

Table 6-6.

Construction works would normally be restricted to the following standard working times:

- Monday-Friday 7am to 6pm
- Saturday 8am to 1pm
- Sunday and Public Holidays No work

Table 6-6: Construction Components

Major Construction Milestones	Approximate Duration
Carriageway Ch 4500 to Ch 6500	8 months
Carriageway Ch 6500 to Ch 10200	10 months
Bridge over existing Oxley Highway	8 months

Much of the project is located in areas away from residential areas. This provides substantial operational advantages during the construction stage.

Work required outside standard working hours would be subject to the procedure contained in the RTA's Noise Management Manual, "Practice Note vii – Roadworks Outside of Normal Working Hours".



OXLEY HIGHWAY UPGRADE

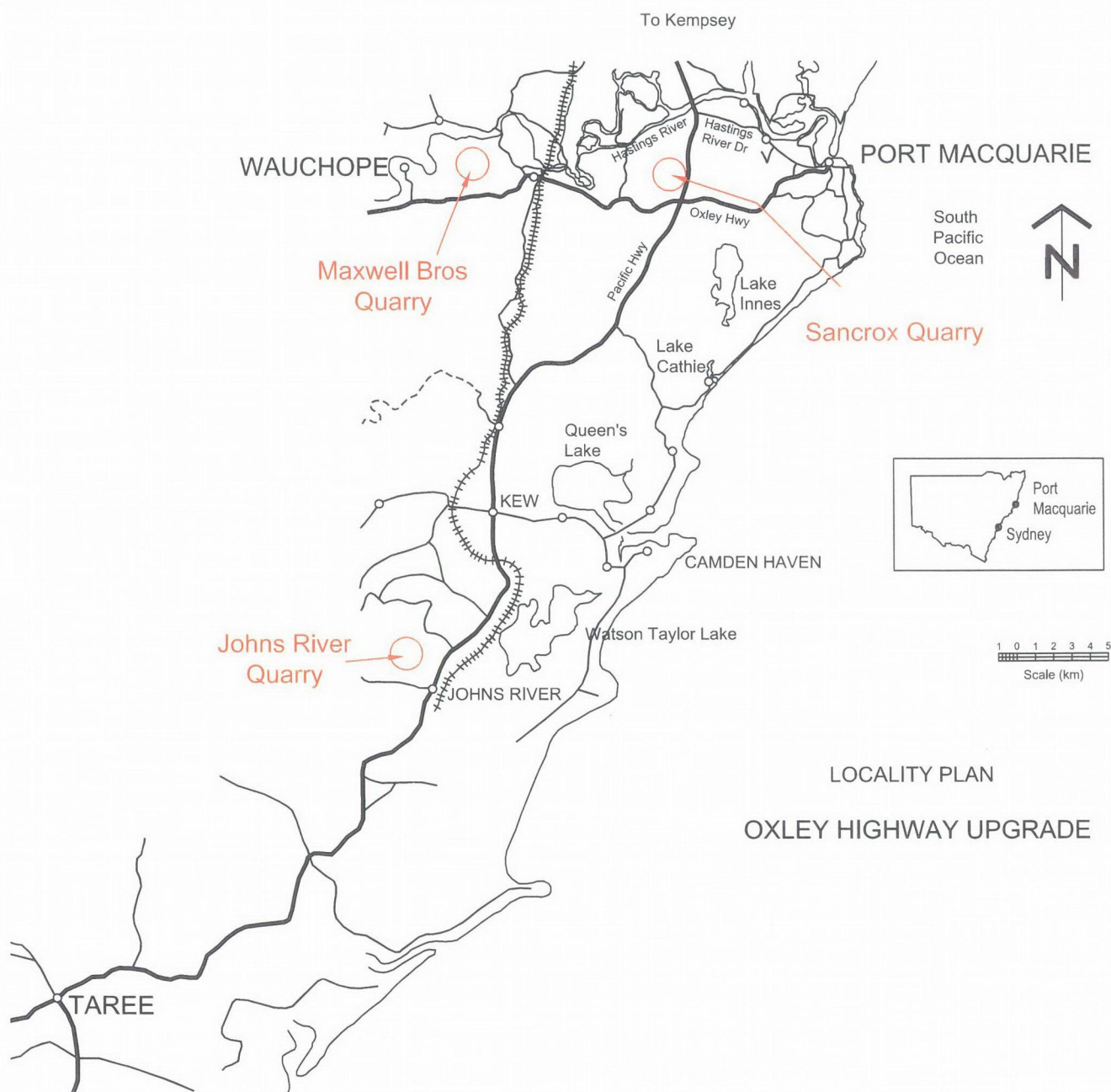


Fig. 6.14

Possible Sites for Off Site Materials
Stockpiles and Batching Plant

6.8 Road User Benefit Cost Analysis

An economic analysis for the project has been carried out in accordance with the RTA's Economic Analysis Manual 1999, the objective being to generate an economic model for the work that proves a strategic Road User Benefit/Cost ratio (RUBCR) that will give an indication of the economic viability of the Proposal. The Road User RUBCR considers factors such as travel speed savings, accident savings, maintenance costs and construction cost.

The Road User BCR for the Proposal indicates that the Proposal will provide a return to the community of at least four times the investment (a RUBCR of 4.2) when a standard RTA discount rate of 7% is used.

A full breakdown is shown in the Traffic Study in **REF Volume Two, Working Paper 6**.

6.9 Refined Concept Design

In May 2004, the Minister for Roads launched a public display for public comment showing the Refined Detailed Concept Design including intersection arrangements.

The process undertaken by the RTA in identifying the Proposal and subsequently defining the Refined Detailed Concept Design for the Proposal has entailed consideration of various environmental impacts associated with individual options, and has resulted in an outcome that has a number of sustainable environmental features as summarised below:

- creation of a safe road design comprising dual carriageway and limited access/egress, allowing for efficient traffic movement with reduced energy costs for users
- reduced reliance on the existing highway with its associated safety and amenity problems
- water quality detention basins (ecological wetlands)
- minimum disruption to habitat within the road reservation, including wire rope barrier to be installed where vegetation is retained to the bottom of fill
- fauna underpasses and culverts for terrestrial fauna along wildlife corridors and minimised road footprint to facilitate migratory aerial movement of juvenile and mature gliders
- fauna exclusion fencing to direct animal movement along safe corridors, and reduce potential for road kill on the existing highway
- appropriate plantings of food trees to enhance habitat values for Koala and Glossy Black Cockatoos
- provision for on-road cycling
- noise amelioration in areas occupied by existing residential development
- minimum disruption to existing land uses within the road corridor
- protection and conservation of known indigenous heritage resources.

These environmental safeguards are embedded in the Proposal and will reduce the environmental impact on the Proposal as well as providing an acceptable environmental outcome. Details of the environmental safeguards are in **Section 8**.

7 Environmental Assessment

This section of the REF makes an assessment of the potential environmental impacts of the Proposal. The assessment is made on the basis of detailed scientific studies where appropriate, using the best available information and predictive models.

The environmental assessment describes the existing situation, predicts the possible impacts of the Proposal, and identifies environmental safeguards that would be required to address potential impacts.

The RTA approach to this project has involved an iterative process whereby the environmental safeguards have been incorporated in the Proposal. The assessment of the likely significance of the environmental impacts of the Proposal would be undertaken inclusive of those environmental safeguards.

The construction contractor would be required to prepare a Construction Environmental Management Plan (CEMP) in accordance with the specifications set out in the RTA's *Environmental Protection (Management Plan) – QA Specification G36, Soil and Water Management (Soil & Water Management Plan) QA Specification G38, and Clearing and Grubbing QA Specification G40*.

The CEMP would incorporate additional site specific requirements, outlined below, which are not covered by G36. The CEMP would be reviewed by the RTA's Environmental Adviser, Northern Region, prior to the commencement of any site works, and would represent a further environmental safeguard in the planning and construction process.

The RTA website www.rta.nsw.gov.au/doingbusinesswithus/specifications provides details on all RTA technical specifications referred to in this Section.



Approximate location of central cross-over looking south from the existing highway.

7.1 Geology, Soils and Landform

This section is based on extracts from a detailed report by the RTA on geotechnical investigations contained in **REF Volume Two, Working Paper 7**.

7.1.1 Existing Situation

Geology

Reference to the 1:250 000 Metallurgical Geology Series Sheet SH56 for Tamworth/Hastings indicates that the Proposal intersects four geological formations within the Port Macquarie Block, as described below:

- Quaternary Alluvium (Qa): comprising mud, silt, sand and gravel
- Fault Zone Complex (Pd): comprising dolerite, gabbro, diorite, basalt, chert and jasper, tonalite, trondhjemite, quartz feldspar porphyry, of early to middle Permian age
- Thrumster Slate (Pet): comprising slate, meta-sandstone and metagranule conglomerate, of early Permian age
- Touchwood Formation (Cet): comprising siltstone, sandstone, conglomerate, basaltic breccia and keratophytic andesite, of early Carboniferous age.

The metamorphic Thrumster Slate Formation underlies the majority of the western half of the study area, whilst the sedimentary Touchwood Formation mostly underlies the eastern half.

These metamorphic and sedimentary formations are intersected by a series of igneous strata associated with the Fault Zone Complex. The geological map indicates that two known contact faults, running roughly NNE-SSW, cross the Proposal at approximate chainages 5900m and 9400m.

The geological map also indicates an additional seven contacts between the Fault Zone Complex and the Thrumster Slate or Touchwood Formations, with similar orientations to the known faults. The strata may be conformable, but folded, or contacts may be faulted.

Soils

Reference to the Kempsey 1:100 000 Soil Landscape Sheet and Report published by DIPNR (formerly Department of Land and Water Conservation-DLWC) indicates that the Proposal crosses three 'Soil Landscape' units, these being:

- the Thrumster residual soil landscape unit
- the Cairncross transitional soil landscape unit
- the Christmas Creek swamp soil landscape unit.

The erosion hazard within the above soil units has been classed as moderate to high for the Thrumster unit, low to moderate for non-concentrated flows and high for concentrated flows for the Cairncross unit, and low for the Christmas Creek unit. Further limitations for each of the soil units are as follows:

- Thrumster – deep regolith, low wet bearing strength, high permeability, strong acidity, aluminium toxicity hazard and low sub-soil fertility
- Cairncross – flooding hazard (localised), waterlogging, run-on, foundation hazards, low wet bearing strength, sodicity, very low permeability, strong acidity, high aluminium toxicity and low fertility

- Christmas Creek – regular flooding hazard, waterlogging, foundation hazards, high plasticity, low wet bearing strength, organic soils (localised), sodicity (localised), low permeability, extreme acidity, high aluminium toxicity potential, low fertility, and acid sulphate soils (localised).

The majority of the soil types encountered along the Corridor are generally silty clays. Soil classification analysis on soil samples taken from the proposed cuts generally classified the soils as medium to high plasticity silts and clays.

Landforms

The landforms listed below are related to the corresponding soil landscape:

- Thrumster Unit - Undulating and rolling rises of 30-60m elevation. Crests dominate the landscape and are broad with slopes of up to 15%.
- Cairncross Unit - Transferral landscapes bordering residual landscapes and linking residual areas with depositional areas. They consist of broad open-depressions and foot slopes of low relief (<2m) and low elevation (1-5m).
- Christmas Creek Unit – Back swamps and flood basins forming extensive swamps of extremely low relief and low elevation.

The Proposal lies predominantly within the Thrumster unit, although a significant length of the eastern section of the Corridor, from near the eastern tie-in at Wrights Road (4900m) to where the Proposal crosses the existing highway (6500m), lies mostly in the Cairncross unit. Near the centre and at the lowest point of this 1.6km section (5300m to 5550m), the Proposal crosses a short (approx 250m) section of the Christmas Creek swamp unit.

The Cairncross unit is also encountered in the western section of the Proposal between approximate chainages 7500m to 7800m and 8200m to 9150m.

7.1.2 Potential Impacts

Harder materials may be encountered in the Fault Zone Complex geological formation which may require blasting, but it is unlikely that this area would be affected by the Proposal. Therefore it is not anticipated that any blasting would be required as part of the Proposal.

The exposure of the residual soils and extremely weathered rock located in the proposed cuttings may result in sheet or rill erosion, as has occurred within the existing borrow pit at chainage 9500m. With respect to dispersion, the results of the Emerson Class Number Tests on soil samples taken from the proposed cuts have indicated that the soils along the Proposal slake but do not disperse. This would indicate that the soils are only moderately susceptible to erosion in the areas of the proposed cuts. Some scouring is also expected at the downstream end of most of the culverts included in the Proposal due to the projected high velocity of stormwater that would be experienced during rainfall events.

Existing erosion and sedimentation patterns have the potential to be affected by the Proposal. The proposed removal of vegetation and earthworks would potentially increase the amount of topsoil exposed to erosion by wind and rain.

Although there are no permanent waterways within the study area, drainage lines eventually lead to the SEPP 14 wetlands located to the north and south of the study area. Sedimentation from the Proposal during construction would potentially result in the degradation of aquatic habitats and water quality within the SEPP 14 wetlands as well as reducing the aesthetic values of surrounding land through the accumulation of soils and sediments.

7.1.3 Environmental Safeguards

- A Soil and Water Management Plan (SWMP) would be prepared in accordance with G38 as part of the Contractors Environmental Management Plan (CEMP) in consultation with DIPNR and DEC prior to the commencement of construction. The SWMP would address the management measures detailed in Section 6.5.1 (Erosion and Sediment Control), 6.5.2 (Stockpile Management), 6.5.3 (Water Quality) and 6.5.4 (Water Extraction) of the RTA's QA Specification G36.
- Consultation would be undertaken with DIPNR prior to construction to identify suitable strategies to be incorporated into the SWMP to prevent erosion and sedimentation during the construction stage.
- No earthworks would be undertaken during periods of moderate or heavy rainfall.
- Appropriate surface drains would be provided to collect and direct clean water around works areas.
- Drainage structures would be installed to protect exposed batter slopes during construction.
- Adequate protection would be provided to prevent soil erosion and siltation of local streams. Silt fences and barriers would be provided to prevent sediment laden runoff from leaving the construction area. Felled trees and shrubs from clearing activities would be reused where appropriate in windrows to address soil erosion.
- Sediment traps would be installed at existing drain inlets where runoff is likely to occur from the construction site.
- Soil batter protection cover such as grass covering on cut soil slopes and compacted fill embankments would be undertaken progressively as works in each area are completed
- Cut and fill batters would be designed at a maximum 2H:1V slope to reduce the risk of erosion. In the large cuttings, berms have been provided at 7 metre intervals (vertically) to minimise the flow length vertically down the batters.
- Geofabric sediment fences would be installed downslope of all disturbed areas.
- If water is pumped from boreholes at any time during construction, it would be appropriately contained and treated prior to discharge to prevent off-site sedimentation. Re-use options would be investigated where possible.
- Vegetation clearance and soil disturbance would be limited to those areas required for construction purposes.
- Regular inspection of the work site would be undertaken during construction activities to ensure that the SWMP is implemented properly and all sediment traps and drainage structures are functioning.
- Sediment basins of an appropriate size and nature (refer *"Managing Urban Stormwater – NSW Dept Housing, 1998"*) would be located at strategic points along the roadway to capture sediment from the road in the long term.
- All stockpiles would be established, managed and decommissioned in accordance with RTA's *Stockpile Management Procedures, 2001*. In addition, all stockpiles would be located at least 50m away from any drainage lines.
- Hard-stand material would be implemented at entry and exit points and would be positioned strategically along major access routes throughout the construction corridor.
- Scour protection would be provided at the downstream end of all culverts. Methods for scour protection associated with the implementation of culverts would include soft engineering options. All scour protection options would be designed in consultation with DIPNR and the RTA's Regional Environmental Advisor during the detailed design stage.

7.2 Contaminated Land, Asbestos and Acid Sulphate Soil

This section is based on extracts from a detailed report by the RTA on geology and soils contained in **REF Volume Three, Working Paper 7**.

7.2.1 Existing Situation

Substantial desk-top research and field testing was undertaken by the RTA to identify the presence of potential soil contaminants, asbestos and / or acid sulphate soils (ASS) in the Proposal corridor and adjacent areas.

The various tests undertaken by the RTA did not identify any significant sources of soil contamination, asbestos or acid sulphate soils within the vicinity of the Proposal.

Contaminated Land

A broad based contamination investigation was carried out to assess the presence of potential contaminant sources, which could affect the construction of the Proposal.

Contamination is generally defined as the presence of a substance at concentrations above those normally found in that locality. Contaminated soils usually result from past or present activities of the land use or from accidental spillages of stored chemicals. Depending on the concentrations present and the environmental setting, contaminated soils may pose a risk to human health and/or the environment (Parsons Brinckerhoff, 2003).

The geotechnical investigations did not identify any obvious contamination sources. Test pit 332 at the western end of the project encountered 2.3m of shale fill, but there were no indications of contamination within this material. There is a stockpile of fill at the eastern end of the Proposal, but visual inspection of stockpile samples did not indicate contamination.

The DEC does not have any listings of contaminated sites within the study area.



Urban development is encroaching towards the Proposal

Asbestos

Construction of the Proposal could potentially disturb soils and/or rock (serpentinities) containing asbestiform minerals. Serpentinite is a metamorphic rock that is composed almost completely of serpentine group minerals. This includes Chrysotile, known as fibrous serpentine, which comprises about 95% of commercial asbestos. Serpentinite is known to occur in the Port Macquarie area, and if located along the Proposal would incur a significant cost to effectively manage.

In order to reduce, or possibly eliminate, the implications of disturbing asbestiform minerals, investigations were conducted on the Proposal to determine:

- the potential for construction disturbance of asbestiform minerals
- the extent of the problem
- steps to minimise or eliminate disturbance.

Surveys and rock samples were undertaken along the Preferred Corridor in December 2003 along the entire Corridor. Asbestiform minerals were not detected in any of the soil and rock samples tested.

Based on the findings of the RTA's surveys, the likelihood of encountering asbestiform minerals in either residual soil or rock materials during construction is considered to be low.

Acid Sulphate Soil

Reference to the 1:25 000 Acid Sulphate Soil (ASS) Risk Map for Wauchope / Port Macquarie indicates a high probability of ASS within the top 1m of the soil profile in the swampy area associated with the Christmas Creek soil landscape unit (approximate chainages 5300m to 5550m).

A total of 17 samples from the current investigation and the corridor selection investigation were tested for the presence of potential ASS. Thirteen samples were excavated from the Christmas Creek soil landscape unit. A further 4 samples were excavated from other low-lying areas throughout the project length. Samples were taken at intervals down the soil profile to a maximum depth of 2m.

None of the samples tested has given an indication of the presence of potential or actual ASS. There is the possibility that ASS may be located at greater depths in the soil profile, but this is unlikely to be disturbed during construction as excavation for the Proposal is unlikely to be greater than 500mm in depth.

7.2.2 Potential Impacts

The presence of any or all of these types of soil contamination could result in potential OH&S issues for construction workers, and degradation of the environment, as well as a substantial increase in project costs, and increased construction delays.

Contaminated Land

The Hastings Council Local Property Register identified the following potential contamination sources in the vicinity of the Proposal:

- Shell Service Station – Corner Oxley Hwy and Pacific Hwy – Stored Fuel
- Lincoln Greenery – 4 Lincoln Road Port Macquarie – Pesticides/Herbicides

The Proposal has the potential to create contaminated land in the construction stage through spillages of fuels and chemicals. The main chemicals likely to be stored and used on

site would include herbicides and fuels. These would be retained in a bunded area and used and stored in accordance with the appropriate guidelines.

Spillages of fuels and other chemicals (from heavy vehicles) could also occur during the operation phase due to accidents on the new road. This potential already exists on the Oxley Highway, and the Proposal is not expected to increase that risk. In creating a safer road, the proposal may actually decrease the risk of accidents, and hence fuel spillages. This is discussed further in **Section 7.16**.

Asbestos

The disturbance of soils and/or rock containing asbestiform minerals during construction potentially has significant adverse implications, on occupational health and safety issues (potentially requiring a change in work method to protect the health and safety of site workers) as well as construction time and costs.

Acid Sulphate Soils

Areas where ASS may be encountered are in the vicinity of the low lying, swampy land. This land is predominantly located along the corridor where there is Christmas Creek soil landscape present. Actual ASS within the Partridge Creek catchment has been recorded in the past, which is mapped as Christmas Creek soil landscape.

The environmental risk associated with ASS in the study area would only be associated with deep excavation, or exposure of ASS to groundwater. If ASS are drained or excavated they would become extremely acid due to the exposure of pyrite to the air. A number of oxidation products are formed, but the principal end product is sulphuric acid. Following heavy rains, these oxidation products may then enter drains and other waterways forming a toxic effluent that may affect aquatic fauna within the SEPP 14 wetlands, the Partridge Creek catchment and eventually Lake Innes and the Hastings River.

It should be noted that the likelihood of disturbing ASS during most construction activities would be extremely low given that excavations on site are unlikely to go below 500mm. There would also be deeper excavations for the relocation of utilities. This is addressed in more detail in **Section 7.14**. In the swampy areas where ASS are most likely to be encountered, there would be no intentional disturbance of even the topsoil layer, as a geotextile fabric would be laid down and covered with a bridging layer and then fill.

The likelihood of an adverse impact on the environment through disturbing any ASS for the Proposal is extremely low.



Low lying area in eastern section of the Proposal.

7.2.3 Environmental Safeguards

Contaminated Land

- Any contaminated lands identified during construction would be managed in accordance with Section 6.16 (Contaminated Ground) of the RTA's QA Specification G36.
- Should unexpected contaminated material be disturbed during earthworks, control measures would be implemented to capture surface runoff and the material would be removed from site and disposed of at an approved DEC site in accordance with the appropriate guidelines.
- Should any spillage occur during the construction activity, the Environmental Adviser, Northern Region, would be contacted immediately, and contaminants would be immediately contained, removed, treated (if necessary) and disposed of to the satisfaction of DEC.
- If imported fill is required it would be sourced from an approved stockpile site or supplier.

Asbestos

- Should soil or rock materials containing asbestiform minerals be excavated during construction, they would be managed in accordance with DEC Environmental Guidelines – Assessment, classification and management of liquid and non-liquid wastes (1999) and Clause 29 of the Protection of the Environment Operations (waste) Regulation 1996
- Risk management procedures for the possible occurrence of materials containing asbestiform minerals would be formulated in accordance with the RTA's QA Specification G22 prior to commencement of earthworks operations. These would be reviewed by the REA prior to implementation.

Acid Sulphate Soil

- Where excavation is to take place below 500mm, excavated materials would be tested for the presence of ASS. Where ASS is present, it would be treated in accordance with the RTA's Guidelines for the Management of Acid Sulphate Soils (Draft, February 2004).

7.3 Hydrology, Hydraulics and Water Quality

This section is based on extracts from a detailed report by WBM Oceanics Australia on Hydrology and Hydraulics contained in **REF Volume Two, Working Papers 8 and 9**.

7.3.1 Existing Situation

Hydrology and Hydraulics

The proposed Oxley Highway Upgrade route traverses the headwaters of the Partridge Creek (Hastings River) and Lake Innes water catchments.

Figure 7-1 shows the location of water courses and sub-catchments in relation to the Proposal and adjacent study area.

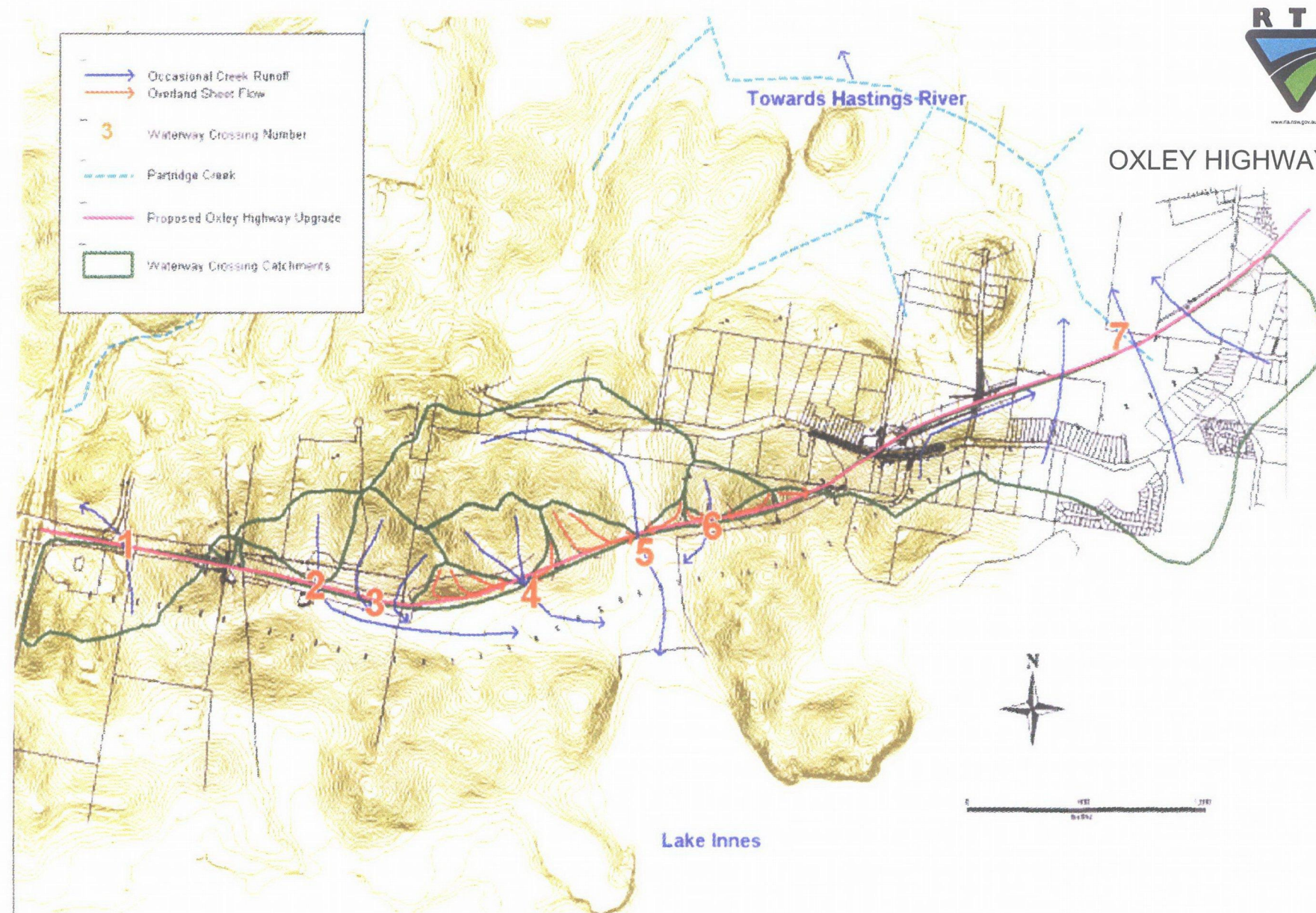


Fig. 7.1
Water Courses and Catchments

The eastern section of the Proposal drains into Partridge Creek, with the western section mostly draining into Lake Innes. The central portion of the proposed route is also located within the Lake Innes catchment area. Runoff in this region flows generally south towards Lake Innes. The far western and eastern portions of the proposed route are located within the Partridge Creek catchment. Runoff in this region flows generally north into Partridge Creek, which then flows into the Hastings River.

The lowest point crossed by the Proposal is in the eastern sector between Wrights Road and the central crossover. This section forms part of the Partridge Creek catchment draining north into the Hastings River.

The Proposal would pass through existing natural flow paths, where storm water runoff concentrates while flowing downstream to floodplains. The characteristics of the flow paths crossing the highway corridor vary depending on the location, with the following points listing the main hydraulic conditions in the study area:

- *Occasional Runoff Creek.* Located at the bottom of a catchment thalweg, the occasional runoff creek is usually dry, draining water only during storm events. The creek slope is relatively steep, preventing backwater effects. The Proposal embankment crosses 6 of these creeks on its western side (approximately chainage 6500 to 10000). The upstream catchments are of varying size, and the downstream creek cross-sectional shapes are mostly flat as they enter the wide Lake Innes floodplain.
- *Overland Sheet Flow.* This type of drainage flows down the side of catchment hills (particularly in the western section of the study area) in an un-concentrated form. The hydraulics of the flow is not one of a free-surface channel, but of sheet flow, which is much slower.
- *Floodplain Area.* The eastern portion of the Proposal (approximately chainage 4500 to 6500) passes through the upper Partridge Creek floodplain. Partridge Creek flows into the Hastings River approximately 6km downstream of the study area. At the Proposal, flood levels within Partridge Creek and its floodplain are influenced by the Hastings River tailwater levels. Existing developments upstream of the Proposal within this floodplain area are currently impacted by existing flood levels.

The floodplain is approximately 1km wide, and is essentially influenced by the downstream Hastings River. For the 100 year ARI flood event, floodwaters from the Hastings River back into Partridge Creek and up to the Proposal, with flood levels peaking at 3.3m AHD. A concurrent flood in the Port Macquarie catchments would result in a wide flow path filling the bottom of the floodplain where the longitudinal flood gradient is flat.

Water Quality

Since none of the seven creek lines intersected by the Proposal contain permanent water flows, no testing of water quality has been undertaken as part of the REF studies. However, water quality testing was undertaken as part of the Aquatic Ecology Assessment for the Oxley Highway Corridor Options Study (AMBS, June 2003). Four sites were sampled within the larger study area; 2 farm dams and 3 drainage lines containing ephemeral pools. It should be noted that none of these sampling sites are located directly within the footprint of the Proposal, but their results give an indication of the general state of the water quality within the study area. The results of the water quality testing are shown in **Table 7-1**

Overall, the pH values were slightly below the recommended range indicating that the waters are slightly acidic. The turbidity of the waters was generally within the recommended range. The sites had very little influence from salinity and conductivity was generally below the recommended range. Two of the sites were within the recommended range of dissolved oxygen and 3 were below the range.

Table 7-1: Water Quality

					Average	ANZECC GUIDELINE
Water Quality Parameters	9100 Dam 1	9100 Dam 2	8800	6600	6000-5700	Default trigger values
Temperature (degrees Centigrade)	22.71	22.2	21.99	19.75	20.04	not recommended
pH	5.89	6.12	6.28	5.82	6.12	6.5-8.0
Turbidity (NTU)	51.5	228	14.4	1.1	6.5	6-50
Salinity (ppt)	0.08	0.04	0.08	0.11	0.06	not recommended
Dissolved Oxygen (%sat)	85.4	105.1	59.5	27.4	47.06	85-110 (%saturation)
Conductivity (uS/cm2)	115	59	129	165	42.97	125-2200

Source: AMBS, June 2003

7.3.2 Potential Impacts

Hydrology and Hydraulics

A section of the Proposal would be located south of the existing highway (chainage 6500 to 10200) cutting through forested catchments feeding Lake Innes' tributaries. The remainder of the Proposal (chainage 4500 to 6500) would be positioned north of the existing highway across the upper Partridge Creek floodplains.

The only changes in topography that would occur as a result of the Proposal are the construction of embankments and cuttings. The proposed embankment would block natural overland sheet flow. Runoff would be collected in longitudinal drains on the upstream side of the highway embankment instead of flowing along the hills down to the floodplain as it does in the existing natural situation. These longitudinal drains would convey runoff to the proposed waterway crossings through the embankment. From each waterway crossing, runoff would then flow via existing flow paths to the main creeks.



Looking west along the Proposal from ridge towards service centre and Pacific Highway.

The catchment limits would be directly influenced by the positions of the waterway crossings. There are approximately 40 low points that can be identified along the existing ground profile. Of these, seven dominant low points were selected as locations for waterway crossings (culverts). They correspond to the natural gully lines at the bottom of the catchment valley. The remaining minor low points would flow to longitudinal drains and then to the dominant low point crossing.

It is proposed that drainage would be achieved either naturally or with the use of urban drainage structures such as concrete gutters or grass swales. Concrete gutters and grass swales would be located at the top of cuttings and at the toe of fills. **Figure 7-1** shows the boundary of the different catchments.

The catchments associated with the waterway crossings numbered 2 to 6 are essentially forested. Catchment 1 and Catchment 7 contain developed areas, either residential or commercial, with impervious areas that may increase the volume of runoff. It is expected that additional runoff due to the transformation of vegetated land into concrete carriageways would flow into the downstream catchment if the drainage retention basins exceed capacity. As the downstream catchments are substantially large, being either Lake Innes or the Hastings River floodplain, no changes of great impact would be expected both in terms of water levels or peak flows. For minor floods up to the highway drainage system capacity, no changes would be expected downstream.

Some of the waterway culvert crossings would result in an increase in the upstream peak 100 year flood level. A total culvert opening of 55m is proposed in the design of the Oxley Highway upgrade, which would have an afflux of 4mm upstream for the 100 year ARI event. It is impossible to accurately define the extent of the impacted zone due to the lack of reliable topographic data, however a survey of local house floors on the northern side of the existing Oxley Highway showed minimum levels of 3.6m AHD. With house floor levels set at 3.6m AHD or higher, existing residences upstream of the proposed highway within the floodplain area would not be affected by potential increases in flood levels.

Water Quality

Approximately 90% of long term rainfall on directly connected impervious surfaces will typically translate into surface runoff. Approximately 20% of long term rainfall on pervious surfaces will typically translate into surface runoff. The Proposal would substantially increase the amount of runoff that is directed into both the Lake Innes and Partridge Creek catchments through an overall increase in the amount of impervious surface in the catchment area.

The Partridge Creek catchment flows into the Hastings River, which is used for both recreation and primary industries (fishing, oyster farming). The Lake Innes catchment is used primarily for nature conservation as it constitutes Lake Innes Nature Reserve. Both Lake Innes and Partridge Creek catchments contain large areas of SEPP 14 wetlands; hence they are both highly sensitive environments and contain elements that are important on both a local and state level.

During the construction phase, water quality would be affected by erosion and sedimentation as surfaces are exposed during earthworks. This has been discussed in detail in **Sections 7.1** and **7.2** above.

During the operation of the new Oxley Highway, water quality would be potentially impacted by stormwater runoff from the road containing categories of pollutants including coarse sediments, litter debris and organics (gross pollutants), total suspended solids, heavy metals and hydrocarbons, free oil and grease and nutrients.

In determining the impacts of the road on water quality, it should be noted that the Proposal would not induce additional traffic using the Oxley Highway. Rather, it will shift the impacts away, to some degree, from the receiving environment of the current Oxley Highway. That is, the Oxley Highway already exists and is currently subject to stormwater quality issues. Such impacts include accidental spills, as well as typical road runoff pollutants. Should an accidental spillage occur during the operational phase, the drainage system would be capable of containing a full transport tank (B-double) of spilt chemicals, after a large rainfall event.

All surface runoff from the carriageways would be conveyed into the longitudinal drainage system. This system would transport the water down to the low points of the longitudinal profile where it would be treated in retention basins before being released into the natural waterways. The longitudinal toe drain outlets would incorporate retention basins in order to treat the highway runoff for water quality purposes where required. Water quality treatments are particularly required where the drain discharges into SEPP 14 wetlands.

7.3.3 Environmental Safeguards

- Water quality would be managed according to details in Section 6.5.3 (Water Quality), 6.5.4 (Water Extraction) and 6.13 (Spillage Prevention and Contamination Management) of the RTA's QA Specification G36.
- The placement of fill material would not be undertaken during periods of rain.
- Stockpiles would not be located within 50m of drainage lines.
- Washout of vehicles, plant or equipment, including cement trucks, would only take place in an impervious bunded area, at least 40m from the nearest drainage line. All water from the washout site would be collected, treated and disposed of in accordance with the appropriate DEC guidelines.
- Dirt and mud would be washed from vehicles leaving the construction area to prevent tracking onto the road. This would be undertaken in an impermeable truck wash area that would be cleaned out as soon as tracking starts to occur.
- Horizontal and long profiles for the Proposal would be designed to accommodate the 1:100 year flood event.



Open grazing land north of the Proposal.

- Culvert drainage would be installed at low points along the Proposal.
- A grassed median strip would be installed, draining its own runoff plus the carriageway runoff where a superelevation configuration exists. The median water would be collected through drainage pits located at strategic points for construction and operation purposes and piped outside of the carriageway to a drainage outlet.
- Detention ponds and wetland filters would be constructed at selected locations along the Proposal. The RTA's Regional Environmental Adviser would review the location and design of these during the detailed design stage.
- The proposed stormwater quality management strategy for the upgrade of the Oxley Highway would incorporate both vegetated swales and sedimentation basins to reduce the annual pollutant loads of Total Suspended Solids, Total Phosphorous, and Total Nitrogen.
- Stormwater treatment such as grass swales or linear roadside strips would be installed where possible for "soft" treatment of runoff from the road surface. The RTA's "Procedure for selecting treatment strategies to control road runoff Version 1.1 June 2003" would be consulted in the selection and design of appropriate treatments.
- Vegetated swales would be provided adjacent to the road as a stormwater treatment measure to convey and filter stormwater where longitudinal gradients are typically in the range 0.5% to 5%. If vegetated swales are to be constructed at slopes greater than 5%, they would need to be suitably reinforced or lined to limit the potential for erosion. Vegetated swales would not be constructed on gradients less than 2% as they may be too flat to perform a conveyance role, with a greater potential for sag points to form along the swale, leading to trapped and possibly stagnating water.
- S-O type gutters would be placed on the side of the Proposal embankment where necessary, collecting the carriageway runoff. The gutter water would be conveyed either through drainage pits or batter drains at design locations to the outer edge of the edge of the footprint where it would be either dispersed via contour drains or carried via a longitudinal toe drain to a water quality pond.
- Sedimentation basins would be installed as an end of line treatment measure to be positioned at chainages corresponding to low points along the length of the highway. The proposed sedimentation basins would target an average hydraulic residence time of approximately 24 hours to ensure adequate time for settling of the suspended solids. Sedimentation basins would be positioned off line alongside the northern and southern sides of the road reserve to receive road runoff conveyed by the vegetated swales and concrete channels.
- The sediment basin sizes would be further optimised by incorporating additional controls in series upstream where practicable. In particular, vegetated filter strips adjacent to the carriageway between the edge of the road pavement and inlets to the drainage system would be provided where possible. The filter strips would assist in reducing the sediment load discharging to the vegetated swales and sediment basins, effectively reducing the maintenance frequency for the treatment measures.
- Specific temporary or permanent sediment traps would be constructed at the toe of the road batters in order to intercept eroded sediment before it enters the drainage system;
- Any herbicides used for weed control would be used in accordance with the Pesticide Act 1999 and Pesticide Amendment (Records) Regulation. Such herbicides would not be stored near drainage lines.

- All fuels and chemicals would be stored within a fully impervious bunded area with the capacity to contain 110% of the contents stored.
- All proposed culverts would be designed and constructed in such a way as to minimise disturbance to any waterways and in accordance with the NSW Government's Flood Policy 1984, and the NSW Government's Floodplain Management Manual, 2001.
- A permit would be sought from DIPNR in accordance with the Water Act 1912 or the Water Management Act 2000 at the time of construction if it becomes necessary to extract water from any waterways. The RTA's Regional Environmental Adviser would also be consulted as to the location of access and methodology in which water would be required.

7.4 Climate

7.4.1 Existing Situation

Climatic information for the study area is taken from the Bureau of Meteorology (BoM) Port Macquarie Weather Station (No. 060026). This weather station, located approximately 5.6km northeast of the study area at Hills Street, Port Macquarie, has been recording meteorological data since 1840 (BoM, 2004).

The study area lies within a warm temperate to sub-tropical climatic zone and is strongly influenced by its proximity to the ocean. The Hastings LGA experiences a marked dry season and a summer-autumn wet period. This pattern is usually reliable in its relative monthly distribution whether in drought or wet years. About 60% of average annual rainfall occurs between December and April. The annual average rainfall for Port Macquarie is 1541mm with February receiving the highest average monthly rainfall (177mm). The annual number of rainy days for Port Macquarie is approximately 134 with March experiencing the highest average monthly number of rainy days (14).

The BoM (2004) has documented significant weather events resulting in heavy rain, hail and strong winds for the Mid North Coast area (which includes Port Macquarie). The latest significant weather events for Port Macquarie occurred in January 2000 (resulting in wind gusts of 93km/h), December 2001 (resulting in heavy rain and 3cm hail), August 2003 (resulting in hail up to 2cm) and January 2004 (resulting in power blackouts and winds greater than 91km/h).



Approximate location of central cross-over looking north from existing highway.

BOM data on temperature collected since 1840 show mean daily maximum temperatures in the Port Macquarie district range from 25 – 26°C between December and February to 18 – 19°C between June and August. Mean daily minimum temperatures range from 17 – 18°C between December and February to 7 – 8°C between June and August. Extremely hot conditions can be experienced during the summer months (in excess of 40°C has been recorded in December and January), associated with hot dry north-westerly winds. Very cold conditions can also be experienced during the winter months (a low of 0°C has been recorded in August), associated with south-westerly fronts bringing strong winds and snow to adjacent mountainous areas in the west.

Wind directions in the Hastings LGA show a seasonal pattern, with winds during the summer months usually from the northeast and winds during the winter months usually from the west to southwest. Morning and afternoon average wind speeds vary between 14.0km/h to 20.1km/h respectively (BoM, 2004). During the summer months and late spring, very hot, dry north-westerly winds may occur for several consecutive days, which result in a severe to extreme fire hazard.

Frosts are rarely experienced in coastal areas of the Hastings LGA and fogs are usually only experienced in valleys during winter (Atkinson 1999).

7.4.2 Potential Impacts

As a result of the high level of rainfall experienced at Port Macquarie, especially during the period between December and April, and the average wind speeds for the area, the risk of erosion (from rainfall and wind) would be increased during earthworks.

The significant weather events associated with the Mid North Coast area, including heavy rains, hail and high winds, all have the potential to impact on worker safety and equipment and environmental integrity during construction. Impacts could include accidents due to poor working conditions with potential spillages and environmental degradation. Construction problems such as sediment-laden water draining from the site or the formation of dust could be amplified during these adverse weather conditions.

Works undertaken during very hot, dry north-westerly winds over consecutive days also has the potential to increase the generation of fires.

7.4.3 Environmental Safeguards

Measures to minimise the risk of erosion, particularly during high rainfall, are described in **Section 7.2** of this REF. Measures proposed to mitigate potential impacts arising from climatic conditions include the following:

- The CEMP for the Proposal would include procedures that cover construction activities and safety during inclement weather such as high winds and heavy rain.
- Works involving cutting, welding, grinding or other activities likely to generate fires would be limited during very hot, dry north-westerly winds.
- Advice from the BoM regarding warnings for significant storm events would be sought daily. This information would be obtained from the BoM website (<http://www.bom.gov.au/weather/warnings.shtml>) or obtained through the Bureau Telephone Weather Services on 1300 659 218.

7.5 Air Quality

This section is based on a detailed report by Holmes Air Sciences on the predicted changes in local air quality associated with the Proposal, contained in **REF Volume Two, Working Paper 10**.

The assessment included an estimation of potential impacts to the local air quality resulting from operation of the Proposal, in addition to providing measures to reduce any impacts to air quality that may occur during the construction of the Proposal. No specific assessment of greenhouse impacts has been undertaken for the Proposal.

The estimation of motor vehicle emissions was based on the use of a computer model to determine the dispersion of emissions and to predict ground-level concentrations of the various exhaust components in the area close to the road.

As part of the assessment, the Caline4 dispersion model was used to estimate the concentration of oxides of nitrogen, carbon monoxide and particulate matter less than 10 micron (PM₁₀) that are likely to be produced in the vicinity of the proposed Southern Deviation Corridor and to determine to what degree the subsequent changes in traffic volumes on the Oxley Highway may affect these emissions.

The National Environment Protection Council of Australia (NEPC) has determined a new set of air quality goals for adoption at a national level, which are part of the National Environment Protection Measures (NEPM). In its publication "Action for Air" (EPA, 1998), the NSW DEC has adopted new air quality goals for PM₁₀ and carbon monoxide consistent with the new NEPM Standard. These air quality goals are used as the assessment criteria for this REF study, and make the NSW standards for these pollutants consistent with the NEPM standards.

No air quality monitoring was undertaken specifically for this assessment and there are no DEC monitoring stations in the vicinity.

7.5.1 Existing Situation

The Oxley Highway is located in a rural residential area and although traffic volumes and industrial emissions would influence air quality, it is unlikely that concentrations would exceed any of the air quality goals.

7.5.2 Potential Impacts

Operation

Potential impacts on air quality resulting from the Proposal were assessed by comparing the predicted ground-level concentrations of roadway emissions for 2003, 2011 and 2021, with air quality goals or other air quality criteria where specified goals were not available.

Concentrations of carbon monoxide (CO), nitrogen dioxide (NO₂) and particulate matter (TEOM PM₁₀) were estimated using the Caline4 dispersion model, using a worst case approach to this assessment, and using vehicle emission rates provided by the (then) NSW EPA.

Using fixed receptors set at 0m, 10m, 20m, 30m and 50m intervals from the outside edge of the proposed road, ground level concentrations of roadway emissions were predicted for 2003, 2011 and 2021. This was done for both the eastern and the western sections of the study area. The predictions did not take into account background levels of pollutants, as in

this rural environment they are likely to be very low, and the major contributor to background levels is likely to be the roadway itself.

Results obtained from the receptors and results of modelling undertaken are summarised below:

- Carbon monoxide (CO) - All predicted concentrations are well below the NSW DEC's 1-hour goal of 30 mg/m³.
- Nitrogen dioxide (NO₂) - Although concentrations of nitrogen dioxide in 2021 show a slight increase, all the predicted values are below the NEPM and DEC goal of 246 µg/m³. All the concentrations decrease with distance from the road.
- Particulate matter (TEOM PM₁₀) - Predicted concentrations of particulate matter in 2021 show a slight increase over existing levels, but, all of the predicted values are below the 24-hour NSW EPA goal of 50 µg/m³.

Due to the present emission controls on motor vehicles and the projected traffic conditions for the years 2011 and 2016, the DEC's carbon monoxide 1-hour goals would not be exceeded as a result of traffic travelling on the existing Oxley Highway or the proposed Southern Deviation Corridor.

In addition, since the highest predicted concentrations of carbon monoxide, nitrogen dioxide and PM₁₀, (using a worst case approach to the assessment) indicate that the NEPM 1-hour goal and the PM₁₀ short-term goal of 50 µg/m³ would not be exceeded as a result of the Proposal. Furthermore, exceedance of air quality goals is not expected at sensitive receptors such as residences.

In summary, the Proposal is not predicted to have adverse air quality impacts, even in the eastern sector where it is closer to existing urban areas than in the central or western part of the Corridor. The Proposal is also more distant from existing development than is the existing Highway alignment, and would be better engineered to further reduce air quality impacts.

Construction

During construction, the Proposal has the potential to induce reductions in short term local air quality through the generation of dust and exhaust fumes from the use of bulldozers, excavators, haul trucks and wind erosion from exposed surfaces.

The effect on local residences is likely to be minor as there are few houses located within the direct vicinity of the proposed works. Environmental safeguards, detailed below, would, however, be implemented to minimise impacts during construction.

7.5.3 Environmental Safeguards

- Air quality would be managed through the implementation of safeguards detailed in Section 6.6 (Air Quality) and Section 6.18 (Restoration of Site) of the RTA's QA Specification G36.
- An Air Quality Management Plan would be prepared as part of the CEMP.
- Trucks entering and leaving the site would be well maintained in accordance with the manufacturer's specifications to comply with all relevant regulations.
- Truck movements would be controlled on site and restricted to designated roadways.
- Truck wheel washes or other dust removal procedures would be introduced to minimise transport of dust off site.

- Construction activities that generate high dust levels would be avoided during high wind periods. Stockpiles and exposed areas would be covered, watered or seeded if they were likely to be more than 2 weeks in the one location.
- Dust monitoring would be carried out at selected locations during construction to determine compliance with DEC's dust deposition goals.
- No burning would occur as part of the Proposal.



Morning traffic on eastern section of existing highway looking west.

7.6 Ecology

This section is based on an ecological assessment of the study area by Australian Museum Business Services (AMBS) contained in **REF Volume Three, Working Paper 11**.

7.6.1 Existing Situation

The ecological assessment involved a detailed review of existing information (including previous flora and fauna reports and wildlife databases) and dedicated flora and fauna field surveys, including terrestrial and aquatic habitat assessments and targeted searches for threatened species listed under the *Threatened Species Conservation (TSC) Act 1995* or the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*.

Field investigations were conducted throughout the study area and on adjoining land but concentrated in particular on the Preferred Corridor. The field investigations involved flora and fauna surveys and an aquatic assessment of the drainage lines within the study area. The surveys were staged and specifically timed to maximise the chance of detecting a representative suite of species, which occur in the area, especially more cryptic threatened flora and fauna species.

Flora

The following 5 plant communities were identified within the boundaries of the study area:

- Dry Blackbutt Tall Open-forest
- Moist Blackbutt Tall Open-forest
- Grey Ironbark/Grey Gum/White Mahogany Open-forest
- Broad-leaved Paperbark/Swamp Oak/Swamp Mahogany Open-forest
- Sedgeland.

The location and boundaries of these plant communities in relation to the study area is shown in **Figure 7-2**.

Complete, continuous stands of native vegetation are mainly restricted to the central section of the Corridor, south of the existing Oxley Highway. This vegetation has been modified through selective logging and clearing by existing landowners. Other vegetation stands in the study area are either regrowth after earlier clearing, or have been regularly grazed or otherwise modified and have maintained understoreys. However, additional clearing has occurred since the AMBS survey, south of the Proposal in the central section.

None of the plant communities in the study area constitutes threatened or endangered ecological communities of state or national conservation significance. However, based on a number of recent independent studies (refer **REF Working Paper 11**) most of the forest types that occur are considered to have regional and/or local conservation significance.

By the completion of the field survey a total of 312 native flora species were identified within the boundaries of the study area. Although the habitat within the study area is considered suitable for a number of threatened flora species previously recorded within 10km of the study area, no plant species listed on either the TSC Act or the EPBC Act were recorded within the boundaries of the study area or the Proposal. **Table 7-2** outlines those threatened flora species previously recorded within 10km of the study area and outlines the likelihood of those species occurring within the study area.

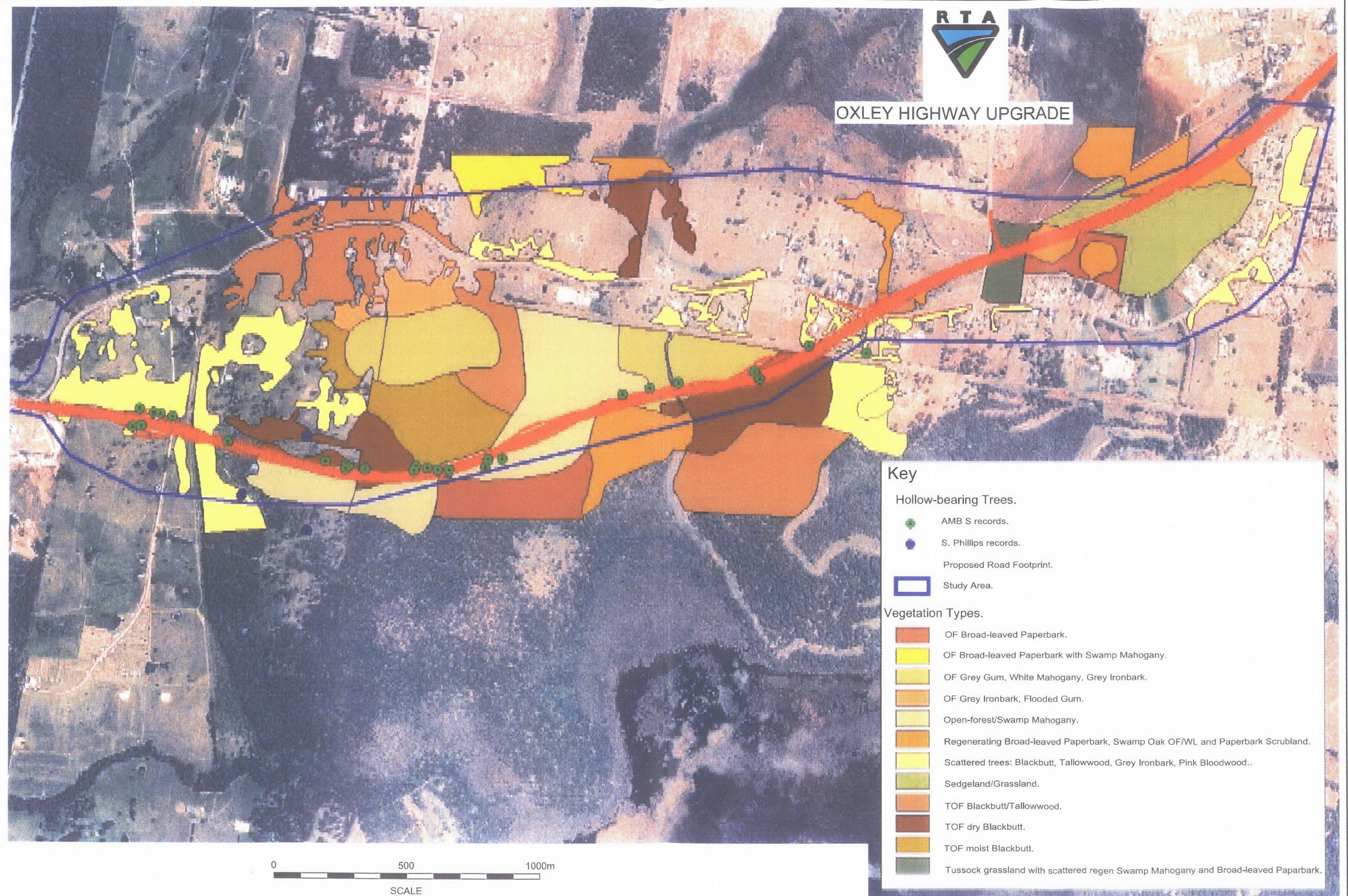


Figure 7.2
Location of Vegetation
Communities

Three regionally significant plant species were recorded in dry and moist open forest communities in the study area. These were:

- *Goodenia fordiana*
- *Persoonia levis*
- *Lomandra filiformis* subsp. *filiformis*.

The following four weed species recorded in the study area are listed as noxious in the Hastings Local Government Area:

- Lantana (*Lantana camara*)
- Bitou Bush (*Chrysanthemoides monilifera* subsp. *rotundata*)
- Groundsel Bush (*Baccharis halimifolia*)
- Crofton Weed (*Ageratina adenophora*).

Table 7-2: Threatened Flora Species within 10km of the Study Area

Species Name	Status		Likelihood of occurrence within the study area
	TSC	EPBC	
<i>Acronychia littoralis</i>	E	E	Unlikely: no appropriate habitat.
<i>Allocasuarina defungens</i>	E	E	Unlikely: no appropriate habitat.
<i>Chamaesyce psammogeton</i>	E		Unlikely: no appropriate habitat.
<i>Cryptostylis hunteriana</i>	V	V	Possible: in moist Blackbutt tall open forest along small portions of the road corridor.
<i>Cynanchum elegans</i>	E	-	Possible: in moist Blackbutt tall open forest along small portions of the road corridor.
<i>Maundia triglochinosides</i>	V	-	Possible: near a drainage line in the eastern section and near creeklines on Vilro Pty Ltd land.
<i>Hakea archaeoides</i> (formerly <i>Hakea</i> sp. Manning River SF)	V	V	Unlikely: study area well below 230m.
<i>Parsonsia dorrigoensis</i>	V	-	Possible: in dry or moist Blackbutt open forest where mature Blackbutts occur.
<i>Thesium australe</i>	V	V	Possible: in association with Kangaroo Grass.
<i>Phaius tankervilleae</i>	E	-	Possible: in Broad-leaved Paperbark Swamp at the eastern end and in regenerating stands on the Vilro Pty Ltd land.
<i>Senna acclinis</i>	E	-	Possible: in small portions of Moist Blackbutt along the road corridor on the Vilro Pty Ltd land.
<i>Melaleuca biconvexa</i>	V	-	Possible: within the cleared area that is regenerating on Vilro Pty Ltd land. Previously recorded nearby.

Source: AMBS 2004 (REF Volume Three, Working Paper 11)

Note Conservation Status: TSC = NSW Threatened Species Conservation Act 1995; EPBC = Environment Protection & Biodiversity Conservation Act 1999
V= vulnerable; E= endangered

Terrestrial Fauna

The diverse array of plant communities in the study area provides habitat for a wide range of common and widespread fauna species, including those reliant on woodland/forest, wetland, shrubland, sedgeland and modified open grassland habitats. The large tract of open forest vegetation along the Preferred Corridor south of the existing Highway (and adjoining fragmented stands to the west) provide valuable habitat for a large number of fauna species, including those species which require high structural and floristic diversity and old growth elements (eg. tree-hollows).

At the time of the AMBS survey the vegetation was determined to be contiguous with Lake Innes Nature Reserve and contributes to a north-south habitat link through the study area and wider locality. However the extent of additional clearing since the AMBS survey, south of the Proposal in the central section, has compromised the continuity of the north-south habitat link with Lake Innes Nature Reserve and reduced the value of the habitat link through the study area.

The study area also forms an integral part of a regional network of fauna habitat corridors identified by the DEC. Those regional corridors have also been compromised by the large extent of clearing south of the Proposal, through the loss of continuity in woodland/forest types. Low-lying sedgelands and associated regenerating shrubland and swamp forest also provide habitat for a wide range of fauna, including frogs, small mammals and birds. Small drainage lines and farm dams provide some limited aquatic habitat in the study area.

By the completion of the field investigations, a total of 219 terrestrial vertebrate species were recorded in the study area, comprising 150 birds, 39 mammals (10 of which were microchiropteran bats), 18 amphibians and 12 reptiles.

Of the fauna species recorded within the study area or in the immediately adjoining habitats, 17 are threatened vertebrate fauna species listed under the Schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act). The details of those threatened fauna species recorded within the study area are shown in **Table 7-3**.

Other highly mobile, wide-ranging threatened fauna species (eg. birds and bats) previously recorded within 10km of the study area that are dependent in some form or another on forest, woodland or shrubland/heath vegetation types were also considered as possibly occurring in the study area (at least on occasion) on the basis of the habitats present. Some of these species are likely to only utilise the habitats in the study area for foraging given an absence of suitable roosting habitat (e.g. cave-dwelling bats). However, other species could potentially be resident in the study area (e.g. tree-hollow dependent fauna).

Table 7-4 lists the threatened fauna species potentially occurring within 10km of the study area.

A number of migratory species listed under the provisions of the EPBC Act have also been recorded within 10km of the study area. However it was considered that the study area does not provide valuable habitat for the migratory species listed under International Migratory Bird Agreements and is unlikely to be of critical significance for the other listed migratory birds.

The study area was considered to be of particular relevance to the Koala, containing areas of 'potential' and 'core' Koala habitat as defined under SEPP 44, and preferred Koala food trees occur within stands of vegetation and as individuals along the proposed road corridor. The vegetation within the study area also contributes to a north-south habitat/movement corridor for Koalas (and other wildlife), which extends from Lake Innes Nature Reserve to

the airport and surrounds and links with east-west regional corridors north and south of the study area.

Aquatic Fauna

Aquatic habitat surveys were conducted in the study area at drainage lines or farm dams with the potential to be affected by the proposed road corridor (Refer to **Table 7-5** for the sampling locations). The aquatic assessment involved assessing the value of the habitat within the study area for native species, analysis of the physio-chemical water quality parameters and sampling for fish.

Prior to the field investigations a search of the Australian Museum Fish database and the NSW Fisheries Rivers Survey (Harris & Gehrke 1997) was conducted to determine threatened fish species previously recorded in the locality. A total of twenty-five fish species have been previously recorded within 10km of the study area. None of the species previously recorded are listed as threatened species pursuant to the *NSW Fisheries Management Act (FM Act) 1994* or the *Commonwealth EPBC Act*.

The results of water quality testing (**Table 7-5**) are shown in relation to the *ANZECC Guidelines for Fresh and Marine Water Quality, National Water Quality Strategy, 2000*. The variation in the temperature of samples at the sites was probably due to the varying depths of the different sampling locations and diurnal influences. The pH values were slightly below the recommended range indicating that the waters are slightly acidic. The turbidity of the waters was generally within the recommended range. The water had little influence from salinity and the conductivity was generally below the recommended range. Two of the sites were within the recommended range of dissolved oxygen saturation and three were below the range.

Only two fish species were collected during the habitat surveys. These were the introduced Mosquito Fish (*Gambusia holbrooki*) and the native Firetail Gudgeon (*Hypseleotris galii*). Neither of these species is considered unique to the study area and neither is considered threatened under the FM Act or the EPBC Act. No threatened fish or macroinvertebrate species of state or national conservation significance were recorded in the study area and none is likely to occur given known distribution of these species and the habitats present within the study area.

7.6.2 Potential Impacts

General Impacts of the Proposal

The potential impacts of the Proposal on the native biota and their habitats would be associated with the construction phase of the development and those associated with the long term operational phase of the road. The potential impacts of the Proposal on native biota would include:

- clearing of native vegetation and habitat loss
- habitat fragmentation and construction of barriers to fauna movement
- wildlife mortality as a result of road strike
- habitat modification
- exacerbation of Key Threatening Processes (KTPs).

In addition to the above, there would be the potential for the Proposal to contribute to adverse cumulative impacts on native biota.

Table 7-3: Threatened Fauna species in the Study Area

Species Name	Status		Location recorded within the study area.
	TSC	EPBC	
Amphibians Wallum Froglet <i>Crinia tinnula</i>	V	-	Recorded in sedgeland, and regenerating shrubland and swamp forest north of eastern portion of the proposed road corridor during the current study and earlier investigations (ERM 2002). Recorded in the Partridge Creek wetlands north of the study area (Aaso 2002).
Green & Golden Bell Frog <i>Litoria aurea</i>	E	E	Recorded in a farm dam in Lake Innes Estate just outside of the southeastern end of the study area that has since been dredged (S Phillips <i>pers comm.</i>).
Mammals Eastern Chestnut Mouse <i>Pseudomys gracilicaudatus</i>	V	-	Recorded in sedgeland, and regenerating shrubland and swamp forest north of the eastern portion of the proposed road corridor during the current study and earlier investigations (ERM 2002). Recorded in Partridge Creek area (Aaso 2002).
Koala <i>Phascolarctos cinereus</i>	V	-	Recorded throughout forest/woodland stands along the western end of the proposed road corridor. Also occurs where Koala food trees (eg. Swamp Mahogany and Forest Redgums) are present along the eastern end of the proposed road corridor (C Rowland <i>pers. comm.</i>).
Yellow-bellied Glider <i>Petaurus australis</i>	V	-	Recorded on Lewis land (M Welsh <i>pers. comm.</i>) and Vilro Pty Ltd land (Biolink 2003; C Rowland <i>pers. comm.</i>) in the western portion of the study area. Feeding notches recorded on Bloodwoods on Vilro Pty Ltd land during current study.
Grey-headed Flying Fox <i>Pteropus poliocephalus</i>	V	V	Recorded in relatively large numbers foraging throughout forest and swamp forest habitats in the study area during the current study.
Large-footed Myotis <i>Myotis adversus</i>	V	-	Calls recorded around farm dams and pools along drainage lines during the current study. Previously recorded around farm dams on Lewis land (M Welsh <i>pers. comm.</i>).
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	V	-	Calls recorded and individuals captured on Vilro Pty Ltd land along the western portion of the proposed road corridor during the current study.
Eastern Falsistrelle <i>Falsistrellus tasmaniensis</i>	V	-	Calls recorded at Anabat survey locations throughout study area during the current study.
Large Bent-wing Bat <i>Miniopterus schreibersii</i>	V	-	Recorded in the study area and on adjoining lands during previous studies (DEC Wildlife Atlas).

Species Name	Status		Location recorded within the study area.
	TSC	EPBC	
Little Bent-wing <i>Miniopterus australis</i>	V	-	Calls recorded at Anabat survey locations throughout study area and individuals captured on Vilro Pty Ltd land along the western portion of the proposed road corridor during the current study.
Birds Black-necked Stork <i>Ephippiorhynchus asiaticus</i>	V	-	Previously recorded in sedgeland, grassland and open swamp forest habitat north of the eastern portion of the proposed road corridor (ERM 2002).
Square-tailed Kite <i>Lophoictinia isura</i>	V	-	Recorded flying over the study area during the current investigations. Recorded previously on Lewis land at the western end of the corridor (M Welsh pers. comm; Biolink 2003).
Swift Parrot <i>Lathamus discolor</i>	E	E	Recorded previously in forest/woodland habitats in the study area (S Phillips pers. comm.).
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	V	-	Recorded flying along the proposed road corridor and surrounding forested land during the current survey; chewed <i>Allocasuarina</i> cones recorded in forest habitat along the western portion of the proposed road corridor during the current study.
Powerful Owl <i>Ninox strenua</i>	V	-	Call recorded near the cemetery immediately east of the Vilro property during the current survey.
Grass Owl <i>Tyto capensis</i>	V	-	Previously recorded in sedgeland, grassland habitat north of the eastern portion of the road corridor (ERM 2002) and at Partridge Creek to the north of the western end of the study area (Aaso 2002).

Source: AMBS 2004 (REF Volume Three, Working Paper 11)

Note Conservation Status: TSC = NSW Threatened Species Conservation Act 1995; EPBC = Environment Protection & Biodiversity Conservation Act 1999

V= vulnerable; E= endangered

Table 7-4: Threatened Fauna Species within 10km of the Study Area

Species Name	Status*		Likelihood of occurrence within the study area
	TSC	EPBC	
Common Blossom Bat <i>Syconycteris australis</i>	V	-	Possible: regenerating paperbark shrubland in the eastern portion of the study area provides potential foraging habitat.
East Coast Freetail Bat <i>Mormopterus norfolkensis</i>	V	-	Likely: potential foraging habitat & roosting resources (tree-hollows).
Common Planigale <i>Planigale maculata</i>	V	-	Possible: open forest habitats
Tiger Quoll <i>Dasyurus maculatus</i>	V	-	Possible: forested areas contiguous with Lake Innes NR in the western portion of the study area.
Brush-tailed Phascogale <i>Phascogale tapoatafa</i>	V	-	Possible: forested areas contiguous with Lake Innes NR in the western portion of the study area.
Eastern Pygmy Possum <i>Cercartetus nanus</i>	V	-	Possible: forested and shrubland areas.
Squirrel Glider <i>Petaurus norfolkensis</i>	V	-	Possible: forested areas contiguous with Lake Innes NR in the western portion of the study area.
Birds Black Bittern <i>Ixobrychus flavicollis</i>		-	Possible: swamp and sedgeland habitat and SEPP 14 wetlands to the north and south of the study area.
Australasian Bittern <i>Botaurus poiciloptilus</i>	V	-	Possible: swamp and sedgeland habitat and SEPP 14 wetlands to the north and south of the study area.
Osprey <i>Pandion haliaetus</i>	V	-	Possible flying over study area, no suitable foraging habitat within the study area; potential nesting and foraging habitat associated with Lake Innes NR and SEPP 14 wetlands adjoining the study area.
Masked Owl <i>Tyto novaehollandiae</i>	V	-	Likely: potential foraging habitat and roosting resources (tree-hollows).
Rose-crowned Fruit-dove <i>Ptilinopus regina</i>	V	-	Possible: forested stands provide potential foraging habitat, although preferred rainforest habitat not present.
Regent Honeyeater <i>Xanthomyza phrygia</i>	E	-	Possible nomadic visitor: Swamp Mahogany provides potential foraging resources in the study area.
Barred Cuckoo-shrike <i>Coracina lineata</i>	V	-	Possible: forested stands provide potential foraging habitat, although preferred rainforest habitat not present.
Reptiles Stephen's Banded Snake <i>Hoplocephalus stephensi</i>	V	-	Possible: moist forest stands provide potential foraging habitat, although preferred rainforest habitat not present.

* **Conservation Status:** TSC = NSW Threatened Species Conservation Act 1995; EPBC = Environment Protection & Biodiversity Conservation Act 1999

Source: AMBS, 2004 (REF volume Three, Working Paper 11)

Table 7-5: Water Quality

Water Quality Parameters	Aquatic Survey Sites					ANZECC Guideline default trigger values (2000)
	ASI Dam 1	ASI Dam 2	A43	AS4	AS4	
Temperature (°C)	22.71	22.2	21.99	19.75	20.04	Not recommended
pH	5.89	6.12	6.28	5.82	6.12	6.5 - 8.0
Turbidity (NTU)	51.5	228	14.4	1.1	6.5	6-50
Salinity (ppt)	0.08	0.04	0.08	0.11	0.06	Not recommended
Dissolved Oxygen (% sat)	85.4	105.1	59.5	27.4	47.06	85-110 (% saturation)
Conductivity (uS/cm ²)	115	59	129	165	42.97	125-2200

Source: AMBS (REF, Volume Three, Working Paper 11)

Key Threatening Processes

The Proposal has the potential to exacerbate a number of KTPs currently listed pursuant to the TSC Act which are regarded to be of potential relevance to the study area and the threatened species which occur including:

- Clearing of native vegetation which is of potential relevance to a number of threatened fauna species (eg. Koala, Yellow-bellied Glider and Grey-headed Flying Fox) which have been recorded in the study area or within 10km of the study area
- Invasion of native plant communities by *Chrysanthemoides monilifera* is currently uncommon in the plant communities in the study area, but has been identified as a specific threatening process for several threatened plant species which are known from the locality and which could potentially occur in the study area (eg. *Cynanchum elegans*). The construction and operational stages of the Highway may facilitate weed invasion through the introduction of weed seeds / propagules, physical disturbance to soils, increased nutrients and light and altered drainage.

Potential Impacts on Threatened Flora Species

The plant communities which occur along the existing Oxley Highway and the proposed road corridor are considered to be locally and regionally significant, but none is considered to be of State or National conservation significance. None of the species or communities is listed as “endangered ecological communities” pursuant to the NSW TSC Act or “threatened ecological communities” pursuant to the EPBC Act. It was considered that the Proposal would not have a significant impact on any state or nationally listed threatened flora species or community.

Potential Impacts on Threatened Terrestrial Fauna Species

The potential impacts of the proposed road upgrade on threatened fauna species or their habitats recorded in the study area, or considered as potentially occurring in the study area, have been considered pursuant to Section 5A of the EP&A Act 1979. The assessment concluded that the proposed activity is likely to result in a significant impact, and hence the need for a SIS on the following three threatened fauna species:

- Koala (*Phascolarctos cinereus*)
- Yellow-bellied Glider (*Petaurus australis*)
- Glossy Black Cockatoo (*Calyptorhynchus lathami*).

Whilst the Proposal is likely to also have at least some adverse impact on the remaining threatened fauna species recorded in the study area and possibly on some of those which could potentially occur on occasion, these impacts are not considered likely to be significant.

Assessments according to the *Administrative Guidelines* provided for assessment of actions under the EPBC Act have concluded that the Proposal is unlikely to have a significant effect on threatened fauna or migratory bird species listed pursuant to the EPBC Act that have been recorded or which could potentially occur in the study area. The remaining matters of National Environmental Significance (NES) listed pursuant to the EPBC Act are not of relevance to the study area. On the basis of the above considerations, the Proposal is not likely to have a significant impact on a matter of NES. Consequently, the Proposal is not considered to constitute a “controlled action” and does not require referral to the Commonwealth Minister for the Environment for approval under the EPBC Act.

Potential Impacts on Threatened Aquatic Fauna Species

The potential impacts of the proposed road upgrade on the threatened aquatic fauna species listed under the schedules of the FM Act are considered pursuant to Section 5A of the EP&A

Act 1979. The potential impacts on threatened aquatic species listed on the EPBC Act are considered in relation to the *Administrative Guidelines* of the EPBC Act.

None of the threatened fish species, aquatic macroinvertebrate species or endangered populations currently listed pursuant to the FM Act or the EPBC Act is of relevance to the aquatic habitats in the study area. Therefore it was considered that the Proposal would not result in a significant impact on any of these species, populations or their habitats or require approval from the Minister for the Environment.

7.6.3 Environmental Safeguards

A number of environmental safeguards, as outlined below and as incorporated into the design of the Proposal, have been identified to minimise the potential impacts on the natural environment, particularly on several threatened species and their habitats.

The aim of these environmental safeguards is to minimise:

- the total area of habitat loss
- habitat fragmentation and barrier effects
- road mortality
- habitat modification and degradation.

In addition to the environmental safeguards incorporated into the design of the Proposal, a number of additional environmental safeguards would be undertaken to further minimise the potential impacts of the Proposal, as outlined below:

- Flora and fauna would be managed in accordance with Section 6.9 (Vegetation), Section 6.10 (Fauna) and Section 6.18 (Restoration of Site) of the RTA's QA Specification G36 and QA Specification G40 – Clearing and Grubbing, and QA Specification R 178 – Vegetation
- Dedicated fauna underpasses of minimum 3.0 x 3.0m and 3.0 x 2.1m dimensions would be constructed along the mid-western portion of the Proposal (approximate chainages 7640 and 8500 respectively) to reduce impacts on the Koala as a result of habitat fragmentation, barrier effects and road mortality. **Figure 6-7** refers. This would also maintain north-south movement corridors for other species.
- Native vegetation would be retained around underpass entrances and Koala feed trees would be planted around underpass entrances to direct animals to the underpasses.
- Wildlife exclusion fencing would be installed along both sides of the Proposal from the western connection to the vicinity of the proposed bridge over the current Oxley Highway.
- An asphalt strip would be placed under wildlife fences to retard vegetation growth.
- A maintenance schedule would be prepared for the wildlife fencing to contend with potential damage and any vegetation regrowth.
- Narrowing of median widths would occur in appropriate locations within the central section of the Proposal to minimise distances between trees for the movement of Yellow-Bellied Gliders.
- Narrow tree clearance zones would be retained on either side of the pavement in two locations within the central section of the Proposal to allow for movement of juvenile Yellow-Bellied Gliders.

- Pre-clearing surveys of vegetated areas (particularly hollow bearing trees) would be undertaken by a qualified and licensed person and in close communication with the RTA, the Construction Contractor and the DEC and/or Wildlife Information and Rescue Service (WIRES) to reduce direct fauna impact associated with the construction of the Proposal.
- Clearing during the breeding season for Koalas (August to December) would include relocation of Koalas found within the activity zone to an alternative location prior to commencement of work. A licensed and qualified person from NPWS would be required for this work.
- Large hollow-bearing trees would be retained within the road reserve where possible. These would be identified and tagged by a qualified ecologist prior to construction.
- Native seeds would be collected by a qualified bush regenerator prior to clearing, for use in the revegetation of disturbed areas. A particular focus would be the collection of *Allocasuarina* seeds to allow re-planting of *Allocasuarinas* in the road reserve post construction for Glossy Black Cockatoo habitat.
- Vegetation to be retained in close proximity to the road would be fenced prior to construction activities commencing so that it is not damaged by construction equipment.
- Shredded native plant material removed from the study area would be used as mulch and groundcover on disturbed areas as well as a sediment barrier where possible.
- The limits of clearing would be clearly marked and contractors would not be allowed to encroach on areas beyond the boundaries of the identified clear zone.
- Parking of machinery and vehicles would be restricted to pre-disturbed areas only.
- Portions of hollow-bearing trees removed from the construction area would be retained and either placed in adjacent bushland as hollow logs, or tied into large trees in adjacent woodland to provide shelter and nest sites for native fauna species.
- Large logs would be removed from the proposed disturbance areas during clearing and placed in adjacent retained vegetation to maintain resources for native fauna.
- A weed management plan would be prepared to control the spread of weeds into adjoining areas.



Existing highway looking west from Lindfield Park Road with possible compound site on right.

- Sediment ponds would be located in existing cleared areas to minimise the loss of habitat and would incorporate habitat features such as macrophyte plantings, rocks and areas of open water.
- Chemical and fuel storage areas would be bunded to contain 110% of the on site liquids.
- An emergency response program would be prepared for accidental spills.
- Disturbed areas would be progressively re-vegetated.
- Topsoil from vegetated areas along the proposed alignment would be removed and stockpiled for application to completed roadside rehabilitation areas.
- Where fragmentation of an existing stand of native vegetation cannot be avoided or where the proposed alignment passes close to existing stands, roadside planting (using local native species) would be carried out as soon as possible after construction, in order to reduce edge effects.
- *Allocasuarina* sp. and known Koala food trees would be planted as the primary landscape tree species in the road reserve to provide supplementary foraging habitat for the Glossy Black-Cockatoo.
- Nest boxes would be provided as compensatory nest sites for the Glossy Black-Cockatoo, Yellow-bellied Glider and other hollow-dependent fauna. Nest boxes would be designed to suit the target species and would be provided on a 2:1 ratio. A maintenance program would also be implemented to ensure that nest boxes are functioning appropriately.
- Should additional vegetation removal be required the RTA's Regional Environmental Adviser would be consulted.

7.7 Land Use, Property and Socio-economic Impact

This section is based on a detailed study of the land use and socio-economic impacts of the Proposal by ERM Australia, contained in **REF Volume Two, Working Paper 1**.

7.7.1 Existing Situation

Existing Land Use

A total area of 15.2 ha has previously been acquired by the RTA for the construction of the Oxley Highway. The RTA will require the acquisition of a further 26 ha for completion of the Proposal.

Existing land uses consist primarily of rural smallholdings and residential development with some commercial and tourist uses, including two caravan parks and a motel in the eastern section of the study area. (Refer Figure 2.1, Working Paper 1).

Residential development in the form of ribbon development exists along a section of the existing highway with a number of relatively small lots, each having direct access to the existing highway. There are a number of community uses including the Port Macquarie Base Hospital, St Columba School and the Crematorium that also have access from the highway.

The commercial land uses consist of a mix of uses with direct access to the highway, including smash repairs, rural supplies, landscape supplies, golf driving range and a mix of other light industries. There is also a number of smaller commercial/home businesses located along the existing alignment. In the south of the study area the preferred route would traverse a large, heavily timbered rural property. Part of this land is zoned 2(a1) Residential and is identified for future urban development.

The agricultural assessment identified that land in the study area would generally be classified as Class 4 Agricultural land, suitable for only intermittent grazing. Agricultural potential is limited due to the low quality of agricultural land and the relatively small size of holdings. There are some boutique agricultural uses including a goat farm and a small vineyard. Otherwise there is no evidence of agricultural use in the study area. In summary there would be no loss of agricultural production as a result of the highway upgrade.

Apart from the existing Oxley Highway that forms the main transport connection between Port Macquarie and the Pacific Highway, there are no major land uses of regional significance in the study area.

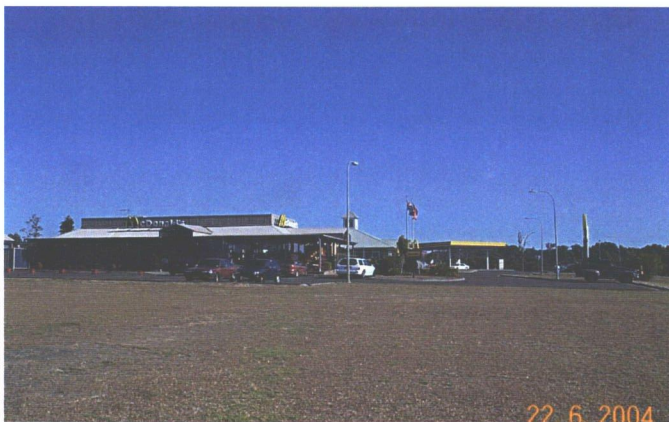
Future Land Use

Western Port Macquarie has been identified for substantial urban development in Hastings Council's Urban Growth Strategy (HUGS). Area 13 forms a large part of the study area and the medium population prediction from HUGS is 6,200 by the year 2021 with increases after that to estimates of up to 20,000. Much of the constraint free rural land in this area is likely to be transformed into housing over the next 20 years and beyond.

A number of urban development proposals in the eastern half of the study area are also currently being considered by Hastings Council. These include:

- expansion of the Retreat Village
- expansion of the Port Gateway Tourist Park
- aged care housing
- RTA/Council upgrade of Major Innes intersection (not part of Oxley Highway Upgrade project).

The information contained in this report is limited to the extent that Hastings Council has not finalised environmental and infrastructure studies for land in the western Port Macquarie area. Future land uses assumed in this report may change as studies for future urban development are completed.



Service station and fast food outlets at western end of corridor.

Demographics

A demographic analysis using 2001 census data has been undertaken to determine the social and economic structure of the population in the study area. The study area contains a resident population of approximately 3,000.

The population within the study area is spread relatively evenly across the age groups. The 10-14 year age group (8.0%) and the 40-44 and 45-49 year age groups (7.3% and 7.2% respectively) have a slightly higher proportion of the population than the other age groups. These peaks indicate that there are a high percentage of households in the early to mid stages of family formation. The 55+ age groups account for 27% of the population in the study area. This suggests that a high proportion of retirees reside in the study area.

The majority of residents are employed outside the study area, as there are few local employment opportunities, and there is a high reliance on motor vehicles for travel to work. Residents living in the study area also use the existing Oxley Highway for access to social and educational facilities.

The Oxley Highway is the only access to and from the locality and is therefore of major social and economic significance to the local community. The majority of individuals in the study area (62%) travel to work by car as the driver, with a further 8.9% as the passenger. This reflects the importance of the road system, particularly the Oxley Highway, to facilitate access to work locations.

The analysis of the age group break up indicates that there are a high proportion of households in the early to mid stages of family formation, which suggests a number of children would be attending various primary and high schools in the region. The majority of the children would need to travel by means of public transport (buses) and private cars to school, which highlights the importance of the road network in the study area. The Oxley Highway provides access to community and recreation facilities required by this sector of the community.

It is clear that the Oxley Highway is of social and economic significance to the population, which relies on employment and community facilities outside the study area. A highway upgrade would improve access for the community.

7.7.2 Potential Impacts

Assessment of the social and economic impacts within the study area and the Preferred Corridor has been based on the feedback from community liaison meetings, community workshops and public displays held for the project during 2003 and 2004, as well as on-site interviews with property owners and field assessment.

Land Use and Property Impacts

The agricultural assessment has not identified any land in the study area that is suitable for cropping, horticulture or high value pastoral activities. In general, agricultural pursuits are limited throughout the study area for a number of reasons including low quality agricultural land, existing and proposed urban development and the relatively small size of landholdings.

In the eastern section, the extent of wetlands and acid sulphate soils places limitations on potential agricultural use. The impact of the Proposal on agriculture would therefore be negligible.

A number of properties would be affected by the Proposal. **Figures 4.1** and **4.2** in **Working Paper 1** provide details of individual land parcels along the Proposal.

Eastern Section

The preferred route affects 5 private properties and a Crown Road Reserve in this section as follows:

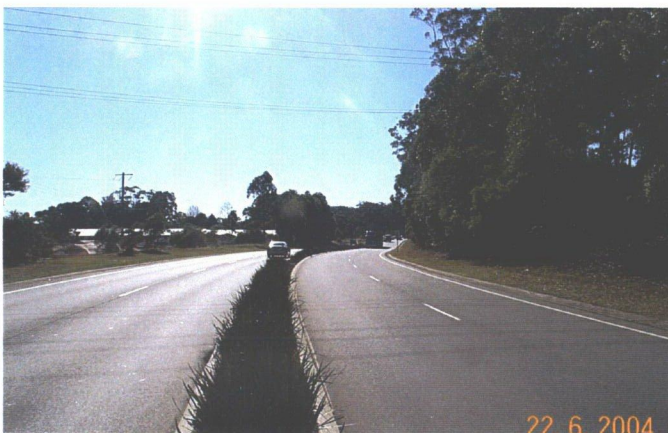
- lot 2 DP 740429
- lot 2 DP 244850
- lot 2 DP 772163
- lot 1 DP 102553
- lot 2 DP 773237

Lot 2 DP 740429, the Port Gateway Tourist Park, would lose a section of property parallel to the north-western boundary of the site. The location of the existing caravan sites and the proposed additional sites would not be affected. Existing sites on the western side of the park would be closer to the Proposal than to the current highway.

Acquisition of a small parcel of land from Lot 2 DP 244850 would be required. This acquisition would not affect the access opportunities or the management of the property, although it would result in a reduction in the size of the property.

Lot 2 DP 772163 would be severed and the section to the north of the preferred route would be land locked. This may cause difficulties in management of the property, however there is no evidence of agricultural activity that could be affected. It would be necessary to provide access to the northern section of the property.

Lot 1 DP 102553 would be severed with a small section of the property to the north of the preferred route being landlocked. This may cause difficulties in management of the property, however there is no evidence of agricultural activity that could be affected. It would be necessary to provide access to the northern section of the property. This could be achieved via Lot 12 DP 812130 which has been previously acquired by the RTA.



Existing Oxley Highway looking east from Wrights Road roundabout

Lot 2 DP 773237 is already severed by a previous acquisition and purchase of land by the RTA. Preliminary plans indicate that a small additional area of acquisition would be required immediately to the north of the Proposal to accommodate batters. The northern section of the property has access from Lindfield Park Road. It would be necessary to relocate this entrance slightly to the north of its existing position. The dwelling on Lot 2 is located in the north-west corner of the property, approximately 250 metres from the Oxley highway. This dwelling would be situated approximately 150 metres from the Proposal.

A parcel of land located to the west of Lot 2 DP 244442 and Part 2 DP 773237, is a Crown Public Road Reserve. The Department of Lands has advised that the RTA would be required to provide access to this road reserve. If an alternative access cannot be provided, closure of the road may be required and the RTA would be required to purchase the land. There would be no requirements for demolition or acquisition of dwellings in this section.

The nearest distance that the Proposal would come to SEPP 14 Wetland No 507 in the eastern section is approximately 85 metres. This proximity to the wetland has been recognised, and appropriate stormwater management and erosion and sediment controls have been proposed to minimise any adverse impacts. Requirements would be imposed on the Contractor to ensure that construction does not encroach into the wetland.

Lindfield Park Road would be severed approximately 250 metres north of the intersection with the Oxley Highway. Access to properties in Lindfield Park Road would be provided from the Proposal by a seagull intersection in the short term, and converted to a left in, left out as part of the development of the West Lindfield area.

The eastern section of the Proposal would require the acquisition of land from 5 properties. The majority of these acquisitions would be relatively minor although access arrangements from some properties to the existing highway would be affected, particularly immediately north of the crossover point. Two properties would be severed creating landlocked parcels to which it would be necessary to provide access. However, access would be negotiated as part of the property negotiations.

If an alternative access cannot be provided for the Crown Public Road Reserve, closure of the road may be required and the RTA would be required to purchase the land.

Although severance may potentially impact on property management, there is no evidence of agricultural activity in the eastern section of the Study Area. It is likely that many of the vacant rural properties would be developed for urban purposes in accordance with HUGS. This issue is addressed in the Planning and Zoning Report (**Working Paper 2** refers).

Western Section

The Proposal affects a number of properties in this section, as follows:

- lot H DP 400213
- lots 13 and 14 DP 22692
- lots 10, 11 and 12 DP 22692
- lot 1 DP 713936
- lot 32 DP 809231
- lot 3 DP 826241
- lot 2 DP 603648
- lot 52 DP 776844
- part Portion 2, DP 221913.

Lot H DP 400213, Lots 13 and 14 DP 22692 and Lots 10, 11 and 12 DP 22692 have frontage to and access from the existing Oxley Highway. The Proposal would cross the existing highway at this point. This crossing would be elevated with a future eastbound on-ramp connecting the existing highway to the Proposal. The on-ramp would be located at the front

of these properties and would preclude access from the existing Oxley Highway. Access would be provided but alternative access would be provided in the future as part of the development of the West Lindfield area.

Lot 1 DP 713936, lot 3 DP 826241 and lot 2 DP 603048 would be severed and sections of each property would be landlocked. Management of these properties may be difficult due to severance, however temporary licensed points of access would be provided with left/in left/out movements only. These access points would be removed with the future development of this area. There is no evidence of agricultural activity on these lots. It is more likely that environmentally unconstrained land would be developed for urban use rather than agricultural activity in the future.

An existing dwelling on lot 1 DP 713936 is currently set back approximately 75 metres from the Oxley Highway. As a result of the Proposal it would be located equidistant from both the existing Highway and the preferred option.

Small sections of portion 52 DP 776844 would need to be acquired to accommodate batters to the preferred route. This would impact only on the section of each property immediately adjacent to the preferred route. Alternative access would need to be provided to the southern section of each property via Lot 10 DP 809815 to the licensed point of access at DP 603648. Severance may affect management of the properties, but it is likely that most unconstrained land in this area would be developed for urban purposes in accordance with Council's urban growth strategy.

Lot 1 DP 603648 currently gains access via a Right of Carriageway (ROW) from the existing Oxley Highway. The Proposal traverses this ROW and a temporary licensed point of access to this property would be provided. The preferred route does not directly affect any dwellings, however, the dwelling on lot 7 DP 227158 would be closer to the preferred route than to the current highway. The distance to the Proposal would be approximately 250 metres.

The western section of the Proposal would require the acquisition of land from a number of properties. Two of the acquisitions would be relatively minor, being for the extension of batters, the balance would result in severance of the affected properties. Although severance may potentially impact on property management, there is no evidence of agricultural activity in the western section of the Study Area. It is likely that many of the vacant rural properties would be developed for urban purposes in accordance with HUGS. This issue is addressed in the Planning and Zoning Report (**Working Paper 2**). One property that relies on a right of way will require the provision of alternate access.

Although no dwellings are directly affected, the dwelling on Lot 1 DP 713936 would be located equidistant to both the exiting highway and the preferred route.

A section of part portion 2 DP 221913 would be required for the relocated access to the Service Centre.

Lot 32 DP 809231 is not directly affected in terms of land acquisition but will form the southern boundary to the Proposal.

Social and Economic Impacts

The upgrade of the Oxley Highway has the potential to affect the local and regional community, as well as individual residents surrounding the existing alignment and the proposed route. Community consultation on the corridor selection and Proposal Design phase of the study has identified a number of potential social and economic impacts (**Working Papers 1&2** refer).

As a result of the Pacific Highway upgrade and the continued increase in population on the mid-north coast, Pacific Highway traffic volumes have increased. Port Macquarie is a major urban and tourist centre on the mid north coast and the Oxley Highway is part of the regional traffic network that serves Port Macquarie. There are no negative regional impacts that would result from the proposed upgrade of the Highway. However, there may be short-term impacts during construction. This would also result in a short-term increase in traffic on Hastings River Drive and associated impacts on residential amenity along the existing alignment and the preferred route.

Access to the Port Macquarie Base Hospital would be maintained during construction.

The 'Do Nothing' option would have major impacts on other roads. Hastings River Drive would attract increased traffic volumes as would the section of Pacific Highway between the Oxley Highway and Hastings River Drive. This may mean improvements to these corridors would need to be brought forward.

Table 7-6 indicates the possible positive and negative impacts in the eastern section that have been identified during the development of the Proposal.

Table 7-7 indicates the possible positive and negative impacts in the western section that have been identified during the development of the Proposal.

Some of the issues raised in these Tables reflect concerns expressed by the community. Whether or not those concerns prove to be substantiated in all cases, they are indicative of the possible impacts that the proposal might have and are included for this reason.



The Proposal would improve residential amenity in the eastern section of the existing highway

Table 7-6: Proposal (Eastern Section) – Likely Positive and Negative Impacts

Item	Likely Positive Impacts	Likely Negative Impacts
Amenity	<p>Reduced traffic volumes and noise levels along the existing alignment in the short term to medium term would improve the amenity for residents along the existing Highway alignment. It should be noted that traffic volumes along the existing corridor would ultimately increase as a result of urban development in the locality.</p> <p>Improved amenity of residential properties on the bypassed section of the existing Highway as a result of the highway relocation.</p>	<p>One dwelling, located at lot 2 DP 773237, would be located closer to the Proposal. Amenity for the residents of this dwelling would be affected both during construction (short term increases in dust, construction noise, vibration) and post construction (increase in traffic noise exposure, vehicle emissions, etc)</p> <p>The Retreat Village could be affected if planned expansion of this development proceeds on land adjacent to the Proposal. In this circumstance, increased noise levels, vehicle emissions and visual amenity could affect future residents.</p> <p>Lot 1 DP 834401 would be bounded on two sides by major roads, the existing highway to the south and the Proposal to the north. This would potentially increase the visual and noise level impacts, however there is currently no residence on this property.</p> <p>Residents have expressed concerns that air quality may decline with associated health problems, particularly for residents that would be adjacent to the existing highway and the Proposal. The assessment of air quality impacts indicates that this situation is unlikely.</p> <p>The Proposal may affect the visual amenity of residents, who would be located near the preferred route, particularly for residents who have chosen this area for the semi-rural lifestyle.</p>
Business	<p>The Proposal allows for businesses in this section to have direct access to the existing alignment, which would still benefit from local through traffic.</p> <p>It is possible that there could be some short-term positive economic impacts for 2 businesses, the Mobil Service Station and the General Store at the Mid Pacific Caravan Park due to increased patronage during construction of the Highway upgrade. However, no certainty can attach to this.</p>	<p>There are a number of businesses located in the section, which would no longer have Highway frontage. Businesses have expressed concerns that the Proposal may result in a reduction in Highway related trade, however it is noted that the highway will remain open to local traffic.</p> <p>The Port Gateway Caravan Park and the Mid Pacific Caravan Park would no longer have frontage to the Oxley Highway. The operators are concerned that this may lead to a decline in business.</p>

Item	Likely Positive Impacts	Likely Negative Impacts
		The Major Innes Motel has reported that it relies on passing highway traffic for 80% of its business. The Proposal crosses the existing alignment near the motel. Highway traffic would be required to continue to the Wrights Road roundabout and travel back along the existing alignment to the motel, increasing travel times. The operators are concerned that loss of visibility and easy access from the Highway could cause a reduction in trade, possibly resulting in the closure of the business.
Safety	<p>Improved safety for local residents living immediately adjacent to the existing Oxley Highway.</p> <p>As the existing Highway would be used as a local access road, pedestrian, cycle and vehicular movement on local roads throughout the area would be more convenient and safer, particularly for children catching buses to school.</p> <p>Increased safety for vehicles gaining ingress and egress for the entire length of the Highway as a result of the incorporation of higher standard intersections and filtering lanes into the Highway design.</p> <p>Increased safety for road users, due to higher standard design and construction.</p>	
Road User Benefits	<p>Travel time saving, due to a higher standard of design and the dual carriageway</p> <p>Vehicle operating cost savings resulting from improved road surface conditions, allowing higher average speeds and flatter, more continuous curvature and grade conditions.</p> <p>Reduced accidents as a result of a higher standard design and improved road surface conditions.</p> <p>Improved functionality at intersections of local roads and the Highway as a result of decreased traffic volumes on the existing Highway.</p>	
Community Facilities	The Proposal would result in less traffic on the existing Highway alignment. This would benefit a number of community facilities in this section, in particular the St Columba Anglican School, which is currently experiencing major ingress and egress problems from Major Innes Drive	

Item	Likely Positive Impacts	Likely Negative Impacts
	and The Ruins Way to the Oxley Highway. With no change to existing junctions these problems are expected to get worse as the school population grows. The Proposal would result in less traffic on the existing alignment and therefore reduce the problem with ingress and egress at these intersections.	
Community	There is widespread community support for the Proposal based on a number of perceived benefits, including improved residential amenity along this section of the Proposal.	The Proposal could cause minor severance of the existing community in the vicinity of the “crossover” of the existing highway.
Economic	There would be improved transport access and lower transport costs along this section of the Proposal due to improved road conditions.	Some landowners are concerned that properties affected by the Proposal may potentially decrease in value. Some landowners are concerned that the preferred route may affect future subdivision potential.
Access	A number of residential and commercial properties fronting the existing Oxley Highway would experience improved access/egress under the Proposal as there would be short to medium term reduction in traffic flows on the existing highway once the Proposal is completed.	Access to the upgraded Highway from adjoining properties and roads would be restricted. This may result in localised increased travel times for residents in this area. Traffic growth on the eastern end of the existing alignment is likely to increase as a result of subdivision in the Innes Peninsula area. The impacts of any improvement works on this section would be the responsibility of Council and have not been considered in this report.
Recreational Facilities	Road access to the golf driving range in Lindfield park Road would be maintained.	The operators of the golf facility have expressed concern about the potential economic impacts on the Port Macquarie Golf Driving Range in the longer term as proposed traffic arrangements would be converted from full-turning access in the short term to a left in/left out onto the Proposal once development of the West Lindfield area commenced.

Table 7-7: Proposal (Western Section) - Likely Positive and Negative Impacts

Item	Likely Positive Impact	Likely Negative Impact
Amenity	The preferred route would reduce traffic volumes and noise levels along the existing alignment, and as a result would improve the amenity for residents adjoining the existing Oxley Highway.	<p>One dwelling on lot 1 DP 713936, would be bounded by two major roads, the Proposal and the existing alignment. Residential amenity would be affected both during construction (short term increases in dust, construction noise, vibration) and post construction (increase in traffic noise exposure, vehicle emissions, etc).</p> <p>Residents have expressed concerns that air quality may decline with associated health problems, particularly for residents that would be adjacent to the existing highway and the Proposal. The assessment of air quality impacts indicates that this situation is unlikely.</p>
Business Effects	There are three existing businesses in this section. The wholesale nursery and the racing stable, which are not reliant on passing Highway trade and the Service Centre at the western end. A roundabout would be located directly to the east of the Service Centre and access would be via the southern leg. A left out exit would be provided in the location of the existing roundabout at the Service Centre, and the roundabout would be removed. The Proposal would have little affect on these businesses.	
Safety	<p>Improved safety for local residents living immediately adjacent to the existing Oxley Highway.</p> <p>As the existing Highway would be used as a local access road, pedestrian, cycle and vehicular movement on local roads throughout the area would be more convenient and safer, particularly for children catching buses to school.</p> <p>Improved safety for vehicles entering and leaving the Highway as a result of the incorporation of higher standard intersections and filtering lanes.</p> <p>Cyclist and pedestrian safety would be improved from its current form.</p>	

Summary

There would be a number of positive and negative social and economic impacts associated with the Proposal. The most notable positive impacts are associated with the improved amenity and safety that would be experienced by a relatively large number of residents. On the other hand, a small number of residences may have a reduction in amenity due to the proximity to the preferred route. No dwellings would be demolished for the Proposal.

A number of businesses would no longer have frontages to the Oxley Highway however these businesses would still benefit from local traffic using the existing highway as a local road. The most notable economic impacts are likely to be on tourist uses. Two caravan parks would no longer have highway frontage, although it is noted that they cater predominantly for permanent residents. The Major Innes motel would be likely to suffer a loss of trade.

7.7.3 Environmental Safeguards

A number of environmental safeguards are proposed to address land use impacts associated with the Proposal as outlined below.

- Traffic during the reconstruction works would be managed in accordance with Section 6.4 (Access and Traffic Management) of the RTA's QA specification G36.
- Access to the Proposal for traffic from the southern part of the study area, including the Major Innes Motel and Crematorium, would be provided by a left in/left out access via a new connection from Phillip Charley Drive intersection.
- A project phone number would be provided so that residents can register concerns during the construction stage. Protocols described in RTA Community Involvement: Practice Notes and Resource Manual (1998) would be followed.
- A Traffic Management Plan (TMP) would be developed for the Proposal in accordance with the RTA's QA Specification G10 – Control of Traffic.
- All property acquisition where necessary would be undertaken prior to construction and would be negotiated in accordance with the RTA's Land Acquisition Policy.
- Alternative access would be provided for the properties affected by the Proposal and where parcels of land become landlocked as a result of the upgrade.
- Compensation would be provided to affected landowners in accordance with the *Land Acquisition (Just Terms Compensation) Act*.
- Connectivity between the areas north and south of the Proposal would be provided at the bridge overpass for existing and future residences.

Other mitigating measures addressing impacts such as noise and dust would also contribute to the amelioration of impacts identified above.

7.8 Indigenous Heritage

This section is based on a detailed study of the heritage impacts of the Proposal by Jacqueline Collins, contained in **REF Volume Three, Working Paper 11**.

7.8.1 Existing Situation

To date, 30 Aboriginal archaeological sites have been registered on the DEC Aboriginal Heritage Information Management System (AHIMS) within a 2km radius of the Proposal. These include 20 stone artefact scatters, nine isolated stone artefacts and a scarred tree.

One isolated artefact and four scatters of between two and six surface artefacts lie on or close to the corridor itself. Most of these known sites occur on ridge/spur crests, or on the banks of water courses and their adjacent footslopes.

Figure 7-3 shows the location of known sites in and adjacent to the Proposal.

A search of the Register of Native Title Claims, the Register of Indigenous Land Use Agreements, the National Native Title Register and the Applications Summary was performed for the Hastings LGA on 30 September 2003. Advice provided by the National Native Title Tribunal indicates that at the time of the search there were no relevant entries in the Registers or Applications Summary. For the purposes of the present study, consultation, including an inspection of the study area, was undertaken with the Birpai Local Aboriginal Land Council (LALC) and the Mingaletta Development Corporation.

On the basis of information gained through Aboriginal consultation, a review of the non historical and archaeological sources, and the conduct and results of the Corridor selection study, there is some limited potential for previously unrecorded Aboriginal sites to be intercepted by the Proposal. In tandem with the corridor's environmental character and disturbance history, known site distributions suggest that the types of sites most likely to occur within the study area would be isolated stone artefacts and stone artefact scatters (open campsites), stone quarries/stone extraction sites and scarred trees.

The REF field survey was conducted on foot with the assistance of a Birpai LALC and Mingaletta Development Corporation Senior Sites Officer on 22 and 23 September 2003. The survey aimed to identify all visible cultural heritage sites and features with the potential to be adversely affected by the Proposal and to define areas that would warrant subsurface testing, salvage and/or construction monitoring.

The results of the surveys included:

- Four scatters of stone artefacts (Sites Ah-D1, D2, D4 and D6) and one isolated find (Ah-D5) recorded in the study corridor. Evidence suggests that a fifth artefact scatter (Ah-D3) would probably also extend into the corridor, and an undetected site (PAD Ah-1) is likely at one further location. Construction of the proposed road would require the destruction or salvage of the isolated find (Ah-D5), one artefact scatter (Ah-D4) and part of a second scatter (Ah-D1).
- The recorded sites within the Proposal have been disturbed by logging and other rural activities, and range from a single isolated find to low-density scatters of between two and 18 visible artefacts. Surface indications suggest that none of the recorded sites would contain either a large number or a high density of undetected artefacts.

OXLEY HIGHWAY UPGRADE

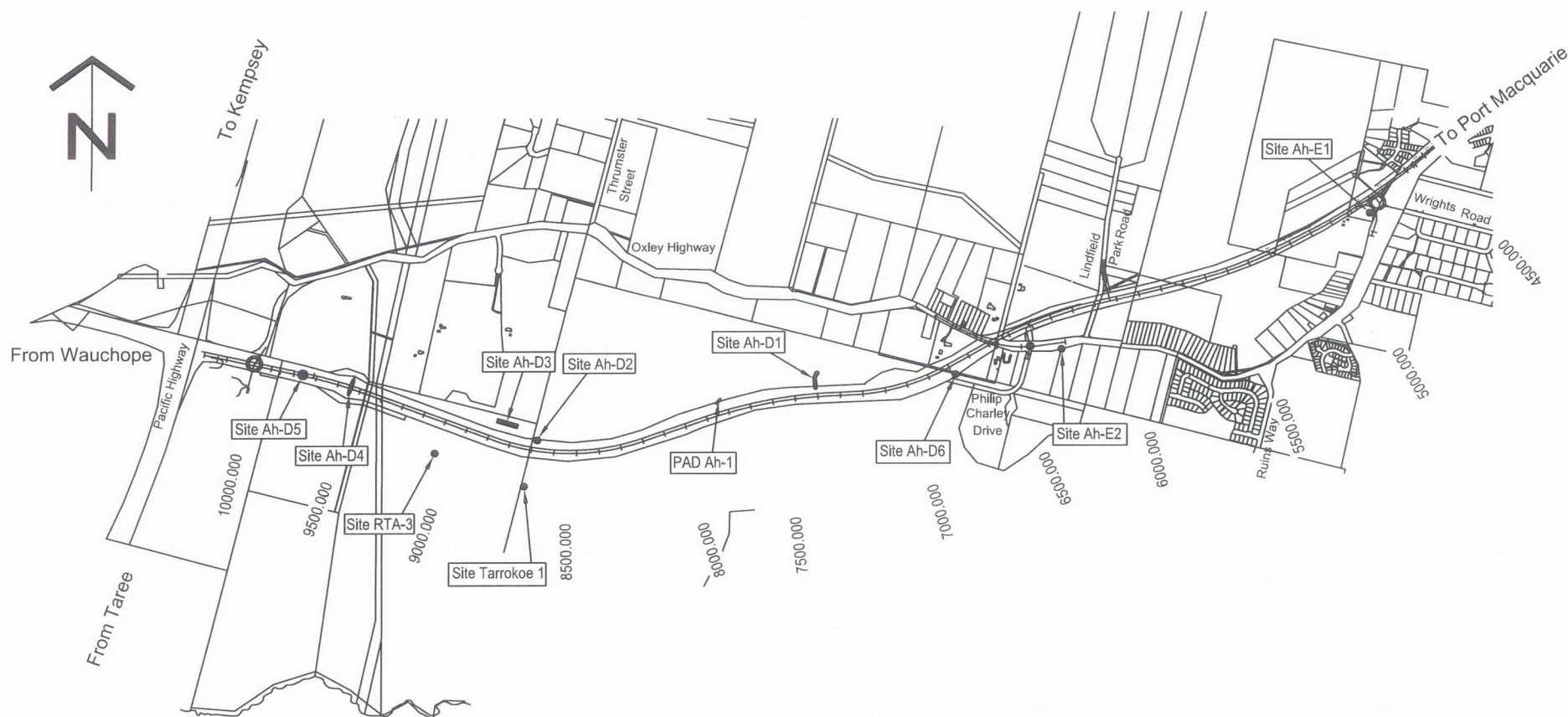


Fig. 7.3
Indigenous Heritage Sites

Owing to vegetation cover, it is estimated that only 5.3% of the Proposal was effectively searched for surface evidence. However, given that most areas surveyed are topographically unsuitable for the establishment of Aboriginal camps, or have been heavily disturbed in the past, it is concluded that the Proposal is unlikely to contain any significant undetected Aboriginal campsites, and that undetected evidence would most likely take the form of a low level background scatter of artefacts along the swamp margins.

- Despite the inspection of all mature trees on and adjacent to the study corridor, no scarred specimens were identified. This is most likely attributable to a long history of logging in forested areas and forest clearance elsewhere.

A significance assessment of the study area was also undertaken. The results of the assessment include:

- Aboriginal informants have assessed the sites as a group to be of moderately high social significance. As a result, a Birpai LALC and Mingaletta Development Corporation Senior Sites Officer has advised that the in situ protection of artefact scatters within the road corridor (where this is feasible) is preferable to archaeological salvage options.
- Given that the archaeological sites or artefacts detected during the survey are small, disturbed and are unlikely to be dense enough to offer any substantial opportunities for further archaeological research, the area is assessed to have minimal further research value and as such the sites are assessed to have a low level of local archaeological/scientific significance.

7.8.2 Potential Impacts

The proposed upgrading would involve bulk earthworks, the provision of drainage, construction of crossovers and a bridge, installation of culverts, and the clearance of approximately 18ha of natural vegetation. All of these tasks require disturbance or removal of the ground surface. Unless identified and protected or salvaged, any cultural heritage sites occurring within the proposed highway corridor are likely to be destroyed or at least substantially disturbed.

Aboriginal stone artefacts are comparatively durable and may survive clearing and excavation works undamaged. However, a site's spatial structure is lost when its soil matrix is disturbed, and any artefacts lying within the depth range of construction-related earthworks would be displaced during the course of construction. In most instances, sites that have lost their spatial integrity are of considerably less scientific value than in situ sites.

Although any site disturbance/destruction directly attributable to the highway upgrading would occur at the time of construction itself, over the longer term the Proposal may indirectly effect the disturbance/destruction of sites on land along the highway margins if this land becomes subject to associated residential and/or commercial development. It is acknowledged that small sites are of research value in that they reflect activities that are as integral a part of a settlement system as activities represented at large sites with diverse cultural materials.

However, due to their disturbance context and low artefact densities, it is considered unlikely that any of the subject sites would provide sufficient further interpretive information to justify the time and expense involved with sub-surface investigation.

7.8.3 Environmental Safeguards

Consultation undertaken in conjunction with this assessment has revealed a moderately high level of Aboriginal social value for sites on or near the study corridor. The suggested actions listed below were developed in liaison with a Birpai LALC and Mingaletta Development Corporation Senior Sites Officer and would be implemented to minimise the impacts of the upgrading proposal on known and potential Aboriginal archaeological and cultural resources.

Site Ah-D1: Artefact scatter (Open camp) - #30-3-323

- Due to the perceived low density of artefacts and disturbance caused by past logging and land clearing, sub-surface investigation of the Site D1 location is not considered warranted. The RTA has re-aligned the road formation towards the southern side of the upgrading corridor to allow part of the Ah-D1 to be maintained intact within the balance of the corridor.
- Once the full extent of the necessary construction impact zone has been identified, a Birpai LALC/Mingaletta Sites Officer would be engaged to collect the affected artefacts under the auspices of a DEC (Section 87) Heritage Impact Permit. In line with Aboriginal community advice, the collected artefacts would be relocated to an adjacent defined place within the undeveloped section of road corridor.
- An appropriately qualified Sites Officer from the Birpai LALC/Mingaletta Development Corporation would be invited to be present on site during earthworks activities in the vicinity of Site Ah-D1 in areas of cultural interest to the local indigenous community. The actual extent of the time that they would be present would be determined by the RTA in liaison with the Birpai Aboriginal community.
- To preserve its Aboriginal social and archaeological values and avoid construction related disturbance, the remaining part of Site D1 would be retained and protected within the undeveloped section of road corridor, and would be fenced to exclude vehicles for the duration of construction.
- To ensure that archaeological materials are not inadvertently disturbed or destroyed during the course of future highway maintenance works, the Site D1 location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the site protection area unless formally approved by the relevant legislative authority (currently DEC).

Site Ah-D2: Artefact scatter (Open camp) - #30-3-324

- The two recorded Site D2 artefacts lie close to, but not on, the proposed road formation. To preserve their Aboriginal social values and avoid construction-related disturbance, the artefacts would be retained and protected within the undeveloped section of the road corridor. The site area would be fenced to exclude vehicles for the duration of construction.
- To ensure that the Site D2 artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, their location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the location unless formally approved by the relevant legislative authority (currently DEC).

Site Ah-D3: Artefact scatter (Open camp) - #30-3-325

- The Site D3 artefact scatter lies beyond the boundary of the proposed road corridor. However, associated subsurface materials may occur on a low terrace that extends into the northern side of the corridor. In order to preserve its potential archaeological values, the subject section of terrace would be protected in its current condition. To this end, the terrace location would be clearly marked and annotated on all development-related highway maps and plans and the landform avoided during the course of construction.
- If construction impacts cannot be avoided, the affected part of the terrace would be subject to subsurface archaeological testing (under the auspices of a DEC Section 87 permit) to determine its cultural status. Appropriate management recommendations would then be developed on the basis of an assessment of the social and scientific significance of any identified materials.

Site Ah-D4: Artefact scatter (Open camp) - #30-3-157

- Once the full extent of the necessary construction impact zone has been identified, a Birpai LALC/Mingaletta Sites Officer would be engaged to collect the Site D4 artefacts under the auspices of a DEC Section 90 permit if the artefacts are to be impacted. In line with Aboriginal community advice, the collected artefacts would be relocated to an adjacent defined place within the undeveloped section of road corridor.
- An appropriately qualified Sites Officer from the Birpai LALC/Mingaletta Development Corporation would be invited to be present on site during the earthworks in the vicinity of Site Ah-D4 areas of cultural interest to the local indigenous community. The actual extent of the time that they would be present would be determined by the RTA in liaison with the Birpai Aboriginal community.
- To ensure that the relocated artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, the relocation place would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the subject location unless formally approved by the relevant legislative authority (currently DEC).

Site Ah-D5: Isolated find - #30-3-156

- Prior to the commencement of any construction-related activity that would directly impact the Site D5 location (an isolated artefact not relocated during this survey), a Section 90 permit would be sought from DEC to allow the artefact to be destroyed during the course of construction.

PAD Ah-I: Potential open campsite

- PAD I lies close to, but not on, the proposed road formation. In order to preserve its potential archaeological value the identified section of footslope terrace be protected in its current condition. To this end, the terrace would be clearly marked and annotated on all development-related highway maps and plans and the landform avoided during the course of construction.
- If construction impacts cannot be avoided, PAD I would be subject to subsurface archaeological testing (under the auspices of a Section 87 permit) to determine its cultural status. Appropriate management recommendations would then be developed on the basis of an assessment of the social and scientific significance of any identified site/materials.

Site Ah-D6: Artefact scatter (Open camp)

- The five recorded Site D6 artefacts lie close to the margin of the proposed road corridor. Given that they can be avoided during construction the artefacts would be retained and protected within the undeveloped section of corridor. The site area would be fenced to exclude vehicles for the duration of construction.
- To ensure that the Site D6 artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, their location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the location unless formally approved by the relevant legislative authority (currently DEC).

General

- Although the area has been substantially disturbed by past road construction and is unlikely to contain significant archaeological evidence, a Birpai LALC/Mingaletta Sites Officer has requested Aboriginal presence on site during vegetation clearance and initial construction-related earthworks in the vicinity of the existing Oxley Highway at Philip Charley Drive. This request would be fulfilled. The actual extent of the time which is spent on site by the Aboriginal community would be determined by the RTA in liaison with the Birpai Aboriginal community and the DEC Cultural Heritage Section.
- Prior to the commencement of any construction-related activities, all RTA project management staff, road, overpass and bridge/culvert construction contractors and their employees would be advised of their legal obligations with regard to Aboriginal cultural materials. This advice should be given in writing and a copy forwarded to DEC Northern Aboriginal Heritage Unit for its records.
- Should any materials thought to be of Aboriginal origin be discovered or exposed during any stage of highway development, work would immediately cease in that locality. The DEC (Port Macquarie District office), the RTA's Regional Environmental Adviser and Aboriginal Programs Consultant and Birpai LALC and Mingaletta Development Corporation would then be contacted for management advice and clearance given by these organisations before work resumes in the subject area.
- The RTA would liaise closely with the Birpai Aboriginal community in relation to cultural matters, and the Land Council and Mingaletta Development Corporation would be kept informed of the timetable for any works associated with the planning and implementation of the Oxley Highway upgrading project.

7.9 Non-Indigenous Heritage

7.9.1 Existing Situation

Background research and a field survey was complemented by a search of heritage registers maintained by Commonwealth and State government agencies to identify sites and places of acknowledged cultural heritage significance with the potential to be adversely affected by the upgrading Proposal.

Searches of the Register of the National Estate, the National Trust of Australia (NSW) Register, the State Heritage Register, the RTA Heritage and Conservation Register, and heritage schedules of the North Coast Regional Environmental Plan 1998 and Hastings Local Environmental Plan 2001 revealed no recorded sites within or in close proximity to the study corridor. The corridor's closest listed sites/places are the Port Macquarie Rifle Range (1km north-west of Wrights Road) and Lake Innes Nature Reserve and adjacent areas

(approximately 750m south). Both of these are listed as Indicative Places (not on the register, but identified as important) on the Register of the National Estate.

Seventeen (17) items of potential non-Indigenous heritage value were identified during the Corridor selection study, all currently used buildings along the existing Oxley Highway relating to the local theme of 'Port Macquarie town development'. No non-Indigenous heritage items, archaeological sites or potential archaeological deposits were detected during selective field inspection of the Southern Deviation Corridor, nor were such sites identified through background research.

7.9.2 Potential Impacts

No potential archaeological site locations were identified through background research, nor were historical sites or materials detected during the Corridor selection and REF surveys. A search of statutory and non-statutory heritage registers revealed that no listed items would be either directly or indirectly affected by the upgrading Proposal.

7.9.3 Environmental Safeguards

- Prior to the commencement of any construction-related activities, all RTA project management staff, road, overpass and bridge/culvert construction contractors and their employees, would be advised of their legal obligations with regard to non-Indigenous 'relics'.
- Should any sites or items of potential non-Indigenous cultural heritage significance be discovered or exposed during any stage of highway development, work would immediately cease in that locality. The NSW Heritage Office would then be contacted for management advice and clearance given before work resumes in the subject area.

7.10 Visual, Landscape and Urban Design Assessment

The visual, landscape and urban design assessment of the Proposal is based on a report by Kiah Infranet contained in **REF Volume Three, Working Paper 13**.

7.10.1 Existing Situation

The landscape along the proposed Oxley Highway upgrade is one of high visual quality with many contrasting types including vegetated hills/ridgelines, undulating open topography with scattered rural farms and floodplain. Towards Port Macquarie, the landscape urbanises, with areas of urban ribbon development beside the road becoming more apparent.

Figure 7-4 identifies 5 landscape character zones along the Proposal. The main features of these character zones are summarised below:

Zone 1: Intersection between the existing Oxley Highway and the Proposal at the western end. This zone is dominated by McDonalds, the service station and associated commercial activity and parking areas on a visually exposed knoll.

The western section of the existing Oxley Highway follows a gentle curve to the north around the side of a knoll, with scattered rural residential development and mixed clearings on both sides of the road. This connection would be retained in the Proposal but would be slightly relocated to join the proposed western roundabout.



OXLEY HIGHWAY UPGRADE



Fig. 7.4
Visual Character Zones

A ridgeline runs at right angles to the alignment of the Proposal at the eastern end of this Zone. It is timbered and forms a prominent landscape feature when viewed from the western part of the Zone.

A service station and fast food outlet is also visually prominent on the southern side of the Proposal in this Zone.

Zone 2: This zone extends from the proposed western intersection of the Proposal to the eastern side of the ridgeline. This included the highest elevation of the Preferred Corridor, and offers extended views to the east and west. The local landscape consists of modified pastureland and partial forested areas.

Zone 3: In this zone the Proposal would pass through an enclosed valley with bushland and cleared areas. This zone comprises undeveloped land with tall trees, and would offer contained views attractive bushland views in both directions from the Proposal.

Zone 4: This zone extends from the central cross-over of the existing highway to the western side of Wrights Road intersection. The main characteristics of the Preferred Corridor area are pastoral land and floodplain, although there are also views towards urban fringe development on both sides of this corridor that includes a pitch and putt golf course, tourist park and mobile home site. The value of the visual amenity in this zone is relatively low.

Zone 5: This zone comprises the intersection of the new road and Wrights Road, and forms the eastern “Gateway” into Port Macquarie with links to the existing highway.

The current views on either side of the Proposal moving east are urban in character and have low amenity due to the proximity of the tourist park and the mobile home development. Views from this zone looking west extend across a low floodplain area and semi-urban fringe development.

7.10.2 Potential Impacts

Two different visual parameters have been used in the visual assessment of the Proposal. These are:

- *Visual Sensitivity* - the ability of the setting to absorb change. Generally, the more natural the setting the more sensitive it is to change.
- *Visual Effect* - the expression of the visual interaction between a proposed project and the existing visual environment. Visual effect can also be expressed as the level of visual contrast (i.e. form, shape, pattern, line, texture and colour) of the project with the setting within which it would be viewed.

Table 7-8 categorises the potential visual impact for each character zone created by the Proposal. A long term visual impact assessment was also considered in response to the changing environment due to the potential urban development in the vicinity of the corridor.

Whilst the visual impact of the Proposal is considered to be medium to high, there have been widespread comments from the local community supportive of the beneficial impact that the Proposal would have as a regional “gateway” image in comparison to the image of the existing highway.

Table 7-8: Visual Assessment

Character Zone	Visual sensitivity	Visual Effect	Visual Impact	Long Term Visual
CZ-1	Medium	Medium	Medium	Low
CZ-2	High	High	High	High
CZ-3	High	High	High	Medium
CZ-4	High	High	High	High
CZ-5	Low	Medium	Medium	Low

Source: Kiah Infranet (REF Working Paper 14)

Character Zone 1 - The overall character in this zone would not be greatly affected. The eastward relocation of the roundabout would maintain a similar character to the present situation. The landscape enhancement and the incorporation of an accent/signature element at the intersection would provide a stronger sense of arrival and improve the overall travel sequence. The design of the Proposal allows for views to signage and also assists in integrating the service area into the adjacent landscape.

Figure 7-5: Photo Montage - West Sector**EXISTING****PROPOSED**

Character Zone 2 - There would be substantial visual impacts within this character zone, particularly at the skyline ridge which is highly exposed from the west. The Proposal requires a major cut at the skyline ridge and its visual impact would be further exacerbated due to the new alignment cutting through relatively open countryside.

However, when reviewing these impacts it is necessary to consider that the surrounding area is part of an urban release area by Hastings Council and that eventually the road would be seen in a less sensitive setting/semi-urban environment.

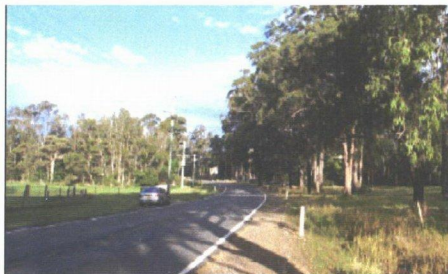
The width of the corridor has been minimised as much as possible at major cuttings to reduce their extent. Landscaping to be undertaken in CZ-2 would reduce the visual impact of the cutting in CZ-3 as viewed from vehicles travelling east.

Character Zone 3 - This zone cuts through an area of native vegetation and hence would have an adverse visual impact. However, there would be limited visual exposure of the site from adjacent areas due to the enclosed setting of the valley. Furthermore, the land directly to the north of the alignment is considered to be potential future development land by Hastings Council.

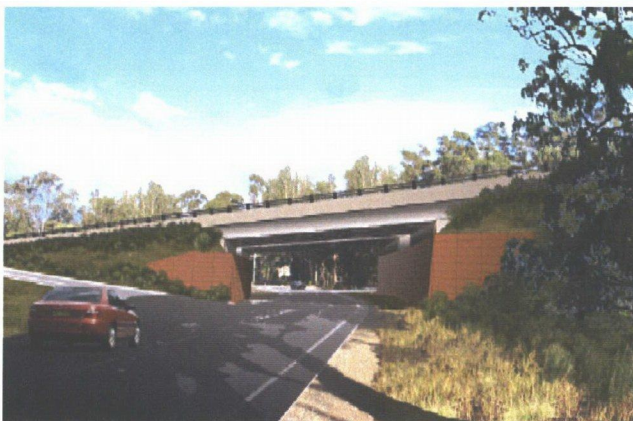
As a result, the Proposal would define a border between bushland and semi-urban areas with the land to the south being under investigation for potential further urban development areas.

Trees would be retained within the road reservation either side of the pavement area to improve the visual quality of the driving experience and to support wildlife management strategies (including Yellow Bellied Glider movements).

Figure 7-6: Photo Montage – Central



EXISTING



PROPOSED

Character Zone 4 - This zone is highly sensitive due to its visually exposed character in the floodplain. The Proposal would define to some extent the urban development towards the south. This would help to integrate the road better within its setting by demarking urban from natural areas.

The Proposal would constitute a new visual element in the existing landscape but it is expected that future urban development will envelop the Proposal on both sides in the relative near future, and fundamentally change the visual context within which the Proposal is located and reduce its visual impact.

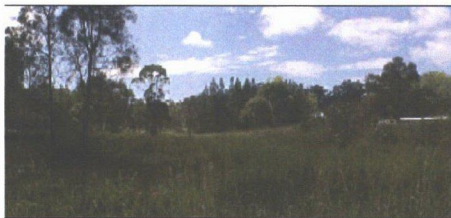
Towards the east, the introduction of noise walls and mounding would visually increase the presence of the Proposal, although it would be in a more urban setting at this location.

Varying fill slopes would be considered to integrate with the natural landform. In addition, earth mounds would be incorporated with noise walls to minimise the apparent height of the noise mitigation structures, as well as integrating the linear mounding within the landscape from outside the corridor.

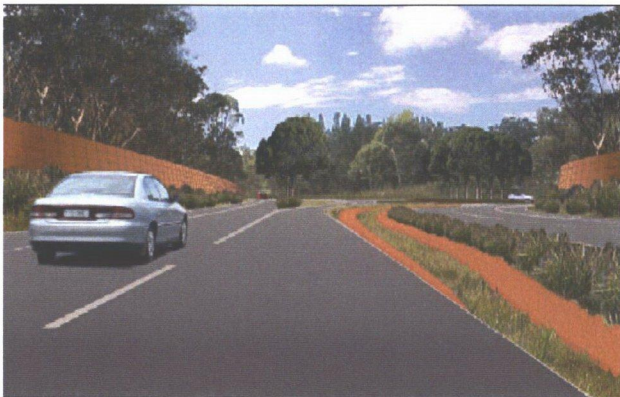
Character Zone 5 - It is anticipated that the character of the Wrights Road intersection would not greatly change. The urban setting is not highly sensitive to change and the introduction of a larger roundabout with landscape features would add interest to the overall setting. Hence the visual effect would be moderated by design.

The visual impact is considered moderate to low since it would not dramatically change the general configuration of the intersection.

Figure 7-7: Photo Montage - East



EXISTING



PROPOSED

Noise walls and associated landscaping would restrict views into and from adjacent residential and commercial tourist activities.

Whilst the Proposal would have visual impacts in key areas (eg zones 2, 3 and 4), the overall design and alignment responds suitably to the site constraints by demarking urban development areas and sensitive landscapes. Sections of the Proposal would also become the buffer between urban and natural zones.

The visual impact of the Proposal may be considered high in some places (eg eastern section, CZ-4) if built in the short term without changes to adjacent land uses. However, it is expected that with the proposed future urban development in this area and associated land clearing the overall impact of the road in its setting would be somewhat reduced.

The Proposal would create an attractive gateway entrance at the western (Pacific Highway) end of the Corridor, and connect with the existing four-lane landscaped highway at the eastern (Wrights Road) end. It would also provide an “exit gateway” from Port Macquarie at the Wrights Road roundabout.

The Proposal would improve the overall amenity for existing urban areas by reducing noise impacts and improving local connectivity.

The visual integration of different roadside components such as noise walls, retaining walls and bridge structures in combination with key landscape features would provide a coherent design that reinforces the significance of the Proposal.

The landscape design takes into consideration environmental impacts such as fauna connectivity and drainage issues.

7.10.3 Environmental Safeguards

The following environmental safeguards would be implemented during the delivery of the project:

- A Landscape Design and Management Plan (LDMP) would be prepared and reviewed by the REA prior to construction.
- All planting areas would contain mixes that reflect the local indigenous species in proportions and diversity which reflect the original community. The planting lists contained in Working Paper 13 would be considered in the LDMP.
- Native grasses used for planting would be a combination of:
 - Hydro-seeding to medians and road verges
 - Wetland filter areas beside the water quality control ponds
- All batters would be rounded off at the top of cuts and the limits of the cuttings graded in the detailed design to integrate with adjoining landforms.
- During detailed design, investigations to vary the fill batter between 2H:1V and 4H:1V would be undertaken for the floodplain area.
- Maximum slope for batters would be 2:1 to enable better growing conditions for revegetation.
- Shotcrete would not be used in the Proposal.
- Consideration would be given in the final design to the use of alternative materials to concrete for any hard-paved channels (eg stone-paved channels in lieu of concrete channels).

- Vegetated swales would be adopted where possible, particularly in the median where grades permit and also along the tops of cuttings.
- Distribution drains would be considered in the final design to maximise infiltration into the ground and reduce runoff.
- Rock mulch swales would be considered in the final design in lieu of concrete drains, for slopes where grass would not suffice.
- Filter beds would be considered in the final design to clean stormwater prior to discharging.
- Water control ponds would be designed as informal, natural shapes.
- Existing dams would be investigated for use as water quality control ponds.
- Water Quality control ponds would be planted with suitable native wetland plants.

7.11 Noise and Vibration

This section is based on extracts from a detailed report by Renzo Tonin on noise and vibration contained in **REF Volume Three, Working Paper 15**.

7.11.1 Existing Situation

The daytime and night time traffic volumes shown in **Table 7-9** and **Table 7-10** have been derived from daily volumes supplied by the RTA. The data shown for the existing road assumed the new road is open and in use. The heavy vehicle percentage has been calculated from 2003 traffic count information on the existing highway and is assumed to apply to both the new road and existing road after opening.

The traffic volumes used have been obtained from historical data and traffic intersection counts with provisions made for future growth taking into account the planned pattern for future development to the west of Port Macquarie. This information has been sourced from Hastings Council, Hastings Roads and Traffic Study (SMEC 2001) and Hastings Urban Growth Strategy (HUGS) 2001. The HUGS report has been used to predict the future development of Area 13 which is in the western section of the proposed corridor. The traffic projections have used Council's medium projection for future population estimates in Area 13.

It would be the responsibility of Hastings Council as the consenting authority to require noise mitigation measures for future approved developments adjacent to the proposed corridor.

The study identified sensitive noise receivers (eg. houses) located along the Corridor, assessed the potential noise and vibration impacts, and identified the need for noise environmental safeguards where required.

To facilitate the assessment of noise impacts from the Proposal, the study area was divided into noise catchment areas (NCAs), which were predicted to be impacted by noise from the Proposal. Noise monitoring was conducted at a number of residential locations in the study area to determine current traffic noise levels (Leq) and background noise levels (L90) in each NCA. **Figure 7-8** refers.

Criteria for selection of noise monitoring locations included:

- proximity to the existing Oxley Highway
- proximity to the Proposal
- noise sensitive sites because of topography and other factors.

The representative L90 background noise levels at the monitoring locations are shown in **Table 7-11** and have been calculated according to the EPA's 10th percentile method. Day represents the period 7am to 6pm, evening 6pm to 10pm and night 10pm to 7am.

Table 7-9: Estimated Traffic Volumes, (Year 2011) Renzo

Period	West Section			East Section		
	New road	Existing road	% Heavy vehicles	New road	Existing road	% Heavy vehicles
Day (7am - 10pm)	15,304	2,728	6	14,576	10,272	6
Night (10pm - 7am)	1,331	237	6	1,268	893	6

Source: Renzo Tonin (REF Volume Three, Working Paper 15)

Table 7-10: Estimated Traffic Volumes (Year 2021)

Period	West section			East section		
	New road	Existing road	% Heavy vehicles	New road	Existing road	% Heavy vehicles
Day (7am - 10pm)	19,984	4,751	6	21,064	11,257	6
Night (10pm - 7am)	1,738	413	6	1,832	979	6

Source: Renzo Tonin (REF Volume Three, Working Paper 15)

Table 7-11: Measured LA90 Background Noise Levels, dB(A)

Monitoring Location	Day dB(A)	Evening dB(A)	Night dB(A)
Location M1 – 955 Oxley Hwy	34	36	34
Location M2 – 18 Bestglen Pl	40	38	32
Location M3 – 714 Oxley Hwy	48	37	28
Location M4 – 697 Oxley Hwy	50	34	27
Location M5 – 1 Lindfield Park Rd	44	36	30
Location M6 – 3 Lindfield Park Rd	38	38	29
Location M7 – 640 Oxley Hwy	-	-	-
Location M8 – Caravan Park	43	37	30
Location M9 – 5 Tudor Grove	47	38	33

Source: Renzo Tonin (REF Volume Three, Working Paper 15)

The measured Leq traffic noise levels at the monitoring locations are shown in **Table 7-12**. The descriptors relevant to traffic noise studies according to the EPA's current policy for traffic noise are the LAeq(15hr) daytime and LAeq(9hr) night time descriptors.

Table 7-12: Measured Traffic Noise Levels (Leq)

Monitoring Location	Representative Weekday/ Weekend	L _{Aeq} (15hr)	L _{Aeq} (9hr)
Location M1 – 955 Oxley Hwy	Weekday	51	45
	Weekend	44	43
Location M2 – 18 Bestglen Pl	Weekday	48	45
	Weekend	45	45
Location M3 – 714 Oxley Hwy	Weekday	67	63
	Weekend	64	63
Location M4 – 697 Oxley Hwy	Weekday	60	55
	Weekend	57	55
Location M5 – 1 Lindfield Park Rd	Weekday	52	48
	Weekend	47	48
Location M6 – 3 Lindfield Park Rd	Weekday	50	46
	Weekend	47	44
Location M7 – 640 Oxley Hwy	Weekday	-	-
	Weekend	-	-
Location M8 – Caravan Park	Weekday	50	46
	Weekend	49	47
Location M9 – 5 Tudor Grove	Weekday	53	50
	Weekend	51	48

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

7.11.2 Potential Impacts

The construction of the realigned road would mean traffic moves closer to some residences. The traffic carrying capacity and traffic mix would change as a result of the project. Traffic noise levels at residences fronting the existing Oxley Highway would be expected to decrease initially due to a decrease in traffic volumes along the existing route.

Construction Noise

During the construction of the Proposal, there would be the potential for the use of construction plant equipment, activities at the site compound and construction vehicle traffic to adversely affect noise receivers in the study area.

The DEC's Environmental Noise Control Manual (ENCM) was used to assess noise generated during the construction phase, including the following criteria from the manual:

- Construction period of 4 weeks and under - The L10 level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).
- Construction period greater than 4 weeks and not exceeding 26 weeks - The L10 level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

Construction period greater than 26 weeks - The L10 level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 5 dB(A). The period of construction for the Proposal is estimated to be 18 months, however, due to the progressive nature of the construction works, it is unlikely that construction noise impacts would be experienced at each of the

identified receivers for the full duration of work. Therefore, an appropriate noise criterion is set under the long term category of “greater than 4 weeks and not exceeding 26 weeks”. Under these circumstances, the L10 noise level from construction activities should not exceed 10dB(A) above the daytime background noise level at the nearest residences along the Proposal.

Calculations for the predicted construction noise used mean values for a range of expected construction equipment to predict the sound pressure level at each monitoring site. The sound power levels for the majority of equipment were based on maximum levels in Table D2 of Australian Standard 2436 - 1981 *"Guide to Noise Control on Construction, Maintenance and Demolition Sites"*. Given that a detailed construction activity plan and schedule have not yet been developed for the project, noise emission levels from construction activities were presented in general terms only. **Table 7-13** shows the predicted external construction noise levels at a range of distances, assuming the worst case of no acoustic attenuation due to intervening topography, ground effects or air absorption.

Table 7-13: Predicted (L₁₀) Construction Noise Levels

Plant Description	At 20m dB(A)	At 40m dB(A)	At 80m dB(A)	At 150m dB(A)	At 250m dB(A)
Rock Breaker	86	80	74	69	64
Concrete Saw	84	78	72	67	62
Jackhammers	81	75	69	64	59
Concrete Leveller	81	75	69	64	59
Mobile Crane	78	72	66	61	56
Scraper	78	72	66	61	56
Front End Loader	78	72	66	61	56
Compactor	78	72	66	61	56
Pavement Laying Machine	78	72	66	61	56
Bulldozer	77	71	65	60	55
Tracked Excavator	76	70	64	59	54
Grader	76	70	64	59	54
Vibratory Roller	75	69	63	58	53
Concrete Truck	75	69	63	58	53
Dump Trucks	73	67	61	56	51
Water Cart	73	67	61	56	51
Rollers	72	66	60	55	50
Asphalt Truck	72	66	60	55	50
Concrete Pump	70	64	58	53	48
Backhoe	70	64	58	53	48

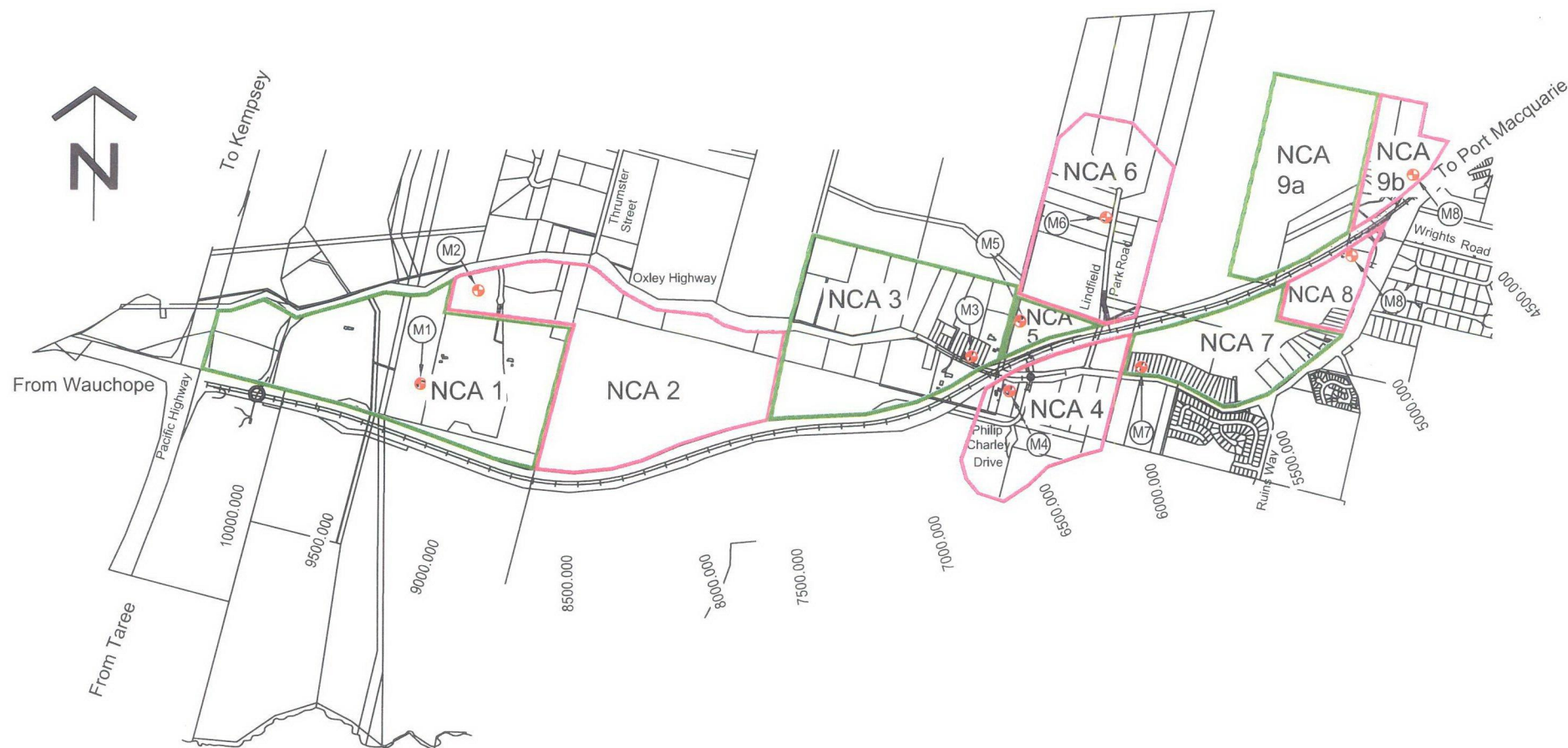
Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

The nearest residences would be within 20m of construction activities in a few isolated locations along the Proposal, and based on the construction noise levels predicted above, the DEC's construction noise criteria are likely to be exceeded at times. Construction noise limits, however, would not be exceeded at residential premises located further from the road works or when lower noise construction activities are being conducted. Noise management measures would be implemented to achieve acceptable construction noise emissions.



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OXLEY HIGHWAY UPGRADE



- Noise Monitor Locations
- Noise Catchment Areas

Fig. 7.8
Location Noise Monitors and
Noise Catchment Areas

Construction Noise from the Proposed Compound Site

A possible compound site to store machinery has been identified between the existing and proposed Oxley Highway at Lindfield Park Road. The nearest residences to the compound would be those on the Oxley Highway to the east, and to the south, across the Oxley Highway. Residences to the east would be most affected as they would be adjacent to the proposed compound and the nearest house could be within approximately 20m of the compound site.

Projected noise levels at the nearest receiver from equipment such as trucks and backhoes could be up to 75dB (A), and higher when equipment is operating concurrently. Therefore, noise levels could potentially exceed the construction noise criteria by around 20dB (A). However, it should also be noted that these noise levels would only be experienced for short periods when equipment is entering or leaving the compound. Noise sources such as air conditioners in site offices that may operate for longer periods are not expected to exceed the criteria. Residences to the south would be at least 100m from compound noise sources and experience noise levels of up to 60dB(A) and should marginally comply with the construction noise criteria.

Construction Traffic Noise

The DEC does not provide noise goals or limits for traffic noise sources specifically related to the construction of a project once vehicles have left the construction site. When these vehicles move onto public roads the vehicle noise may be perceived as part of the general road traffic. As there are no DEC or other noise limits that apply to the assessment of temporary construction traffic noise, guidance is obtained from the DEC's Environmental Criteria for Road Traffic Noise (ECRTN) which sets long term traffic noise limits. The relevant long term goals for land use developments with potential to create additional traffic are:

- Arterial Road LAeq(15hr) 60
- Collector Road LAeq(1hr) 60
- Local Road LAeq(1hr) 55

To assess whether or not trucks associated with the construction of the Proposal could potentially increase traffic noise levels at residences, the US Federal Highway Administration's (FHWA) traffic noise model was used to calculate traffic noise from construction traffic. This model is most suited to intermittent and low volume traffic flow conditions. The assessment was undertaken with the expected construction vehicle traffic supplied by the RTA and shown in **Table 7-14**, and for the hours between 7am and 6pm on weekdays and 8am to 1pm Saturdays.

Table 7-14: Expected Construction Stage Traffic Volumes

Description	Fill Stage	Pavement Stage
Trips per day	250	140
Duration	18 weeks	20 weeks

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 1.5)

On the existing Oxley Highway, construction traffic would increase the proportion of heavy vehicles during the day from approximately 6 to 8%, which equates to an increase in traffic noise of less than 1dB (A). This minor increase would be virtually imperceptible to the human ear and is therefore inconsequential to residents living along the Oxley Highway.

Leq(1hr) traffic noise levels at 20m are expected to be approximately 66dB(A) based on a maximum of 250 truck trips per day during construction, which equates to approximately 23 trucks per hour if trips are spread evenly over the day. This level exceeds the ECRTN criteria for collector roads and local roads. Therefore, if construction traffic uses collector or local roads to access the construction site, there is potential for a noise impact on some residences. A distance of 20m is the approximate minimum distance between traffic and the nearest affected residences for this study area.

Construction Vibration

The effects of ground vibration from the construction stage of the Proposal may be broadly defined by the following three categories:

- Disturbance to building occupants - Vibration in which the occupants or users of the building are inconvenienced or possibly disturbed
- Effects on building contents - Vibration where the building contents may be affected
- Effects on building structures - Vibration in which the integrity of the building or structure itself may be prejudiced.

In general, vibration criteria for human disturbance are more stringent than vibration criteria for effects on building contents and building structural damage. Hence, compliance with the more stringent limits dictated by the criteria for human disturbance, would ensure that compliance is also achieved for the other two categories.

Chapter 174 of the DEC's ENCM presents vibration level limits based on Australian Standard AS 2670.2-1990 "Evaluation of human exposure to whole body vibration – Continuous and shock induced vibration in buildings". It states that for human comfort, vibration from activities such as construction work shall not exceed a prescribed curve of vibration limits expressed in terms of velocity units over a range of frequencies. The set levels aim to protect human comfort. The DEC advocates that general vibration in buildings be assessed in terms of "continuous" or "intermittent / impulsive" vibration criteria, while vibration generated from construction sites is to comply with the "intermittent / impulsive" vibration limits set out in the ENCM.



Upgrade of Major Innes
Road and existing highway
looking west.

The DEC guidelines also require the restriction of vibration generating activities to within normal construction hours if vibration levels exceed the “continuous” vibration limits. Therefore, if vibration is not perceivable or is within “continuous” vibration limits, then no time restriction should apply.

Jackhammers, bulldozers, vibratory rollers and trucks are the types of construction plant most likely to cause significant vibration. The pattern of vibration radiation is very different from the pattern of airborne noise radiation, and is very site specific.

Geotechnical investigations on the Proposal to date have not revealed any evidence to suggest that rock blasting would be required.

Operational Noise

Road traffic noise impact is assessed in this report in accordance with the ECRTN and the RTA’s Environmental Noise Management Manual (ENMM).

The daytime and night time traffic volumes used for modeling existing and future road traffic noise were derived from daily volumes supplied by the RTA, with reference to information sourced from Hastings Council, Hastings Roads and Traffic Study (SMEC 2001) and HUGS 2001.

The Oxley Highway is an arterial road because it handles through traffic bound for another locality and has characteristically heavy and continuous traffic flows during peak periods. As the road would be substantially realigned by the Proposal, the upgrade is classed as a “new freeway / arterial road” according to the ECRTN. Therefore, the Proposal criteria as set out in the ECRTN apply to the operational stage of the Proposal. **Table 7-15** refers. These criteria apply at the facades of all existing residential premises along the Proposal.

The DEC’s traffic noise policy also sets guidelines for the assessment of traffic noise on sensitive land uses such as schools, hospitals, places of worship and recreation areas. The known sensitive land uses within the study area and DEC noise criteria guidelines are shown in **Table 7-16**.

Table 7-15: Environmental Criteria for Road Traffic Noise

Type of Development	Criteria		
	Day dB(A)	Night dB(A)	Where Criteria are Already Exceeded
New freeway or arterial road corridor	LAeq(15hr)55	LAeq(9hr)50	The Proposal should be designed so as not to increase existing noise levels by more than 0.5 dB. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in service vehicles; greater use of public transport; and alternative methods of freight haulage.

Source: DEC

Table 7-16: Noise Sensitive Sites & DEC Road Traffic Criteria

Sensitive Noise Site Location	DEC Daytime Criteria Leq (1hr), dB(A)	
	Day	Night
The crematorium on Philip Charley Drive which contains a chapel and should be considered as a place of worship.	40*	40*
The golf driving range on Lindfield Park Road, which is considered an active recreation area.	60	-

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

Note: * noise criteria for internal levels

Future traffic noise levels at completion of the project (Year 2008), and 10 years after completion (Year 2018), have been predicted using the "Calculation of Road Traffic Noise" (CoRTN) traffic noise model developed in the United Kingdom in 1988. The results of this modeling at each location are shown in **Table 7-17** and **Table 7-18**.

The noise levels shown are those at the facade of the dwelling, on the side facing the Proposal. The future-existing noise levels are the predicted traffic noise levels in the year 2008 if the Proposal was not constructed. The total future levels are additions of the contributions from the Proposal and existing road.

For most of the residential locations assessed, traffic noise levels either already exceed the ECRTN daytime or night time criteria, or are predicted to exceed the criteria in the future. In the year 2018, traffic noise levels are predicted to exceed the criteria by up to 12dB (A) during the day and by up to 14dB (A) during the night. Further, at some locations, traffic noise levels are considered to be 'acute' as they are greater than 65 LAeq (15hr) and 60 LAeq (9hr). Therefore, according to the ENMM, potential noise control options such as noise barriers, quieter pavements and architectural treatments would be required.

Table 7-17: Daytime Traffic Noise Levels

Location	DEC Criteria LAeq(15hr)- dB(A)	Measured Existing LAeq(15hr) - dB(A)	5 Years after opening LAeq(15hr) - dB(A)	10 years after opening LAeq(15hr) - dB(A)
Location 1 – 955 Oxley Hwy	55	51	56	58
Location 2 – 18 Bestglen Pl	55	48	53	54
Location 3 – 714 Oxley Hwy	55	67	65	67
Location 4 – 697 Oxley Hwy	55	60	65	67
Location 5 – 1 Lindfield Park Rd	55	52	59	60
Location 6 – 3 Lindfield Park Rd	55	50	55	57
Location 7 – 640 Oxley Hwy	55	-	59	61
Location 8 Caravan Park	55	50	65	66
Location 9 – 5 Tudor Grove	55	53	55	56
Golf Driving Range	60	-	53	55
Crematorium - LAeq(1hr) internal	40	-	<38	<39

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

Table 7-18: Nighttime Traffic Noise Levels

Location	DEC Criteria LAeq(9hr) dB(A)	Measured Existing LAeq(9hr) dB(A)	5 Years after opening LAeq(9hr) dB(A)	10 years after opening LAeq(9hr) dB(A)
Location 1 – 955 Oxley Hwy	50	45	53	54
Location 2 – 18 Bestglen Pl	50	45	49	51
Location 3 – 714 Oxley Hwy	50	63	61	63
Location 4 – 697 Oxley Hwy	50	55	62	63
Location 5 – 1 Lindfield Park Rd	50	48	55	57
Location 6 – 3 Lindfield Park Rd	50	46	50	52
Location 7 – 640 Oxley Hwy	50	-	54	56
Location 8 – Caravan Park	50	46	60	61
Location 9 – 5 Tudor Grove	50	50	51	52

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

Traffic noise levels at the golf driving range are predicted to be less than the 60 LAeq (15hr) limit for active recreation areas, and therefore are considered to be acceptable.

Internal noise predictions inside the chapel building at the crematorium assume a 20dB (A) noise reduction through the building envelope. Based on this assumption, internal noise levels are predicted to be below the 40 LAeq (1hr) internal limit for places of worship, and therefore are considered to be acceptable.

Maximum Noise Assessment

The DEC's policy on traffic noise does not specify a night-time Lmax noise limit or noise goal. This is primarily because research conducted to date in this field has not been definitive and the relationship between maximum noise levels, sleep disturbance and subsequent health effects is not currently well defined. According to the policy however, the likely maximum or peak noise levels are to be broadly assessed and reported for the night-time period, which is considered by the DEC as being 10pm to 7am.

According to Practice Note (iii) of the RTA's ENMM, a maximum noise event can be defined as any pass by for which: $L_{max} - L_{eq}(1hr) \geq 15dB(A)$.

Recent noise monitoring shows that Lmax traffic noise levels at night along the existing Oxley Highway can reach approximately 80dB(A) as a repeatable maximum level for residences close to the road (eg. 714 Oxley Highway).

The Lmax noise level for a truck traveling at 100kph, the maximum posted speed for the Proposal, was calculated to be approximately 85dB (A) at a distance of 20m from the FHWA traffic noise model. At 80kph the Lmax level is calculated to be approximately 82dB (A) at 20m. These source levels were used to predict Lmax noise levels at the facades of each assessed residence, as shown in **Table 7-19**.

In terms of Lmax noise levels, the Gateway Tourist Park would be the worst affected receiver location as vans or units at the rear of the park would be located close to the Proposal. Predicted maximum noise levels there could be as high as 82dB (A), more than approximately 20dB (A) above the ambient Leq (1hr) noise level.

In terms of the $L_{max} - L_{eq}(1hr)$ metric, Location 9 is shown to be the worst affected location, with Lmax noise levels reaching up to 28dB(A) above the Leq(1hr) noise levels.

Table 7-19: Maximum Nighttime Noise Levels (Road Traffic), dB (A)

Nearest Affected Residences	Noise Levels at Receiver Location				
	Modeled* Lmax Trucks at posted speed	Year 2008		Year 2018	
		Typical Leq(1hr) at night	Lmax - Leq(1hr)	Typical Leq(1hr) at night	Lmax - Leq(1hr)
Location 1 – 955 Oxley Hwy	66	54	12	55	11
Location 2 – 18 Bestglen Pl	56	51	5	52	4
Location 3 – 714 Oxley Hwy	73	63	10	64	9
Location 4 – 697 Oxley Hwy	78	63	15	65	13
Location 5 – 1 Lindfield Park Rd	69	56	13	58	11
Location 6 – 3 Lindfield Park Rd	62	51	11	52	10
Location 7 – 640 Oxley Hwy	67	56	11	52	15
Location 8 – Caravan Park	82	62	20	63	19
Location 9 – 5 Tudor Grove	80	52	28	54	26

Source: Renzo Tonin, 2004 (REF Volume Three, Working Paper 15)

7.11.3 Environmental Safeguards

Measures to mitigate potential construction and operational noise impacts were considered in accordance with the DEC ECRTN and Practice Note(iv) of the RTA's ENMM. A combination of physical roadside barriers, architectural treatment to buildings and road pavement choice were considered the most feasible and effective noise environmental safeguards for the operational stage of the Proposal.

General Noise and Vibration Environmental Safeguards

- Noise and vibration would be managed through the implementation of environmental safeguards detailed in Section 6.7 (Noise Control) and 6.8 (Ground Vibration and Air Blasting) of the RTA's QA Specification G36.
- Should works be required outside standard working hours, the procedures contained in the RTA's *Environmental Noise Management Manual 2001*, "Practice Note (vii) Roadworks Outside of Normal Working Hours" would be followed.
- Plant and equipment would be properly maintained and treated with 'silencing' kits.
- Plant would be strategically positioned on site to reduce the emission of noise to the surrounding neighborhood and to site personnel.
- Equipment would be switched off when not in use for extended periods during construction work.
- Noise compliance monitoring for all major equipment and activities on site would be undertaken prior to commencement of work on site.
- A management procedure would be put in place to address noise and vibration complaints that may arise from construction activities.
- Good relations with people living and working in the vicinity of a construction site would be established at the beginning of a project and be maintained throughout the project. Community liaison would be undertaken in accordance with the RTA's *Community Involvement Practice Notes and Resource Manual 1998*.

- Where noise level exceedances cannot be avoided, then consideration would be given to implementing time restrictions and/or providing periods of respite for residents.
- In some cases, after the options above have been exhausted, physical controls such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" would be applied to construction equipment to achieve the noise criteria.
- It would be the responsibility of Hastings Council as the consenting authority to require noise environmental safeguards for future approved developments adjacent to the Proposal.

Construction Traffic Noise Environmental Safeguards

- Access to the construction site would be directly from the Oxley Highway or through vacant land.
- Site access points would be located away from residences.
- The volume of construction traffic entering the site would be distributed evenly throughout the day where possible.
- Construction traffic on local roads at night would be avoided.

Construction Compound Noise Environmental Safeguards

- A site on the western and eastern side of Lindfield Park Road between the proposed and existing highways has been identified for a possible compound site. A 4 metre solid screen would be required adjacent to the existing houses on the eastern boundary. There would be no gaps between panels or underneath the screens. Parking areas for construction equipment and light vehicles would be located along the eastern boundary. A buffer zone would be provided between the screen and the possible construction compound to reduce the height requirements of the screens. The determination of the buffer zone and the resulting screen height would be the responsibility of the construction contractor in accordance with noise mitigation criteria.
- Active use of the site compound would be limited to the construction hours of 7am to 6pm on weekdays and 8am to 1pm on Saturdays. Equipment would not be started or 'warmed up' in the compound outside these hours.



Possible location for temporary site compound looking west from Lindfield Park Road to existing highway

Construction Vibration Environmental Safeguards

- The proper implementation of a construction noise and vibration management plan would be undertaken to avoid adverse vibration disturbance to affected occupancies. This would include consultation with affected property owners/residents, and would be aimed at providing a communication path directly to the contractor.
- Vibration testing would be carried out on actual equipment on site to determine acceptable site-specific buffer distances to sensitive occupancies.
- A minimum buffer distance of approximately 20m would be maintained to prevent vibration exceedances from all construction equipment with the exception of heavy vibratory rollers.
- Additional vibration monitoring would be conducted when construction activities are at the nearest point to the nominated occupancies.
- Periodic monitoring would be conducted at all critical or sensitive areas and the vibration levels would be tested for compliance with the set vibration limits. This monitoring would be undertaken in accordance with the noise and vibration monitoring program described in a construction noise and vibration management plan.
- If vibration is found to be excessive, management measures would be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller rock breakers, establishment of safe buffer zones and if necessary, time restrictions for the most excessive vibration activities. Time restrictions would be negotiated with affected receivers.
- A building condition report on the state of the existing buildings nearest to the works would be undertaken before the construction work commences and after construction is complete.

Operational Noise Environmental Safeguards

The following measures provide noise control solutions to reduce noise impacts to residential receivers. **Figure 6-8** and **Figure 6-9** show the location of proposed noise environmental safeguards.

The measures proposed relate to acoustics only. Supplementary professional advice would be sought as needed in terms of fire ratings, structural design, buildability, fitness for purpose and the like. Visual impacts are discussed in **Section 7.10** above.

The ECRTN requires that all “feasible and reasonable” environmental safeguards should be adopted to meet the target noise levels as specified in **Working Paper 14**. Practice Note (iv) of the RTA’s Environmental Noise Management Manual (ENMM) has been used for assessing feasible and reasonable treatment options.

Table 7-20 shows the required noise barrier / mound heights along the Proposal.

The section between chainages 5500 – 4800 on the north side of the Proposal takes into account the current approved development within the Retreat Village. Although it is understood that there may be further development of the Retreat Village in the future, the RTA would only provide feasible, cost effective noise mitigation for approved developments. It is expected that possible future urban development would incorporate design elements or other safeguards in recognition of the proposal and its noise environment.

The required noise barrier / mound between chainages 5450 – 5100 on the south side of the Proposal takes into account the approved aged housing development at Lot 1 DP735097.

Noise barrier calculations for NCA8 and NCA9a assume hard facings on noise barriers. Noise from vehicles can reflect back off the barrier towards residences on the opposite side of the road, potentially increasing noise levels. However, should these noise barriers have absorptive facings, it has been estimated that the height of the noise walls for NCA8 and NCA9a could be reduced to 4m and 2m respectively. The possibility of implementing absorptive noise barriers would be further investigated during the detailed design and costing phase of the project.

Architectural treatment may be required for a number of dwellings along the Proposal where it is not practical to provide noise walls or mounds. Architectural treatment may include provision of courtyard walls, or acoustic glazing of affected windows. The residences identified for architectural treatment, as shown in **Table 7-21**, are based on site inspections, aerial photos, and cost effectiveness analysis results. A total of 5 or 6 dwellings would be potentially involved.

The final pavement surface would be determined during the detailed design. Minimising road traffic noise would be considered as a criterion for the selection of the final pavement surface.

Measures to mitigate the impacts of noise would be further examined in accordance with Practice Note IV of the RTA's ENMM during detailed design. The affected residents would be consulted during detailed design to further determine the preferred method of treatments.

Table 7-20: Noise Barrier/Mound Locations and Heights

NCA	Chainage	Side	Approx Length	Nominal Height
NCA4	6700 – 6400	South	300m	1.5m (3m)
NCA8	5100 – 4800	South	300m	5m (6m)
NCA8	5450 – 5100	South	350m	5m (6m)
NCA9a	5500 – 4800	North	700m	2.5m (3.5m)
NCA9b ²	4800 - 4650	North	150m	1.5m
TOTAL			1.8km	-

Source: Renzo Tonin (REF Volume Three, Working Paper 15)-

Note: 1. Numbers in brackets indicate required barrier height including 2dB (A) modelling tolerance.

2 A 1.5m earth mound for NCA 9b has been added for completeness and is to link to existing mound.

Table 7-21: Architectural Treatment of Dwellings

Road Section	Approx Chainage	Reduction Required	Estimated No. of Residences
NCA1	9300 - 8900	< 10dB(A)	3
NCA3	7500 - 6500	< 10dB(A)	0 (4)
NCA3	7500 - 6500	> 10dB(A)	2
NCA5	6400	< 10dB(A)	1
NCA6	6100	< 10dB(A)	0 (1)
TOTAL			6 (5)

Source: Renzo Tonin (REF Volume Three, Working Paper 15)

Note: Architectural treatment for a number of residences in brackets () subject to post-construction noise monitoring.

7.12 Waste Minimisation and Management

7.12.1 Potential Impacts

Major waste streams associated with the Proposal would include:

- vegetative materials from clearing and grubbing activities
- bitumen, concrete and asphalt
- major earthworks potentially producing an excess of spoil
- waste oils, liquids and fuels from maintenance of construction plant and equipment
- wastes from site compounds (including sewage waste, putrescible waste etc) and potential batch plants
- litter from road users
- building waste (packaging material, scrap metal, plastic wrapping, cardboard)
- temporary fencing.

The Proposal has the potential to introduce pollution and potential contaminants to the environment if the above waste streams are not adequately managed.

7.12.2 Environmental Safeguards

The principles of waste management are to minimise the amount of waste generated, recycle waste wherever possible and dispose of the remainder in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (the WARR Act). Accordingly, the following waste minimisation and impact mitigation methods are proposed:

- The management of waste would be undertaken in accordance with Section 6.17 (Waste Management) of the RTA's QA Specification G36.
- The Resource Management Hierarchy principles of the WARR Act would be adopted. They are as follows:
 - avoid unnecessary resource consumption as a priority
 - avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery)
 - disposal is undertaken as a last resort.
- A Waste Management Plan (WMP) would be prepared and incorporated in the CEMP. The plan would outline comprehensive plans of action for key waste stream identified and specify waste management procedures to be followed during construction by the Contractor. Wastes generated would be collected in appropriate containers within the compound site or stockpiled within designated stockpile areas awaiting disposal.
- The Proposal has been designed to reduce waste by broadly balancing the amount of cut to fill along the Preferred Corridor where possible.
- All weed species would be transported in a covered load to an appropriately licensed tipping site, to prevent the further spread of weeds.
- Logs, branches and other suitable habitat material would be placed within neighbouring stands of riparian vegetation. Vegetative material in excess of this requirement would be mulched and used for landscaping works following construction, or used for windrows and sediment control.

- Waste oils, liquids and fuels would be stored in appropriate containers, and kept in a locked storage area with an impermeable solid floor and bunded walls prior to disposal at an appropriately licensed landfill facility.
- Garbage bins would be provided for the collection of compound site waste and emptied regularly.
- Portable toilets would be properly maintained.
- In the event that excess spoil is generated, Hastings Council or local businesses would be offered excess spoil for reuse.
- Vegetation not reused on site would be transferred to a landscape supplier for composting.
- Kerb and pavement materials on sections of the existing highway that are affected (eg western end) would be collected and transported to crushing and recycling plants.
- Environmental safeguards associated with contaminated waste and acid sulphate soils are outlined in **Section 7.2** above.

7.13 Associated Infrastructure and Activities

7.13.1 Existing Situation

Compound Site

The Proposal includes a possible site compound near the eastern side of the central cross-over, located on relatively level ground and requiring minimal clearing of native vegetation. The compound site would have a hardstand surface comprising gravel of a sub-base quality.

Details of this site are outlined in **Section 6.7.7** of this REF.

Likely activities / infrastructure at the compound site would include: site offices; lunchrooms; vehicle and fuel storage; vehicle and equipment wash-down area.

The site contains approximately 2.37 ha of native vegetation comprising 0.07ha of Blackbutt-Tallowood Tall open Forest and 0.15 ha of regenerating broad-leafed Paperbark and Swamp Oak and tussock grassland. The native vegetation on the proposed compound site has been variously modified through human activity including burning, grazing, clearing and slashing. The remainder of the site comprises grazed grassland.

No threatened flora species have been recorded in the compound site area and the vegetation communities are not listed as endangered ecological communities pursuant to the TSC Act of EPBC Act.

No archaeological sites are known to exist on the compound site. There are a number of houses located approximately 20m east of the eastern boundary of the proposed site.

Access to the compound site would be from Lindfield Park Road. This site would be used to house the administrative offices of the Contractor for the project, as well as machinery, fuel supplies and related materials. Vehicle movements at the compound site would be limited to equipment leaving in the morning and entering in the evening.

Equipment that may be used and or stored at the compound site would include:

- light transport vehicles
- rollers
- backhoe
- wood chippers (not active at compound site)
- stump grinders (not active at compound site)
- excavators
- service vehicles
- chainsaws (not active at compound site)
- water tankers
- concrete pumps (not typically active at compound site)
- cement trucks
- bulldozers
- graders
- front end loaders
- compactors and compressors
- excavation trucks
- cranes

Geotechnical Investigations

Geotechnical assessments done for the REF and Detailed Concept Design stages have been undertaken in accordance with acceptable environmental practice. It is likely that further geotechnical investigations would be required for the detailed design stage; as is standard practice. Any further geotechnical investigations may require additional separate environmental impact assessment.

Quarry Sites

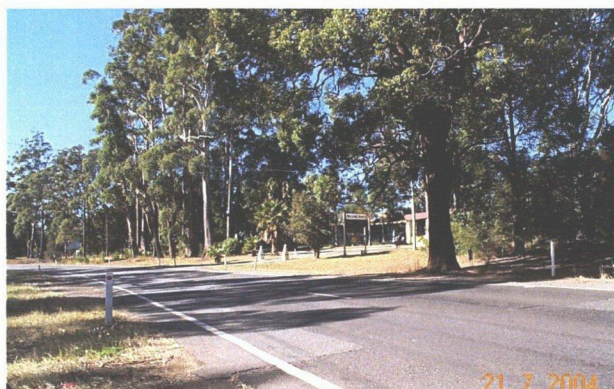
It is not envisaged that the Proposal would require the establishment of any new quarry sites. Material required would be sourced from the local region. **Figure 6-14** refers.

Stockpile Sites

It is envisaged that materials required for road works that are not available from the Proposal would generally be stockpiled off-site, potentially at a number of existing stockpile locations. These actions may require separate environmental impact assessment that would be the responsibility of the Contractor or supplier in terms of environmental management and operation in accordance with DEC and Hastings Council requirements. The RTA would be the proponent if a Part 5 EP&A Act approval was required.

Batch Plants

No batch plants are likely to be required for the Proposal. If batch plants are required, a separate environmental impact assessment would be undertaken. Whilst the Contractor would be responsible for the assessment, the RTA would be the proponent if a Part 5 EP&A Act approval was required.



*Major Innes Motel on the
Oxley Highway*

7.13.2 Potential Impacts

It is not expected that the site compound would have an adverse long term impact on the environment, as it would only be occupied for the duration of the project (approximately 18 months), and then rehabilitated after construction is complete. In the short term however, the compound site may cause some loss of amenity for adjacent residents. These impacts would mainly include noise and dust. Some short term loss of habitat would also occur.

The nearest residences to the compound are those on the Oxley Highway to the east, and to the south, across the Oxley Highway. Residences to the east would be most affected as they are adjacent to the compound and the nearest house could be within 20m of compound noise sources. Noise levels at the nearest receiver from equipment such as trucks and backhoes could be up to 75dB(A), and higher when equipment is operating concurrently. Therefore, noise levels could potentially exceed the construction noise criteria by around 20dB(A). However, it should also be noted that these noise levels would only be experienced for short periods when equipment is entering or leaving the compound. Noise sources such as air conditioners that may operate for longer periods are not expected to exceed the criteria.

Residences to the south would probably be at least 100m from compound noise sources and experience noise levels of up to 60dB(A) and should marginally comply with the construction noise criteria.

Air quality impacts of the site compound from dust would be minimal as the floor of the compound site would be hardstand (sub-base gravel). Construction equipment movements to and from the compound would be limited to leaving in the morning and returning in the afternoon. Service vehicles would access the compound at various times throughout the day however volumes would be low. Therefore, overall impacts on air quality as a result of the compound site would be minimal.

No threatened fauna species were recorded on the site. However, the vegetation provides some habitat for a number of the more mobile and wide ranging species which are known to occur in the locality (e.g. microchiropteran bats and birds).

The site is of potentially most relevance to the Koala given the presence of primary foraging trees (e.g. Tallowood; Forest Red Gum). However, the small area to be removed is not considered to contribute substantially to the overall impacts of the Proposal which have already been assessed as being significant with respect to the Koala.

Construction of the compound site would not impose any additional adverse impacts on the Yellow-bellied Glider or the Glossy Black Cockatoo or other threatened species previously recorded in the locality given the nature of the habitats present and/or the small area of native vegetation to be removed.

7.13.3 Environmental Safeguards

- A solid screen would be constructed along the eastern boundary of the compound site to reduce noise from construction equipment by 5 to 10dB(A). The screen would be at least 4m high and would be constructed from timber, metal or any solid material. There would be no gaps between panels or underneath the screen.
- Parking areas for construction equipment and light vehicles would be located adjacent to Lindfield Park Road and not alongside the eastern boundary.
- Use of compounds would be limited to the construction hours of 7am to 6pm on weekdays and 8am to 1pm on Saturdays. Equipment would not be started or 'warmed

up' in the compound outside these hours. Earth bunding would be provided around the perimeter of the compound site to protect against spillage of dangerous goods.

- Straw bales would be provided on all drainage lines within and surrounding the compound site for water quality protection.
- The floor of the compound site would be constructed of low-dust materials (eg sub-surface gravels) and would be "wet down" in prolonged dry conditions to avoid dust impacts.
- Machinery would not be left to idle whilst in the compound site.

7.14 Utility Services

7.14.1 Existing Situation

There are three fibre optic networks in the Preferred Corridor; including Telstra, Optus and Nextgen (Figure 6-1 refers.) The main areas of concern are in the western section where all three networks cross the Proposal. The Proposal crosses Telstra and Optus facilities at 9km 250 in fill and the crossing of the Nextgen cables is in cut at 9km 350.

Optus is also affected in two other fill areas:

- at the Highway crossover.
- within the eastern flood plain, between Lindfield Park Road and Wrights Road.

Minor power alterations would be required at 9km300, the Highway crossover, Lindfield Park Road and Wrights Road.

The Proposal crosses existing water mains at 6km800, the Highway crossover near Philip Charley Drive, Lindfield Park Road and Wrights Road.

7.14.2 Potential Impacts

Any damage to these utility services during construction could have major consequences in terms of disruption costs and inconvenience to users.

Any relocation of communications line would require excavation and the potential to expose acid sulphate soils particularly in the eastern section. Water quality may be affected by erosion and sedimentation as surfaces are exposed during excavation. This action would require a separate Environmental Impact Assessment by the RTA.

7.14.3 Environmental Safeguards

The following environmental safeguards have been implemented or are proposed for treatment of utility services:

- Detailed location of all underground utilities by 'potholing' has been undertaken during the concept design.
- All public utilities affected by the Proposal would be relocated prior to construction.
- Erosion and sedimentation fencing would be used to protect area excavated for utility relocation.

- Where excavation is to take place below 500mm, excavated materials would be tested for the presence of Acid Sulphate Soils (ASS). Where ASS is present it would be treated in accordance with the RTA's guidelines for the management of Acid Sulphate Soils (Draft February 2004)
- The construction contractor would be required to identify on the ground all public utilities prior to commencement of construction.
- Any alteration or relocation of utilities and services would be carried out to the satisfaction of the relevant serviced provider and apportionment of cost would be negotiated with the service utility provider
- The Contractor would provide advice to the community in advance of work to be undertaken on utility services that may cause disruption to on-going community or business services.

7.15 Demand on Resources

7.15.1 Existing Situation

Construction of the Proposal would require the use of substantial materials for basic earthworks, pavement surfaces and associated works. The road corridor has the potential to provide much of this material, supplemented by other sources in the local region.

7.15.2 Potential Impacts

The demand on resources is not expected to increase substantially as a result of the Proposal as the majority of fill is expected to be generated on site.

Approximately 320,000m³ of fill material required for the Proposal would be sourced from the cuttings in the western section of the corridor and used in the eastern section. Approximately 69,000m³ of bridging layer, 48,000m³ of selected pavement material and 5,800m³ of sub base and base would be required for the Proposal. These materials would be sourced from local commercial quarries, potentially including:

- Sancrox Quarry (CTK) – is located along Sancrox Road, Wauchope (turn left off Pacific Highway approximately 2.2km north of the Oxley Highway). The quarry produces sub base, base and select materials, concrete aggregate and –90mm to –150mm ballast. The ballast material is generally used for filling Gabion Baskets, but can be used for Bridging Layer.
- Maxwell Bros Quarry (Rosewood) – is located on the corner of Quarry Road and Rosewood Road, Wauchope (turn right off the Oxley Highway, approximately 12km west of the Pacific Highway). The quarry produces sub base, base and select material.
- Johns River Quarry (Boral Resources) – is located on Bulleys Road at Johns River (South of Kew, approximately 35km south of the Oxley Highway). The quarry produces sub base, base and select material, and a –80mm crusher run that is used for bridging layers.

Approximately 23,000m³ of concrete and 48,000 tonnes of asphalt would be required for the final pavement layers. These materials would be sourced from local suppliers or from possible batch plants in the study area.

Other materials required for the Proposal are:

- precast concrete pipes and box culverts
- kerbs and gutters
- rock filled gabions and mattresses
- sprayed bituminous surfacing
- safety barriers and guideposts
- signposting and line marking
- fencing.

No materials in short supply would be required for the Proposal.

7.15.3 Environmental Safeguards

- Environmental safeguards associated with cut material taken from the corridor have been discussed in Sections 7.1 to 7.3 of this REF.

7.16 Operational Hazards and Risks

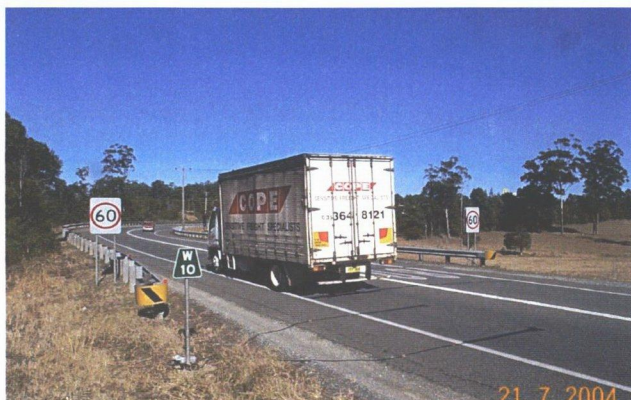
7.16.1 Existing Situation

The existing Oxley Highway is the primary transport corridor into the major centre of Port Macquarie, and carries trucks transporting potentially dangerous goods. The most common dangerous goods are flammable and combustible liquids, liquefied petroleum gases, flammable gases, toxic materials and reactive materials.

Heavy vehicles account for approximately 3% of the total traffic. It is anticipated that only a small percentage of these would carry dangerous goods. Research shows that dangerous goods vehicles represent about 1.15% of all heavy vehicles in NSW (Source: EIS Pacific Highway Upgrade Coopernook to Moorland Feb 2000). The likelihood of an incident would be small.

The transport of dangerous goods is controlled by the provisions of the *Dangerous Goods Act 1997* which defines the categories of goods, labelling, packaging for transport and compatibility with one another for transport. These safeguards minimise the impacts of the severity of any incident.

The drainage lines within the study area run into the Partridge Creek and Lake Innes catchments. Both of these are highly sensitive aquatic environments, containing SEPP14 Wetlands.



The Proposal will remove heavy vehicles from the existing highway and improve existing amenity

7.16.2 Potential Impacts

There are a number of operational risks that could potentially occur with the Proposal, including:

- general traffic accidents along the Proposal
- the transportation of dangerous goods along a new alignment.

The Proposal has been designed as a high standard alignment to a 100 kph design speed. The majority of the traffic would be travelling at this speed for the length of the Proposal. This introduces the potential for high severity accidents at the junction with Lindfield Park Road where there would be right turning movements across the eastbound carriageway. There would also be high speed traffic entering the lower speed environments at the western and eastern connections.

There is potential for a hazardous incident to occur during the transportation of dangerous goods on any highway and although this is a low risk, it has the potential to cause serious environmental and community effects. It should be noted that this is already a risk on the existing Oxley Highway, and that the Proposal would therefore not introduce any additional risks. Indeed, the Proposal likely to reduce current risks. Water quality ponds have been incorporated into the design of the Proposal so that any hazardous chemical which is spilled onto the road would drain directly into these ponds, for containment and disposal in accordance with DEC Guidelines. This would constitute a considerable environmental improvement over the current road.

Safety improvements associated with building a higher standard road carriageway would reduce the potential for a hazardous goods incident. The construction of a new dual carriageway road would provide a far safer transport corridor than the existing winding two-lane highway.

Response times for environmental incidents for the Proposal are likely to be satisfactory as a full time fire station is located at Port Macquarie. The NSW Fire Brigade has the responsibility for managing chemical and fuel spills, and operates under the DEC Guidelines 'Chemical Responses Manual' for spillage. The DEC is responsible for offering advice on containment and cleanup. The RTA has procedures for assisting these authorities in the management and cleanup of such incidents. Together these agencies and procedures are considered adequate to fully address any incidents for the Proposal.

7.16.3 Environmental Safeguards

A number of measures have been incorporated into the design of the Proposal to minimise the risks associated with accidents. These include:

- The concept design minimises the access points along the length of the Proposal with only one direct access point at Lindfield Park Road.
- Access at the bridge over the existing Oxley Highway would be via left in movements only, as would access via the roundabouts at the eastern and western connection to the Proposal.
- The access to Lindfield Park Road would be converted to a left in/left out only in conjunction with the development of the West Lindfield area and in consultation with Hastings Council. In the interim, the performance of the junction with Lindfield Park Road would be monitored and if the risk of accidents increases then traffic management measures would be considered such as reduction in the speed limits.

- A Road Safety Audit would be undertaken on the detailed design. This would address the safety issues of the connections to low speed environments at the western and eastern ends.
- In the event of a hazardous goods incident the road drainage has been designed to direct flows to water quality ponds to protect sensitive areas such as Lake Innes Nature Reserve and the SEPP 14 Wetlands to the north.
- Median turning areas to provide better response times for emergency and maintenance vehicles would be considered in the detailed design stage. Traffic would also be diverted along the existing Oxley Highway if required, during a hazardous goods incidence.

7.17 Cumulative Environmental Effects

Clause 228 (2) of the Environmental Planning and Assessment Regulations 2000 requires that an environmental assessment under Part 5 of the Act take into account any cumulative environmental impact with other existing or likely future activities.

The anticipated cumulative environmental effects of the Proposal relate to the combined effect of individual impacts of the Proposal as well as to the cumulative effect of this Proposal with other nearby infrastructure projects or planned infrastructure projects or activities in the locality.

7.17.1 Impacts

In conjunction with other improvement works on the Pacific Highway, accessibility between Sydney, Newcastle and Port Macquarie would be improved. Accordingly, the Proposal could play a small role in the development in the Port Macquarie area and the multiplicity of positive and negative impacts which that development would occasion.

In terms of currently proposed urban development, the most relevant project with the potential to result in cumulative impacts with the Proposal is the future urbanisation of Area 13. The Proposal would both contribute to access to this area and be affected by the increased traffic volumes that the area would generate. The development of this area would also result in increased traffic on the existing Oxley Highway, with the resulting diminution of any positive or negative impacts on the existing highway resulting from the construction of the Proposal.

Other cumulative environmental effects of the Proposal relate to traffic, noise, biodiversity, water quality and infrastructure. These impacts are discussed below.



The Proposal would improve road alignment and safety

Traffic

At present, the Oxley Highway and Hastings River Drive serve separate traffic catchment areas. Any transfer of traffic on the current road network, without substantial improvement to one of these routes, would involve a major increase in travel time for users and is unlikely. The exception relates to a small proportion of traffic originating at Wauchope or Rawdon Island, which may take a longer travel path to avoid the increasing traffic on the Oxley Highway.

However, with the completion of the Proposal, some of the traffic using Hastings River Drive may revert to using the higher standard of road that the Proposal offers. On this basis the impact on Hastings River Drive would be beneficial.

The proposed access arrangements onto the Proposal would cater for development proposed in HUGS for medium population growth and would not affect the Proposal.

The Proposal would provide good access to Port Macquarie for a 20 year planning period and cater for all road users. However, the projected increase in traffic from urban development and growth in through traffic would be considerable at the intersections of Wrights Road and at Lake Road. All traffic to and from the west would be funnelled through this section which is currently constructed to a four lane divided road. The provision of a local road network would be beneficial in removing unnecessary local trips on the Oxley Highway and is critical if traffic congestion is to be avoided in the future.

Noise

The Proposal contains noise attenuation measures to ensure that it meets current DEC standards for all sections of the Proposal. Should new urban development encroach on the Proposal subsequent to approval of the REF, additional noise mitigation may be required, but the costs of this would be met by the proponent.

Biodiversity

The Proposal would result in the loss of habitat along the corridor for a number of native fauna species, including the threatened Koala, Glossy Black Cockatoo and Yellow-Bellied Glider. This would be a permanent loss of habitat and a partial barrier to north-south wildlife movement. However, the design incorporates fauna underpasses, fauna exclusion fencing, narrow median widths, feed tree plantings and other landscape treatments that would facilitate continued fauna movement along identified wildlife corridors that intersect with the Proposal. With the implementation of HUGS for Area 13 there could be a large amount of ongoing clearing of wildlife habitat in the western section of Port Macquarie and this could be subject to assessment by the developer in relation to potential impacts on threatened species.

Measures to minimise the impacts of the Oxley Highway upgrade would also contribute to minimising the impacts of the cumulative effects on biodiversity within the region.

Water Quality

The Proposal will only generate a small percentage increase in the amount of impervious surface area in both catchment areas, and could result in additional pollutant loads flowing into SEPP14 wetlands. However, this threat would be mitigated by effective stormwater control ponds located adjacent to the Proposal to capture road stormwater runoff and is not expected to have any cumulative impact..

Infrastructure

The Proposal would act as a major infrastructure element in the future development of western Port Macquarie. The new highway alignment would take visitor and regional traffic as well as serving the immediate urban area. The presence of improved accessibility, road safety and travel time could facilitate new urban development in the corridor. Further, in conjunction with ongoing improvement to the Pacific Highway, the Proposal could contribute to improved access between Sydney, Newcastle and Port Macquarie and play a role in continuing urban expansion in the Port Macquarie area. The Proposal would have the potential to contribute to the following cumulative social and economic impacts:

- Improved road user safety by contributing to a reduction in accidents.
- Reduced travel times and increased travel efficiency.
- Travel cost savings for motorists due to an improvement of transport links in the region.
- Increased economic activity of adjacent commercial areas due to improved accessibility and increased tourist visitations.

It has also been noted that the RTA would continue discussions with Hastings Council for an additional traffic underpass at the western end of the Corridor, to service new residential and/or commercial development to the north and south of the Proposal. The concept design of the Proposal is sufficiently flexible to facilitate north-south movements, but any proposals would be subject to separate environmental impact assessment and funding by the proponent at that stage.

7.17.2 Environmental Safeguards

No additional environmental safeguards (other than those contained in the Detailed Concept Design) are intended to address cumulative impacts associated with the Proposal.

7.18 Principles of Ecologically Sustainable Development

The principles of ecologically sustainable development (ESD) have formed an integral part of option evaluation, concept design and environmental assessment for the Proposal. Broadly speaking, ESD is development that aims to meet the needs of Australians today, while conserving natural resources and ecosystems for the benefit of future generations, and its guiding principles need to be considered in the planning and management of transport systems in Australia.

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

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

Table 7-22 outlines the relationship between the above objectives and a number of guiding principles incorporated in the *EP&A Act*. It is considered that the Proposal is more compatible with ESD principles than a “do nothing” option or the option of upgrading the Oxley Highway along its existing alignment as both options do not address RTA Safety, Amenity and road efficiency objectives.

Table 7-22: Principles of ESD Applied to the Proposal

Principle	Application to The Proposal
Precautionary Principle	<p>A comprehensive range of environmental studies has been undertaken as part of the assessment of the Proposal, including a review of corridor options as well as identification and assessment of the preferred alignment and design of the Proposal. The evaluation of options and the assessment of the Proposal have concentrated on avoiding irreversible impacts on the environment wherever possible.</p> <p>In the absence of full scientific information and rigour, environmental safeguards have been implemented in accordance with the precautionary principle. These would include such things as: minimisation of the loss of vegetation within the Preferred Corridor through a narrowed median; adopting the use of fauna underpasses and related fauna fencing; and addressing the conservation of Aboriginal heritage resources to the satisfaction of the local Aboriginal community.</p>
Intergenerational Equity	The Proposal would improve access into Port Macquarie and would cater for existing and future generations of users. The Proposal would provide long term improvements to travel times between the Pacific Highway and Port Macquarie. The economic and social disruption resulting during the construction stage would be alleviated through a road that provides improved access for commuters and tourists, with benefits for a number of local businesses.
Conservation of Biological Diversity & Ecological Integrity	The upgrade of the Oxley Highway has been under consideration for a number of years. This has resulted in extensive investigations into the biological diversity and ecological integrity of the surrounding environment, as well as the likely impacts of the Proposal. Conclusions and recommendations from the assessments were used to determine measures that attempt to maintain the biological diversity of resources in the local area.
Improved Valuation & Pricing of Environmental Resources	The criteria used in the evaluation of options focussed on a range of environmental and community factors, as well as engineering and economic considerations. This approach has ensured that appropriate values have been attached to all environmental considerations during assessment. This is discussed in detail in Chapter 5.

7.19 Summary of Environmental Effects

7.19.1 Summary of Key Issues

Key issues have been identified in consultation with the local community throughout the study during the Corridor selection stage and design concept stage, and noted as follows:

- strong community concerns about road safety, noise, loss of residential amenity, increasing inconvenience, and congestion on the existing Oxley Highway alignment
- a strong community desire to see the Oxley Highway built sooner rather than later
- the need for a new highway that would integrate existing and future urban development in west Port Macquarie
- loss of Koala habitat and restrictions on the movement of wildlife
- potential noise impacts
- land acquisition for roadworks
- loss of direct highway access/egress for several existing business outlets along the eastern section of the highway as a result of the realignment of the Proposal
- severance of land on a few non-urban properties and the need for new access provisions.

There has been consistently strong support for the Proposal and the consultation process from a large majority of the local community throughout the Oxley Highway Upgrade study.

7.19.2 Summary of Beneficial Effects

The Proposal would greatly improve the level of road transport service between Port Macquarie and the Pacific Highway. It would provide good access to the potential future urban expansion to the west of Port Macquarie as well as catering for the traffic to/from Wauchope and regional/interstate visitors. Other beneficial effects would include:

- substantial improvements to road safety, road congestion, and residential amenity
- improved “gateway” to Port Macquarie
- more efficient road operations and resulting benefits to the local economy
- minimal land acquisition
- the relatively isolated “greenfields” location of the Corridor with minimal impact on existing and future urban development in the study area
- improved amenity for residents along the existing Oxley Highway
- substantial new capital works investment in the local area
- minimal disruption to traffic flow during the construction period.

7.19.3 Summary of Adverse Effects

The Proposal would result in some adverse effects, as outlined below, but these have been reduced to the fullest extent possible through environmental safeguards incorporated in the Proposal:

- loss of vegetation in the central part of the corridor
- disruption to unrestricted fauna movement across the Corridor
- disruption to several indigenous heritage sites
- disruption of traffic flow during parts of the construction period
- predicted increases in noise levels in a few locations and impact on some residential dwellings
- likely significant impact on threatened species.

8 Implementation Stage

8.1 Environmental Management Plan

The RTA would require the project Contractor to prepare a Construction Environmental Management Plan (CEMP) in accordance with the specifications set out in the RTA's *Environmental Protection (Management Plan) – QA Specification G36*. The CEMP would incorporate additional site specific requirements, outlined below, which are not covered by G36.

Environmental safeguards detailed in this report would also be incorporated into other supplementary EMPs required.

The CEMP would be reviewed by the RTA Environmental Adviser, (Northern Region), prior to the commencement of any site works.

8.2 Environmental Safeguards

As outlined above, all steps in the planning and design process to date have been directed at reaching an outcome for the general location of the upgrade (Preferred Corridor) and the more specific concept design elements of the new highway (the Proposal) that addresses environmental issues and minimises the overall environmental impact. **Table 8-1** summarises the environmental safeguards listed above in the REF that would be implemented as part of the Proposal.



Photomontage looking east from near the Service Centre at the western end of the Proposal

Table 8-1: Environmental Safeguards

Issue	Environmental Safeguards
Geology, Soils and Landforms (refer Section 7.1.3)	<ul style="list-style-type: none"> • A Soil and Water Management Plan (SWMP) would be prepared in accordance with G38 as part of the Contractors Environmental Management Plan (CEMP) in consultation with DIPNR and DEC prior to the commencement of construction. The SWMP would address the management measures detailed in Section 6.5.1 (Erosion and Sediment Control), 6.5.2 (Stockpile Management), 6.5.3 (Water Quality) and 6.5.4 (Water Extraction) of the RTA's QA Specification G36. • Consultation would be undertaken with DIPNR prior to construction to identify suitable strategies to be incorporated into the SWMP to prevent erosion and sedimentation during the construction stage. • No earthworks would be undertaken during periods of moderate or heavy rainfall. • Appropriate surface drains would be provided to collect and direct clean water around works areas. • Drainage structures would be installed to protect exposed batter slopes during construction. • Adequate protection would be provided to prevent soil erosion and siltation of local streams. Silt fences and barriers would be provided to prevent sediment laden runoff from leaving the construction area. Felled trees and shrubs from clearing activities would be reused where appropriate in windrows to address soil erosion. • Sediment traps would be installed at existing drain inlets where runoff is likely to occur from the construction site. • Soil batter protection cover such as grass covering on cut soil slopes and compacted fill embankments would be undertaken progressively as works in each area are completed • Cut and fill batters would be designed at a 2:1 slope to reduce the risk of erosion. In the large cuttings, berms have been provided at 7 metre intervals (vertically) to minimise the flow length vertically down the batters. • Geofabric sediment fences would be installed downslope of all disturbed areas. • If water is pumped from boreholes at any time during construction, it would be appropriately contained and treated prior to discharge to prevent off-site sedimentation. Re-use options would be investigated where possible. • Vegetation clearance and soil disturbance would be limited to those areas required for construction purposes. • Regular inspection of the work site would be undertaken during construction activities to ensure that the SWMP is implemented properly and all sediment traps and drainage structures are functioning. • Sediment basins of an appropriate size and nature (refer "<i>Managing Urban Stormwater – NSW Dept Housing, 1998</i>") would be located at strategic points along the roadway to capture sediment from the road in the long term. • All stockpiles would be established, managed and decommissioned in accordance with RTA's Stockpile Management Procedures, 2001. In addition, all stockpiles would be located at least 50m away from any drainage lines. • Hard-stand material would be implemented at entry and exit points and would be positioned strategically along major access routes throughout the construction corridor. • Scour protection would be provided at the downstream end of all culverts. Methods for scour protection associated with the implementation of culverts would include soft engineering options. All scour protection options would be designed in consultation with DIPNR and the RTA's Regional Environmental Advisor during the detailed design stage.



Issue	Environmental Safeguards
Contaminated Land, Asbestos and Acid Sulphate Soil (refer Section 7.2.3)	<p>Contaminated Land</p> <ul style="list-style-type: none"> Any contaminated lands identified during construction would be managed in accordance with Section 6.16 (Contaminated Ground) of the RTA's QA Specification G36. Should unexpected contaminated material be disturbed during earthworks, control measures would be implemented to capture surface runoff and the material would be removed from site and disposed of at an approved DEC site in accordance with the appropriate guidelines. Should any spillage occur during the construction activity, the Environmental Adviser, Northern Region, would be contacted immediately, and contaminants would be immediately contained, removed, treated (if necessary) and disposed of to the satisfaction of DEC. If imported fill is required it would be sourced from an approved stockpile site or supplier. <p>Asbestos</p> <ul style="list-style-type: none"> Should soil or rock materials containing asbestiform minerals be excavated during construction, they would be managed in accordance with DEC Environmental Guidelines – Assessment, classification and management of liquid and non-liquid wastes (1999) and Clause 29 of the Protection of the Environment Operations (waste) Regulation 1996. Risk management procedures for the possible occurrence of materials containing asbestiform minerals would be formulated in accordance with the RTA's QA Specification G22 prior to commencement of earthworks operations. These would be reviewed by the REA prior to implementation. <p>Acid Sulphate Soil</p> <ul style="list-style-type: none"> Where excavation is to take place below 500mm, excavated materials would be tested for the presence of ASS. Where ASS is present, it would be treated in accordance with the RTA's Guidelines for the management of Acid Sulphate Soils (Draft, February 2004).
Hydrology, Hydraulics and Water Quality (refer Section 7.3.3)	<ul style="list-style-type: none"> Water quality would be managed according to details in Section 6.5.3 (Water Quality), 6.5.4 (Water Extraction) and 6.13 (Spillage Prevention and Contamination Management) of the RTA's QA Specification G36. The placement of fill material would not be undertaken during periods of rain. Stockpiles would not be located within 50m of drainage lines. Washout of vehicles, plant or equipment, including cement trucks, would only take place in an impervious bunded area, at least 40m from the nearest drainage line. All water from the washout site would be collected, treated and disposed of in accordance with the appropriate DEC guidelines. Dirt and mud would be washed from vehicles leaving the construction area to prevent tracking onto the road. This would be undertaken in an impermeable truck wash area that would be cleaned out as soon as tracking starts to occur. Horizontal and long profiles for the Proposal would be designed to accommodate the 1:100 year flood event. Culvert drainage would be installed at low points along the Proposal. A grassed median strip would be installed, draining its own runoff plus the carriageway runoff where a superelevation configuration exists. The median water would be collected through drainage pits at design locations and piped outside of the carriageway to a drainage outlet.

Issue	Environmental Safeguards
Hydrology, Hydraulics and Water Quality (refer Section 7.3.3) (Con't)	<ul style="list-style-type: none"> • Detention ponds and wetland filters would be constructed at selected locations along the Proposal. The RTA's Regional Environmental Adviser would review the location and design of these during the detailed design stage. • The proposed stormwater quality management strategy for the upgrade of the Oxley Highway incorporates both vegetated swales and sedimentation basins to reduce the annual pollutant loads of TSS, TP and TN. • Stormwater treatment such as grass swales or linear roadside strips would be installed where possible for "soft" treatment of runoff from the road surface. The RTA's "Procedure for selecting treatment strategies to control road runoff Version 1.1 June 2003" would be consulted in the selection and design of appropriate treatments. • Vegetated swales would be provided adjacent to the road as a stormwater treatment measure to convey and filter stormwater where longitudinal gradients are typically in the range 0.5% to 5%. If vegetated swales are to be constructed at slopes greater than 5%, they would need to be suitably reinforced or lined to limit the potential for erosion. Vegetated swales would not be constructed on gradients less than 2% as they may be too flat to perform a conveyance role, with a greater potential for sag points to form along the swale, leading to trapped and possibly stagnating water. • S-O type gutters would be placed on the side of the Proposal embankment where necessary, collecting the carriageway runoff. The gutter water would be conveyed either through drainage pits or batter drains at design locations to the outer edge of the edge of the footprint where it would be either dispersed via contour drains or carried via a longitudinal toe drain to a water quality pond. • Sedimentation basins would be installed as an end of line treatment measure to be positioned at chainages corresponding to low points along the length of the highway. The proposed sedimentation basins would target an average hydraulic residence time of approximately 24 hours to ensure adequate time for settling of the suspended solids. Sedimentation basins would be positioned off line alongside the northern and southern sides of the road reserve to receive road runoff conveyed by the vegetated swales and concrete channels. • The sediment basin sizes would be further optimised by incorporating additional controls in series upstream where practicable. In particular, vegetated filter strips adjacent to the carriageway between the edge of the road pavement and inlets to the drainage system would be provided where possible. The filter strips would assist in reducing the sediment load discharging to the vegetated swales and sediment basins, effectively reducing the maintenance frequency for the treatment measures. • Specific temporary or permanent sediment traps would be constructed at the toe of the road batters in order to intercept eroded sediment before it enters the drainage system. • Any herbicides used for weed control would be used in accordance with the Pesticide Act 1999 and Pesticide Amendment (Records) Regulation. Such herbicides would not be stored near drainage lines. • All fuels and chemicals would be stored within a fully impervious bunded area with the capacity to contain 110% of the contents stored. • All proposed culverts would be designed and constructed in such a way as to minimise disturbance to any waterways and in accordance with the NSW Government's Flood Policy 1984, and the NSW Government's Floodplain Management Manual, 2001. • A permit would be sought from DIPNR in accordance with the Water Act 1912 or the Water Management Act 2000 at the time of construction if it becomes necessary to extract water from any waterways. The RTA's Regional Environmental Adviser would also be consulted as to the location of access and methodology in which water would be required.



Issue	Environmental Safeguards
Climate (refer Section 7.4.3)	<ul style="list-style-type: none"> • The CEMP for the Proposal would include procedures that cover construction activities and safety during inclement weather such as high winds and heavy rain. • Advice from the BoM regarding warnings for significant storm events would be sought daily. This information would be obtained from the BoM website (http://www.bom.gov.au/weather/warnings.shtml) or obtained through the Bureau Telephone Weather Services on 1300 659 218. • Works involving cutting, welding, grinding or other activities likely to generate fires would be limited during very hot, dry north-westerly winds.
Air Quality (refer Section 7.5.3)	<ul style="list-style-type: none"> • Air quality would be managed through the implementation of safeguards detailed in Section 6.6 (Air Quality) and Section 6.18 (Restoration of Site) of the RTA's QA Specification G36. • An Air Quality Management Plan (AQMP) would be prepared as part of the CEMP. • Trucks entering and leaving the site would be well maintained in accordance with the manufacturer's specifications to comply with all relevant regulations. • Truck movements would be controlled on site and restricted to designated roadways. • Truck wheel washes or other dust removal procedures would be introduced to minimise transport of dust off site. • Construction activities that generate high dust levels would be avoided during high wind periods and stockpiles and exposed areas would be covered, watered or seeded if they were likely to be more than 2 weeks in the one location. • Dust monitoring would be carried out at selected locations during construction to determine compliance with DEC's dust deposition goals. • No burning would occur as part of the Proposal.
Ecology (refer Section 7.6.3)	<ul style="list-style-type: none"> • Flora and fauna would be managed in accordance with Section 6.9 (Vegetation), Section 6.10 (Fauna) and Section 6.18 (Restoration of Site) of the RTA's QA Specification G36 and QA Specification G40 – Clearing and Grubbing, and QA Specification R 178 – Vegetation • Dedicated fauna underpasses of minimum 3.0 x 3.0m and 3.0 x 2.1m dimensions would be constructed along the mid-western portion of the Proposal (approximate chainages 7640 and 8500 respectively) to reduce impacts on the Koala as a result of habitat fragmentation, barrier effects and road mortality Figure 6-6 and Section 6.5.5 refers. This would also maintain north –south movement corridors for other species. • Native vegetation would be retained around underpass entrances and Koala feed trees would be planted around underpass entrances to direct animals to the underpasses. • Wildlife exclusion fencing would be installed along both sides of the Proposal from the western connection to the vicinity of the proposed bridge over the current Oxley Highway. • An asphalt strip would be placed under wildlife fences to retard vegetation growth. • A maintenance schedule would be prepared for the wildlife fencing to contend with potential damage and any vegetation regrowth. • Narrowing of median widths would occur in appropriate locations within the central section of the Proposal to minimise distances between trees for the movement of Yellow-Bellied Gliders. • Narrow tree clearance zones would be retained on either side of the pavement in two locations within the central section of the Proposal to allow for movement of juvenile Yellow-Bellied Gliders.

Issue	Environmental Safeguards
Ecology (refer Section 7.6.3) (Con't)	<ul style="list-style-type: none"> • Pre-clearing surveys of vegetated areas (particularly hollow bearing trees) would be undertaken by a qualified person and in close communication with the RTA, the Construction Contractor and the DEC and/or Wildlife Information and Rescue Service (WIRES) to reduce direct fauna impact associated with the construction of the Proposal. • Clearing during the breeding season for Koalas (August to December) would include relocation of Koalas found within the activity zone to an alternative location prior to commencement of work. • Large hollow-bearing trees would be retained within the road reserve where possible. These would be identified and tagged by a qualified ecologist prior to construction. • Native seeds would be collected by a qualified bush regenerator prior to clearing, for use in the revegetation of disturbed areas. A particular focus would be the collection of Allocasuarina seeds to allow re-planting of Allocasuarinas in the road reserve post construction for Glossy Black Cockatoo habit. • Vegetation to be retained in close proximity to the road would be fenced prior to construction activities commencing so that it is not damaged by construction equipment. • Shredded native plant material removed from the Proposal would be used as mulch/groundcover on disturbed areas as well as a sediment barrier where possible. • The limits of clearing would be clearly marked and contractors would not be allowed to encroach on areas beyond the boundaries of the identified clear zone. • Parking of machinery and vehicles would be restricted to pre-disturbed areas only. • Portions of hollow-bearing trees removed from the construction area would be retained and either placed in adjacent bushland as hollow logs, or tied into large trees in adjacent woodland to provide shelter and nest sites for native fauna species. • Large logs would be removed from the disturbance areas during clearing and placed in adjacent retained vegetation to maintain resources for native fauna. • A weed management plan would be prepared to control the spread of weeds into adjoining areas. • Sediment ponds would be located in existing cleared areas to minimise the loss of habitat and would incorporate habitat features such as macrophyte plantings, rocks and areas of open water. • Chemical and fuel storage areas would be bunded to contain 110% of the on site liquids. • An emergency response program would be prepared for accidental spills. • Disturbed areas would be progressively re-vegetated. • Topsoil from vegetated areas along the proposed alignment would be removed and stockpiled for application to completed roadside rehabilitation areas. • Where fragmentation of an existing stand of native vegetation cannot be avoided or where the proposed alignment passes close to existing stands, roadside planting (using local native species) would be carried out as soon as possible after construction, in order to reduce edge effects. • Allocasuarina sp. and known Koala food trees would be planted as the primary landscape tree species in the road reserve to provide supplementary foraging habitat for the Glossy Black-Cockatoo and Koala. • Nest boxes would be provided as compensatory nest sites for the Glossy Black-Cockatoo, Yellow-bellied Glider and other hollow-dependent fauna. Nest boxes would be designed to suit the target species and would be provided on a 2:1 ratio. A maintenance program would also be implemented to ensure that nest boxes are functioning appropriately. • Should additional vegetation removal be required the RTA's Regional Environmental Adviser would be consulted.



Issue	Environmental Safeguards
Land Use and Socio- Economic (refer Section 7.7.3)	<ul style="list-style-type: none"> • Traffic during the reconstruction works would be managed in accordance with Section 6.4 (Access and Traffic Management) of the RTA's QA specification G36. • A left in/left out access is provided with a connection to the Phillip Charley Drive intersection to provide access to the Proposal from south of the study area, including the Major Innes Motel and Crematorium. • A project phone number would be provided so that residents can register concerns during the construction stage. Protocols described in RTA Community Involvement: Practice Notes and Resource Manual (1998) would be followed; • A Traffic Management Plan (TMP) would be developed for the Proposal in accordance with the RTA's QA Specification G10 – Control of Traffic. • All property acquisition where necessary would be undertaken prior to construction and would be negotiated in accordance with the RTA's Land Acquisition Policy. • Alternative access would be provided for the properties affected by the Proposal and where parcels of land become landlocked as a result of the upgrade. • Compensation would be provided to affected landowners in accordance with the Land Acquisition (Just Terms Compensation) Act. • Connectivity between the areas north and south of the Proposal would be provided at the bridge overpass for existing and future residences to minimise effects.
Indigenous Heritage (refer Section 7.8.3)	<p>Site Ah-DI: Artefact scatter (Open camp) - #30-3-323</p> <ul style="list-style-type: none"> • Due to the perceived low density of artefacts and disturbance caused by past logging and land clearing, sub-surface investigation of the Site DI location is not considered warranted. The RTA has re-aligned the road formation towards the southern side of the upgrading corridor to allow part of the Ah-DI to be maintained intact within the balance of the corridor. • Once the full extent of the necessary construction impact zone has been identified, a Birpai LALC/Mingaletta Sites Officer would be engaged to collect the affected artefacts under the auspices of a DEC Heritage Impact Permit. In line with Aboriginal community advice, the collected artefacts would be relocated to an adjacent defined place within the undeveloped section of road corridor. • An appropriately qualified Sites Officers from the Birpai LALC/Mingaletta Development Corporation would be invited to be present on site during earthworks activities in the vicinity of Site Ah-DI in areas of cultural interest to the local indigenous community. The actual extent of the time that they would be present would be determined by the RTA in liaison with the Birpai Aboriginal community. • To preserve its Aboriginal social and archaeological values and avoid construction related disturbance, the remaining part of Site DI would be retained and protected within the undeveloped section of road corridor, and would be fenced to exclude vehicles for the duration of construction. • To ensure that archaeological materials are not inadvertently disturbed or destroyed during the course of future highway maintenance works, the Site DI location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the site protection area unless formally approved by the relevant legislative authority (currently DEC).

Issue	Environmental Safeguards
Indigenous Heritage (refer Section 7.8.3) (Con't)	<p>Site Ah-D2: Artefact scatter (Open camp) - #30-3-324</p> <ul style="list-style-type: none"> The two recorded Site D2 artefacts lie close to, but not on, the proposed road formation. To preserve their Aboriginal social values and avoid construction-related disturbance, the artefacts would be retained and protected within the undeveloped section of the road corridor. The site area would be fenced to exclude vehicles for the duration of construction. To ensure that the Site D2 artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, their location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the location unless formally approved by the relevant legislative authority (currently DEC). <p>Site Ah-D3: Artefact scatter (Open camp) - #30-3-325</p> <ul style="list-style-type: none"> The Site D3 artefact scatter lies beyond the boundary of the proposed road corridor. However, associated subsurface materials may occur on a low terrace that extends into the northern side of the corridor. In order to preserve its potential archaeological values, the subject section of terrace would be protected in its current condition. To this end, the terrace location would be clearly marked and annotated on all development-related highway maps and plans and the landform avoided during the course of construction. If construction impacts cannot be avoided, the affected part of the terrace would be subject to subsurface archaeological testing (under the auspices of a DEC Section 87 permit) to determine its cultural status. Appropriate management recommendations would then be developed on the basis of an assessment of the social and scientific significance of any identified materials. <p>Site Ah-D4: Artefact scatter (Open camp) - #30-3-157</p> <ul style="list-style-type: none"> Once the full extent of the necessary construction impact zone has been identified, a Birpai LALC/Mingaletta Sites Officer would be engaged to collect the Site D4 artefacts under the auspices of a DEC Section 90 permit if the artefacts are to be impacted. In line with Aboriginal community advice, the collected artefacts would be relocated to an adjacent defined place within the undeveloped section of road corridor. An appropriately qualified Sites Officer from the Birpai LALC/Mingaletta Development Corporation would be invited to be present on site during the earthworks in the vicinity of Site Ah-D4 areas of cultural interest to the local indigenous community. The actual extent of the time that they would be present would be determined by the RTA in liaison with the Birpai Aboriginal community. To ensure that the relocated artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, the relocation place would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the subject location unless formally approved by the relevant legislative authority (currently DEC). <p>Site Ah-D5: Isolated find - #30-3-156</p> <ul style="list-style-type: none"> Prior to the commencement of any construction-related activity that would directly impact the Site D5 location (an isolated artefact not relocated during this survey), a Section 90 permit would be sought from DEC to allow the artefact to be destroyed during the course of construction.

Issue	Environmental Safeguards
Indigenous Heritage (refer Section 7.8.3) (Con't)	<p>PAD Ah-I: Potential open campsite</p> <ul style="list-style-type: none"> PAD I lies close to, but not on, the proposed road formation. In order to preserve its potential archaeological value the identified section of footslope terrace be protected in its current condition. To this end, the terrace would be clearly marked and annotated on all development-related highway maps and plans and the landform avoided during the course of construction. If construction impacts cannot be avoided, PAD I would be subject to subsurface archaeological testing (under the auspices of a Section 80 permit) to determine its cultural status. Appropriate management recommendations would then be developed on the basis of an assessment of the social and scientific significance of any identified site/materials. <p>Site Ah-D6: Artefact scatter (Open camp)</p> <ul style="list-style-type: none"> The five recorded Site D6 artefacts lie close to the margin of the proposed road corridor. Given that they can be avoided during construction the artefacts would be retained and protected within the undeveloped section of corridor. The site area would be fenced to exclude vehicles for the duration of construction. To ensure that the Site D6 artefacts are not inadvertently disturbed or destroyed during the course of future highway maintenance works, their location would be clearly marked and annotated on all relevant RTA maps and plans. No surface or subsurface disturbance would occur in the location unless formally approved by the relevant legislative authority (currently DEC). <p>General</p> <ul style="list-style-type: none"> Although the area has been substantially disturbed by past road construction and is unlikely to contain significant archaeological evidence, a Birpai LALC/Mingaletta Sites Officer has requested Aboriginal presence on site during vegetation clearance and initial construction-related earthworks in the vicinity of the existing Oxley Highway at Philip Charley Drive. This request would be fulfilled. The actual extent of the time which is spent on site by the Aboriginal community would be determined by the RTA in liaison with the Birpai Aboriginal community and the DEC Cultural Heritage Section. Prior to the commencement of any construction-related activities, all RTA project management staff, road, overpass and bridge/culvert construction contractors and their employees would be advised of their legal obligations with regard to Aboriginal cultural materials. This advice should be given in writing and a copy forwarded to DEC Northern Aboriginal Heritage Unit for its records. Should any materials thought to be of Aboriginal origin be discovered or exposed during any stage of highway development, work would immediately cease in that locality. The DEC (Port Macquarie District office), the RTA's Regional Environmental Adviser and Aboriginal Programs Consultant and Birpai LALC and Mingaletta Development Corporation would then be contacted for management advice and clearance given by these organisations before work resumes in the subject area. The RTA would liaise closely with the Birpai Aboriginal community in relation to cultural matters, and the Land Council and Mingaletta Development Corporation would be kept informed of the timetable for any works associated with the planning and implementation of the Oxley Highway upgrading project.

Issue	Environmental Safeguards
Non-Indigenous Heritage (refer Section 7.9.3)	<ul style="list-style-type: none"> • Prior to the commencement of any construction-related activities, all RTA project management staff, road, overpass and bridge/culvert construction contractors and their employees, would be advised of their legal obligations with regard to non-Indigenous 'relics'. • Should any sites or items of potential non-Indigenous cultural heritage significance be discovered or exposed during any stage of highway development, work would immediately cease in that locality. The NSW Heritage Office would then be contacted for management advice and clearance given before work resumes in the subject area.
Visual & Landscape (refer Section 7.10.3)	<ul style="list-style-type: none"> • A Landscape Design and Management Plan (LD&MP) would be prepared and reviewed by the REA prior to construction. • All planting areas would contain mixes that reflect the local indigenous species in proportions and diversity which reflect the original community. The planting lists contained in Working Paper 13 would be considered in the LD&MP. • Native grasses used for planting would be a combination of: <ul style="list-style-type: none"> – Hydro-seeding to medians and road verges – Wetland filter areas beside the water quality control ponds • All batters would be rounded off at the top of cuts and the limits of the cuttings graded in the detailed design to integrate with adjoining landforms. • During detailed design, investigations to vary the fill batter between 2:1 and 4:1 will be undertaken for the floodplain area. • Maximum slope for batters would be 2:1 to enable better growing conditions for revegetation. • Shotcrete would not be used in the Proposal. • Consideration would be given in the final design to the use of alternative materials to concrete for any hard-paved channels (eg stone-paved channels in lieu of concrete channels). • Vegetated swales would be adopted where possible, particularly in the median where grades permit and also along the tops of cuttings. • Distribution drains would be considered in the final design to maximise infiltration into the ground and reduce runoff. • Rock mulch swales would be considered in the final design in lieu of concrete drains, for slopes where grass would not suffice. • Filter beds would be considered in the final design to clean stormwater prior to discharging. • Water control ponds would be designed as informal, natural shapes. • Existing dams would be investigated for use as water quality control ponds. • Water Quality control ponds would be planted with suitable native wetland plants.
Noise and Vibration (refer Section 7.11.3)	<p>General Noise and Vibration Environmental safeguards</p> <ul style="list-style-type: none"> • Noise and vibration would be managed through the implementation of environmental safeguards detailed in Section 6.7 (Noise Control) and 6.8 (Ground Vibration and Air Blasting) of the RTA's QA Specification G36. • Should works be required outside of standard working hours, the procedures contained in the RTA's Environmental Noise Management Manual 2001, "Practice Note (vii) Roadworks Outside of Normal Working Hours" would be followed. • Plant and equipment would be properly maintained and treated with 'silencing' kits. • Plant would be strategically positioned on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel.

Issue	Environmental Safeguards
Noise and Vibration (refer Section 7.11.3 (con't))	<ul style="list-style-type: none"> • Equipment would be switched off when not in use for extended periods during construction work. • Noise compliance monitoring for all major equipment and activities on site would be undertaken prior to commencement of work on site. • A management procedure would be put in place to address noise and vibration complaints that may arise from construction activities. • Good relations with people living and working in the vicinity of a construction site would be established at the beginning of and be maintained throughout the project. Community liaison would be undertaken in accordance with the RTA's Community Involvement Practice Notes and Resource Manual 1998. • Where noise level exceedances cannot be avoided, then consideration would be given to implementing time restrictions and/or providing periods of respite for residents. • In some cases, after the options above have been exhausted, physical controls such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" would be applied to construction equipment to achieve the noise criteria. • It would be the responsibility of Hastings Council as the consenting authority to require noise environmental safeguards for future approved developments adjacent to the Proposal. <p>Construction Traffic Noise Environmental safeguards</p> <ul style="list-style-type: none"> • Access to the construction site would be directly from the Oxley Highway or through vacant land wherever possible. • Site access points would be located away from residences. • Traffic entering the construction site would be controlled to ensure that where possible construction traffic is distributed evenly throughout the day. • Construction traffic on local roads at night would be avoided. <p>Construction Compound Noise Environmental safeguards</p> <ul style="list-style-type: none"> • A site on the western and eastern side of Lindfield Park Road between the proposed and existing highways has been identified for a possible compound site. A 4 metre solid screen would be required adjacent to the existing houses on the eastern boundary. There should be no gaps between panels or underneath the screens. Parking areas for construction equipment and light vehicles should be located along the eastern boundary. Providing a buffer zone between the screen and the possible construction compound would reduce the height requirements of the screens. The determination of the buffer zone and the resulting screen height would be the responsibility of the construction contractor. • Active use of the site compound would be limited to the construction hours of 7am to 6pm on weekdays and 8am to 1pm on Saturdays. Equipment would not be started or 'warmed up' in the compound outside these hours. <p>Construction Vibration Environmental safeguards</p> <ul style="list-style-type: none"> • The proper implementation of a construction noise and vibration management plan would be undertaken to avoid adverse vibration disturbance to affected occupancies. This would include consultation with affected property owners/residents, and would be aimed at providing a communication path directly to the contractor. • Vibration testing would be carried out on actual equipment on site to determine acceptable site-specific buffer distances to sensitive occupancies. • A minimum buffer distance of approximately 20m would be maintained to prevent vibration exceedances from all construction equipment with the exception of

Issue	Environmental Safeguards
Noise and Vibration (refer Section 7.11.3 (Con't))	<p>heavy vibratory rollers.</p> <ul style="list-style-type: none"> • Additional vibration monitoring would be conducted when construction activities are at the nearest point to the nominated occupancies. • Periodic monitoring would be conducted at all critical or sensitive areas and the vibration levels would be tested for compliance with the set vibration limits. This monitoring would be undertaken in accordance with the noise and vibration monitoring program described in a construction noise and vibration management plan. • Where vibration is found to be excessive, management measures would be implemented to ensure vibration compliance is achieved. Management measures may include modification of construction methods such as using smaller rock breakers, establishment of safe buffer zones and if necessary, time restrictions for the most excessive vibration activities. Time restrictions would be negotiated with affected receivers. • A building condition report on the state of the existing buildings nearest to the works would be undertaken before the construction work commences and after construction is complete. <p>Operational Noise Environmental safeguards</p> <ul style="list-style-type: none"> • The location of proposed noise environmental safeguards are shown on Figures 6-8 and 6-9. • Table 7-20 shows the recommended noise barrier / mound heights along the proposal. • Table 7-21 lists the number and location of residences that may be subject to architectural treatment for noise attenuation.
Waste Minimisation and Management (refer Section 7.12.2)	<ul style="list-style-type: none"> • The management of waste would be undertaken in accordance with Section 6.17 (Waste Management) of the RTA's QA Specification G36. • The Resource Management Hierarchy principles of the WARR Act would be adopted. They are as follows: <ul style="list-style-type: none"> – avoid unnecessary resource consumption as a priority – avoidance is followed by resource recovery (including reuse of materials, reprocessing recycling, and energy recovery) – disposal is undertaken as a last resort. • A Waste Management Plan (WMP) would be prepared and incorporated in the CEMP. The plan would outline comprehensive plans of action for key waste stream identified and specify waste management procedures to be followed during construction by the Contractor. Wastes generated would be collected in appropriate containers within the compound site or stockpiled within designated stockpile areas awaiting disposal. • The Proposal has been designed to reduce waste by broadly balancing the amount of cut to fill along the Preferred Corridor where possible. • All weed species would be transported in a covered load to an appropriately licensed tipping site, to prevent the further spread of weeds • Logs, branches and other suitable habitat material would be placed within neighbouring stands of riparian vegetation. Vegetative material in excess of this requirement would be mulched and used for landscaping works following construction, or used for windrows and sediment control. • Waste oils, liquids and fuels would be stored in appropriate containers, and kept in a locked storage area with an impermeable solid floor and bunded walls prior to disposal at an appropriately licensed landfill facility. • Garbage bins would be provided for the collection of compound site waste and emptied regularly. • Portable toilets would be properly maintained. • In the event that excess spoil is generated, Hastings Council or local businesses would be offered excess spoil for reuse.

Issue	Environmental Safeguards
Waste Minimisation and Management (refer Section 7.12.2) (con't)	<ul style="list-style-type: none"> • Vegetation not reused on site would be transferred to a landscape supplier for composting • Kerb and pavement materials on sections of the existing highway that are affected (eg western end) would be collected and transported to crushing and recycling plants. • Environmental safeguards associated with contaminated waste and acid sulphate soils are outlined in Section 7.2 above.
Associated Infrastructure and Activities (refer Section 7.13.3)	<ul style="list-style-type: none"> • A solid screen would be constructed along the eastern boundary of the compound site to reduce noise from construction equipment by 5 to 10dB(A). The screen would be at least 4m high and would be constructed from timber, metal or any solid material. There would be no gaps between panels or underneath the screen. • Parking areas for construction equipment and light vehicles would be located adjacent to Lindfield Park Road and not alongside the eastern boundary. • Use of compounds should be limited to the construction hours of 7am to 6pm on weekdays and 8am to 1pm on Saturdays. Equipment should not be started or 'warmed up' in the compound outside these hours. Earth bunding would be provided around the perimeter of the compound site to protect against spillage of dangerous goods. • Straw bales would be provided on all drainage lines within and surrounding the compound site for water quality protection. • The floor of the compound site would be constructed of low dust materials and would be "wet down" in prolonged dry conditions to avoid dust impacts. • Machinery would not be left to idle whilst in the compound site.
Utility Services (refer Section 7.14.3)	<ul style="list-style-type: none"> • Detailed location of all underground utilities by 'potholing' has been undertaken during the concept design. • All public utilities affected by the Proposal will be relocated prior to construction. • Erosion and sedimentation fencing would be used to protect area excavated for utility relocation. • Where excavation is to take place below 500mm, excavated materials would be tested for the presence of Acid Sulphate Soils (ASS). Where ASS is present it would be treated in accordance with the RTA's guidelines for the management of Acid Sulphate Soils (Draft February 2004). • The construction contractor would be required to identify on the ground all public utilities prior to commencement of construction. • Any alteration or relocation of utilities and services would be carried out to the satisfaction of the relevant serviced provider and apportionment of cost would be negotiated with the service utility provider. • The Contractor would provide advice to the community in advance of work to be undertaken on utility services that may cause disruption to on-going community or business services.
Demand on Resources (refer Section 7.15.3)	<ul style="list-style-type: none"> • The environmental impact of cut material taken from the corridor in the Proposal, as well as the environmental safeguards associated with this activity have been discussed elsewhere in this REF. • Rock material, concrete and bitumen required from external sources will be subject to separate environmental assessment and relevant Council requirements.

Issue	Environmental Safeguards
Operational Hazard and Risk (refer Section 7.16.3)	<ul style="list-style-type: none"> • The concept design minimises the access points along the length of the Proposal with only one direct access point at Lindfield Park Road. • Access at the bridge over the existing Oxley Highway would be via left in movements only, as would access via the roundabouts at the eastern and western connection to the Proposal. • The access to Lindfield Park Road would be converted to a left in/left out only in conjunction with the development of the West Lindfield area and in consultation with Hastings Council. In the interim, the performance of the junction with Lindfield Park Road would be monitored and if the risk of accidents increases then traffic management measures would be considered such as reduction in the speed limits. • A Road Safety Audit would be undertaken on the detailed design. This would address the safety issues of the connections to low speed environments at the western and eastern ends. • In the event of a hazardous goods incident the road drainage has been designed to direct flows to water quality ponds to protect sensitive areas such as Lake Innes Nature Reserve and the SEPP 14 Wetlands to the north. • Median turning areas to provide better response times for emergency and maintenance vehicles would be considered in the detailed design stage. Traffic would also be diverted along the existing Oxley Highway if required, during a hazardous goods incidence.

9 Consideration of Environmental Factors

9.1 Matters of National Environmental Significance and Commonwealth Land

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that matters of National Environmental Significance (NES) be considered. These matters and their application to the Proposal are summarised in **Table 9-1**.

The Proposal would not impact on any Matters of NES or affect Commonwealth land or Regional Forest Agreements. Therefore the Proposal does not require referral to the Commonwealth Department of Environment and Heritage.

Table 9-1: Relationship to Matters of National Environmental Significance

Factor	Impact
a) Any environmental impact on a World Heritage property? The Proposal would not affect any World Heritage property.	nil
b) Any environmental impact on National Heritage places? The Proposal would not affect any National Heritage places.	nil
c) Any environmental impact on wetlands of international importance? The Proposal crosses two water catchments that contain SEPP 14 wetlands located to the north and south. However, there no RAMSAR Convention wetlands of international significance located within or in close proximity to the Proposal.	nil
d) Any environmental impact on Commonwealth listed threatened species or ecological communities? The Proposal would not have any impact on Commonwealth listed threatened species or ecological communities.	nil
e) Any environmental impact on Commonwealth listed migratory species? The Proposal would not have any impact on Commonwealth listed migratory species.	nil
f) Does any part of the Proposal involve a nuclear action? The Proposal would not involve a nuclear action.	nil
g) Any environmental impact on a Commonwealth marine area? The Proposal would not affect a Commonwealth marine area.	nil
h) Any impact on Commonwealth Land? Commonwealth land would not be affected, indirectly or directly, as part of this Proposal.	nil

9.2 Clause 228 Checklist

The following aspects of the Proposal are considered against the checklist in Clause 228 of the EP &A Regulation 2000. **Table 9-2** refers. The checklist and RTA response should be read in the context of the description of the Proposal (**Section 6**), Environmental Assessment (**Section 7**) and Implementation Stage (**Section 8**) containing environmental safeguards as outlined above.

Table 9-2: Clause 228 Checklist

Factor	Impact	
	Short term	Long term
<p>a) Any environmental impact on a community?</p> <p>The Proposal involves the construction of a new highway alignment running roughly parallel to but separate from the existing highway. The new alignment avoids major property severance and requires only partial land acquisition from a relatively few land owners to complete RTA ownership of the Proposal.</p> <p>The local community would substantially benefit by improved road safety and increased urban amenity. The Proposal would also provide appropriate access / egress to adjacent areas for future urban development.</p> <p>Short term negative impacts potentially include traffic delays and construction noise. Impacts would be minimised through the implementation of controls and measures described in Section 8.2 of this REF.</p>	<p>Negative</p> <p>Positive</p> <p>Negative</p>	<p>Positive</p> <p>Positive</p> <p>Positive</p>
<p>b) Any environmental impact on the ecosystems of the locality?</p> <p>The Proposal traverses an area in the central part of the Corridor containing a substantial stand of native vegetation which is used as a resource for native species and is part of a north-south wildlife corridor. Clearing associated with the Proposal would result in loss of habitat and a significant impact on Koalas, Yellow-Bellied Gliders and Glossy Black Cockatoos. Environmental safeguards incorporated in the Proposal would help maintain connectivity and reduce the severity of impacts on wildlife movement. (Section 7.6 refers).</p>	<p>Negative</p>	<p>Negative</p>
<p>c) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>The Proposal would not adversely affect any aesthetic recreational, scientific or other environmental quality or value of the locality. (Section 7.7 refers)</p>	<p>Nil</p>	<p>Nil</p>

Factor	Impact	
	Short term	Long term
<p>d) 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?</p> <p>The Proposal affects several indigenous sites as outlined in Section 7.8. Environmental safeguards have been identified and agreed with the local Aboriginal community for the affected sites.</p> <p>There are no non-indigenous heritage resources within the corridor.</p> <p>No other adverse effects are anticipated on any locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations.</p> <p>Refer Section 7.8 and 7.9.</p>	<p>Negative</p> <p>Nil</p> <p>Nil</p>	<p>Positive</p> <p>Nil</p> <p>Nil</p>
<p>e) Any impact on the habitat of any protected (within the meaning of the National Parks and Wildlife Act 1974)?</p> <p>The habitat of protected species would be affected by the Proposal due to the loss of habitat and intrusion of the Proposal across established wildlife corridors. Environmental safeguards incorporated in the Proposal would help to maintain connectivity and reduce the severity of impacts on wildlife movement. Refer Section 7.6.</p>	<p>Negative</p>	<p>Negative</p>
<p>f) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</p> <p>No species would be endangered as a result of the Proposal. Section 7.6 refers.</p>	<p>Nil</p>	<p>Nil</p>

Factor	Impact	
	Short term	Long term
<p>g) Any long-term effects on the environment?</p> <p>Over the long term, the Proposal would provide improved transport and economic benefits to Port Macquarie and the adjacent region. Cumulatively with Pacific Highway improvements and urban development proposals, it would contribute to the ongoing urban growth of the Macquarie area and associated positive and negative impacts. Refer Section 6.8, 7.7 and 7.19.</p> <p>The Proposal would result in a loss of habitat and potential impact on three threatened fauna species. Section 7.6 refers.</p>	<p>Nil</p> <p>Nil</p>	<p>Positive</p> <p>Positive</p>
<p>h) Any degradation of the quality of the environment?</p> <p>During construction, the proposed works may create noise levels that would affect the surrounding environment, but proposed environmental safeguards would minimise this impact.</p>	<p>Negative</p> <p>Negative</p>	<p>Nil</p> <p>Positive</p>
<p>i) Any risk to the safety of the environment?</p> <p>Once operational, the Proposal would offer an improved level of road safety compared with the existing Oxley Highway.</p> <p>There is the potential for some disruption and a short term safety risk to motorists and workers during construction.</p> <p>There is a risk of damage to the environment from spillage of dangerous materials during construction and operation of the Proposal. However, this risk would be lower than for the existing highway, and would be further managed by the use of environmental safeguards in the Proposal (eg water quality control, ponds)</p>	<p>Nil</p> <p>Negative</p> <p>Negative</p>	<p>Positive</p> <p>Nil</p> <p>Negative</p>
<p>j) Any reduction in the range of beneficial uses of the environment?</p> <p>The Proposal would not reduce the range of beneficial uses of the existing environment. Section 7.7 refers.</p>	<p>Positive</p>	<p>Positive</p>

Factor	Impact	
	Short term	Long term
<p>k) Any pollution of the environment?</p> <p>The assessment of water, air and noise pollution undertaken for this REF and the associated environmental safeguards for both the construction and operational stages of the Proposal confirms that there would be minimal pollution impact on the environment. Refer sections 7.2, 7.5 and 7.11.</p>	Positive	Positive
<p>l) Any environmental problems associated with the disposal of waste?</p> <p>Minimal waste would be generated as a result of the Proposal. No discharge of solid waste or polluted water to the surrounding environment is envisaged during construction of the Proposal. The RTA would adopt the principles of reduce, reuse and re-cycle as part of the project. Refer section 7.12.</p>	Positive	Positive
<p>m) Any increased demands on resources, natural or otherwise, which are, or are likely to become in short supply?</p> <p>The Proposal has been designed to balance the volumes of cut and fill required during construction. Existing quarries, stockpiles and batching plants in the local region have been assessed as having adequate resources to meet the requirements of the Proposal.</p> <p>There would not be any increased demand on resources, natural or otherwise which are, or are likely to become, in short supply.</p>	Positive	Positive

10 Certification

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



Robert Purdon (BA Hons; MTCP)
Director, Purdon Associates

31 August 2004

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



Peter Black
(Project Manager, RTA)

31 August 2004

11 Glossary

AQMP	Air Quality Management Plan
ASL	Above sea level
ASS	Acid sulphate soil
BoM	Bureau of Meteorology
CEMP	Construction Environment Management Plan
CEW	Corridor Evaluation Workshop
CLG	Community Liaison Group
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation
DIPNR	NSW Department of Infrastructure, Planning and Natural Resources
Discount rate	The term is used in RUBCR (see above) to relate future costs to current day values
DLWC	Department of Land and Water Conservation
DMR	(former) NSW Department of Main Roads
ECRTN	Environmental Criteria for Road Traffic Noise
EIS	Environmental Impact Study
ENCM	Environmental Noise Control Manual
ENMM	Environmental Noise Management Manual
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (as amended)
EPA	NSW Environment Protection Authority
ESD	Ecologically Sustainable Development
HUGS	Hastings Urban Growth Strategy
Kph	Kilometres per hour
LDMP	Landscape Design Management Plan
LGA	Local Government Area
MVK	Million vehicle kilometres
NCREP	North Coast Regional Environmental Plan 1988
OH&S	Occupational health and safety
QA	Quality Assurance
REF	Review of Environmental Factors
RTA	NSW Roads and Traffic Authority
RUBCR	Road User Benefit Cost Ratio (refer discount rate below)
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SWMP	Soil and Water Management Plan
VMS	Value Management Study
WMP	Waste Management Plan

12 References

NB: Refer to Working Papers 1 – 15 (Volumes 2 & 3) for a more detailed list of references to specific environmental and other technical studies.

Australian Museum Business Services, June 2003
(Commonwealth) Environment Protection and Biodiversity Conservation (EPBC) Act 1999
1:250 000 Metallurgical Geology Series
ANZECC Guidelines for Fresh and Marine Water Quality, National Water Quality Strategy, 2000
Australian Heritage Council (Consequential and Transitional Provisions) Act 2003
Australian Heritage Council Act 2003
BoM website (<http://www.bom.gov.au/weather/warnings.shtml>)
Clearing and Grubbing QA Specification G40
Construction Environmental Management Plan (CEMP)
Environment and Heritage Legislation Amendment Act
Environmental Impact Assessment Policy, Guidelines and Procedures, Version 4 (RTA, April 2001)
Environmental Noise Management Manual (ENMM)
Environmental Planning and Assessment Act
Environmental Planning and Assessment Regulation 2000
Environmental Protection (Management Plan) – QA Specification G36
Fisheries Management (FM) Act 1994
Hastings Council's Urban Growth Strategy (HUGS)
Hastings Local Environmental Plan 2001 (Hastings LEP)
Kempsey 1:100 000 Soil Landscape Sheet
National Parks and Wildlife Act 1974
National Strategy for Ecologically Sustainable Development (NSED)
Native Title Act 1993
Native Vegetation Act 2003
Native Vegetation Conservation Act 1997
North Coast Regional Environmental Plan 1988 (NCREP)
NSW Fisheries Management Act (FM Act) 1994
NSW Heritage Act 1977
Protection of the Environment Operations Act 1997
Rural Fires Act 1997
Soil and Water Management (Soil & Water Management Plan) QA Specification G38
Threatened Species Conservation (TSC) Act 1995
Threatened Species Conservation Act 1996
Waste Avoidance and Resource Recovery Act 2001 (the WARR Act)