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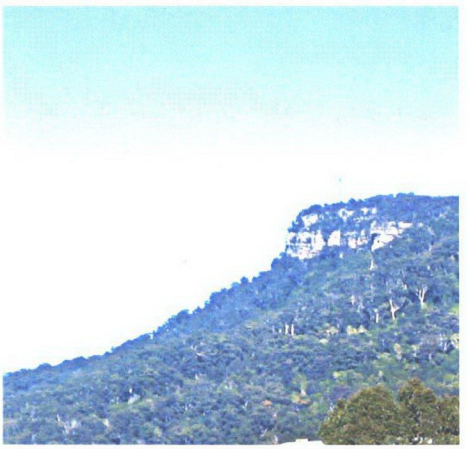
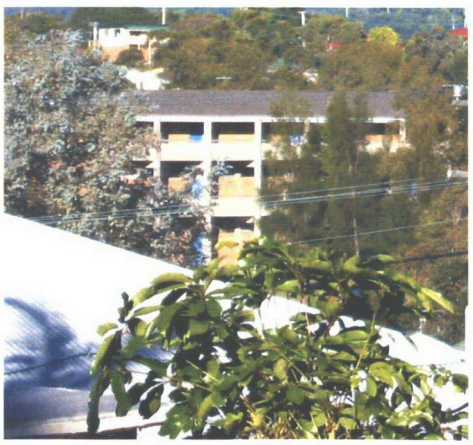
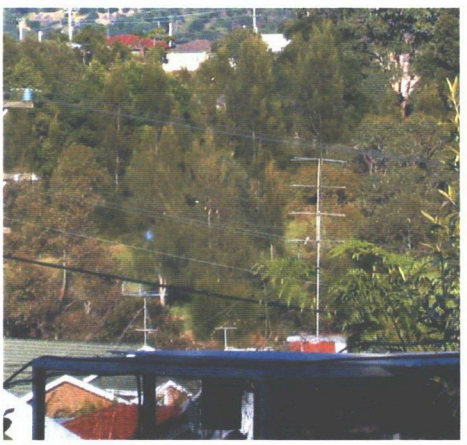
Northern Distributor Extension

Environmental Impact Statement

November 2002



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Northern Distributor Extension Wollongong

Environmental Impact Statement

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Submission of environmental impact statement (EIS)

Prepared under the *Environmental Planning and Assessment Act 1979* Section 112

EIS prepared by	
Name	Robert Purdon
Qualifications	BA Hons; MTCP
Address	Purdon Associates Pty Ltd 3/9 McKay Street Turner ACT 2612
In respect of	Proposed Extension of the Northern Distributor, Wollongong

Part 5 Activity	
Proponent name	NSW Roads and Traffic Authority
Proponent address	Level 4, 90 Crown Street Wollongong NSW 2500
Land on which activity to be carried out: address, lot number, DP/MPS, vol/fol etc	All lands required for the construction and operation of the proposed distributor, as shown in **Figures 6.1** to **6.7** and described in **Section 6**.
Proposed development	The EIS Proposal broadly follows a road reservation identified in the mid 1940s and included in the Wollongong City Local Environment Plan (LEP) 1990 and extends from Bellambi Lane, to the Princes Highway near Molloy Street in Bulli. The route includes hydraulic structures across a number of minor creek crossings. Existing streets would be retained for local access. Refer **Figures 6.1** to **6.9** in the EIS.
Environmental Impact Statement	An Environmental Impact Statement (EIS) is attached.
Certificate	I certify that I have prepared the contents of this Statement and to the best of my knowledge ■ It is in accordance with clauses 230 and 231 of the Environmental Planning and Assessment Regulation 2000, ■ It contains all available information relelvant to the environmental assessment to which this environmental impact statement relates; and ■ It is true in all material particular and does not, by its presentation or omission of information, materially mislead.
Signature	
Name	Robert Purdon
Date	November 2002

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Working Papers

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1 Concept Design and Property Acquisition by RTA
2 Consultations Report by Purdon Associates
3 Transport & Traffic by Forbes Rigby/Gabites Porter
4 Topography, Geology, Soils and Borrow Materials by Coffey Geosciences
5 Flooding & Drainage by Connell Wagner
6 Water Quality by Forbes Rigby
7 Air Quality Assessment by Holmes Air Sciences
8 Biodiversity by Lesryk Environmental Consultants
9 Socio-economic and Land Use by EGIS
10 Noise Assessment by Wilkinson Murray Pty Ltd
11 Urban & Landscape Design by Infranet/Kiah Environmental Designers
12 Heritage by DIG International & Rod Howard Heritage Conservation
13 Operational Hazards & Risks by Connell Wagner
14 Road User Cost Benefit Analysis by Sinclair Knight Mertz

Acknowledgments

The overall EIS process has been managed by RTA Southern Region Development Section, Wollongong. The EIS report has been prepared by Purdon Associates Pty Ltd for the RTA (Southern Region Client Services), and draws on separate reports from the specialist consultant team commissioned by RTA for this project.

The RTA also wishes to acknowledge the time and commitment made by members of the Community Liaison Group chaired by David Campbell (Member for Keira) and the contribution made by many local residents and organisations throughout the consultation process on this project.

Glossary of Terms and Abbreviations

Acronym/ Technical Term	Meaning
µg/m3	micrograms per cubic metre
µm	0.000001 metres or 1 x 10–6 metres
AADT	Annualised Average Daily Traffic
AEC	Area of Environmental Concern
AEP	Annual Exceedance Probability The probability of rainfall or flood event of given magnitude being equalled or exceeded in any one year.
AHD	Australian Height Datum National reference datum for level
Ammonia	Compound of nitrogen found dissolved in water with the common sources being domestic sewage and industrial effluent. Ammonia is a non-persistent and non-cumulative toxicant to aquatic life
ANZECC	Australian and New Zealand Environment Conservation Council
ANZECC&ARMCANZ (2000)	Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand. Authors of the October 2000 document 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality'
Aquifer	Well-defined subsurface layer saturated with water.
ARI	Average Recurrence Interval. The expected or average interval of time between Exceedances of a rainfall or flood event of given magnitude.
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARR	Australian Rainfall and Runoff National Code of Practice for Drainage Published by Institution of Engineers Australia
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soil Management Advisory Committee
Australian Height Datum	National reference datum for level
AWT	Australian Water Technologies Pty Ltd
Bacteria and Viruses	Include pathogens that can cause disease in bathing waters and make shellfish consumption unsafe.
BCR	Benefit Cost Ratio
BH3	Borehole number 3
Biochemical Oxygen Demand	Measure of the organic pollution of water, expressed as the amount of oxygen that is taken up when bacteria break down a sample of organic matter. Removal of large quantities of oxygen from the receiving waters can lead to fish kills.

Acronym/ Technical Term	Meaning
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylene, Xylene
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
CBD	Central Business District
CBR	California Bearing Ratio
CDS	Continuous Deflective Separator Units
CH3000	Chainage 3000 (metres)
CLG	Community Liaison Group
CO	Carbon monoxide
CoC	Chemical of Concern
DCP1	Dynamic Cone Penetrometer test number 1
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving, for example metres per second.
Dissolved Oxygen	Oxygen that dissolves in water directly from air or as a by-product of photosynthesis by aquatic plants and algae.
DLWC	Department of Land and Water Conservation
DOT	Department of Transport
DUAP	Department of Urban Affairs and Planning, now PlanningNSW
ECRTN	Environmental Criteria for Road Traffic Noise
Effluent	The liquid discharge after sewage treatment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EIS Proposal	Extension of the Northern Distributor from Bellambi Lane to Princes Highway at Molloy Street, Bulli, City of Wollongong
EMC	Event Mean Concentration
EMP	Environmental Management Plan
EMS	Environmental Management System under ISO 14000
EP & A Act	Environmental Planning and Assessment Act 1979
EPA	New South Wales Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
Escarpment	A cliff or steep slope of some extent, generally separating two level or generally sloping areas.

Acronym/ Technical Term	Meaning
ESD	Ecologically Sustainable Development
Estuary	A partially enclosed coastal river mouth, characterised by tidal effects and mixing of fresh and sea water
Eutrophication	Usually refers to the process where a waterbody is under stress from abundant nutrient loadings resulting in excessive growth of algae in waterways
EXTRAN	Design module in SWMM
Faecal Coliforms	Bacteria that inhabit the intestines of humans and other mammals and are present in faeces. Used as an indicator of sewage pollution in water.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake of dam. And/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
FR	Forbes Rigby Pty Ltd
GPS	Global Positioning System
GPT	Gross Pollutant Trap
Gradient	Slope or rate of fall of land/pipe/stream
Ha	Hectare (=10,000 m^2)
Hazard	A source of potential harm or a situation with a potential to cause loss. In relation to this Study the hazard is flooding which has the potential to cause damage to the community.
Heavy Metals	Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Mercury, Zinc
Hydraulics	Term given to the study of water flow in waterways; in particular, the elevation of flow parameters such as water level and velocity.
Hydrograph	A graph that shows how the discharge or stage/flood level at any particular location varies with time during a flood.
Hydrology	Term given to the study of the rainfall and runoff process; in particular, the elevation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
Hyetographs	Graphical representation of rainfall event, rain intensity verses time
ICMC	Illawarra Catchment Management Committee
IFD	Intensity-Frequency-Duration (of rainfall)
ISO 14000	International Environmental Standard
Km	Kilometre
LATM	Local Area Traffic Management
Leachate	Water which has passed through the soil containing soluble substances
LEP	Local Environmental Plan
Local Drainage	Are smaller scale problems in urban areas. They are outside the definition of major drainage in this glossary.

Acronym/ Technical Term	Meaning
m	Metre
m^2	Square metre
m^3	Cubic metre
m^3/s	Cubic metre per second
mg/Nm^3	milligrams per normalised cubic metre
mm	0.001 metres or 1 x 10-3 metres
NATA	National Association of Testing Authorities, Australia
NDE	Northern Distributor Extension
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
NHMRC	National Health and Medical Research Council
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NURP	National Urban Runoff Program
Nutrients	Derived from fertilisers and detergents, including phosphorus and nitrogen. In high concentrations, can cause excessive growth of aquatic plants and can lead to eutrophication of ponds, streams and the poorly flushed estuaries.
O&G	Oil and Grease
OC/OP	Organochlorine and Organophosphorous Pesticides
OSD	On-Site Detention
P1	Piezocone penetration test number 1
PAH	polycyclic aromatic hydrocarbons
Pathogen	An agent such as a virus, bacterium or fungus that can cause disease in humans. Pathogens can be present in municipal, industrial and non-point source discharges.
Peak discharge	The maximum discharge occurring during a flood event
pH	The hydrogen ion concentration in water, a measure of acidity or alkalinity. pH is expressed on a scale of 1 to 14 with low numbers indicating 'acidic' conditions and high numbers basic or alkaline conditions. pH 7 is neutral.
PIARC	Permanent International Association of Road Congress
PID	Photo Ionisation Detector
Pluviometer	Real time record of rain, Depth of rain collected against time
PM_{10}	particulate matter less than 10 µm in diameter
PMF	Probable Maximum Flood Flood calculated to be the maximum ever likely to occur.

Acronym/ Technical Term	Meaning
pNSW	PlanningNSW
POCAS	Peroxide Oxidation Combined Acidity and Sulfate test method
PoEO	Protection of the Environment Operations Act
POSA	Potential Oxidisable Sulfuric Activity
pphm	parts per hundred million
ppm	Concentration in Parts Per Million
ppm	parts per million
Probable maximum flood (PMF)	The greatest depth of precipitation for a given duration meteorology possible over a given size storm area at a particular location at a particular time of year, with no allowance made for long-term climatic trends. It is the primary input to the estimation of the probable maximum flood.
PVC	Poly Vinyl Chloride
QA/QC	Quality Assurance and Quality Control
RAFTS	Design module in SWMM
REP	Regional Environmental Plan
Riparian	Area directly adjoining or directly influencing the waterway
Risk	Chance of something happening that would have an impact. It is measured in terms of consequences and likelihood. In the context of this Study it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
RSA	Rail Services Australia
RTA	Roads and Traffic Authority of New South Wales
RUBCR	Road Users Benefit Cost Ratio
Runoff	The amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
RVEA	Russell Vale Emplacement Area
SEPP	State Environmental Planning Policy
Sewerage	The infrastructure used to convey sewage
SKM	Sinclair Knight Mertz
SRA	State Rail Authority
Suspended Solids	Mass of material suspended in the water. Water quality would decrease with increasing concentrations of suspended solids.
SWC	Sydney Water Corporation
SWMM	Flood routing computer package
SWMP	Soil and Water Management Plan
TAA	Total Actual Acidity
TCM	Total Catchment Management

Acronym/ Technical Term	Meaning
TN	Total Nitrogen
TP	Total Phosphorus
TP4	Test Pit number 4
TPA	Total Potential Acidity
TPH	Total Petroleum Hydrocarbons
TQM	Total Quality Management
TSP	Total suspended particulates
TSS	Total Suspended Solids
TTS	Transportation and Traffic Systems Ltd, a subsidiary of Gabites Porter
Turbidity	A measure of the light scattering capacity of the water, which is a reasonable indicator of the amount of particulate matter
VEPA	Victorian Environment Protection Authority
VHC	Volatile Halogenated Compounds
VKT	Vehicle Kilometres Travelled
VMS	Value Management Study
WARR Act	Waste Avoidance and Resource Recovery Act
WCC	Wollongong City Council
Wetland	Ecological community dependent on the presence of shallow, still water or on the water logging of the soil, either permanently, frequently or for occasional prolonged periods.
WHO	World Health Organisation
WLEP	Wollongong Local Environmental Plan 1990 (as amended)
WOLSH	Traffic modelling and forecast study for the Wollongong/Shellharbour area
WRAPP	Waste Reduction and Purchasing Policy
WSUD	Water Sensitive Urban Design

Summary

Purpose of EIS

This Environmental Impact Statement (EIS) has been prepared on behalf of the NSW Roads and Traffic Authority (RTA) in accordance with legislative requirements. It describes and examines the impacts associated with construction of a new four lane controlled access dual carriageway section of the Northern Distributor, extending from Bellambi Lane to the Princes Highway near Molloy Street in Bulli.

The road is known as the Northern Distributor Extension (NDE). It would be a three (3) kilometre extension of the existing Northern Distributor passing through the suburbs of Russell Vale, Woonona and Bulli in the northern part of the Wollongong urban area.

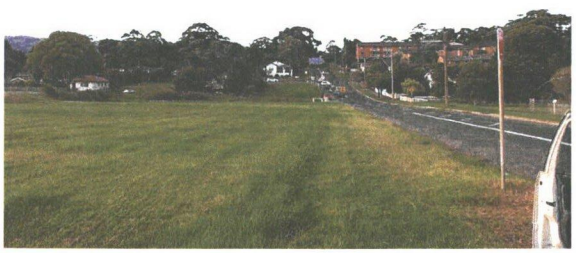
The EIS covers the social, economic, environmental impact of the proposed development, and provides an opportunity for public comment on all aspects of the development.

The specific purposes of the EIS are to:

- Demonstrate the need for the EIS Proposal;
- Ensure that the EIS Proposal complies with the relevant statutory requirements;
- Summarise the strategic and cumulative impacts of the EIS Proposal on the land use and transport systems of the local area;
- Summarise the discrete and cumulative impacts on the environment;
- Examine whether the EIS Proposal is justified in terms of the principles of Ecologically Sustainable Development (ESD);
- Establish the basis for subsequent environmental management of construction and operation if the EIS Proposal proceeds; and
- Provide an overview of the impacts and benefits of the EIS Proposal and provide mitigation measures where possible.

Section 6 of the EIS describes the EIS Proposal.

Throughout this document, mention is made of the EIS Proposal for the NDE. This refers to a specific proposal for the NDE (described in **Section 6**) that has resulted from extensive technical assessment and community input undertaken by the RTA since 1998.



View from Thompson Street looking north to Campbell Street.

Completion and acceptance of the EIS by the Minister for Planning is a necessary step in the overall decision making process for this project but does not of itself indicate or imply a formal commitment by the NSW Government to construction of the proposed NDE.

The RTA is the proponent and nominated determining authority for the EIS Proposal for the purposes of Part 5 of the *NSW Environmental Planning & Assessment Act 1979* (EP&A Act).

This EIS has been prepared by the RTA and a team of specialists. A series of detailed **Working Papers** have been prepared for this EIS and are included as separate volumes to this EIS.

Project Background and Context

The proposed NDE corridor runs for a length of about 3kms in a north-south alignment parallel to the Princes Highway and main Sydney-Wollongong railway line. It is generally contained within a road reservation which was identified in the 1940s and traverses an urban environment containing medium to low density residential housing, schools and other community facilities, open space and light industry.

The proposed road would run alongside the alignment of a number of existing local roads, through an area that is mostly flat coastal land bisected by a number of minor watercourses and low ridges.

The general study area extends from the beaches in the east and the escarpment to the west. The relative short distance between the escarpment and the beach creates a unique landscape setting. **Figure 1** refers.

The proposed NDE route is part of the wider urban transport network linking the northern suburbs of Wollongong to the metropolitan area. It also forms part of the regional transport network from Sydney to the Illawarra and is included within the 2010 NSW Integrated Transport Strategy.

Access to the proposed NDE from the north would be from Bulli Pass and Lawrence Hargrave Drive. These links, together with Mt Ousley, form the main road connection from the Illawarra to Sydney.

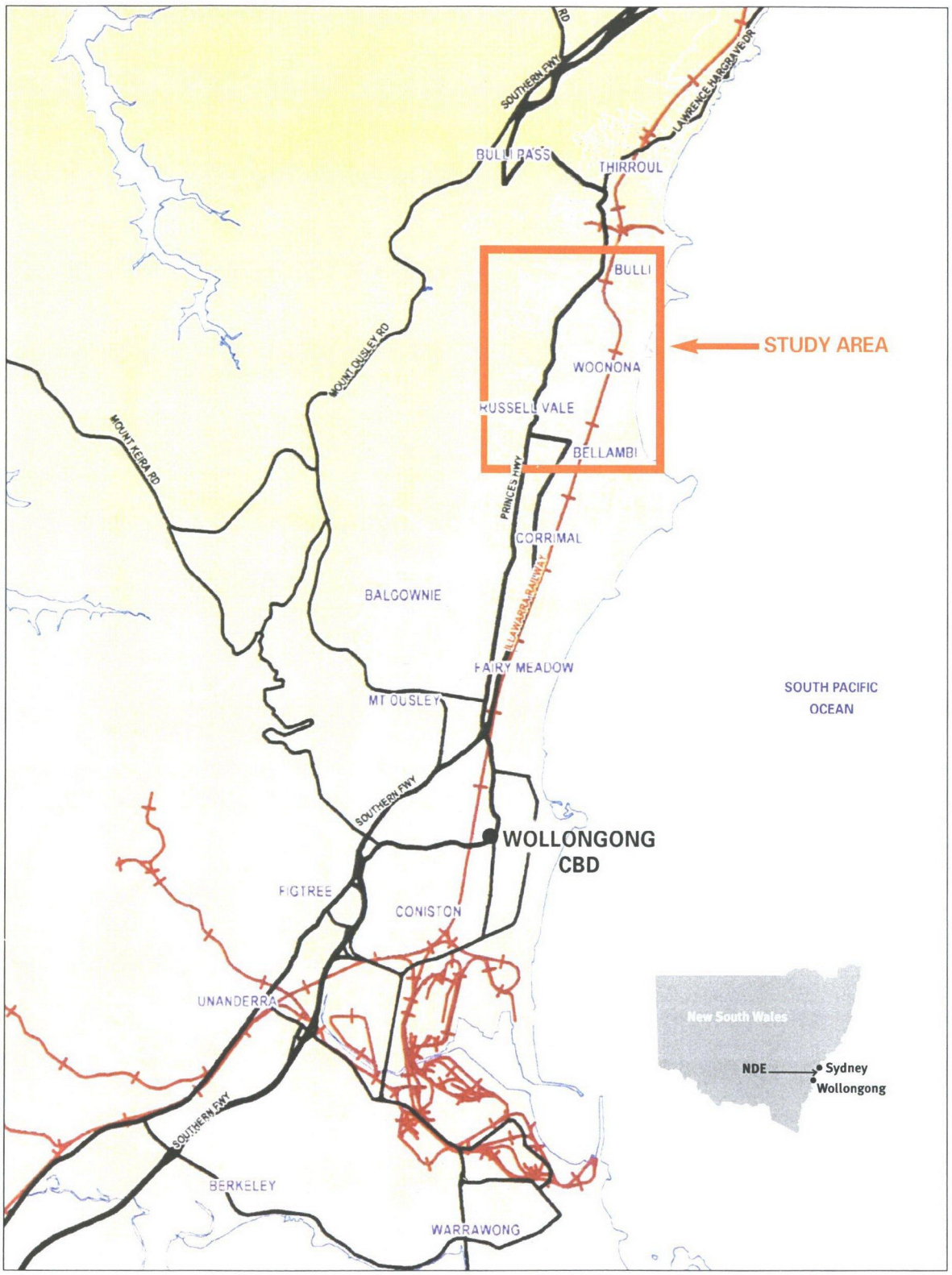
Need for NDE and Objectives

In 1993, a section of the Northern Distributor was opened between North Wollongong and Bellambi Lane in Russell Vale. The need for extension of this route has increased in recent years due to growing traffic congestion, road user safety and amenity issues along the Princes Highway and through the local street network. The potential for the declining business opportunities in the Woonona shopping centre due to increased parking restrictions along the existing highway was also a consideration.

The proposed NDE is intended to service transport needs of the local community as well as road users from the northern suburbs of Wollongong and traffic moving between Wollongong and Sydney.

The EIS Proposal sits within the context of a number of strategic policies and statutory plans that are relevant to the local area. The most relevant is *"Action for Transport 2010"*. The underlying rationale for extension of the Northern Distributor was presented in the NSW Government Integrated Transport Plan *"Action for Transport 2010"*. This strategy covers transport initiatives throughout the whole state, including the Illawarra.

Figure 1: Regional Context



Legend

- Study Area
- Main road network
- Railway

Source: RTA

Taken together with other major improvements including the widening of Mount Ousley Road, the extension of the Northern Distributor was seen as providing improved links to Sydney and better road access to Port Kembla.

In 2000, the RTA initiated a series of background studies to investigate the underlying rationale for the proposed NDE and to review earlier road design concepts.

The need for extension of the Northern Distributor is based on the following considerations:

- To improve the **efficiency of traffic flow** through the northern suburbs of Wollongong by reducing congestion along the Princes Highway; and
- To reduce the problems (**noise, safety and amenity**) resulting from an increased level of through traffic currently using local residential areas.

View from Thompson Street towards Campbell Street.

The existing Princes Highway would not be able to cater for projected increases in traffic demand and there is a need to initiate action to address this situation. Without action, there would be a progressive deterioration in the efficiency of the transport network, increased traffic volumes passing through local streets and an increase in traffic safety problems.

In the current situation, the proposed NDE should serve the twin purpose of a local distributor and a through-route for northern suburbs and inter-city traffic.

The project scope includes improved amenity on the Highway and local street networks as well as good east/west cross corridor access.

Construction of the preferred option could be undertaken with minimal disruption to local traffic movement as the route is largely located on land not used for local roads.

The design for the proposed NDE should not rule out the possibility of upgrading the status of the proposed NDE from a distributor function to a higher grade arterial road in the future if required and subject to further environmental impact assessment and extensive community consultation.

The **main objectives** for the proposed NDE were initially determined in 1998, but have been subsequently extended and revised in conjunction with further studies and extensive community consultation process:

- **Improve road safety** by reducing through traffic on the Princes Highway through local business districts;
- **Improve road safety** by removing unnecessary through traffic from residential streets north of Bellambi Lane;
- Provide a **consistent level of service** between Wollongong and Bulli along the Northern Distributor;
- **Improve travel time** between North Wollongong and Bulli;

- Ensure design is able to accommodate the **future transport developments**;
- Maintain an **integrated local community** by retaining appropriate east/west movement links across the Northern Distributor corridor;
- Improve the local **noise** environment in the general vicinity of the proposed NDE corridor;
- Ensure no adverse impact on current drainage provisions and flood mitigation measures.

A key objective of the overall planning and design process for the proposed NDE was the need for continued community consultation.

Options for Extension of the Northern Distributor

As part of the background studies, the RTA has examined a number of transport options for the northern Wollongong corridor. These options included:

- Do nothing;
- Extend Bellambi Lane over the escarpment via Rixons Pass;
- Extend the proposed NDE beyond Molloy Street to connect with the foot of Bulli Pass;
- Extend the proposed NDE from Molloy Street to a mid-way connection with Bulli Pass at or above the "bend";

View of Mitchell Road looking south towards Bellambi Lane.

- Review the need for a two lane or four lane proposed NDE; and
- Extend along the railway line to foot of Bulli Pass.

Each of the above options was considered in terms of engineering feasibility, environmental impact, contribution to the traffic network and cost.

It was concluded that, whilst some medium to longer term road improvement was required in the area, it was not financially viable within the foreseeable future to contemplate road projects that had a major impact on the escarpment. Moreover, extension of the proposed NDE broadly along the gazetted alignment provided positive benefits to the local community and to through traffic.

Consequences of Not Undertaking the NDE

In light of the established project need and objectives for the EIS Proposal, there would be a number of consequences of not proceeding with the project:

- There would be a gradual increase in through traffic along local roads, exceeding their capacity to provide safe access/egress for local residents;
- The extra traffic would generate noise levels in excess of current acceptable limits and there are no cost effective methods of mitigating this impact;
- Predicted crash rates within the study area could be expected to increase significantly;

- The accident severity index in the area is also expected to increase;
- Increased traffic congestion along the Princes Highway would create the need for extended clearway zones (no parking) for more of the day, resulting in loss of business opportunities for the Woonona local shopping centre and reduced amenity for residents using this centre;
- The increased congestion would also lead to reduced levels of efficiency in the road transport network, including an adverse impact on inter-city traffic movement.

Project Description

The current concept design for the proposed NDE is known as the **EIS Proposal** and is shown on **Figure 2**. It involves construction of a four-lane dual carriageway distributor road with controlled access from Bellambi Lane to the Princes Highway near Molloy Street.

The EIS Proposal broadly follows the alignment of several local roads including York Road, Mitchell Road, and Thompson Street. North of Farrell Road, the EIS Proposal connects to the Princes Highway via a section of undeveloped road reserve.

View south towards Farrell Road showing road reserve.

The main features of the proposed NDE are summarised below (moving north to south):

- **Princes Highway / Molloy Street:** An at-grade four-way signalised intersection with pedestrian access for all movements;
- **Farrell Road (east) and Molloy Street:** a new local road connection from Farrell Road east to the Princes Highway via Molloy Street;
- **Farrell Road:** Creation of cul-de-sac in Farrell Road, with a new pedestrian overbridge across the Distributor linking Farrell Road east and west;
- A new **roundabout** at the junction of Farrell Road and Thompson Street;
- **Russell and Hopetoun Streets:** Both streets would become culs-de-sac at their eastern end, but retain current access to the Princes Highway;
- Construction of a new **pedestrian footpath and bicycle link** between Farrell Road and Campbell Street on the western side;
- **Campbell Street:** A grade-separated interchange with the proposed NDE bridging over Campbell Street and incorporating south facing on and off-ramps. Retain existing east-west access along Campbell Street;
- **Thompson Street:** The northern end of Thompson Street would connect to Farrell Road east via a new roundabout. Create new culs-de-sac north of Campbell Street to improve traffic safety in this area, and south of Campbell Street to provide access to three properties affected by the southbound on-load ramp from Campbell Street. The southern section of Thompson Street would be linked to Park Road and a southbound access to the proposed NDE;

Legend

EIS Proposal

Source: RTA

- **Park Road /Gray Street:** A new vehicle and pedestrian overbridge at Park Road connecting Gray Street via Mitchell Road and provision for southbound access and egress to the Distributor. Northbound access to Park Road and Gray Street would be via a new intersection between Alice Street and Doris Avenue and Mitchell Road. Northbound access from Gray Street to the proposed NDE;
- **Mitchell Road** would become one way northbound direction for traffic between Park Road and Rose Street;
- **York Road area:** Provide a new at-grade signalised intersection (with full turning movements) midway between Alice Street and Doris Avenue, and a new cul-de-sac at the southern end of York Road;
- A new service road east of the NDE to cater for the light industrial area between **Alice Street and Collaery Road**;
- **Watts Lane:** A short extension to Watts Lane is required to service the light industrial area;
- **Bellambi Lane intersection:** Provide right (north) turns from Bellambi Lane intersection onto the Distributor.

In summary, the EIS Proposal contains four major intersections (excluding the connections to the Northern Distributor at Bellambi Lane). There are two new signalised intersections, two bridges (Campbell Street and Park Road) and one pedestrian overpass (Farrell Road).

Varying forms of noise barrier (cuttings; earth mounds; concrete walls) have been provided in the concept design for the entire length of the proposed NDE route, with the exception of the frontage to industrial land along the south east section of the route.

There would also be extensive native landscaping throughout the length of the proposed NDE, and provision of five new on-site detention ponds and siltation traps at appropriate locations along the corridor.

Community Involvement

An extensive program of community consultation has been undertaken by the RTA in the lead up to and during this EIS. (**Working Paper 2** refers.) Activities have included:

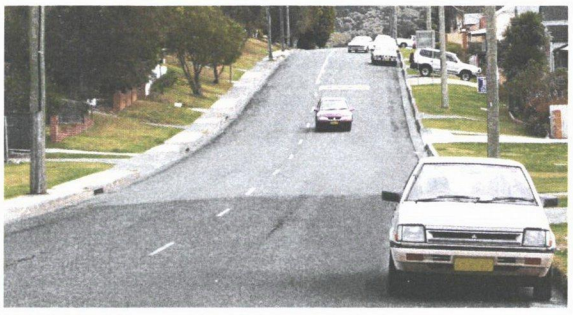
- The establishment of a Community Liaison Group comprising a selection of local residents, community representatives and business people;
- Stakeholder workshops;
- Newsletters;
- Staffed information displays;
- Mail-back surveys;
- A telephone hotline service; and
- Meetings with individuals and organisations.

The consultation process has identified a wide range of local concerns and has provided valuable input to the RTA and consultant team during various steps in the planning process. The EIS Proposal includes a number of positive suggestions and inputs from the local community.

The RTA has made a number of changes to initial concept designs for the proposed NDE as a result of issues arising from stakeholder consultation.

In addition to design elements in the EIS Proposal that are a direct design response to the stated project objectives (listed above), other changes now contained in the EIS Proposal have arisen from the consultation process:

- A shift of the proposed NDE further eastward from housing along York Road;
- A new signalised intersection between Alice and Doris Streets serving local residents and industry;
- A road cutting and overbridge near Park Road and Gray Street to facilitate pedestrian safety, reduce noise and improve traffic efficiency;
- Provision of an overpass at Campbell Street to replace the proposed signalised intersection;
- Inclusion of local area traffic management plans as mitigation measures on several local streets with access to the proposed NDE ;
- Continued community involvement and feedback throughout the planning process;
- There has been strong and widespread support from the local community for an early completion of the preferred proposed NDE Option.



View of Campbell Street west towards Princes Highway.

Some community concern has been expressed for the Northern Distributor to continue north from Molloy Street to connect with Bulli Pass. This approach was seen by the community as a means of resolving traffic and safety problems in the vicinity of Bulli shopping centre and further north. There has been a recent Government announcement allocating funds to the RTA for further study of this issue.

Impact Assessment

Transport and Traffic

A Transport and Traffic Study was undertaken for this EIS by Forbes Rigby and Gabites Porter (**Working Paper 3**) to collect traffic and land use data and model projected traffic flows and impacts on the road network of different traffic scenarios. The study also included surveys of pedestrian and bicycle movements and bus services.

The impact of the EIS Proposal would introduce significant changes to the study area but would have demonstrable net benefits in the following ways:

- Redirection of through traffic onto the proposed NDE and away from local roads and the current Princes Highway;
- Improved regional access for local residents and visitors;
- Maintenance of safe and convenient east-west movement patterns for vehicles, pedestrians and bicycles;

- Retention of safe and convenient access to schools and other land uses;
- Savings in travel distances and associated environmental benefits;
- Reduced rates of accidents and severity of accidents; and
- Improvements to the amenity of the Woonona Shopping Centre.

The above improvements are also broadly consistent with key issues raised during community consultations and stakeholder discussions.

Notwithstanding the above, there would be some negative traffic impacts associated with the EIS Proposal including:

- Increased traffic volumes along the Princes Highway through Bulli shopping centre;
- Small increases in traffic volumes by 2016 along a few local streets including Campbell street, Gray Street and Park Road;
- Minor inconvenience caused by some street closures; and
- A small increase in traffic diverted from Mt Ousley.

The EIS Proposal was compared with a do nothing option for 2016. The former provided a number of advantages including:

- Predicted savings of 8,260 vehicle kilometres travelled average weekday and an annual saving of approximately $6 million of network operating costs;
- Reduced vehicle emission effects; and
- Reduced traffic accident effects.

Campbell Street east towards Thompson Street.

Local Access and Movement

The study area and surrounding areas generally are heavily oriented towards north-south movement patterns in their physical layout, and several barriers to east-west movement presently exist in the study area, namely the Princes Highway in the west and the railway line in the east.

Community cohesion is currently adversely affected by the large volumes of through traffic on the Princes Highway. Increasing volumes of traffic would result in further deterioration of conditions in terms of local accessibility to schools, shops and other destinations, amenity and safety for pedestrians and cyclists, and noise and visual amenity.

The proposed NDE is not likely to result in significant severance impacts in terms of community identity and cohesion. The concept design included in the EIS Proposal has taken into account local movement patterns of vehicles, bicycles and pedestrians, and has made provision for retention of these movement patterns. The proposal may result in improved east-west accessibility due to the improved function of the east-west intersections at Gray Street/Park Road and Campbell Street.

Adequate provision has been made in the design of the proposed NDE to cater for east-west movements. Where possible, provision for east-west movement across the proposed NDE would be located so as to be consistent with the existing access across the railway line. This is the case at Molloy Street/Rixon Avenue/Farrell Road east, Campbell Street and Gray Street/Park Road.

Culs-de-sac in Farrell Road west, Hopetoun Street, Russell Street and parts of Thompson Street would result in minor changes to local movement patterns but would still permit access to the main transport network without major inconvenience. They would also result in improved local traffic safety in the affected streets.

Properties on Thompson Street opposite the high school would be affected by the creation of a cul-de-sac south of Campbell Street. Vehicular access to the north, south and west for these residents would be available via the proposed Thompson Street southern connection to Park Road and the south-bound and north-bound on-load ramps on to the proposed NDE. Any minor loss of convenience in this area would be offset by substantially reduced local traffic volumes and much better access/egress to local residences.

Properties in the vicinity of Nicholson Road, Gray Street, Alfred Street, Hale Street and Stanhope Street would be able to use the proposed grade-separated intersection at Gray Street/Park Road for easterly movements, and access to the proposed NDE in northerly and southerly directions.

Properties fronting Mitchell Road between Rose Street and Gray Street would be restricted to one-way access in a northerly direction on that part of Mitchell Road that is to be retained. Access to these properties would therefore be via Gray Street and John Street. Although this access arrangement would be considerably different to the existing situation, it is considered to be adequate.

On the western side of the proposed NDE, south of Rose Street through to Bellambi Lane, vehicular access/egress would be available via the proposed signalised intersection between Rose Street and Doris Avenue. This would facilitate movement in a northerly and southerly direction via the proposed NDE, and would also allow easterly movement via the proposed NDE and Bellambi Lane.

EIS Proposal has pedestrian overbridge at Farrell Road for safety and convenience.

Access to the east would also be available via York Road, Mitchell Road (including the one-way section) and the Gray Street/Park Road overbridge. Access to the north, east, south and west would be similarly available for industrial properties on the eastern side of the proposed NDE in this location. Traffic volumes along York Road and Mitchell Road are expected to substantially decline with completion of the EIS Proposal.

Access during Construction

Only minor local inconveniences are anticipated during construction of the proposed NDE as most of the EIS Proposal would be built alongside existing roads. Key points of temporary conflict include Campbell Street and Park Road bridges where short term temporary partial road closures could be expected. Appropriate traffic management measures would be implemented to ensure impacts are minimised.

Pedestrian and Bicycle Access

Existing east-west pedestrian and bicycle access has been catered for at all vehicular crossings of the proposed NDE, and through specific design elements of the proposed NDE.

In particular, a pedestrian overpass would be provided over the proposed NDE at Farrell Road, which would link with a new footpath and cycleway from Farrell Road to Russell Street. This would cater for pedestrian and bicycle access to Woonona High School in particular, as well as other general pedestrian and bicycle movements in the locality.

Thompson Street south towards Muir Street.

Safe and convenient bicycle and pedestrian access along the southern section of the route is catered for in the EIS Proposal by provision of two signalised intersections (Bellambi lane and near Doris Avenue) and use of local streets and footpaths.

On balance, pedestrian and bicycle movements at all existing cross-overs along the existing NDE route would be much safer post completion of the EIS Proposal.

Bus Services

The EIS Proposal would facilitate commuter express services to, from and through the study area.

Emergency Services

The existing Northern Distributor south of Bellambi Lane was regarded by Emergency Services as having had a positive effect on the area as it reduced response times by a reduction of congestion in local streets and the Princes Highway within the area. The EIS Proposal is expected to have net gains for Emergency Services activities through the facilitation of faster response times and adequate median openings for emergency turns.

Topography, Geology and Soils

A study of topography, geology and soils was undertaken by Coffey Geosciences for this EIS (refer **Working Paper 4**). This study concluded that there are no significant geological or topographic constraints to the EIS Proposal.

Based on site investigations and a review of existing recorded data, there is a low probability of acid sulfate soil. Contamination has occurred in a few localised sites within the EIS Proposal corridor. This would be subject to further testing during the construction phase.

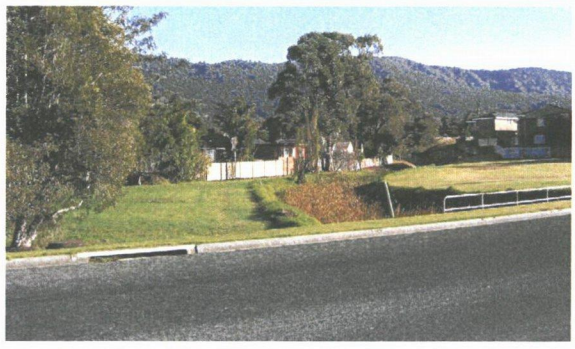
The engineering design incorporated into the EIS Proposal is in accordance with RTA practice and would not create adverse environmental impacts. Mitigation measures would ensure compliance with these requirements.

The project is not expected to require rock blasting. Excavation of material from road cuttings along the route is expected to balance the quantities needed for fill batters without the use of off-site fill.

Flooding & Drainage

The EIS Proposal includes hydraulic structures and on site detention (OSD) basins that have been based on Wollongong City Council's draft blockage guidelines and key performance criteria. The structures have been sized to ensure flood levels in the vicinity of the proposed NDE do not exceed existing flood levels.

A Flooding and Drainage study was undertaken for the EIS by Connell Wagner (**Working Paper 5**) to consider the impact of the proposed NDE on flooding conditions in the vicinity of the route. Catchments extending upstream to the escarpment and downstream to the ocean have been examined in determining design flood flows and flood levels. The impacts of future catchment conditions and Council's OSD policy have also been considered.



The EIS Proposal crosses a number of small creeks along the route.

The results of extensive community consultation and on site verification, together with recorded flood levels, have been considered in the model for the 1998 flood event. Calibration of the model indicates that it represents a reasonable mathematical interpretation of how the total catchment would behave.

The main conclusions are:

- Construction of the proposed NDE with bridges and culverts used in the EIS Proposal would provide negligible effect on flooding levels from about 60m upstream or downstream of the proposed NDE and no residential dwellings would be worse off from flooding due to the proposed NDE;
- The worst potential flood would occur when the railway structures are fully blocked. The backwater effect on flooding is felt back as far as the proposed NDE. In a probable maximum flood only Creek 7 (south of Campbell Street) has an increase in level upstream of the proposed NDE due to the proposed structure;
- The proposed NDE would not cause any streams to cross flow that have not done so previously. In some cases, streams which cross flow immediately downstream of the NDE proposal may cross flow upstream. However this would not affect local residences;

- The proposed NDE would not be overtopped by the 100 year ARI flood, but the road pavement would be overtopped to a minor extent in 3 locations during the peak maximum flood. Provision has been made for gaps in noise barriers at creek crossings to allow the flood to pass over the proposed NDE; and
- There is no situation where cross flow between major catchments can occur by water flowing along the proposed NDE.

Water Quality

A Water Quality study has been undertaken for this EIS by Forbes Rigby (refer **Working Paper 6**). Previous studies indicate that the existing water quality environment within the study catchment is generally poor with recorded high levels of nutrients and suspended sediment exceeding accepted criteria. Latest studies confirm poor water quality from a number of pollutant sources in these creeks especially during wet weather conditions.

Typical detention basin.

The principal area of environmental sensitivity downstream of the proposed NDE is the Bellambi Lagoon. The proposed NDE would involve significant construction activities and ultimately represent a potential source of pollution.

During construction, the principal threat to water quality is that of increased sediment load. This would be managed through implementation of best practice soil and water management principles. During the operational phase of the proposed NDE, it is anticipated that there would only be a very small increase in pollutant generation.

Long term water quality controls including sedimentation and spill capture basins would be implemented as part of the proposed NDE. These controls should reduce the transfer of pollutants into downstream water bodies by as much as 80%.

Further significant benefits would be realised through relocation of traffic away from the existing Princes Highway which has no water quality controls onto the proposed NDE which would have permanent water quality controls incorporated into its design.

Through adequate maintenance of long term water quality controls, the EIS Proposal can be constructed without any significant cumulative impacts. The effectiveness of the water quality controls would be monitored through a water quality monitoring program.

Air Quality

A detailed assessment of air quality impacts has been undertaken for this EIS by Holmes Air Sciences (**Working Paper 7**) to assess the impact of the proposed NDE on amenity of the surrounding area.

The results of the detailed air quality assessment conclude that:

- Predicted concentrations of air pollutants due to the operation of the proposed NDE are low in comparison to relevant air quality goals. It is unlikely that air quality goals would be exceeded due to motor vehicles using the road; and

- Predicted concentrations of benzene (and other pollutants) are not at levels which would pose health effects. However it is recognised that there may be no safe level for exposure to benzene.

The proposed NDE is expected to improve travel times, which would directly affect vehicle emissions. This assessment has been based on current vehicle emission and fuels standards. It is likely that, with the introduction of further standards and potential improvements to vehicle technology, pollutant concentrations predicted for 2006 and 2016 would be lower than those presented in the detailed assessment.

Biodiversity

A detailed flora and fauna impact assessment has been undertaken for this EIS Proposal by Lesryk Environmental Consultants (**Working Paper 8**) to assess the impact of the proposed NDE on biodiversity within the proposed NDE corridor.

The EIS Proposal passes through an area that has a low level of biodiversity and ecological value. The habitat in the road corridor is not important for any of the threatened species, populations or ecological communities listed under the NSW Threatened Species Conservation Act 1995 previously recorded in the study region.

The EIS Proposal would not result in any of these threatened species, their populations, ecological communities, or habitats being significantly impacted upon such that a viable population of that species is placed at risk of extinction. Similarly, the works would not fragment, disturb or alter any movement or dispersal corridors, or isolate any proximate areas of suitable habitat.

Based on the results of field work and a review of known literature sources and databases, it is considered that there are no ecological constraints to the current proposed NDE proceeding as planned.

The proposed works would not significantly affect any populations of native plants, animals or fish such that they are placed at risk of extinction. Similarly the works would not remove or significantly affect any habitats of local, regional, state or national conservation concern.

The EIS Proposal would not have a significant impact on the threatened species, its populations, ecological communities or habitats under provisions of Section 5A of the Environmental Planning and Assessment Act 1979.

Mitchell Road north towards Park Road.

The EIS Proposal is not considered to affect, threaten or have an adverse impact on any of the Nationally significant species listed under the Schedules to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 that were recorded or could potentially occur within, or adjacent to, the study area. Therefore, no referral to the Federal Minister of the Environment for consideration or approval is required.

No Koala populations are considered to occur in close proximity to the study area. The area is not considered Potential or Core Koala habitat. Giving consideration to the objectives of SEPP 44, it is considered that the proposed works would not require the preparation of a Plan of Management for Koalas, or the adoption of any other mitigation measures.

Based on the EIS assessment, a Species Impact Statement is not required and referral to the NSW Minister for the Environment is not required.

Noise

A detailed assessment of noise impacts has been undertaken for this EIS by Wilkinson Murray (**Working Paper 10**).

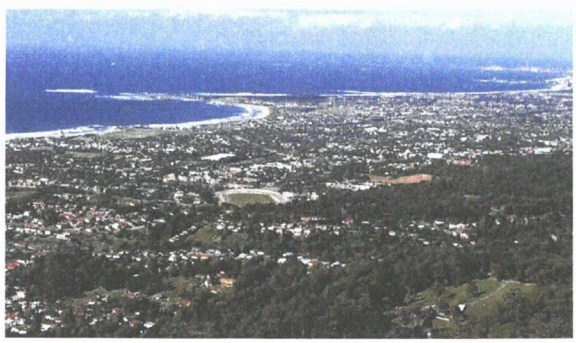
The EIS Proposal contains a number of noise mitigation measures in the form of cuttings, earth mounds and barriers, as well as an 80km/h speed limit, grade-separated intersections and quiet road surface designed to meet all relevant noise criteria.

Operational Noise

At residences near the route of the EIS Proposal, noise levels would generally reduce after opening of the proposed NDE. This results from the extensive noise mitigation measures proposed as part of the project design. In addition, noise levels due to the proposed NDE at most residences are expected to comply with the base noise criteria recommended by the Environmental Criteria For Road Traffic Noise (ECRTN) published by the NSW Government.

At Woonona High School and Russell Vale Public School noise levels from the proposed NDE are expected to comply with the relevant noise criteria in the ECRTN for the classrooms, playgrounds and sporting fields.

Some other roads would be affected by operation of the proposed NDE. A noticeable decrease in noise level would result on the Princes Highway between Bellambi Lane and the proposed intersection with the proposed NDE near Molloy Street. North of this, there would be a small (probably not noticeable) increase in noise level.



View of study area from Illawarra Escarpment.

The only other significant changes would be a possible noticeable increase in noise level in Campbell Street and Gray Street just west of the proposed NDE and a substantial decrease in noise level in much of York Road, Mitchell Road and Thompson Street. These changes to other roads represent the changes due to traffic growth between the existing situation and 2016 as well as the change due to the introduction of the proposed NDE.

Overall, the proposed NDE would bring significant noise level reductions in the area, with some negative effect on Campbell Street and Gray Street just west of the proposed NDE as a result of traffic entering the proposed NDE along these streets. Local traffic management measures are proposed to reduce traffic speed and noise in these streets.

Construction Noise and Vibration

Relatively high noise levels are expected at the nearest residences during construction of the proposed NDE. Such noise levels are typical of construction of roads in metropolitan areas and cannot be avoided.

Some vibration is expected at the nearest residences during construction. This is likely to result in discomfort to some residents, particularly from vibratory compaction and ripping of rock, but damage is not expected to buildings as a result.

Cultural Heritage

A study of cultural heritage was undertaken for this EIS by Rod Howard Heritage Conservation and DIG International (**Working Paper 12**).

No known Aboriginal archaeological sites have been recorded in the study area. Whilst few archaeological assessments have been carried out in the proximity of the study area, cartographic and photographic evidence suggests that the majority of the study area has been impacted by non-indigenous occupation and activities over the last 150 years.

The study area was inspected on foot with an Illawarra LALC representative and representatives of NSW National Parks and Wildlife Service in 2001. No archaeological sites were found and no areas of potential archaeological deposits were located.

It is unlikely that construction of the proposed NDE would impact Aboriginal archaeological remains.

The EIS Proposal involves demolition of three heritage houses in Farrell Street west that have been listed in LEP 1990 and removal of two ageing Norfolk Island pine trees near the intersection of Gray Street and Park Road. Removal of these items is not regarded as having a major impact on cultural resources with other than high local heritage value.

The Seaview Guest House located at 300 Princes Highway is not regarded as having high heritage status. It is not directly affected by the EIS Proposal for this section of the Northern Distributor.

There are no known items of indigenous heritage in the study area affected by the EIS Proposal.

Visual

An assessment of visual impacts arising from the EIS Proposal has been undertaken for this EIS by Infranet and Kiah Environmental Designers (**Working Paper 11**).

Whilst the EIS Proposal would result in a new section of road, the overall visual impact would be low. This reflects the fact that for most of its length it would be replacing existing roads and would have a substantial landscape component along its entire length.

In other locations (eg southern section of the proposed NDE), the use of landscaped sound mounds would make a positive improvement to the outlook of housing opposite industrial land uses.

The route does not impact on open spaces and would not be visually significant from public viewing places along the escarpment.

The EIS Proposal includes benefits from ESD initiatives such as improving the biological quality and ecological value through revegetation strategies, introducing sensitive water management and waste minimisation both during and after construction.

Throughout the community consultation process to date, comment on all aspects of the proposed landscaping for the EIS Proposal has been positive, and there has been no substantial comment on any negative visual impacts of the project.

Mitigation measures include the introduction of artistic panels along sound wall structures and the use of transparent materials in strategic locations.

Generally, it can be stated that the overall EIS Proposal would have a low visual impact on the existing landscape and the surrounding community. This is because the design has incorporated, where possible, considerable landscape and urban design elements to minimise this impact. This includes provision of landscaped noise barriers and maximising visual exposure to local streetscapes for pedestrians at overpasses.

Other Social Impacts

A Socio-economic and Land Use study was undertaken for this EIS by Egis (**Working Paper 9**) to assess impacts of the EIS Proposal.

Social impacts are described as the direct impacts on people, their amenity, health and the way they use their community. Many impacts which may be considered from a strictly environmental point of view also have social implications. These have been discussed elsewhere and include noise effects, impacts on access and visual impacts.

Safety

On balance, the EIS Proposal is considered to have substantial safety improvements for road users as well as pedestrians and cyclists.

Amenity

Specific amenity issues relating to noise and air quality are discussed above. In general, the amenity of the study area is expected to improve as a result of the construction of the proposed NDE.

The EIS Proposal will improve pedestrian and cyclist safety.

On some residential streets within the study area, traffic volumes would decrease substantially following construction of the proposed NDE (eg Farrell Road east and west; Hopetoun Street; Russell Street; Thompson Street; Mitchell Street and York Road).

Similarly, there would be a reduction in traffic volumes along the Princes Highway between Bellambi Lane and Molloy Street. This would contribute to an improved amenity within the retail and commercial strip at Woonona in particular, but also for residences located on the Princes Highway in Woonona and Russell Vale.

However, some streets within the study area would experience an increase in traffic volumes as a result of the EIS Proposal in excess of projected traffic volumes under a "no change" option (eg Molloy Street, Rixon Avenue, Campbell Street, Gray Street and Park Road). These streets would provide important east-west crossings of the proposed NDE. This increase in traffic is unavoidable, however appropriate traffic calming measures have been identified to manage the increased traffic and safety issues.

As the NDE is proposed to terminate at the Princes Highway near Molloy Street, it would effectively funnel traffic onto the highway through Bulli shopping centre. Whilst traffic levels on the Highway at Bulli are not predicted to be significantly greater than existing traffic levels immediately after opening, as traffic volumes increase over time, there would be greater levels of traffic being funnelled into Bulli between Molloy Street and Lawrence Hargrave Drive. Some reduction in amenity along this section of the Princes Highway is likely.

Property Impacts, Land Acquisition and Compensation

The general corridor for the Northern Distributor Extension has been established for over 60 years, and has been shown on planning instruments since 1968.

The RTA has had discussions with the remaining affected property owners during the refinement of the EIS Proposal and preparation of the EIS studies to identify potential impacts and the way the construction and operation would affect them and their amenity.

Most properties required for the EIS Proposal have now been acquired by the RTA. Whole or partial acquisition of about 28 properties would still be required. Of these properties, ten (10) are not included in the current arterial road zoning. There are 9 residences and two properties containing businesses to be wholly acquired. These latter properties are located in the vicinity of the proposed intersection of the proposed NDE and the Princes Highway and contain a veterinary surgeon and a two storey commercial and residential building.

Property acquisition would be carried out in accordance with the RTA's Land Acquisition Policy Statement.

Health and Psychological Effects

The EIS Proposal is not expected to create any significant adverse health problems for local residents.

Construction Workforce

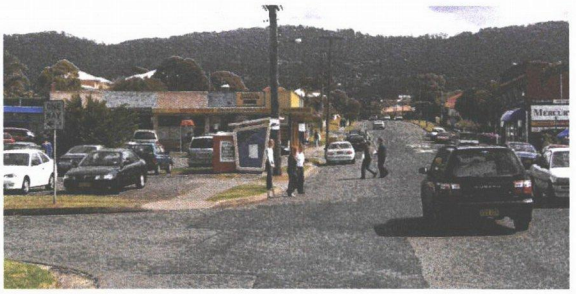
The EIS Proposal is likely to create an opportunity for substantial employment in the construction industry and related sectors for a period of up to two years.

Impacts on Local Economy

The construction phase of the proposed NDE is not expected to generate any significant adverse impact on local business. However, the presence of a large local workforce would have a positive impact on local retail trade during the construction phase.

Some access restrictions may occur to properties in the vicinity of the Princes Highway at its intersection with the proposed NDE during construction. This would be minimised by ensuring that adequate access is maintained to all properties during the construction period.

Access for heavy vehicles is also an issue for a small number of the industrial businesses located within the study area. The delivery of materials and transport of finished goods create a requirement for the businesses to have turning space for such vehicles to access their premises.



East Woonona shopping centre along Park Road.

The design of the EIS Proposal provides good access/egress to all business along the route.

The main potential business impacts of the proposed NDE would be on the local shopping centres of Woonona and Bulli located on the Princes Highway.

Woonona

This centre would benefit from the EIS Proposal by experiencing a reduction in through traffic, the removal of some highway parking restrictions and an improvement in local amenity for shoppers.

Bulli

This centre would be subject to increased traffic flow along the highway north of Molloy Street, and the associated increase in parking restrictions on the highway.

There was strong community support for future extension of the proposed NDE (north of Molloy Street) to the west of the centre along the current gazetted alignment.

Hazards

An Operational Hazards and Risk report was prepared by Connell Wagner for this EIS (**Working Paper 13**). This undertook an assessment of the risks associated with the EIS Proposal using a process in accordance with the Australian Standard for risk assessment AS/NZS 4360.

Whilst a large number of potential risks were identified and assessed, there were no major risks that could not be addressed by suitable mitigation measures.

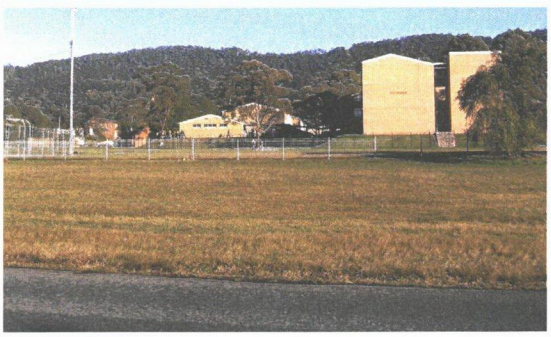
The risk assessments also indicated no adverse environmental findings and the project appears to be ecologically sustainable.

A **risk management plan** would need to be reviewed at appropriate intervals during the project to ensure that actions are taken as required and that any new risk issues are added into the plan.

Mitigation Measures

The level of concept design incorporated into the EIS Proposal together with current RTA practice for new road projects has meant that many aspects of the design once regarded as "mitigation measures" such as noise barriers and landscaping have now been included in the current EIS Proposal.

However, the EIS assessment has identified a number of general and specific mitigation measures that would apply to the EIS Proposal for the proposed NDE.



Woonona High School from Thompson Street.

These mitigation measures are detailed in relevant sections of the EIS report. The mitigation measures cover a wide range of matters including but not limited to:

- Local area traffic management plans for selected streets;
- Flooding;
- Water quality;
- Air quality;
- Noise controls;
- Procedures for management of acid soils and contaminated lands;
- Energy management;
- Waste management;
- Input procurement; and
- Additional soil testing during construction.

ESD Principles

The EIS Proposal is consistent with the four principles of ESD:

Precautionary Principle — there are no major uncertainties about the impact of the EIS Proposal.

Intergenerational Equity — the EIS Proposal would improve amenity and safety for local residents and improve the efficiency of the transport network for both the local and wider community. The project would generate new job opportunities during construction and improve infrastructure for existing and future business activity in this part of the Illawarra and beyond.

Conservation of Biodiversity — The EIS Proposal does not have any adverse impact on threatened or endangered species. No significant native habitats are affected. Landscaping proposed for the proposed NDE would increase native habitats locally.

Improved Valuation and Pricing of Environmental Resources — The EIS Proposal does not denigrate the value of existing natural resources. The concept design for the project and proposed management practices during the construction phase include a number of features that have net positive environmental values.

Cumulative Impact

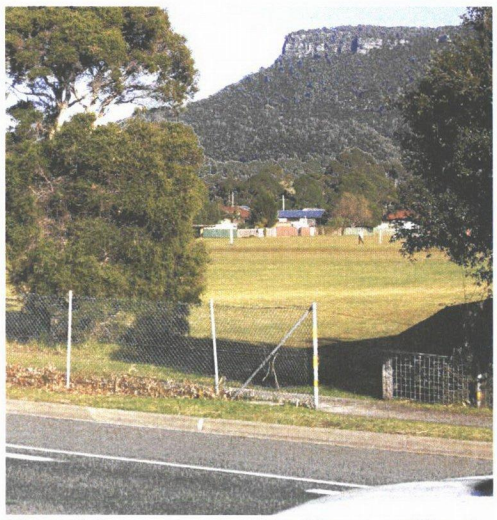
The project is considered to have a positive cumulative impact with no major adverse effects.

Economic Analysis

A detailed road user cost benefit analysis has been undertaken for the project and shows a Benefit Cost Ratio of approximately 1.8 to 1. This analysis has been based on detailed cost estimates and traffic projections using recent traffic counts.

Project Justification

The EIS Proposal for extension of the Northern Distributor from Bellambi Lane in Woonona to the Princes Highway near Molloy Street in Bulli would have net benefits to the local community and the wider travelling public. These benefits include improved safety and amenity, increased efficiency of the transport network, and improved business prospects in Woonona local centre.



View of the escarpment from Thompson Street.

There are no major impacts on the physical environment or water and air quality, and the engineering design would ensure that there would be no impact on local flooding in storm events up to and including the 1 in 100 year flood.

The project is also consistent with the principles of Ecological Sustainable Development.

Not withstanding the benefits provided by the Preferred proposed NDE Option, some adverse impacts on the local community would be generated including: more traffic through Bulli Shopping Centre; loss of several heritage houses; increased traffic on some feeder streets; views of noise barriers; and minor disruption to existing pedestrian movements.

Mitigation measures have been recommended that would address all of the adverse impacts of the EIS Proposal.

Next Steps

This EIS is on public display for a period of four (4) weeks during which time any member of the public can make a written representation. These comments would be reviewed by the RTA and planningNSW as part of the EIS assessment process before a final decision is made.

The EIS would be on display at the following locations throughout the exhibition process:

- RTA Southern Region Wollongong, Level 4, 90 Crown Street Wollongong;
- RTA Motor Registry, Park Mall Corrimal;
- Wollongong Library, Burelli Street;
- Corrimal District Library, Short Street;
- Bulli Library, Princes Highway;
- Thirroul Library, Lawrence Hargrave Drive;
- NSW RTA, Centennial Plaza, 260 Elizabeth Street, Surry Hills;
- PlanningNSW, Information Centre, Ground Floor, Henry Deane Building, 20 Lee Street, Sydney;
- New South Wales Environment Centre, Level 5, 362 Kent Street, Sydney.

The EIS Report and Working Papers will be available on the RTA website www.rta.nsw.gov.au.

Copies of the EIS Report and Working Papers will be available for purchase at the RTA Southern Region Wollongong at a price of $25 per copy and $10 for a compact disc.

Persons or organisations wishing to comment on the proposal are invited to make written representations before close of the display period.

Representations can be sent to the following address:

Project Manager
Northern Distributor Extension
RTA Southern Region
Level 4, 90 Crown Street,
Wollongong NSW 2500.
Fax: 02 4227 3705
E-mail: kali_gupta@rta.nsw.gov.au

1. Overview and Background

1.1 Introduction

An Environmental Impact Statement (EIS) is required under NSW legislation for new major road projects which are likely to significantly affect the environment. The proposal for an extension of the Northern Distributor (NDE) in Wollongong for a length of about 3km from Bellambi Lane in Woonona to the Princes Highway at Bulli requires preparation of an EIS that describes and assesses the impact of this proposed road.

The EIS covers the social, economic and environmental impact of the proposed development, and provides an opportunity for public comment on all aspects of the development.

Throughout this document, mention is made of the EIS Proposal for the proposed NDE. This refers to a specific proposal for the NDE (described in detail below) that has resulted from extensive community input and professional assessment undertaken by the Roads and Traffic Authority of NSW (RTA) over recent years.

Completion of the EIS and approval by the Minister for Planning are necessary steps in the overall decision making process for this project but does not of itself indicate or imply a formal commitment by the NSW Government to construction of the proposed NDE.

1.2 Background, Regional Context and Study Area

The proposed NDE is intended to form the next stage of the Northern Distributor that would ultimately link the Wollongong CBD to the foot of Bulli Pass. **Figure 1.1** refers.

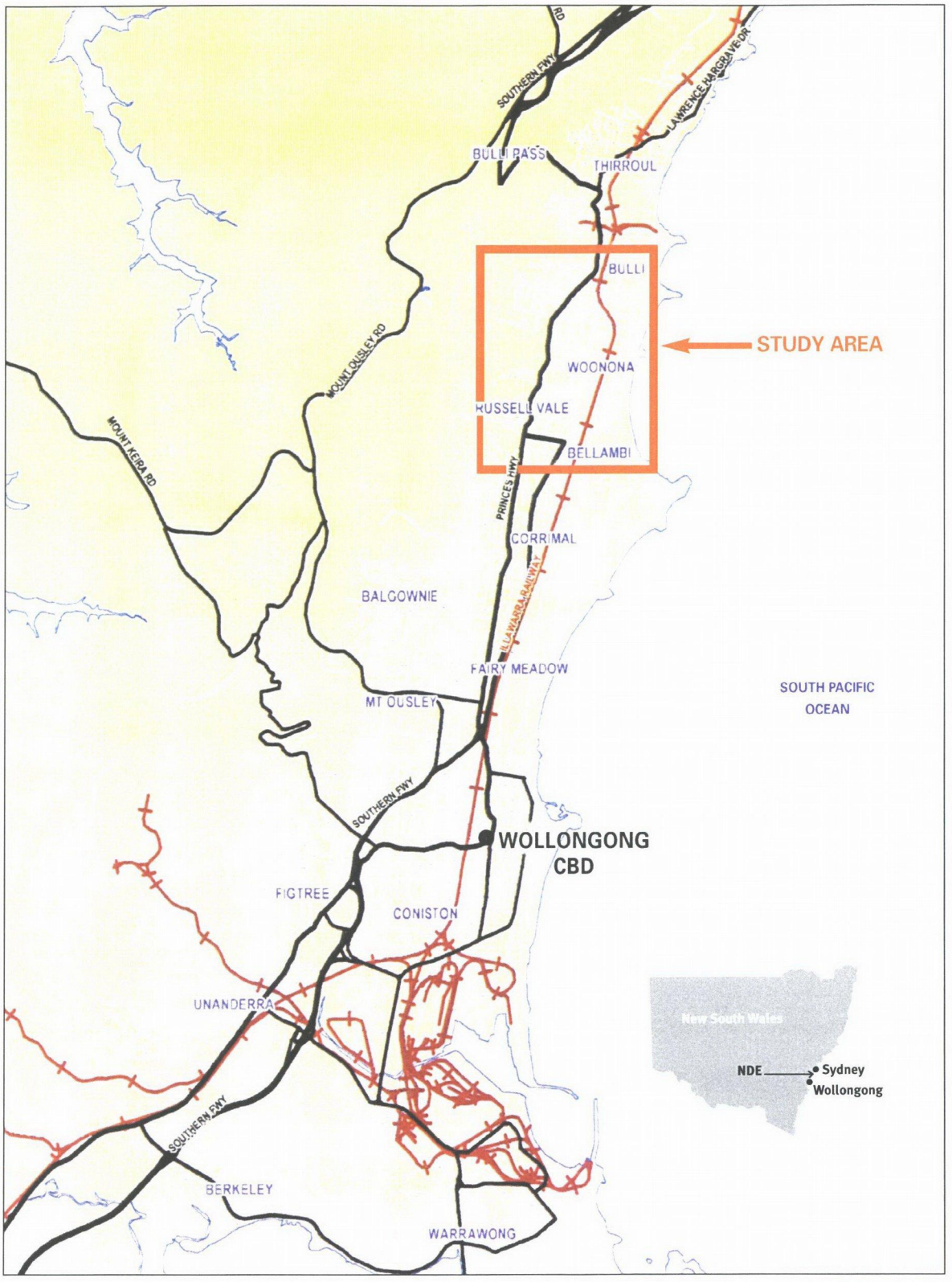
The proposed NDE corridor runs in a north-south alignment parallel to the Princes Highway and main Sydney-Wollongong railway line. The general study area extends from the beaches in the east to the escarpment to the west. The relatively short distance between the escarpment and the beach creates a unique landscape setting which also influences the microenvironment of the corridor. **Figure 1.2** refers.

The RTA proposes to extend the Northern Distributor from Bellambi Lane to rejoin the Princes Highway near Molloy Street. The proposed route follows the existing road reservation gazetted in the Wollongong City LEP. Land along the corridor has been reserved for the Northern Distributor Extension for many years. The RTA already owns most of the land required, which has been gradually acquired since the 1940s.

The Northern Distributor between North Wollongong and Bellambi Lane was progressively opened to traffic between 1990 and 1993. Currently the Distributor finishes at Bellambi Lane.

Since opening in 1993, the Northern Distributor has become a major arterial for the City of Wollongong. The city's growth is in a north-south direction due to the Pacific Ocean and Illawarra Escarpment, which place considerable constraints on east-west movement. It is the desire for movement in a north-south direction, which increases the significance of the Northern Distributor.

Figure 1.1: Regional Context



Legend

- Study Area
- Main road network
- Railway

Source: RTA

Figure 1.2: Study Area

Legend

EIS Proposal (indicative route)

Source: RTA (base map from UBD)

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Planning for the proposed NDE commenced with a Value Management Study which was commissioned by the RTA in September 1998.

In May 2000 the RTA completed a Project Justification Study for the proposed NDE from Bellambi Lane to Molloy Street. This was based on previous studies including a traffic modelling and forecast study for the Wollongong /Shellharbour area (WOLSH model), the value management study, an urban design overview, design of alternative options and traffic impact studies.

The proposed NDE route is part of the wider urban transport network linking the northern suburbs of Wollongong to Central Wollongong. It also forms part of the regional transport network from Sydney to the Illawarra and is included within the NSW Integrated Transport Strategy "*Action for Transport 2010*".

Access to the proposed NDE from the north is from Bulli Pass and Lawrence Hargrave Drive. These links, together with Mt Ousley Road, form the main road connections to Sydney.

The proposed NDE corridor traverses an urban environment containing medium to low density residential housing, community facilities, open space and light industry. The area is mostly flat coastal land bisected by three main watercourses, contained within narrow reserves, parks or creek easements.

Land use immediately adjacent to the western side of the proposed NDE corridor is predominantly residential but includes Woonona High School. Land use adjacent to the eastern side includes short sections of light industrial development at either end of the route, with housing and two small pockets of local open space comprising the balance of the route.

The Corridor is susceptible to flooding resulting from the large extent of low-lying land, steep topography to the west and urban development in the upstream catchment.

1.3 Project Need and Objectives

This section discusses the underlying need for the project and the specific objectives that have been formulated for its implementation.

In 1993, a section of the Northern Distributor was opened between North Wollongong and Bellambi Lane in Russell Vale. The need for extension of this route has become more pressing in recent years with growing traffic congestion, safety and amenity issues along the Princes Highway and through the local street network. Loss of business opportunities in the Woonona shopping centre as a result of increased parking restrictions along the highway was another consideration.

In 2000 the RTA initiated a series of background studies to investigate the underlying rationale for the proposed NDE and to review earlier concept road designs.

The **need** for extension of the Northern Distributor is based on the following considerations:

- To improve the **efficiency of traffic flow** through the northern suburbs of Wollongong by reducing congestion along the Princes Highway; and
- To reduce the **adverse impacts of noise, safety and other amenity** issues resulting from an increased level of through traffic using local residential areas.

The existing Princes Highway would not be able to cater for projected increases in traffic demand and there is a need to initiate action to address this situation. Without action, there would be a progressive deterioration in the efficiency of the transport network, increased traffic volumes passing through local streets and an increase in traffic safety problems.

In the current situation, the proposed NDE should serve the twin purpose of a local distributor and a through-route for northern suburbs and inter-city traffic.

The project scope must include improved amenity on the highway and local street networks as well as good east/west cross corridor access.

Construction of the preferred option could be undertaken with minimal disruption to local traffic movement, as the route is largely located on land not used for local roads.

The design for the proposed NDE should not rule out the possibility of upgrading the status of the proposed NDE from a distributor function to a higher grade arterial road in the future if required and subject to further study and community consultation.

The **main objectives** for the proposed NDE were initially determined in 1998. They have been subsequently extended and revised by the RTA and through the associated community consultation process as outlined below:

- **Improve road safety** by reducing through traffic on the Princes Highway through local business districts;
- **Improve road safety** by removing unnecessary through traffic from residential streets north of Bellambi Lane;
- Provide a **consistent level of service** between Wollongong and Bulli along the Northern Distributor;
- **Improve travel time** between North Wollongong and Bulli;
- **Minimise the impacts** of additional traffic generation on the Princes Highway between Molloy Street and Lawrence Hargrave Drive/Bulli Pass;
- Ensure design is able to accommodate the future strategic road transport scenario (refer **Section 4** of this document);
- Minimise any adverse impact on existing east/west community movement by retaining appropriate links across the Northern Distributor corridor to maintain an **integrated community**;
- Improve the local **noise** environment in the general vicinity of the proposed NDE corridor;
- Ensure no adverse impact on current **drainage provisions and flooding**; and
- Continue **community consultation** throughout the planning and design process.

1.4 EIS Proposal Summary

The EIS Proposal for the proposed NDE involves construction of a **four-lane dual carriageway distributor road with controlled access from Bellambi Lane to the Princes Highway near Molloy Street**.

The main features of the proposed NDE are summarised below (moving north to south):

- **Princes Highway/Molloy Street:** An at-grade four-way signalised intersection with pedestrian access for all movements;
- **Farrell Road (east) and Molloy Street:** a new local road connection from Farrell Road east to the Princes Highway via Molloy Street;
- **Farrell Road:** Creation of a cul-de-sac in Farrell Road, with a new pedestrian overbridge across the Distributor linking Farrell Road east and west;
- A new **roundabout** at the junction of Farrell Road and Thompson Street;
- **Russell and Hopetoun Streets:** Both streets proposed to become cul-de-sacs at their eastern end. Retain current access to the Princes Highway;
- Construction of a new **pedestrian footpath and bicycle link** between Farrell Road and Campbell Street on the western side;
- **Campbell Street:** A grade separated interchange with the proposed NDE bridging over Campbell Street and incorporating south facing on and off-ramps. Maintain current east-west vehicular and pedestrian/bicycle access and on and off ramps to proposed NDE from Campbell Street;
- **Thompson Street:** The northern end of Thompson Street connected to Farrell Road east via a new roundabout. A cul-de-sac north of Campbell Street created to improve traffic safety in this area. A cul-de-sac south of Campbell Street created to provide access to three properties affected by the southbound on-load ramp from Campbell Street. The southern section of this street linked to Park Road and a southbound access to the proposed NDE;
- **Park Road/Gray Street:** A new vehicle and pedestrian overbridge at Park Road connecting Gray Street via Mitchell Road and provision for southbound access and egress to the Distributor. Northbound access to Park Road and Gray Street to be via a new intersection between Alice Street and Doris Avenue and Mitchell Road;
- **Mitchell Road** to become one way in a northbound direction for traffic between Park Road and Rose Street;
- **York Road area:** A signalised at-grade intersection midway between **Alice Street and Doris Avenue** serving the local residential area west of the Distributor and a service road connecting to the eastern industrial area. This allows full turning movement and facilitates access to/from the railway station, beach, local shops, school catchment east of the proposed NDE and community facilities. The southern end of York Road to contain a cul-de-sac;
- **Watts Lane:** A short extension to Watts Lane required servicing the light industrial area;
- **Bellambi Lane intersection:** Right (north) turns provided from Bellambi Lane intersection onto the Distributor.

Figure 1.3 summarises the EIS Proposal.

Figure 1.3: EIS Proposal Summary

Signalised intersection at Princes Highway/ Molloy Street
Pedestrian bridge over Farrell Road
Farrell Road cul-de-sac
Roundabout at Farrell Road/Thompson Street
Footpath & cycleway from Farrell Road to Campbell Street
Hopetoun Street cul-de-sac
Russell Street cul-de-sac
Thompson Street cul-de-sac
Bridge over Campbell Street
Northbound offload ramp
Southbound onload ramp
Thompson Street cul-de-sac
Northbound onload ramp
Kialoa Street cul-de-sac
Roundabout at Gray Street
Southbound offload & onload ramps
Bridge over NDE links Gray Street & Park Road
One way section Mitchell Road
Access road to properties
Footpath & cycleway to Wynn Street
Signalised intersection between Doris Ave & Alice Street
Service road to industrial area
York Road cul-de-sac
Watts Lane cul-de-sac
Right turn from Bellambi Lane
EXISTING TRAFFIC SIGNALS
HOSPITAL ROAD
FARRELL ROAD
VILLIERS AVENUE
RUSSELL ST
ROBERT ST
CAMPBELL ST
FRANKLIN AVENUE
THOMPSON STREET
GRAY ST
PARK RD
PRINCES HIGHWAY
ROSE ST
ALICE ST
DORIS AVE
CORRIMAL ROAD
COLLIERY ROAD
YORK ROAD
TERAMA ST
BELLAMBI LANE
To Wollongong
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A detailed description of the EIS Proposal is provided in **Section 6**. **Working Paper 1** provides a description of the EIS Proposal and has been prepared by the RTA Road Design Section. It provides details of each design element in the EIS Proposal for the proposed NDE including vertical and horizontal alignment, intersection treatments, bridges, pedestrian access, service roads and drainage.

2. NDE Project Development

This Section documents the history of the current EIS Proposal for the Northern Distributor Extension and the options analysed by RTA for alternative routes.

2.1 History

The current EIS phase of the proposed NDE project was commenced in early 2002 with an announcement by the RTA that an EIS would be undertaken for the project. The project has a long history, commencing with designation of the route corridor in the 1940s. More recently, the RTA initiated new studies in 2000 leading up to the current phase, with the key steps outlined in **Figure 2.1** and discussed below.

2.1.1 Background Studies

Following a Value Management Study initiated by the RTA in September 1998, a number of technical studies were commenced in 2000 to address initial concept design and project feasibility. These previous studies are summarised below.

Traffic

A traffic study of the EIS Proposal, completed by **Forbes Rigby/Gabites Porter** in August 2001, analysed existing transport features and conditions based on background traffic volumes, peak-period intersection counts, traffic origin-destination counts, accident history and a survey of pedestrian movements, bus operations and parking. It also provided an analysis of projected traffic conditions associated with the various options developed for the proposed NDE and analysed the effects of the preferred proposed NDE on traffic impacts, parking at Woonona and Bulli Shopping Centres, impacts on pedestrian and cyclist movement, effects on local schools and bus services.

This study was commissioned as an extension to the earlier Project Justification Report by **Sinclair Knight Mertz** (SKM) in May 2000. The data obtained for the Forbes Rigby/Gabites Porter traffic study and the methodology adopted included the following:

- Traffic data from RTA's Traffic Counting Stations and Wollongong City Council's traffic counts located within the study area;
- Additional peak period manual traffic counts, incorporated at the request of the Community Liaison Group (CLG), to provide a better picture of local areas of concern including the length of the survey being extended to cover the pick-up and drop-off period at the local schools;
- Origin-Destination traffic counts to measure the amount of through traffic between Bellambi Lane and Bulli Pass;
- A mail out survey in late 2000 to parents from all local schools to determine movement patterns, parent concerns, mode of travel and other catchment data;
- A pedestrian survey to assess the main pedestrian movement networks in the study area. Two full-day pedestrian counts were undertaken on a typical midweek and typical weekend at the start of the May 2001 school term; and

- A field survey undertaken to identify the non-vehicular transport services and infrastructure available in the pedestrian catchment. The survey also included bus services and routes for school and public transport, location of taxi ranks and the presence of paths, cycle-ways and purpose built access-ways and informal walkways used for pedestrian and/or cycle use.

Flooding and Drainage

The Flooding and Drainage Study for the Northern Distributor Extension was conducted by **Connell Wagner Pty Ltd** in July 2001 and involved a range of flood studies including a review of recent flood history. In summary the key issues addressed in the Study were:

- The existing hydrologic and hydraulic conditions on the proposed Northern Distributor Extension route;
- The impact of the hydrologic and hydraulic conditions on the proposed Northern Distributor Extension;
- The impact of provision of the proposed new road on flooding characteristics in the area; and
- Measures to address impacts.

The study considered upstream catchments extending to the Illawarra Escarpment and downstream controls to the ocean in determining design flood flows and flood levels. The study made a number of recommendations about drainage structures that have been incorporated into the current road design for the EIS Proposal.

Urban Design and Landscape Design

Infranet and Kiah Environmental Design undertook an urban and landscape design study for the proposed NDE. The report describes the site context and landscape character zones along the proposed NDE alignment, identifies design issues and analyses main opportunities and constraints. It made urban and landscape design recommendations that have subsequently been incorporated into the current EIS Proposal, and provided a basis for design of noise attenuation devices for the proposed NDE.

Noise Assessment

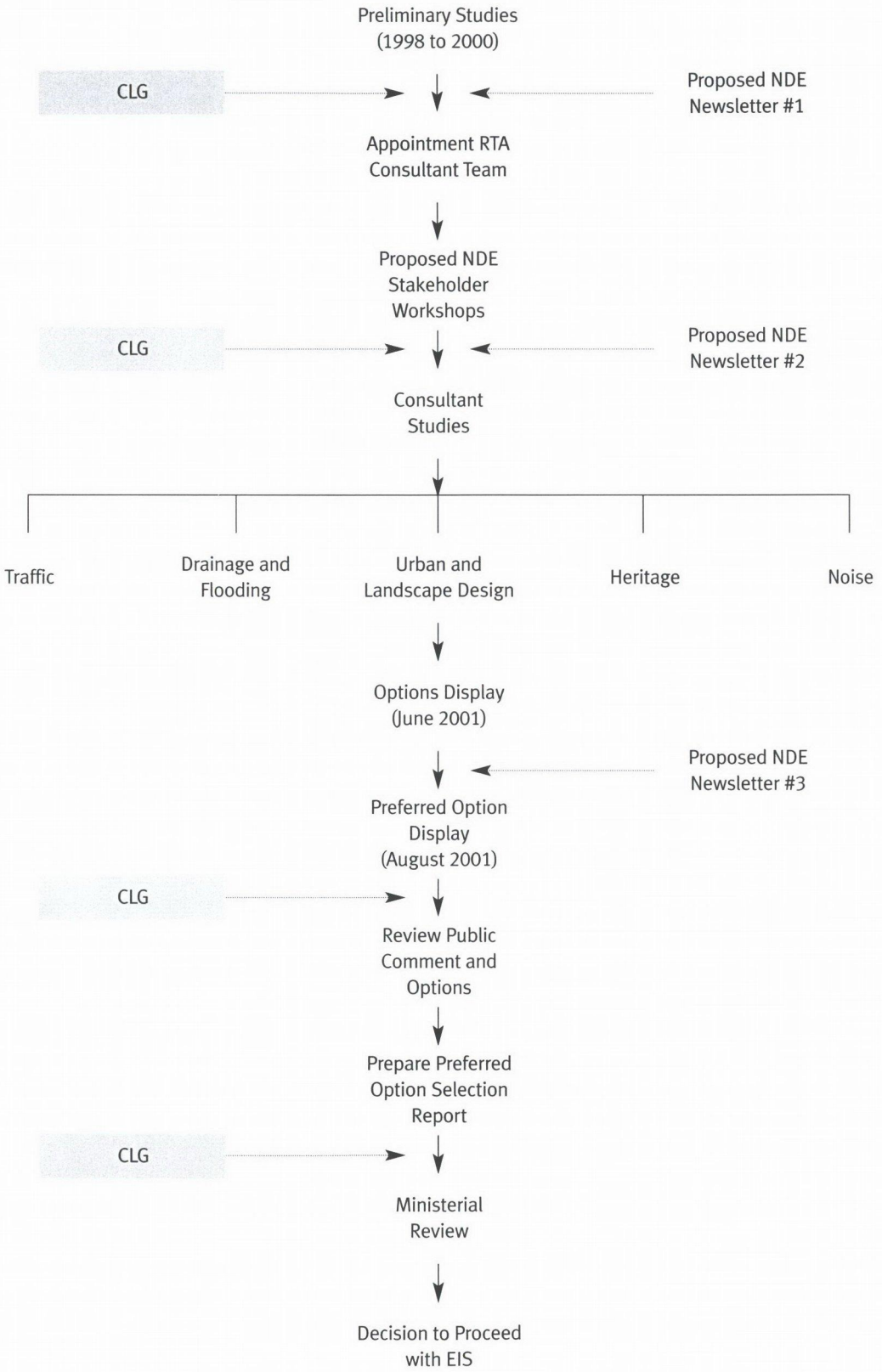
Wilkinson Murray Pty Ltd prepared an operational noise assessment for the proposed NDE in 2001. The report:

- Provides the results of existing noise level measurements at selected locations along the route and associated local streets;
- Predicts noise levels and changes in noise levels as a result of the proposed NDE; and
- Describes possible noise mitigation measures.

The noise assessment has been carried out in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN), published by the NSW Government in May 1999.

Noise mitigation measures recommended by this study have subsequently been incorporated into the EIS Proposal for the proposed NDE.

Figure 2.1: Pre EIS Consultation Milestones



Source: Purdon Associates

Cultural Heritage

DIG International Pty undertook the Cultural Heritage Study in August 2001. This report is an assessment of the potential impacts of the current options on the indigenous and non-indigenous cultural heritage values and items within the study corridor. It was primarily a desk-based assessment that determined, as far as reasonably possible from existing records and field work, the nature of the heritage resource within the study area. The study involved consultation, source identification and data collection and site inspections. The study identified the impact on historical houses and natural heritage.

Options Selection Workshop

An Options Selection Workshop was convened by the RTA in June 2001 as part of the proposed NDE planning process. This workshop provided an opportunity for the RTA and consultant team, as well as other selected stakeholders, to determine a preferred option for the proposed NDE based on the background studies and review of community comments.

The major outcome of the workshop was the selection of the preferred option to be investigated by the RTA for the proposed NDE, and an action plan for the project. This preferred option has subsequently been modified as a result of further studies and community input, resulting in the EIS Proposal.

Road User Cost Benefit Analysis

Sinclair Knight Mertz (SKM) prepared an update of the road user cost benefit analysis (RUCBA) of the preferred option for the proposed NDE in August 2001.

A previous RUCBA was undertaken as part of the May 2000 Project Justification Report for the proposed NDE also prepared by SKM. The update was to take account of the results of recent traffic analysis and other impact studies, which were recommended in the Project Justification Report as necessary to confirm the conclusions reached at that stage of project development.

The RUCBA took into account the following effects of the different options compared with the base case:

- Project capital costs (land acquisition and construction);
- Road maintenance costs;
- Vehicle operating costs;
- Road user travel time costs;
- Accident costs;
- Emission costs (i.e. air pollution and greenhouse gas emissions); and
- Non-quantifiable benefits such as; Noise, Cultural Heritage; and Flooding and Drainage.

The results of both the main RUCBA and the sensitivity testing indicated at that stage that the Preferred proposed NDE Option was an economically worthwhile investment. The investment of $44m in the Preferred Option with a 7% discount rate showed a Benefit to Cost Ratio (BCR) of 2.1 to 1.

Community Involvement

A report on community involvement was prepared by Purdon Associates to document issues raised and attitudes towards the project. On balance there was strong support for the proposed NDE prior to the EIS phase.

2.1.2 Revised Concept Design

The proposed NDE Revised Concept Design Report culminated in a Preferred Options Report prepared by the RTA in November 2000. This was subsequently modified in response to other detailed studies and the consultation process during early 2002 as part of the EIS study (refer **Section 6** below and **Working Paper 1**).

2.2 Options for Northern Distributor Extension

2.2.1 Introduction

This Section discusses strategic options for the proposed NDE as distinct from design options associated with a specific route.

Whilst the main purpose of the proposed NDE study was to focus on the best design solution from Bellambi Lane to the Princes Highway near Molloy Street, the community consultation process raised some concerns about "bigger picture" transport issues. These included:

- The justification for extension of the proposed NDE beyond Bellambi Lane and the need for greater reliance on public transport;
- Alternative routes including Rixons Pass;
- Extension beyond Molloy Street to Bulli Pass; and
- The need for a two lane or four lane NDE.

Each of these strategic options is discussed below, and in the context of projected demand arising from population and employment growth as well as other social trends. **Figure 2.2** summarises the location of route options considered by the RTA.

"Action for Transport 2010"

The underlying rationale for extension of the Northern Distributor was presented in the NSW Government Integrated Transport Plan *"Action for Transport 2010"*. This strategy covers transport initiatives throughout the whole State, including the Illawarra. Taken together with other major improvements including the widening of Mount Ousley Road, the extension of the Northern Distributor was seen as providing improved links to Sydney and better road access to Port Kembla.

Projected Population Growth

Total population of the Wollongong and Shellharbour area is expected to grow to about 305,000 by 2016, an increase of 72,000 people. The major predicted growth areas are located at Shellharbour, Albion Park and West Dapto.

In the area of the Northern Distributor Extension, future urban development is likely to occur on both sides of the Princes Highway, with an additional 1,000 households or more, between 1996 and 2016.

All evidence suggests that there is a gradual increase in the extent of car ownership and increase in the use of vehicles for journeys to work, shopping, school, recreation pursuits or other social activity.

The effect of these changes would be greater traffic generation and more reliance on the need for movement throughout the Wollongong area.

Projected Traffic Volumes

Projected traffic flows for the year 2016 on the road network were undertaken by the RTA with and without the EIS proposal. **Working Paper 3** provides details of traffic projections and analysis of future traffic impacts.

The forecast traffic flows for the year 2016 show marked changes in the pattern of traffic flow. For example, traffic flows on the Princes Highway from Bellambi Lane to Molloy Street would be much lower with the EIS Proposal than without this part of the Distributor.

Traffic flows along the existing York/Mitchell/Thompson alignment would be substantially lower once the proposed NDE is built, as the former roads would revert to local streets.

Some increased additional traffic volume is projected for several local streets that intersect with the proposed NDE eg. Campbell Street (west); Gray Street (west); Park Road; and Farrell Road (east). Traffic volumes are projected to increase on the Princes Highway south of Park Road (Bulli) with the proposed NDE.

2.2.2 Strategic Options

"No NDE" Option

The "No NDE" or "Do Nothing" option is essentially the existing road layout with projected traffic. Thus the Princes Highway remains as the main through route, and the York/Mitchell/Thompson route carries a certain amount of through traffic and distributes traffic to the places along its length.

None of the basic proposed NDE objectives as outlined in **Section 1.3** would be addressed by this option.

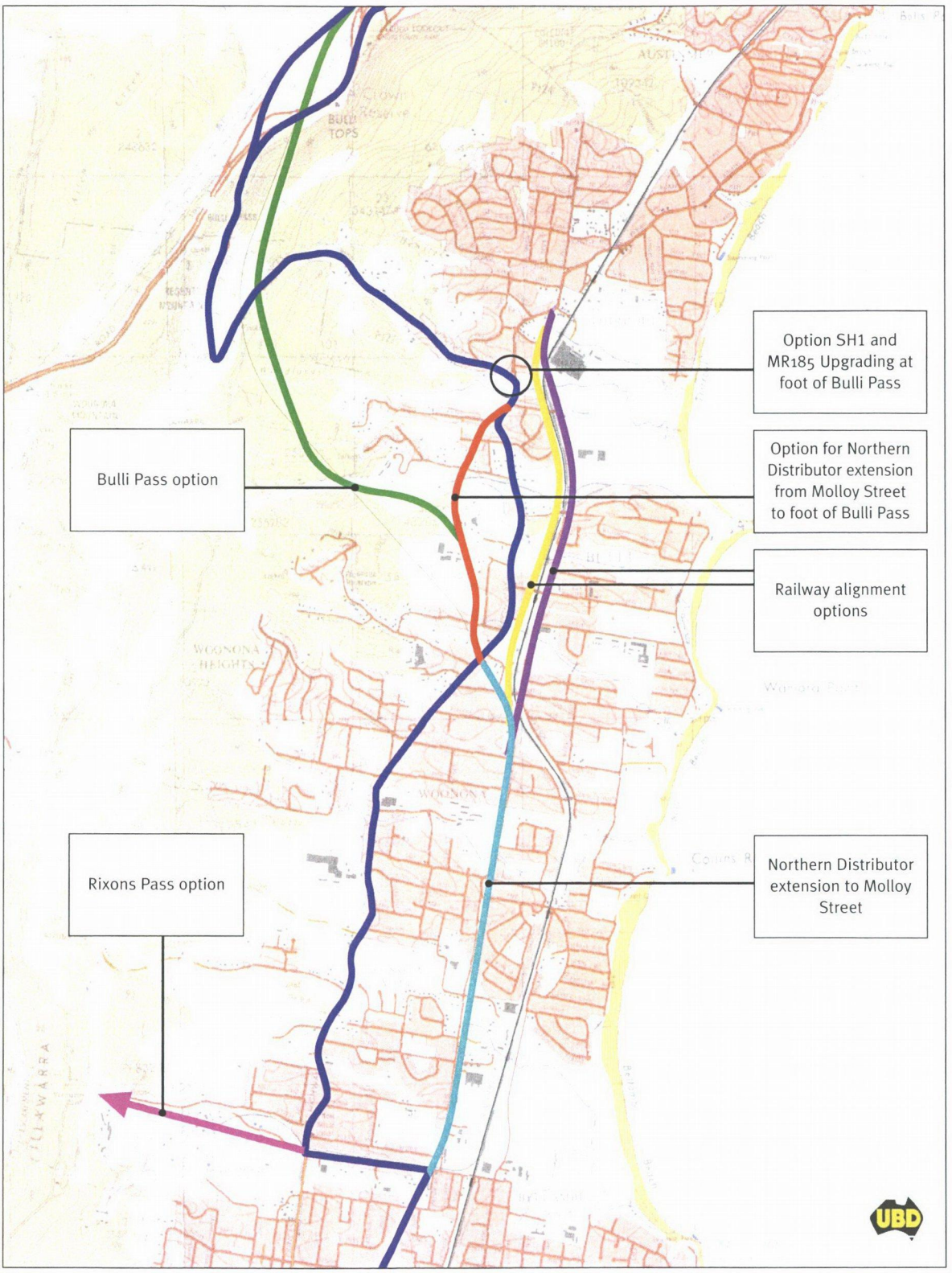
With the "No NDE" option, the traffic analysis shows that by 2016, the Princes Highway would be operating near capacity, while York Road would also reach capacity. Without the proposed NDE, the projected traffic through the Woonona shopping centre will increase to 30,000 vehicles per day and would require the removal of all on-street parking by approximately 2008 and introduction of full-time clearway and/or no-stopping restrictions by 2016.

Under the "No NDE" option, traffic management actions could be introduced on the York/Mitchell/Thompson route and Princes Highway to improve safety, amenity and traffic management.

The overall approach would be to divert through-traffic back to the Princes Highway as much as possible using various traffic management measures, as follows:

- Close off the north leg of Northern Distributor/Bellambi Lane intersection, provide two left turn lanes on the northbound approach into Bellambi Lane and reinstate the right turn from Bellambi Lane to York Road;

Figure 2.2: Route Options for NDE



Legend

Source: RTA (base map from UBD)

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- Re-open the old York Road to the east of the present route;
- Close Thompson Street north of Hopetoun Street;
- Re-configure the Bellambi Lane approach at Princes Highway/Bellambi Lane intersection to include a right turn north bound;
- Provide clearway on both sides of Princes Highway from Bellambi Lane to Bulli, initially for peaks only as at present but for up to 12 hours in the future, depending on conditions;
- In the longer term, provide off street parking to compensate parking lost due to the extended clearway on Princes Highway;
- Install new signals at Campbell Street/Princes Highway intersection with a right turn from Princes Highway into Campbell Street; and
- Ban right turn for northbound traffic from Princes Highway into Russell Street at Russell Street/Princes Highway intersection.

The results of traffic modelling of these local area traffic management (LATM) actions show that the Princes Highway is likely to reach capacity by 2006. This suggests that the "No NDE" option is at best only a short-term solution to relieve traffic congestion and improve safety on local roads.

Two community surveys were conducted during 2001 and 2002 as part of the RTA consultation process. **Figure 2.3** and **Working Paper 2** refer. The results showed that:

- There was a very high level of support for construction of the Northern Distributor Extension, with 87% of respondents supportive of the proposed NDE and only 8% not supportive;
- 89% of survey respondents expected to use the Northern Distributor Extension once completed. Only 5% indicated that they would not use the proposed NDE;
- Approximately 60% of respondents saw the completed proposed NDE as being either a benefit (31%) or a major benefit (29%) to their movement patterns. A further 9% did not consider that the proposed NDE would have any effect; and
- 21% of respondents felt that the proposed NDE would have either a minor or major disruption to existing movement patterns. A further 10% were unsure of the impact of proposed NDE on their movement patterns.

Rixons Pass

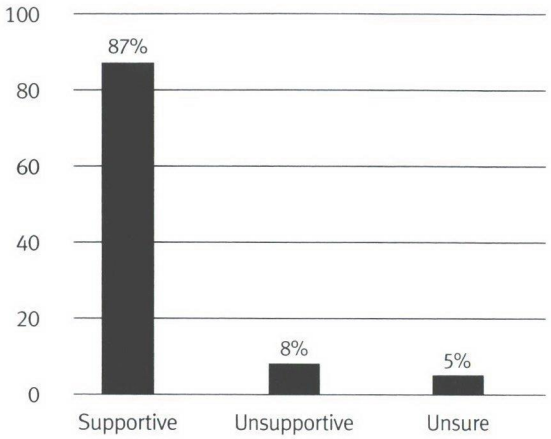
Several members of the community raised the prospect of creating a new escarpment crossing at Rixons Pass, using Bellambi Lane west as the access point for this route (**Figure 2.2** refers).

Rixons Pass would require a tunnel through the escarpment and/or a series of viaducts across the face of the escarpment, and would be an alternative escarpment crossing for both Mt Ousley and Bulli Pass. It was also argued by proponents of this scheme that construction of Rixons Pass would alleviate the need for construction of the proposed NDE beyond Bellambi Lane.

The RTA has undertaken preliminary investigations of this option. Whilst technically feasible, there would be substantial environmental, geotechnical and engineering problems associated with its construction, as well as a cost in excess of $200 million. This option would not serve traffic movements to and from suburbs north of Bellambi Lane.

Figure 2.3: Results of Community Attitude Surveys (2001; 2002)

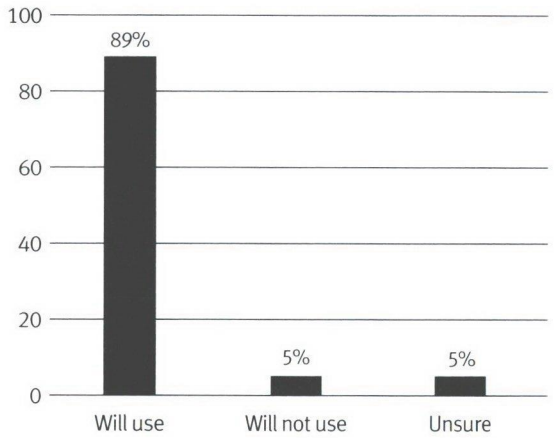
Support for NDE



Source: Purdon Associates, 2001

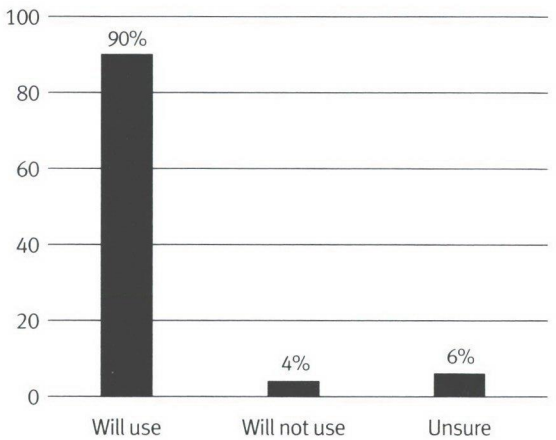
Expected Use of NDE

2001



Source: Purdon Associates, 2001

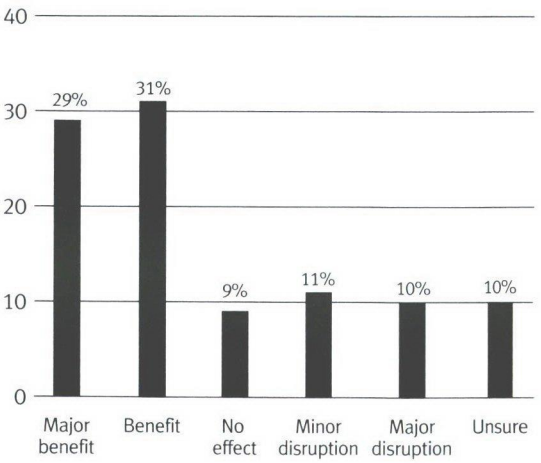
2002



Source: Purdon Associates, 2002

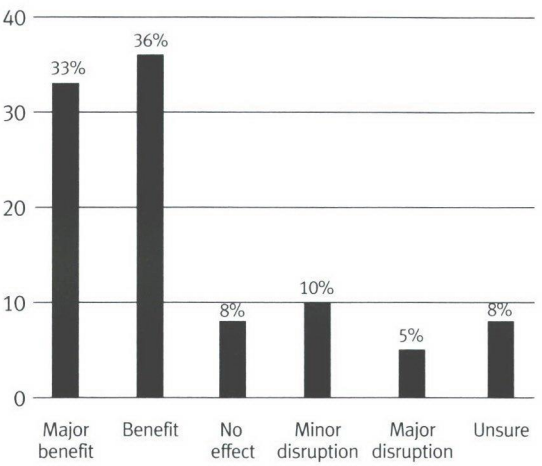
Expected Impact on Movement Patterns

2001



Source: Purdon Associates, 2001

2002



Source: Purdon Associates, 2002

Based on the above, it is concluded that the Rixons Pass option is not a feasible short to medium term transport solution for this part of the Illawarra or the study area.

Northern Route Options

Extension of the Northern Distributor is part of the overall transport network improvements listed under the Illawarra and South Coast section of the Government's *"Action for Transport 2010" — an integrated transport plan for NSW*. This strategy envisaged that a "...widening of Mount Ousley Road together with extension of the Northern Distributor would provide improved links to Sydney and better road access to Port Kembla". The current proposed NDE project is a logical next step in the completion of this wider transport strategy.

Community comments during the consultation process identified the need for several related issues to be addressed:

- Priority for an upgrade of Bulli Pass, especially the intersection with Lawrence Hargrave Drive;
- An improved connection from Bulli Pass to the west of Bulli shopping centre, connecting with the proposed NDE at Molloy St;
- The need to explore other routes that would link the proposed NDE to Bulli Pass. These are shown on **Figure 2.2** and include the following routes:
  - East of the railway line;
  - Viaduct over the railway line;
  - West of the railway line;
  - Use of the existing Princes Highway through Bulli shopping centre;
  - West of Bulli shopping centre using the existing gazetted alignment; and
  - Far western option to link with the "elbow" on Bulli Pass.

The traffic analysis found that extending the Northern Distributor to Molloy Street results in some additional traffic using Bulli Pass rather than Mount Ousley but the level was minor (about 700 vehicles per day). The analysis concluded that the level of redistribution would not significantly bring forward any action required north of the Bulli shopping area if the Northern Distributor were extended to Molloy Street.

There would be a significant increase in traffic on the Princes Highway through the Bulli shopping area with the termination of the Northern Distributor at Molloy Street, due to diversion from Park Road and Franklin Avenue. This increase would be around 5,000 vehicles per day on the current 20,000 vehicles per day. These traffic volumes would be similar to the current volumes north of Park Road and would require similar parking restrictions after the Northern Distributor was extended to Molloy Street.

A corridor for further extension of the Northern Distributor past the Princes Highway at Bulli to Lawrence Hargrave Drive is identified in the Wollongong City Council LEP (1990). The route has been shown in **Figure 2.2.**

Extension of the Northern Distributor to Molloy Street would reduce the traffic volumes through Woonona from the current level of 21,000 vehicles per day to 11,000 vehicles per day. The road at this level could operate without peak hour clearways. The present full time no stopping restrictions could be reduced in extent with increases to the existing parallel parking areas.

The RTA has undertaken a preliminary assessment of each of the above options, but more detailed studies would be required beyond the scope of this EIS to establish the full project viability (including environmental impact; design, traffic implications; and cost) of the preferred route north of Molloy St.

At this stage however, the most likely route would be the existing gazetted alignment for the following reasons:

- The gazetted route has been shown on Council's planning scheme since the late 1940s;
- It would connect easily to the proposed NDE;
- The gazetted route is technically feasible;
- All other options are considerably more expensive and would have land use implications not previously considered by property owners and land users in the respective corridors; and
- There would be impacts on heritage properties associated with the railway options.

Two-Lane Vs Four-Lane Options for NDE

Another strategic issue is whether the RTA should plan for a two or four lane option for the proposed NDE. In reality, both options would occur along the same broad route and gazetted alignment between Bellambi Lane and Molloy Street. They would also be subject to the same considerations about connections north of Molloy Street.

Figure 2.4 compares the two and four lane options as envisaged in 2000. Both options were initially considered in the Project Justification Report (SKM, 2000) and have been subsequently reviewed by Forbes Rigby/Gabites Porter as part of the current study, using a modified version of the four-lane model based on the latest round of concept design studies and community comment.

The **two-lane option** provided a new two-lane two-way urban road with provision for later widening to four lanes. The basic difference would be the width of cross section. The alignment would follow that of the ultimate four-lane option, east of York Road and west of Thompson Street. It therefore replaces the initial Option D (as subsequently modified by the Value Management Study and Urban Design Study in 1998/99), which used York Road and Thompson Street.

The main features of the two-lane option are as follows:

- Signalised intersection south of Molloy Street with Princes Highway;
- Closure of Russell Street;
- Signalised intersection at Campbell Street;
- Pedestrian overbridge at Woonona High School;
- Signalised intersection at Gray Street/Park Road;
- Existing road from Terania Street to Gray Street becomes a service road on the western side;
- Right turn movement allowed from Bellambi Lane to the Northern Distributor Extension;
- U-turn breaks in medians for emergency vehicles; and
- Acquisition of some houses and shops and the route designed for later widening to four lanes if required.

The traffic analysis suggested that the proposed NDE and Princes Highway would approach capacity by 2016 with the two-lane option. Therefore, widening of the proposed NDE to four lanes would be required in the longer term.

The **four-lane option** provided a new four-lane divided high standard arterial urban road, as described in **Section 6** below, and would be of similar standard to the existing Northern Distributor south of Bellambi Lane.

The main features of the four-lane option are as follows:

- Signalised intersection at Princes Highway and Molloy Street;
- New road connection from Farrell Road east to Molloy Street;
- Closure of Russell and Hopetoun Streets at eastern end;
- South bound on-ramp from Farrell Road east;
- Signalised intersection at Campbell Street;
- Pedestrian underpass for Woonona High School south of Campbell Street;
- Overpass at Gray Street/Park Road for east west vehicles and pedestrian movements;
- At grade signalised intersection on the proposed NDE between Doris Street and Alice Street;
- New service road on eastern side from Bellambi Lane to Alice Street;
- Allow right turn movement from Bellambi Lane to the Northern Distributor Extension; and
- Acquisition of some shops and houses.

Traffic volumes on the Princes Highway north of Bellambi Lane in 2016 would be less than the 1999 traffic levels, resulting in improved capacity.

In **summary**, either road option could be built along the gazetted alignment. Initial construction of the two-lane option, with possible upgrade to four lanes if required, would not result in a 50% reduction in cost because of the economics in construction costs achieved by the need to do bulk earthworks and bridges/culverts for both options.

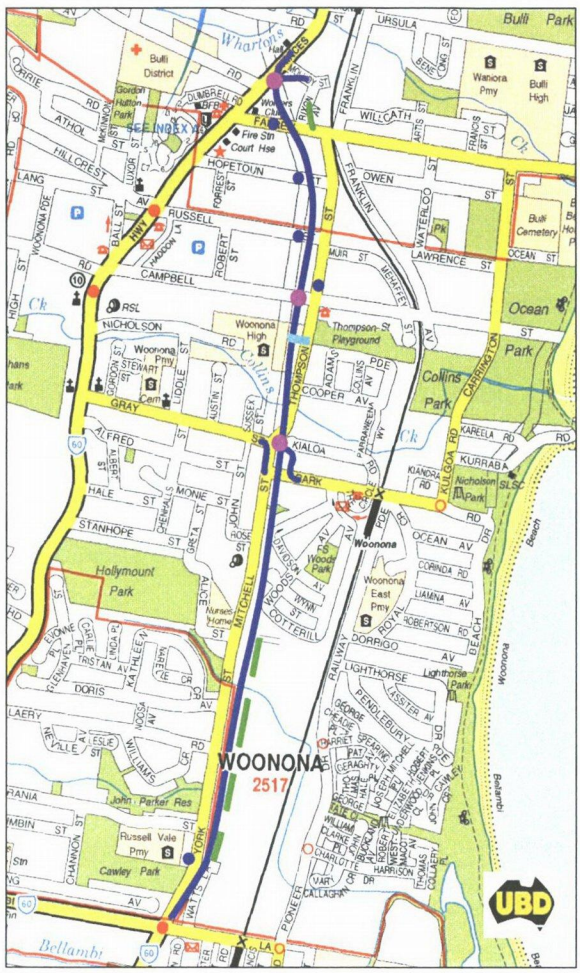
The initial assessment of the two and four lane options by SKM in 2000 narrowly supported the two-lane version because of costs and projected traffic flows.

The benefit/cost analysis undertaken in August 2001 by SKM indicates that the best solution based on a 2010 completion date for the project is to construct a four-lane road. The basis for this conclusion is as follows:

- Higher traffic projections resulting in a need for the extra lanes sooner than previously projected;
- Higher benefit cost ratio based on reduced number of at-grade intersections in the total network;
- Reduced inconvenience to the local community during a shorter construction phase;
- Better employment generation outcomes; and
- Strong community support in favour of the four-lane option.

Figure 2.4: Two and Four Lane NDE Alignment

Two lane option (2000)



Legend

- Proposed cul-de-sac
- Proposed signalised intersection
- Service/connecting road
- Pedestrian overbridge to Woonona High School

Source: RTA (base map from UBD)

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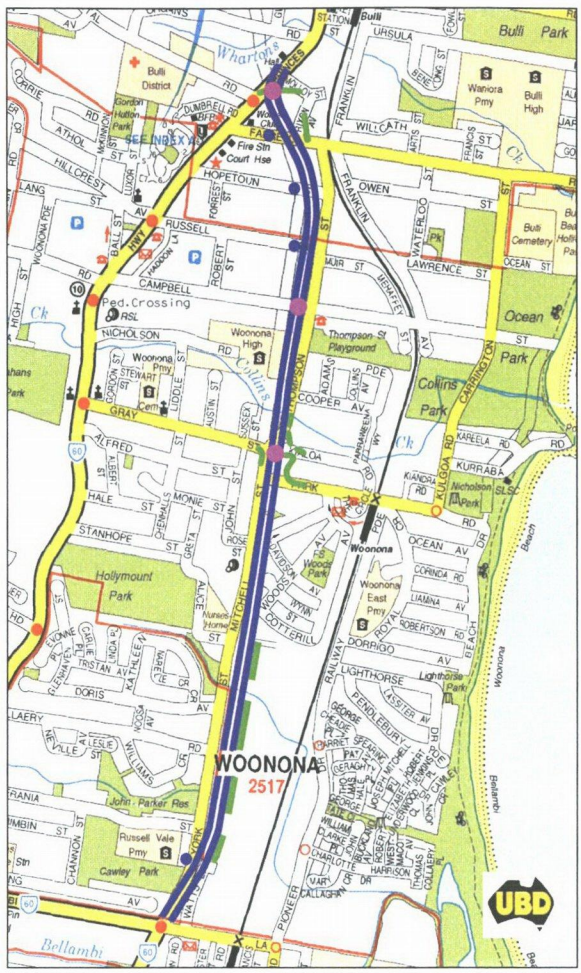
Four lane option (2000)



Legend

- Proposed cul-de-sac
- Proposed signalised intersection
- Service/connecting road

Source: RTA (base map from UBD)

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At the time of the initial assessment by SKM (2000), the **two-lane** option was seen to provide a positive net present value of $10.9 million with a corresponding BCR of 1.4 to 1. If the project were delayed by 5 years the BCR would increase to 1.9 to 1. The **four-lane** option provided a positive net present value of $12.5 million with a corresponding BCR of 1.36 to 1. If the project were delayed by 5 years the BCR would increase to 1.8 to 1.

An updated BCR was undertaken in August 2001 by SKM. This showed a BCR of 2.1 to 1 assuming a construction start in 2008 for the Preferred proposed NDE Option.

2.2.3 NDE Road Design Options

Within the nominated corridor for the proposed NDE, it was necessary to identify and evaluate a variety of individual intersection treatments as well as other engineering, hydraulic and urban design elements of the project. This was done using an assessment of weightings and rankings against specified selection criteria for the proposed NDE. Key design elements included:

- Vertical alignment;
- Street intersections;
- Pedestrian over and under passes;
- Bridges and culverts;
- Noise attenuation treatments; and
- Landscape themes.

Within the framework of a four lane divided road solution for the proposed NDE, decisions were required in the concept design stage concerning the treatment of each intersection and other design elements. Having identified a range of options for each main design element (eg intersection treatments for Molloy Street and the Princes Highway, the RTA team then undertook a quantitative assessment of the net benefits.

The evaluation criteria used to analyse each part of the proposed NDE are listed below:

- Road safety;
- Efficiency of proposed NDE as a distributor road;
- Accessibility on and off the proposed NDE;
- Disruption to local community as a result of the proposed NDE;
- Impact of new traffic noise;
- Community acceptance;
- Visual impact;
- Pedestrian safety;
- Acquisition of homes and businesses;
- Compatibility with future arterial north of Molloy Street; and
- Heritage impact.

A weighting was assigned to each of the above selection criteria, and the same weightings applied to selection criteria of each section of the proposed NDE analysed. The evaluation approach allowed decisions on the best package of intersection treatments and other design elements along the road to be determined. The final package of design elements determined by this process is included in the EIS Proposal described in **Section 6** below.

2.2.4 Summary of Options

The following conclusions were drawn from the above options assessment:

- The justification for early completion of the proposed NDE is based on projected population and household growth, as well as increased traffic volumes in the study area. The proposed NDE is designed to service traffic movements generated in the study area and far northern suburbs of Wollongong as well as to improve inter-city transport connections;
- Rixons Pass is not a realistic short to medium term option to replace the proposed NDE because of the very substantial capital outlays and environmental impact associated with construction;
- Overall, there was a reasonably strong community preference for a four-lane proposed NDE option;
- Construction of the proposed NDE would have major traffic planning benefits for the northern suburbs of Wollongong by providing better access to and from the CBD. However construction of the road has implications for the social and natural amenity as well as the economic viability of the surrounding suburban areas. These matters have been further addressed at the detailed design level discussed below.

Princes Highway near Molloy Street.

2.2.5 Consequences of Not Undertaking the Proposed NDE

In light of the established project need and objectives for the EIS Proposal, there would be a number of consequences of not proceeding with the proposed NDE:

- There would be a gradual and significant increase in through traffic along local roads, exceeding their capacity to provide safe access/egress for local residents;
- The extra traffic would generate noise levels in excess of current acceptable guidelines and there would be no mechanism for mitigation of these higher noise levels;
- The crash rate within the study area could be expected to increase significantly;
- There would also be an increase in the accident severity index in the area;
- Increased traffic congestion along the Princes Highway would create the need for extended clearway zones (no parking) for more of the day, resulting in loss of business opportunities for the Woonona local shopping centre and reduced amenity for residents using this centre; and
- The increased congestion would also lead to reduced levels of efficiency in the road transport network, including an adverse impact on inter-city traffic movement.

3. Community Involvement

Over recent years the RTA has undertaken an extensive amount of community consultation on the proposed NDE project, using a variety of techniques to provide information to the local community and obtain involvement in the planning process. The EIS phase of this project represents the latest step in this process and provides all stakeholders and the wider community with a further opportunity for information and input.

Working Paper 2 has been prepared by Purdon Associates for this EIS and provides a detailed summary of the timing, type of activity and main outcomes of the consultation process undertaken to date.

As a result of community involvement in the proposed NDE project, a number of design changes have been made, culminating in the EIS Proposal.

A number of **stakeholders** have been involved in the consultation process prior to the EIS phase including the following:

- Members of the CLG (Community Liaison Group);
- Residents living within the proposed NDE corridor;
- Residents beyond the immediate study area;
- Community organisations including schools, churches, sporting and recreation clubs;
- Traders along the route and on the Princes Highway;
- Companies with business affected by the proposed NDE (e.g. bus operators, local factories);
- Road users (local area and beyond);
- Government agencies including Department of Planning (PlanningNSW), EPA, Sydney Water, DLWC, State Rail, Police, Ambulance, Fire Brigade; and
- Wollongong City Council.

Types of **stakeholder consultations** for the proposed NDE project included:

- Community Liaison Group meetings;
- Workshops;
- Newsletters;
- Media articles, advertisements and public notices;
- Free call contact line;
- Public information displays; and
- Individual discussions/briefings.

3.1 Consultations — Pre-EIS Phase

3.1.1 Consultation Activities

An extensive program of stakeholder consultations has been carried out by the RTA in the pre-EIS phase of the project. These consultations have helped identify issues and comments on design options as well as provide stakeholders with information about the status and content of the proposed NDE studies.

The nature and outcomes of consultation during the pre-EIS phase were addressed in preparation of proposed NDE design options and are summarised below. The consultation process included the following initiatives:

Community Liaison Group

In May 2000, a **Community Liaison Group** (CLG) was established by David Campbell MP, State Member for Keira. The role of this Committee was to provide advice and feedback to the RTA team on the proposed NDE Options Study. This Committee comprised a number of individuals from a geographically representative cross-section of the community and included residents and members of the business community. The CLG met 10 times up to the announcement about commencement of the EIS, and has continued to operate throughout the current study as a key element in the community consultation process (see below).

Thompson Street towards Campbell Street.

The Community Liaison Group (CLG) consists of a group of individuals from a wide cross section of the community including the Local State Member for Keira, business owners and operators as well as affected residents. The purpose of the CLG was to assist with the provision of advice from the community through the individuals in the group. It has provided comments on various issues such as option selection, road design and background papers. The preliminary discussions with the CLG also aided in the preparation of the Community Involvement Plan.

Community Involvement Plan

The RTA formally adopted a **Community Involvement Plan** after discussion with the CLG at the outset of the NDE Option study in 2001. This has been used as a framework for the consultation process. The consultation process undertaken for the proposed NDE aimed to:

- Ensure adequate information was provided to the local community about the project; and
- Provide opportunities for community input into the formulation and assessment of concept design options for the project.

These aims were achieved by consulting with a wide range of community members and stakeholder groups via a number of consultative activities throughout the study period from November 2000 to August 2001.

Stakeholder Workshops

A number of workshops have been held with a variety of stakeholders attending. The majority of these were held during the early stages of the NDE study process, with approximately 50 interested parties attending. The main issues that were raised during these meetings included discussions of traffic, stormwater, bus and emergency services, heritage, noise and the effects of the proposed NDE on businesses in Woonona.

More recently, a series of stakeholder workshops were held in May 2002 to provide an update and get feedback on progress with the proposed NDE design options.

Media Articles, Advertisements and Public Notices

A variety of methods have been adopted to convey information to the public in order to keep them informed of the EIS Proposal's progress. The methods include advertisements in the *Wollongong Adviser*, notices circulated to schools and libraries, flyers delivered to all the homes within the study area, media articles and poster displays.

Information Hotline

An information hotline (free-call) was operated throughout the study period to take enquires from members of the community. This service was used to discuss and clarify various issues and options, as well as the provision of any other information regarding the proposed NDE.

Public Information Displays

Two public displays were held in June and August 2001. Approximately 360 people attended the June display with nearly 110 written comments received. A summary letter was sent to the residents that attended the June display that outlined the issues stated in the written comments received.

The second public information display was held in August 2001 in a shopfront venue on Princes Highway in Woonona to present the preferred option for the proposed NDE. About 1,060 people attended this display with about 600 written comments received. This display was staffed over 10 days including two weekends, and provided the local community with many opportunities to visit the display and ask questions

Individual Discussions/Briefings

Individual discussions/briefings were completed with representatives from Woonona High School and Wollongong City Council as well as several land owners directly affected by the NDE proposal.

Newsletters

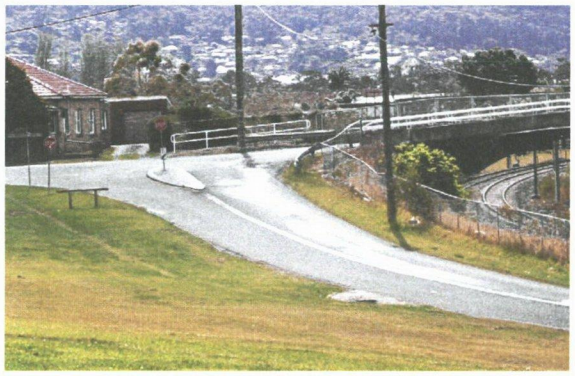
Some community consultation had been undertaken prior to the current proposed NDE study, including distribution of Newsletter No 1in August 1999 to households in the general study area.

There have been a number of newsletters produced and distributed to both people directly affected and within the wider community. The first contained maps of the route and outlined the intended project. The second outlined the issues raised during the initial stakeholder workshops (detailed above) and indicated a timetable for the study itself as well as the consultant team.

The third newsletter included a summary of comments from the public information display in June 02 and also described the RTA's preferred route option and information on the proposed public display.

3.1.2 Stakeholder Issues Pre-EIS

Based on feedback from the community at two public displays, there was a high level of satisfaction with the consultation process for this project in the pre-EIS phase, and strong support for the project. The process has helped the RTA with a clearer identification of stakeholder issues as an important input to the study process. The consultation process has also provided useful comment on the range of design options presented by the RTA team.



Intersection of Farrell Road and Thompson Street.

This Section summarises community and other stakeholder attitudes toward specific aspects of the proposed NDE.

In many cases, the issues raised in initial workshop consultations were raised again during latter stages of the consultation process, although there was a general acknowledgment by most stakeholders that many of these earlier issues had been successfully addressed by RTA in the proposed NDE concept designs.

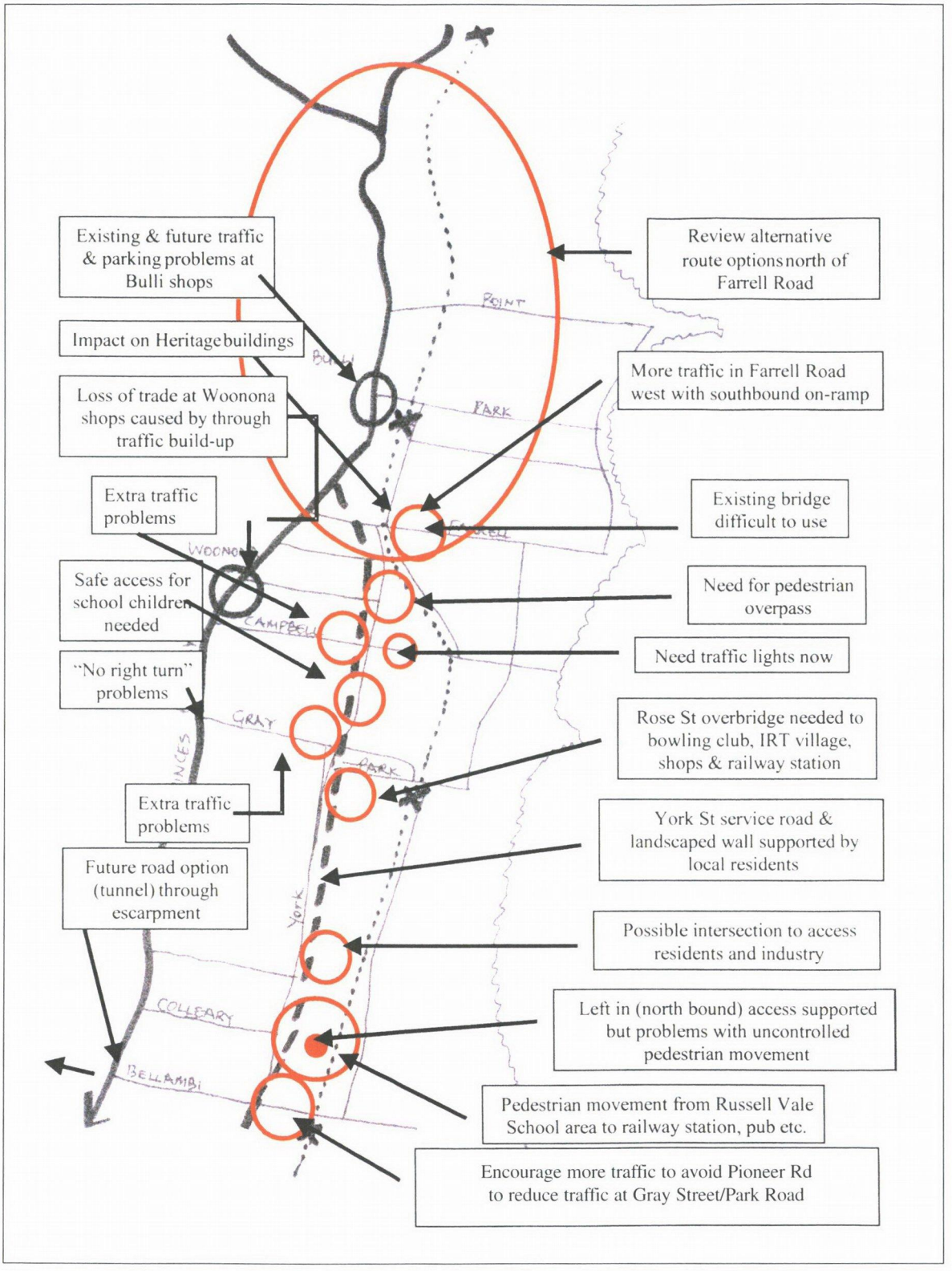
The main issues raised during the initial consultation process (as distinct from comments on specific design options for the proposed NDE) are listed below under broad subject headings. **Figure 3.1** refers.

The full list of comments is included in **Working Paper 2**.

General Comments

- Integrate the proposed NDE into the northern suburbs without dividing the existing community.
- Minimise the number of new traffic lights on the proposed NDE.
- Increased local traffic volumes in "side streets" is a cause for significant community concern.
- Concern that local streets would be unable to cope with additional traffic.
- Need to consider what changes would occur to through traffic as a result of proposed NDE i.e. traffic flows on Princes Highway and Pioneer Road.
- Need to consider impact of traffic exiting the Distributor at the northern end of the extension.
- Make data and findings of the traffic study available to the public.

Figure 3.1: Summary of Community Issues



Legend

Railway line and Station

Approximate NDE Route

Source: Purdon Associates

Justification of Future Route Options

There were mixed views about a convincing justification for the proposed NDE, but the majority of the community was more concerned about the timing and route of the proposed NDE.

Whilst a few people argued the case for construction of a route via Rixons Pass, the majority of comments argued the need to resolve the route beyond Molloy Street and to build this section as part of the current project to avoid adverse impact on Bulli shopping centre.

East West Movement

The majority of comments emphasised the importance of maintaining safe east/west movement for traffic and pedestrians, i.e. for access to the beach, railway stations and schools. The need for convenient and safe access on and off the proposed NDE was also a major issue.

Other issues raised included:

- Access to schools is most important, as children do not have fully developed road sense. Schools may need to prohibit unsafe movement and channel students into designated passages including drop-off and pick-up points for cars/buses;
- Need for improved access for Woonona High School students over both the Distributor and the railway, near Farrell Road.
- Streets north of Campbell Street would have difficulty accessing the beach and railway stations;
- Need for additional pedestrian access near Russell Street and Muir Street; and
- Need for a pedestrian overpass at Seaview Retirement Village (Corner of Mitchell Road and Park Street);
- Need for additional pedestrian access/overpass between Gray Street and Bellambi Lane, i.e. around Rose and Alice Streets area; and
- Need to access Holymount Estate and East Woonona from the Distributor without going along the Princes Highway'

Safety Issues

Pedestrian and road safety generally were key issues raised by all stakeholders. Comments were made about the safety of existing intersections, and the need to ensure that the proposed NDE would improve the current situation at affected intersections.

The main traffic-related issues raised to date have been the need to integrate the extension into the northern suburbs community to ensure that the new road does not divide existing neighbourhoods, in particular the impact of increased traffic volumes on local streets and associated impacts on pedestrian safety.

The community has indicated it's desire that the RTA consider all transport options ie. bicycle, bus and pedestrian movement as well as traffic management issues through Woonona and Bulli shopping centres. The community has also indicated that safe access to local schools is a priority.

Specific issues in regard to the existing business conditions in Woonona and Bulli:

- Trade in both centres has been negatively affected by the imposition of clearways. Trade in Corrimal has been the main beneficiary (although the convenience and popularity of shopping centres like Corrimal must also be a factor);
- There is insufficient off-street parking in Bulli;
- Congestion in Woonona shopping centre is significant on Saturday mornings; and
- Off street parking in Woonona shops is not adequately signposted or utilised.

Buses

- Dions provide the main bus service for the Woonona/ East Woonona areas. Patrons are mostly elderly people and students, with some commuters.
- Buses are mainly used for shopping trips, mostly at Corrimal as banks have closed at Woonona. Need to consider the changing demographics and future bus patrons of the area.
- Main connectors for buses to the Princes Highway are Point Street, Farrell Road and Bellambi Lane.
- Dions bus routes are flexible but it is important to consider how changes in route would impact on travel time, as increases in time reduces use of public transport.
- Important that the buses continue to stop outside the retirement villages (i.e. on Alice Street and Park Road) and that residents are not expected to catch buses from the Princes Highway.
- Need to determine if there would be bus stops or an express bus service only along the Distributor. Bus stops would need to be at sites where people can cross over safely (i.e. overhead walkway). Demand for service also needs to be considered. Suggestion of introducing a peak time route along the Distributor.

Stormwater Issues

- During 1998 Collins Creek was the most affected waterway, flooding along the front of the school and many homes in Thompson Street. The creek floods higher than 1m (Connell Wagner model prediction).
- Need to consider 100% blockages in stormwater modelling (Council draft blockage policy guidelines). This is necessary even to represent the natural system.
- Important that proposed NDE results in no worse stormwater and flooding impacts than the existing situation.
- Areas north of Bulli shopping centre should be assessed in relation to stormwater and flooding if options to extend proposed NDE to the foot of Bulli Pass are considered.
- Collins Creek would be expected to flood at higher levels than 1m, especially if culverts were blocked.
- Residents indicated that stormwater pipes under Mitchell Road are inadequate now and would need to be replaced when the Distributor is extended.
- Need to clean out the creek near Alice Street.

- Where flooding occurs across the road it is important to examine where this water exits the road.
- A number of non-permanent creeks carry water during periods of rain. Examples raised include the flow of water near Bulli Workers Club, along Molloy Street and along Princes Highway north of Organs Road.
- Need to consider flows that come from sources other than creeks. Increasing development density in the catchment is resulting in more hard surfaces and run off. This has the potential to increase flooding in the area, for example, around Collins Creek and the Boral development. Council's residential policy allows for 50% site cover as well as hardstand for courtyard areas and driveways.
- Need to rejuvenate existing creek systems and increase native plantings.
- proposed NDE should be a flood free route for emergency service vehicles.

Older People

- Preference for all at-grade crossings but an overpass, with wheelchair access, is an option. Safety concerns exist in relation to pedestrian underpasses/tunnels.
- Noise barriers may be seen as a loss of visual amenity for residents.
- Retirement villages require safe, convenient and at-grade access.
- Older people generally free to travel outside peak travel times.
- Need to consider access to sporting facilities, churches, retail, shopping.

Heritage

- Farrell Road is seen as one of the best examples of Federation heritage in Wollongong.
- A late 1800s two storey building on the highway near Molloy Street is under threat.
- Bulli has a heritage theme that is being reinforced as an important part of the local environment.
- RTA heritage consultants should contact local heritage interest groups.

Noise

- Important that noise controls be designed as an integral part of the proposed NDE and not incorporated after the road has been built.
- Need to consider noise levels not only along the route of the extension but also in side streets. Noise from excess traffic in local streets also needs to be considered.
- Removal of vegetation for the proposed NDE has the potential for local residents to perceive an increase in local noise levels.
- Noise barriers should not exacerbate flooding issues.
- People generally do not want tall noise barriers particularly where these dominate visually.
- Sound barriers on the proposed NDE may be necessary to protect residents from noise especially in the tight 'squeeze' points (e.g. south of Gray Street/Park Road).

Land Acquisition

- All households affected by the proposed NDE should be contacted by the RTA.
- Residents with properties affected by the proposed NDE should be given early and full compensation by RTA.

Existing Infrastructure

- There are no fundamental obstacles caused by the location of existing utility services but the actual impact (and cost) of relocations cannot be resolved until detailed plans of the proposed NDE are available.

3.2 Consultations During the EIS Phase

During the EIS phase, a variety of forms of consultation was undertaken. The consultation process extended to the adjacent suburbs of Corrimal and Thirroul for the purposes of comparison in the business' responses (in both Corrimal and Bulli) as well as the proven effects of the existing Northern Distributor (Corrimal) from a land valuation/real estate perspective. Newsletters were distributed from Woonona to Thirroul.

Working Paper 2 provides details of the consultation approach and its outputs. **Figure 3.2** shows the main EIS community consultation milestones.

Methods used are summarised below:

- Community Liaison meetings;
- Newsletters 4 (May 02) and 5(October 02);
- Comment feedback survey (May–June 02);
- Stakeholder workshops (May 02);
- Discussions with local residents about stormwater/flooding issues;
- Discussions with Woonona High School;
- Telephone hot line calls with local residents.

The **Community Liaison Group** met on four separate occasions in Wollongong during the EIS phase.

Stakeholder workshops were held during March 02 with representatives from a range of government agencies and business/community groups to discuss progress with the EIS studies and talk about key issues. A summary of issues is listed in **Working Paper 2**.

Discussions were held with representatives of **Woonona High School and the Department of Education** to discuss pedestrian access to the school and related issues. A number of options were canvassed for access across Thompson Street in the vicinity of the current crossing, but an underpass was ruled out on the grounds of public safety during flood events. Alternative improvements to school access were agreed via Campbell street and an upgraded bus stop in Liddle Street.

The May 2002 Newsletter was distributed to all households and business in Woonona, Russell Vale, Bulli and Thirroul. It contained a summary of proposed changes to the proposed NDE arising from reviews undertaken during the previous several months and also contained a free-post **survey of community attitudes** to the latest proposed NDE proposal.

The detailed analysis of this community attitude survey is contained in **Working Paper 2**. There was strong overall support for the project including the latest proposal for a Campbell Street interchange.

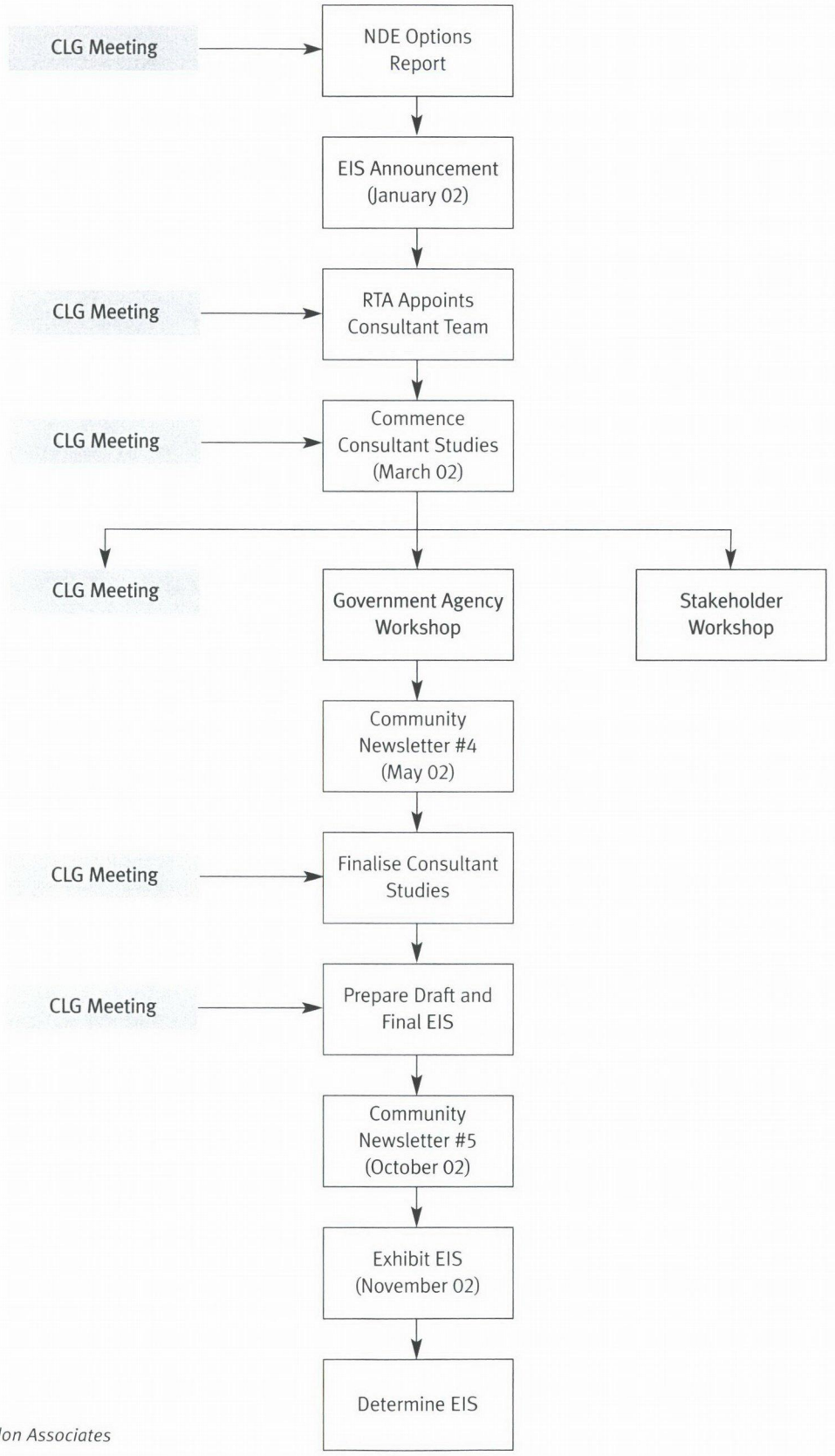
A number of local residents used the free-call line to ask questions about the project. Issues included:

- Traffic impacts along Campbell Street;
- Stormwater drainage on Thompson Street;
- Operation of proposed intersections;
- Impact on local traffic movements;
- Noise levels along parts of the route; and
- Expected construction start dates and traffic arrangements during construction.

Responses from **Stakeholder Interviews** undertaken by EGIS for this EIS are included in **Working Paper 9 (Socio-economic and Land Use Study)**. Interviews were conducted with affected property owners, representatives from Wollongong City Council and planningNSW, a sample of business owners and traders in Bulli, Corrimal, and Woonona, local property agents, and emergency service providers,

Connell Wagner consulted with a number of local residents with experience of recent **large flood events** in the study area. The consultation provided useful local information and helped verify results of the computer model generated to test the effects of the proposed NDE on flood activity in the local area. **Working Paper 5** refers.

Figure 3.2: EIS Consultation Milestones



Source: Purdon Associates

4. Strategic and Statutory Planning Context

4.1 Regional Planning and Transport Strategies

A number of strategic planning policies and statutory plans are relevant to the EIS Proposal. These are summarised below and provide a framework for consideration of the proposed NDE Proposal.

4.1.1 State Environmental Planning Policies

The State Environmental Planning Policy (SEPP) *State Environmental Planning Policy No.4 — Development Without Consent (SEPP4)* applies to the EIS Proposal.

This SEPP permits certain development by public authorities to be undertaken without development consent where it would otherwise be permissible only with consent. Clause 11c of this SEPP permits the RTA to undertake classified road or tollway construction without consent, where consent would have otherwise been required. This SEPP however does not apply where zoning prohibits roads or where items identified as heritage items under an Environmental Planning Instrument are affected.

There are no coastal wetlands gazetted under state Environmental Planning Policy 14 (SEPP14) within the study area.

4.1.2 State Planning Strategies

"Action for Transport 2010"

"Action for Transport 2010" — An Integrated Transport Plan for NSW is a strategy outlining how the NSW Government's long term vision for the state's transport needs can be met. The Plan contains a detailed construction program for the expansion of the rail and bus network and for major roads.

The Plan has been divided into regions and the region relevant to the EIS Proposal is defined as the "Illawarra and the South Coast". *"Action for Transport 2010" — Illawarra* has identified the extension of the Northern Distributor along with the widening of Mt Ousley Road as providing improved links to Sydney.

An overview of the strategies and actions relevant to the project follows:

Objective 2: Provide more and better transport choices.
Strategy A.4: Improve public transport on roads.

The EIS Proposal is consistent with this strategy in that a new faster link to Wollongong's northern suburbs would be available via the EIS Proposal for road-based public transport. The Proposal would also reduce traffic congestion on existing bus routes.

Strategy A.6: Implement regional transport planning.
Action 2.22: Develop a long-term strategy for improving transport in the Illawarra.

The EIS Proposal would enable the Illawarra sub-committee of the Metropolitan Strategy Committee to better achieve this aim with a more viable road-based public transport alternative.

PlanningNSW — Shaping Our Cities

Shaping Our Cities provides the broad, updated framework for planning priorities in Sydney, Newcastle, Wollongong and the Central Coast, otherwise known as the Greater Metropolitan Region.

Shaping our cities is accompanied by detailed planning strategies for specific regions including the Illawarra, which encompasses the study area. At the time of writing the planning strategies for the Illawarra had not yet been released.

EPA Action for Air

Action for Air focuses primarily on regional air pollution in the Greater Metropolitan Region of NSW which includes Wollongong. It contains diverse strategies and actions, approaching the problem of air pollution on many fronts. The Action plan has a number of key objectives which are supported by strategies and actions.

An overview of the strategies and actions relevant to the project follows:

Objective 2: Provide more and better transport choices.

Strategy A.4: Improve public transport on roads.

The EIS Proposal is consistent with this strategy in that a new faster link to Wollongong's northern suburbs is available via the EIS Proposal for road-based public transport.

Strategy A.6: Implement regional transport planning.

Action 2.22: Develop a long-term strategy for improving transport in the Illawarra.

The EIS Proposal would enable the Illawarra sub-committee of the Metropolitan Strategy Committee to better achieve this aim with a more viable road-based public transport alternative.

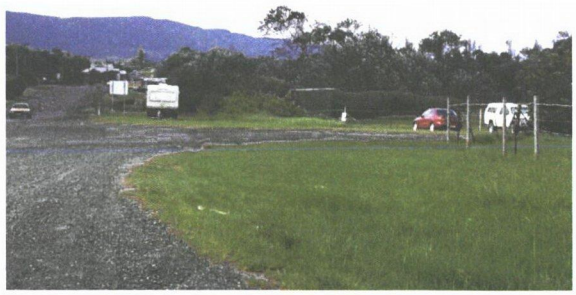
Draft Illawarra Escarpment Study

Discussions with PlanningNSW have revealed that this draft study has not yet been released and is relevant to land lying west of the Princes Highway. However, the report of the Commission of Inquiry into the Illawarra Escarpment has been reviewed to ascertain if any recommendations affect the EIS Proposal.

The Commission of Inquiry and subsequent report concentrated on land forming the Illawarra Escarpment generally lying west of the existing Princes Highway. The EIS Proposal does not impact on land identified as 'core escarpment lands' in the report, nor does it conflict with any of the recommendations outlined in the Commission of Inquiry Report.

Regional Environmental Plans

Illawarra Regional Environmental Plan No.1 (REP 1) applies to the EIS Proposal. This REP includes general matters for consideration, aimed at maximising the opportunities for the people of the region and the state to meet their individual and community economic and social needs. It makes particular reference to the way in which these needs are related to the allocation, availability and management of the region's land resources, having regard to objectives specified in the REP.



York Road north looking towards industrial areas.

The specific REP objectives relevant to the EIS Proposal are as follows;

REP (Part 3 Objective 42. Activities)

A determining authority (within the meaning of Part 5 of the Act) should, when considering a Proposal for roads, gas or water pipelines, railways, reservoir or transmission lines, consult the Secretary of the Department of Mineral Resources and take into consideration:

- the impact the EIS Proposal would have, or is likely to have, on the availability of coal resources; and
- the cost to the community of not proceeding with the EIS Proposal or redesigning or relocating the development the subject of the EIS Proposal compared with the cost to the community of rendering coal resources unavailable.

It should be noted that the EIS Proposal would not sterilise any coal reserves.

REP (Part 3 Objective 80. Transport and Service Corridors.)

The objectives relating to transport and service corridors are:

- to facilitate the development of a public transport system which enhances the mobility of those without access to private vehicles and provides a reasonable alternative to the private car on key routes;
- to encourage the development of a satisfactory system of urban, inter-urban and inter-regional links to meet existing and future communication and utility installation needs;
- to improve road safety and protect public investment in main and arterial roads by the control of adjacent land uses;
- to facilitate the development of air transport opportunities in the region;
- to accommodate private vehicles which are expected to remain an important mode of passenger transport in the region, in planning provisions; and
- to reduce the adverse environmental impact of road haulage of extractive materials and other bulk freight.

For constructing a safer, more efficient road in terms of less intersections, and quicker journeys for cars and road based public transport, the EIS Proposal would be consistent with this objective.

REP (Part 3 Objective 95. Waste Disposal)

The objectives relating to waste disposal are:

- to dispose of waste materials in a manner which positively contributes to the environment or does least environmental harm; and
- to encourage the most efficient use of resources by recycling or alternative use.

The EIS Proposal, through the implementation of waste minimisation and input procurement principles outlined in this document would meet these objectives.

REP (Objective 98.)

Public authorities should consider using appropriate industrial waste for construction, road building works, earth filling, flood mitigation and the like. The EIS Proposal would meet this objective through the use of slag in the construction process.

4.2 Statutory Planning

4.2.1 Introduction

This Section provides information on the planning context in which the EIS Proposal is being considered. It discusses the position in regard to relevant local, regional and state planning instruments and policy.

4.2.2 Existing Planning Controls

The planning instrument controlling development in the study area is the City of Wollongong Local Environmental Plan 1990 (Amended to 1 March 2002). Within the study area, the proposed alignment is mostly within land reserved for Roads (9b).

There are locations where land would be required outside this reservation subject to detail design (finalisation). The relevant zoning of this particular land has been examined to determine permissibility of 'roads' under the LEP.

The relevant zoning of such land is shown in **Table 4.1**

Table 4.1 Land Zoning

Zoning	Permissibility
2(a) Residential	Permitted with development consent
2(b) Residential	Permitted with development consent
4(a) Industrial	Permitted with development consent
6(a) Public Recreation	Permitted with development consent

The table above reveals that, for all zones, roads are permitted with the consent of Council. If land is to be acquired in any of these zones, the environmental assessment is able to be undertaken under Part 5 of the *Environmental Planning & Assessment Act, 1979* through the provisions of SEPP No. 4 discussed in **Section 4.1.1**.

4.2.3 Heritage Controls

Heritage items that are listed on any environmental planning instrument are not covered by the provisions of SEPP 4. As such, these items need to be carefully considered in the planning context.

A review of Council's LEP revealed the listed heritage items that would be potentially affected by the EIS Proposal as shown in **Table 4.2**.

Table 4.2 Heritage Items Identified in LEP

Item	LEP Ref.
Houses 81–101 Farrell Road*	6182. Local Heritage Significance
Norfolk Island Pine, Mitchell Road	6516. Local Natural Heritage Significance.

* Note: Houses located at 81, 83 & 85 Farrell Road will require demolition.

In this situation however, the RTA would utilise the provisions of Clause 41 (Savings) of Wollongong City LEP.

Clause 41 (Savings) of Wollongong City LEP states;

"... Nothing in this plan shall be construed as restricting or prohibiting or enabling the Council to restrict or prohibit — *.(a) the carrying out of development of any description specified in Schedule 3 (of the LEP).*"

Clause 8 to Schedule 3 states. 'The carrying out of any development required in connection with the construction, reconstruction, improvement, maintenance, repair or operation of any road except the widening or realignment of such road'.

The EIS Proposal constitutes 'construction of a road' and development consent is not required. The assessment of the EIS Proposal can proceed under provisions of Part 5 of the *EP&A Act*.

4.3 Other Statutory Planning Approvals & NSW Government Requirements

Should the RTA Chief Executive decide to proceed with the EIS Proposal, the RTA or its contractors would need to obtain relevant approvals and licences that are generally aimed at monitoring the performance of the EIS Proposal both during its construction and operation. Schedule 2 of the *EP&A Regulation* requires an EIS to contain a list of any approvals that must be obtained under any Act or law (other than the *EP&A Act*) before the EIS Proposal may lawfully be carried out.

NSW Government approvals and licences which may be relevant to the EIS Proposal would include those required under the following legislation.

4.3.1 Protection of the Environment Operations (PoEO) Act, 1997

The NSW Environment Protection Authority (EPA) is the responsible agency for the administration of the PoEO Act in relation to air, noise, water pollution and waste management. The EIS Proposal would not be a scheduled activity under this Act and as such an Environmental Protection Licence would not be required. The RTA is aware of the principles of this Act and ensures environmental impacts are adequately managed through the implementation of the Project and Contractor's Environmental Management Plans.

4.3.2 National Parks & Wildlife Act, 1974

Approval would be required from the Director-General of the National Parks & Wildlife Service under Section 87 (1) of the *National Parks and Wildlife Act 1974* for a permit to excavate archaeological sites & relics. Under Section 90(2) of this Act, approval from the Director-General would also be required for a Consent to Destroy permit for any identified archaeological sites or remains should any be found during construction. No relics or archaeological sites have been identified in the study area nor are they considered likely to be uncovered.

4.3.3 Threatened Species Conservation Act, 1995

Although no threatened flora or fauna species were found during field investigations the RTA is aware of the requirements of this Act during the construction of the EIS Proposal should the decision be made to proceed. Processes under the Act and the Section 5A requirements of the *EP&A Act* were followed during the preparation of the EIS.

4.3.4 Native Vegetation Conservation Act

The Department of Land & Water Conservation (DLWC) is responsible for the management of native vegetation clearance under the provisions of Part 2 of the *Native Vegetation Conservation Act 1997*. Due to the nature of the study area, native vegetation clearance is less than 2 ha so the exemptions for consent from DLWC provided by Section 12 of the Act would apply.

4.3.5 Water Management Act, 2000

The *Water Management Act*, 2000 commenced on 1 January 2001. The Act incorporates the provisions of various previous Acts relating to the management of surface and ground water in NSW and provides a single statute for regulation of water and works that affect surface and ground water both fresh and marine. Some licensing and approval processes of this Act are yet to come into force, with previous legislation still applying. These include the permit provisions of Part 3A of the *River and Foreshores Improvement Act, 1948* and those in the *Water Act, 1912*. These are discussed below.

4.3.6 River and Foreshores Improvement Act, 1948

The Department of Land & Water Conservation has an approval role under Part 3A of the *River and Foreshores Improvement Act, 1948* which refers to 'protected land'. This includes in-channel areas and land within 40 metres of a river or creek or other watercourse. Under Section 22H of the Act the RTA is exempt from the need to obtain a permit under Part 3A.

Furthermore, Section 22H of the Act allows the DLWC by notice in writing to direct a person to carry out specified work. The DLWC may do this if satisfied that any excavation or removal of material from any land has damaged or detrimentally affected or is likely to damage or detrimentally affect 'protected land'. The DLWC may also do this if satisfied that something has been done that has obstructed or detrimentally affected the flow of 'protected waters' or is likely to do so.

4.3.7 Water Act, 1912

The *Water Act, 1912* is also administered by the DLWC. A licence under the Act would be required if water were to be extracted from any waterways or adjacent waterways or if the waterways were to be realigned during construction. Since Collins Creek would be realigned, a licence would therefore be required under this Act.

4.3.8 Heritage Act, 1977

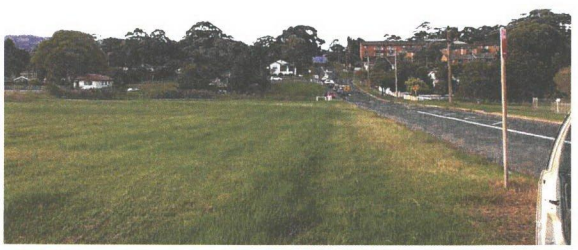
Approval may be required from the NSW Heritage Office in relation to impacts (excavation or disturbance) to non-indigenous heritage items under the provisions of the *Heritage Act, 1977*, if any are unearthed during construction.

4.3.9 Fisheries Management Act, 1994

Liaison would be required with NSW Fisheries in relation to Section 199 of *the Fisheries Management Act, 1994*. This would require the RTA, before it carries out or authorises the carrying out of dredging or reclamation work in any waters as part of the EIS Proposal, to give the Minister for Fisheries written notice of the proposed work, and to consider any matters concerning the proposed work that are raised by the Minister within 28 days after the giving of notice (or such other period as is agreed between the Minister and the public authority). The RTA is also to notify the Minister of any dredging or reclamation work that it proposes to carry out or authorise despite any matter raised by the Minister. Approval would also be required under Section 205 of the Act to carry out an activity which damages marine vegetation such as mangroves. No such vegetation would be affected by the EIS Proposal.

Section 218 requires the RTA to notify the Minister for Fisheries prior to constructing culverts on a waterway.

4.3.10 Waste Avoidance and Resource Recovery Act, 2001



The EIS Proposal includes an overpass at Campbell Street and cutting to the north.

The Environment Protection Authority administers this Act. The primary objective of the Act is to achieve reductions in waste volumes disposed of in NSW and to establish a hierarchy of avoidance, reuse, recycling and reprocessing and disposal. The Act contains requirements in relation to disposal and transport of waste and prevents the disposal of waste on any land unless it is an approved waste facility. Any waste disposed of as a result of the EIS Proposal would be at a suitably approved landfill site under the Act. Transport of any waste would be by a suitably licensed contractor under the provisions of the Act.

4.3.11 Local Government Act, 1993

The *Local Government Act 1993* requires Councils to prepare plans of management for land in their ownership or control that is classified for community purposes. This generally includes open space. The EIS Proposal lies adjacent to open space land at a number of locations. If detail design requires the EIS Proposal to pass through such land it should be consistent with the requirements of the plan. If required, the land would be rezoned prior to construction.

5. Decision Making Process

5.1 Introduction

This Section outlines the approval process the EIS Proposal must follow to obtain planning approval under both state and federal legislation. It provides information on the EIS preparation and exhibition as well as details on representations by the community and what occurs after exhibition and the steps to be followed in obtaining planning approval.

5.2 Background

The EIS Proposal is being developed under the provisions of the *NSW Environmental Planning & Assessment Act, (EP&A Act) 1979*. This Act is the principal Act governing planning legislation in NSW. It sets the framework for the development of land as well as environmental assessment procedures for infrastructure proposals.

5.3 The Proponent

The RTA is the proponent and nominated determining authority for the EIS Proposal for the purposes of Part 5 of the *EP&A Act*. (see **Section 4.2**)

5.4 Environmental Impact Assessment Requirements

5.4.1 EIS Requirements

Within NSW, development approval and environmental assessment procedures are governed by the provisions of the EP&A Act and the *Environmental Planning & Assessment Regulation, 2000*. This EIS has been prepared in accordance with the provisions of that legislation and in accordance with the requirements of the Director-General of the Department of Planning, NSW. The particular requirements for this EIS, as specified by the Director-General, are outlined in **Appendix A** of the EIS.

The land affected by the EIS Proposal is variously zoned under the provisions of City of Wollongong Local Environmental Plan (LEP) 1990, and for the most part the EIS Proposal is located in zones or reservations in which the construction of roads is permitted without development consent. Details on zoning and permissibility are outlined in **Section 4.2** of this EIS (Statutory Planning).

Under the provisions of State Environmental Planning Policy (SEPP) No. 4 — 'Development Without Consent', development consent for construction associated with a Classified Road is not generally required. In some sections of the EIS Proposal, items listed on the Wollongong City Heritage Schedule are affected.

Although in these cases SEPP 4 does not apply, the RTA however would utilise savings provisions within the Wollongong City LEP to allow the EIS Proposal to be assessed under the provisions of Part 5 of the EP&A Act.

5.4.2 Significance of Environmental Impact

Section 111 of the EP&A Act requires a determining authority to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity". Section 112 of the EP&A Act requires the determining authority to consider whether the proposed activity is "likely to significantly affect the environment". If so, the determining authority (in this case the RTA) is required to prepare and consider an EIS. The RTA has examined the likely impacts of this Proposal and considers that they are likely to significantly affect the environment. It has therefore resolved to prepare and consider an EIS for this Proposal. In accordance with the provisions of the EP&A Act, the EIS Proposal is subject to the approval of the Minister for Planning and then determination by the Chief Executive of the RTA.

5.4.3 Species Impact Requirements

Taking into consideration the provisions of the *Threatened Species Conservation Act, 1995*, the EIS Proposal has also been assessed under Section 5A of the EP&A Act (the 8 part test), to determine whether a Species Impact Statement (SIS) is required. As the EIS Proposal would not have a significant impact on threatened species, a SIS has not been prepared. (Refer **Section 12.5**)

5.4.4 Commonwealth Requirements

The *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999* commenced on 16 July 2000. The Act introduced new assessment and approval systems for:

- Actions that have a significant impact on matters of National Environmental Significance,
- Actions that have a significant impact on the environment of Commonwealth Land, and
- Actions carried out by the Commonwealth Government.

As the Commonwealth is not undertaking the project, nor does the preferred route affect the environment of Commonwealth Land, neither of these triggers applies to the EIS Proposal. The triggers contained in the *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999* which relate to matters of national environmental significance were considered in the preparation of the EIS. The matters of national environmental significance identified in the EPBC Act consist of:

- World heritage properties;
- Ramsar wetlands;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions.

The EIS Proposal would not impact on any of these factors and no further assessment was required for these triggers. The EIS Proposal would have no affect on matters of national environmental significance and therefore the Commonwealth approval process is not applicable to this Proposal.

5.5 Purpose of this Environmental Impact Statement

The EIS provides the community, government and other interested parties with information about the EIS Proposal, its potential environmental impacts and the RTA's proposals to manage and mitigate the adverse impacts during construction and operation.

5.5.1 Purpose of the EIS

The specific purposes of the EIS are to:

- Ensure that the EIS Proposal complies with the relevant statutory requirements;
- Summarise the strategic and cumulative impacts of the EIS Proposal on the land use and transport systems of the local area;
- Summarise the discrete and cumulative impacts on the environment;
- Examine whether the EIS Proposal is justified in terms of the principles of Ecologically Sustainable Development (ESD);
- Establish the basis for subsequent environmental management of construction and operation if the EIS Proposal proceeds; and
- Provide an overview of the impacts and benefits of the EIS Proposal and provide mitigation measures where possible.

5.5.2 Scope and Structure of the EIS

The EIS is being managed by the RTA's Development Section, Southern Region Wollongong. A team of consultants has prepared specialist studies. Purdon Associates has been engaged by the RTA to compile all of the reports arising from the Specialist Studies as well as to write the EIS.

The study team is listed in **Appendix B**. Specialist studies used as the basis for this EIS are published as separate **Working Papers** to the EIS and summarised in **Table 5.1**.

Any recommendations in the Working Papers are those of the authors of those papers. They may or may not have been adopted by the RTA, either wholly or in part, in the main volume of the EIS. At all times, the environmental safeguards, mitigating measures and management actions identified in the main volume of the EIS are those which are proposed to be adopted in relation to the proposed activity. If there is any inconsistency between proposed measures in the EIS main volume and recommendations in the Working Papers, the position in the EIS main volume will prevail.

Table 5.1: List of EIS Working Papers

Number	Title	Organisation
1	**Concept Design and Property Acquisition**	RTA — Southern Technical Services (Design) and Client Services (Property)
2	**Consultations**	Purdon Associates
3	**Transport**	Forbes Rigby/Gabites Porter
4	**Geology, Soils and Borrow Materials**	Coffey Geosciences
5	**Flooding & Drainage**	Connell Wagner
6	**Water Quality**	Forbes Rigby
7	**Air Quality Assessment**	Holmes Air Sciences
8	**Biodiversity**	Lesryk Environmental Consultants
9	**Socio-economic and Land Use**	EGIS
10	**Noise Assessment**	Wilkinson Murray Pty Ltd
11	**Urban & Landscape Design**	Infranet/Kiah Environmental Designers
12	**Heritage**	DIG International & Rod Howard Heritage Conservation
13	**Operational Hazards & Risks**	Connell Wagner
14	**Road User Cost Benefit Analysis**	Sinclair Knight Mertz

5.6 Exhibition of the EIS

The EIS would be advertised and placed on public exhibition by the RTA for a period of 4 weeks. The EIS and accompanying Working Papers would be available for viewing at the following locations:

- Roads & Traffic Authority Office, Centennial Plaza, 260 Elizabeth Street, Surry Hills;
- RTA Southern Region Wollongong, Level 4, 90 Crown Street Wollongong;
- PlanningNSW, Sydney Information Centre, Ground Floor, Governor Macquarie Tower, 1 Farrer Place, Sydney;
- New South Wales Environment Centre, Level 5, 362 Kent Street , Sydney;
- New South Wales Government Information Centre, Goodsell Building, Corner Phillip and Hunter Streets, Sydney;
- RTA Motor Registry, Corrimal;
- Wollongong City Council Library;
- Corrimal District Library, Sharp Street; and
- Bulli Library, Princes Highway.

The EIS and/or CD may be purchased from the RTA Regional Office in Wollongong, and would also be available on the Internet at www.rta.nsw.gov.au.

During the exhibition period all members of the community, interest groups and government authorities are invited to view the EIS and to make a representation on any aspect of the EIS Proposal.

A printed "Overview" of the EIS would also be available to interested parties, and a "Community Update" would be distributed to all business outlets and households in the study area at the outset of the EIS public exhibition period to advise of exhibition details.

5.7 Guidelines for Making a Representation

People wishing to make a representation, should include:

- their nature of interest in the EIS Proposal;
- their opinions on the EIS Proposal;
- any suggestions they wish to make about alternatives, or improvements to the EIS Proposal;
- any additional measures considered necessary to adequately protect the environment;
- any errors or omissions in the information presented in the documents;
- any additional factual information they have (and its source); and
- any other aspects that they consider relevant to this EIS Proposal and its determination.

In order to make it easier for the matters raised in representations to be analysed and properly considered, they should also:

- list points wherever possible to make the issues clear;
- refer each point to the relevant section (or sub-section) of this document and/or the Working Papers;
- include their name, address and date if they would like their representation acknowledged; and
- ensure that their representation is as legible as possible.

Representations should be forwarded to:

Project Manager
Northern Distributor Extension
RTA Southern Region
Level 4, 90 Crown Street,
Wollongong NSW 2500.
Fax: 02 4227 3705
E-mail: kali_gupta@rta.nsw.gov.au

All information included in written representations are collected for the sole purpose of assisting in the assessment of this Proposal. The information may be used during the environmental impact assessment process by relevant staff and contractors including the RTA's Project Manager, RTA Planning and Environmental staff and/or the RTA's EIS study team. The information may be disclosed during the environmental impact assessment process to appropriate agencies, including PlanningNSW.

The supplier can indicate at the time of supply of information that it should be kept confidential. In this situation, the RTA would attempt to keep the material confidential, but there may be legislative or legal justification for the release of the information, for example under the *Freedom of Information Act, 1989* or under subpoena or statutory instrument.

The supply of information to the RTA is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any information provided by other respondents if a respondent has indicated that the representation should be kept confidential. Any respondent may make a correction to the information they have provided by providing the correction in writing to the same address where the original representation was sent.

The information would be held by the RTA Southern Region, Development Section Wollongong.

5.8 EIS Determination Process

The determination process for the EIS is summarised in **Figure 5.1**.

After the completion of the exhibition period, the RTA would review all representations and contents of the EIS and prepare a Representations Report and Preferred Activity Report. These documents would incorporate:

- consideration of the EIS;
- consideration of all the representations and responses to the issues raised; and
- any new information on the EIS Proposal, any modifications, proposed environmental measures, controls and commitments.

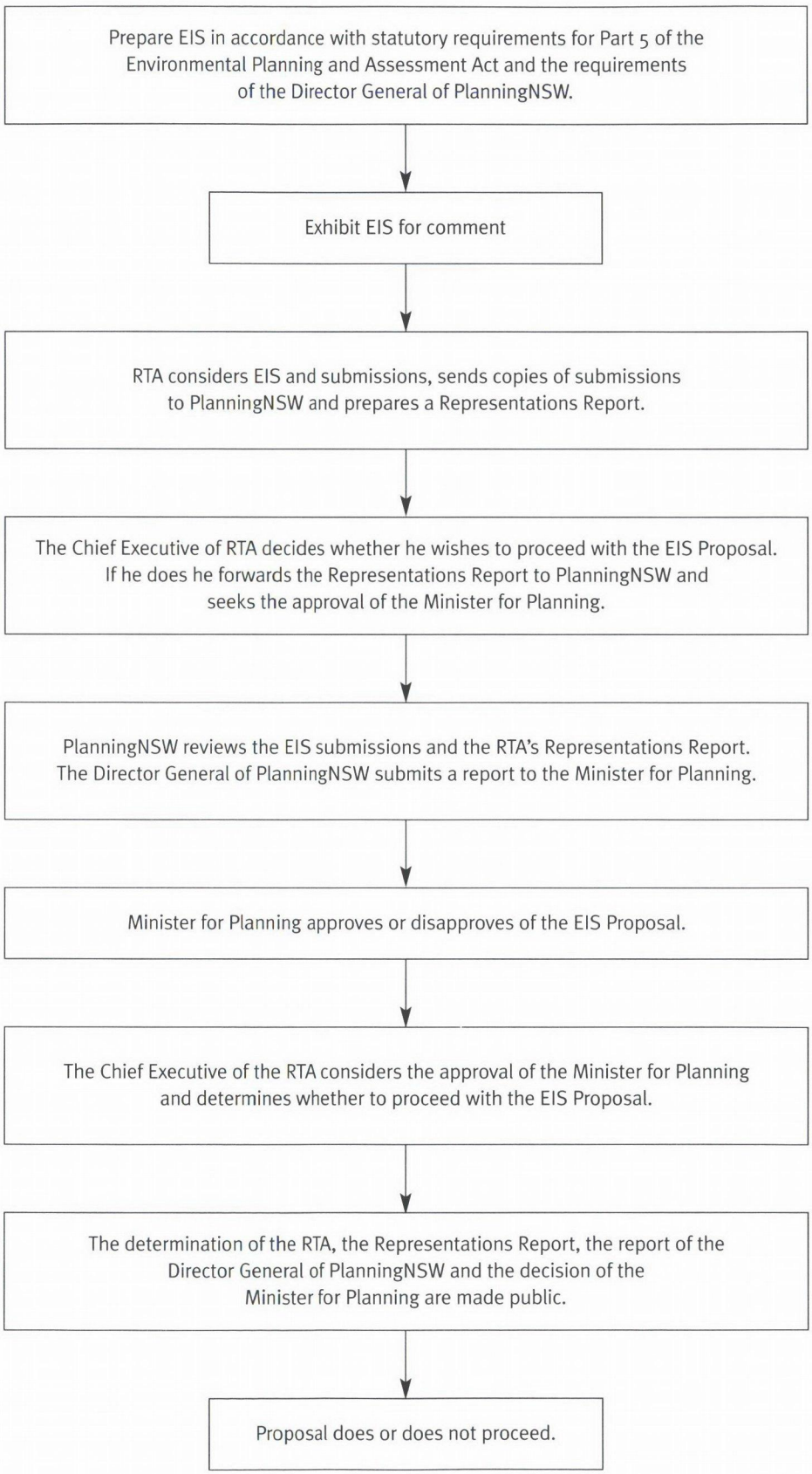
Copies of representations and the RTA Representations Report (including the Preferred Activity Report) would be forwarded to PlanningNSW for approval by the Minister for Planning. The Preferred Activity Report would then be placed on public exhibition.

PlanningNSW would examine the Preferred Activity and prepare a report to the Minister for Planning. Acting on that report and after consultation with the Minister for Roads, the Minister for Planning would decide whether to grant approval to the EIS Proposal. The Minister for Planning may attach conditions to an approval. If approval is given, the RTA would then determine whether the Preferred Activity would proceed.

Should the Preferred Activity be approved, the RTA would:

- notify the local community of the decision to proceed with this Proposal by correspondence, newspaper notices and/or information sheets;
- make available for public perusal the Representations Report, the approval of the Minister for Planning, the Preferred Activity Report, the report of the Director General of the Department of PlanningNSW and the Determination of the Chief Executive of the RTA at the locations where the EIS was exhibited;
- notify affected property owners of the decision, making contact soon after the announcement to clarify the likely impacts on individual properties, the anticipated timing and staging of any construction and to explain the process of property acquisition.

Figure 5.1: EIS Determination Process



Source: RTA

Owners would be kept informed and consulted during all stages of the design and construction process. During the detailed design stage, negotiations would be held to address the owners' concerns and formalise any property adjustments;

- prepare a detailed **Project Environmental Management Plan** (PEMP) for both construction and post-construction stages of the project prior to construction commencing. The PEMP would require the preparation of specific plans for community consultation, landscape and urban design, erosion and sedimentation control, waste management, traffic management, air quality, noise and any other plans required as part of the conditions of approval issued by the Minister for Planning;
- ensure that contractors for the construction of the Preferred Activity have an environmental management system prepared in accordance with the NSW Government Environmental Management System Guidelines (1999) and accredited by the RTA. The contractor would also be required to demonstrate the successful implementation of their environmental management system at a project level; and
- would meet those conditions imposed by the Minister for Planning, either directly of through its contractual requirements.

6. Description of the EIS Proposal

This Section describes the EIS Proposal that is the subject of environmental assessment in subsequent parts of this EIS. It provides a detailed description of individual components of the road, as well as the underlying design principles and assumptions used in the planning process.

Working Paper 1 has been prepared by the RTA Design and Property Sections for this EIS. It includes project details as well as a background analysis of all major design options for the project.

The process of identifying, evaluating and determining a design concept for the route has been an important step in the overall planning, design and construction process for the proposed NDE. As part of this process, various sub-options have been prepared and evaluated by the RTA and the Consultant team. In turn, this material has been presented by the RTA in two public displays (June and August, 2001) to guage community reaction and support.

All of the main elements in the EIS Proposal were contained in Newsletter 4 that was distributed to the community in May 2002 and discussed with the Community Liaison Group.

The EIS Proposal provides a total design package at a concept design level including noise mitigation, structures designed to accommodate 1 in 100 year flood events, on-site water detention ponds and landscape concepts. Under other circumstances these elements may be considered mitigating measures. However, in this case they have been incorporated into the EIS Proposal because of the advanced level of planning for the project and the need to provide the local community with a high level of understanding and certainty about the impact of the EIS Proposal.

Adoption of a final set of concept designs (and ultimate final design drawings) for the route would then require more detailed engineering and landscape design at a later stage in the overall project after acceptance of the EIS but prior to construction.

6.1 Project Objectives

The main objectives for the Northern Distributor Extension (proposed NDE) were initially determined in 1998. They have been subsequently extended and revised in response to community input and are adopted by the RTA for the EIS Proposal as listed below:

- **Improve road safety** by reducing through traffic on the Princes Highway through local business districts;
- **Improve road safety** by removing unnecessary through traffic from residential streets north of Bellambi Lane;
- Provide a **consistent level of service** between Wollongong and Bulli along the Northern Distributor;
- **Improve travel time** between North Wollongong and Bulli;
- Ensure design is able to accommodate the **future transport developments** (described in **Section 2.2.1**);

- Minimise adverse impact on existing community movement networks by assisting **integration of the community** with appropriate east/west links across the Northern Distributor corridor;
- Improve the local noise environment in the general vicinity of the proposed NDE corridor;
- Ensure no adverse impact on current **drainage provisions and flooding**; and
- Continue **community consultation** throughout the planning and design process.

6.2 NDE Design Objectives and Guidelines

This section summarises the main design objectives and guidelines used in the proposed NDE concept design. The broader objectives for the EIS Proposal were presented in **Section 1.3** above.

The main groups of design guidelines include:

- road engineering,
- drainage
- noise attenuation; and
- urban and landscape design.

6.2.1 Engineering Design

The RTA has set the following engineering design criteria for the Northern Distributor Extension as shown in **Working Paper 1**:

Horizontal Alignment

- Designed for a minimum 100km/hr.

Vertical Alignment

- Designed for a minimum 90km/hr.

Road Cross Sections

- A four-lane divided road with full access control. Cross Section element widths are as shown on the RTA's typical sections. (Refer **Figure 6.8** and engineering cross-sections in **Working Paper 1**) The shoulder width would incorporate a cycleway adjacent to both directions of traffic.

Intersections

- Grade separation is proposed for Gray Street/Park Road and Campbell Street. At grade signalised intersections are proposed for Molloy Street, and between Doris Avenue and Alice Street.

Pedestrians

- Pedestrian movement across the proposed NDE would be restricted to controlled access points including signalised intersections, bridges, and pedestrian overpasses.
- Connectivity required on the western side of the Distributor between Farrell Road and Campbell Street.

Service Roads

- General desirable minimum widths to be 8.5m for two way traffic and 5.5m for one way traffic. Exceptions to this would be the access connection (short length) south of Park Road on the eastern side (min. 3.5 wide) and the two way section of Mitchell Road (short length) between Rose Street and Station chainage 4900 (min 7m wide). **Figure 6.5** refers.
- Remnant sections of York Road, Mitchell Road and Thompson Street to become local service roads.
- An additional connection would be required to connect Molloy Street with Farrell Road and a service road would be required along the eastern side of the Distributor from Alice Street to the southern boundary of Bellambi RTA District Office to service the light industrial area.
- Watts Lane would need to be extended at least to the southern boundary of the vacant light industrial land.

Median Widths

- Median width to be 5.0m maximum and 2.0m minimum.

Bridges

- Bridge over Campbell Street to have a minimum clearance of 4.6m.
- Bridge over proposed NDE at Park Rd/Gray Street to accommodate vehicles and pedestrians.

Drainage

- Drainage structures to be designed in accordance with the Draft Guidelines developed by Wollongong City Council.
- Following consultation with stakeholders and the community a number of key performance criteria were identified for the proposed Distributor. These are summarised briefly as follows:
- Adoption of the 100-year ARI (or 1% AEP)[1] event as the design flood for the proposed Distributor Extension to provide for acceptable flood immunity and use as emergency route/access;
- Existing flood levels and extents not to be exceeded for flood events up to and including the 100-yr ARI event and probable Max flood (PMF);
- Existing overland flow paths and distribution of flows to be maintained for events up to and including the Probable Maximum Flood; and
- Compliance with WCC draft blockage policy guidelines.

1 ARI and AEP are the two probability terms adopted for use in Australia and documented in Australian Rainfall & Runoff 1997. ARI or 'Average Recurrence Interval' is the average or expected value of the period between exceedances of a given discharge. AEP or 'Annual Exceedance Probability' is the probability of exceedance of a given discharge within a period of one year. A 10% AEP event is equivalent to a 10-yr ARI event, 5% AEP to 20-yr ARI, 2% AEP to 50-yr ARI and a 1% AEP event to a 100-yr ARI event.

Wherever possible the proposed NDE should encompass the principles of sensitive water planning design and management. Such principles increase infiltration of stormwater back into the soil, slow down velocities and purify the water before it re-enters the creek system, thereby creating a more sustainable design solution.

The EIS Proposal includes on-site detention ponds and adjacent spillage/sedimentation traps.

6.2.2 Urban and Landscape Design Guidelines and Themes

This group of guidelines is detailed in EIS Working Paper 11 and relates to design of the road as seen from the driver's perspective. These guidelines also address how the proposed NDE would fit into the surrounding environment, including issues of cross-movement and wider landscape context. Specific items include:

- Road Alignment
- Pedestrian Underpasses
- Local Traffic
- Median Treatments
- Pedestrians
- Road Signage
- Local Character & Accent Features
- Lighting
- Sound Attenuation
- Fences
- Hard Surfaces
- Landscape Design
- Major Structures
- Noise Criteria

Culs-de-sac in Russell and Hopetoun Streets will reduce through traffic.

Sound Attenuation

The proposed alignment would require extensive sound attenuation, with the treatment varying according to the width of the proposed NDE Corridor. In this regard, two general treatments have been applied:

- Where the corridor width is generous, (eg: York Road at the southern end of the proposed NDE), sound mounding would be introduced in order to minimise the visual impacts of sound attenuation;
- In locations where the corridor width is restricted, sound walls would be integrated with other roadside elements. This occurs along Mitchell Road where sound walls would be integrated with back fences on the eastern side, with bridge abutments at Park Road, with pedestrian overpass ramps at Farrell Road and with accent features/gateways at the Princes Highway. Roadside landscaping has been used to offset the visual impact of high sound walls where appropriate.

Plant species on the mounding would reflect the indigenous species of the area. Earth shaping would be designed to integrate well with the surroundings and not appear as if it is "superimposed" on the landscape. It is important to create a variety of spatial experiences for the traveller.

Security fencing 1800mm high would be carefully integrated with the mounding to avoid its being visible on the ridgeline of the mound.

Design of earthworks would create some "open" spaces and gentler slopes beside the road where possible, rather than imposing steep batters everywhere which enclose the space and restrict views out. For example, the open space on the York Road side of the proposed NDE would enhance the local neighbourhood. Gentle slopes can be used for recreational purposes.

Stormwater passage is designed to flow through gaps in the mounding.

Acoustic Walls

Wherever possible the need for vertical retaining walls has been reduced by integrating walls with landscape design and earthshaping to reduce their scale.

It is proposed to use coastal and escarpment themes as inspiration for the design of the walls, and to adopt a consistent approach to the walls. The themes would be applied as separate elements to the wall. This way a design consistency can be achieved while introducing a variety of textures that reflect the identity of the locality.

This theme could be achieved by using the concrete panels that have already been used along the proposed NDE near the intersection of Bellambi Lane and the proposed NDE. Alternatively, concrete panels with a consistent texture to all wall surfaces which express a horizontal casting of the form work would be used.

The concrete finish would be enhanced with colour additive such as 'sand' to complement features from the general locality (sand, sandstone). The rippled effect from the form work would be interpreted as sand patterns, the escarpment or even waves. In order to add interest to the wall and reduce its height appearance, a series of small panels which incorporate local themes would be introduced at mid-height.

Vertical panels are proposed along the walls to enrich the overall horizontality of the wall with a vertical rhythm. The panel size could be approximately 100 cm in height by 60 cm in width and spaced between 1 to 2 metres on centre. These panels vary in texture according to the locality of the wall yet maintain a consistency of detail. The length of each panelled section could vary from 20 to 100 metres. The repetition of the panels would then visually assist in breaking the monotony and height appearance of the wall.

The panels would vary in material, ranging from sheet metal to reflect water and industry, textured light-weight concrete panels with colour additives to reflect sand and sandstone forms as well as weathered steel panels to reflect the steel industry of Wollongong. It is suggested these panels be provided only at strategic locations where they are highly visible and assist in the visual mitigation of the sound walls.

Public Art

The previously mentioned panels could become part of a public arts project which engages local artists in their creation. In addition, the opportunity exists to introduce public art at key locations such as at the intersection of the Princes Highway and the proposed NDE and in the vicinity of the water quality ponds near Doris Avenue.

Landscape Themes

Landscape design themes have been adopted for the EIS Proposal. These are intended to create recognisable themes along the proposed NDE by reinforcing either the natural or cultural context of each identifiable area. The transition between the areas would be carefully handled in the detail design phase.

Design themes have been determined for precincts along the proposed NDE route and described in detail in **Working Paper 11**.

6.2.3 Noise Criteria

The relevant residential noise criteria recommended by the EPA and RTA guidelines are shown in **Working Paper 10**.

The proposed NDE project would be required to consider separate noise criteria for residential areas and schools, and for different parts of the route classified as existing and new roads.

The proposed NDE is considered to be a redevelopment of an existing arterial road between Bellambi Lane and Farrell Road. Between Farrell Road and the Princes Highway, it is considered to be a new arterial road. The Princes Highway is considered to be an existing arterial road. Other roads and streets potentially affected by the development are considered to be existing collector roads.

The EIS Proposal will reduce noise levels and through traffic for residents in York Road.

The NSW Government has recently proposed new traffic **noise guidelines for residential areas** that have been agreed between the RTA and the EPA (ECRTN, EPA, 1999). The new guidelines are non mandatory. However, they suggest that "...in some instances the criteria may only be achievable 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".

The base criteria for new arterial roads in **residential areas** are $L_{Aeq,15hr}$ 55dBA for daytime, and $L_{Aeq,9hr}$ 50dBA for night time. For redevelopment of an arterial road, the base criteria are $L_{Aeq,15hr}$ 60dBA for daytime and $L_{Aeq,9hr}$ 55dBA for night time.

For the proposed NDE, emphasis has been placed on the base criteria and the allowable increments (0.5 and 2dB). For **existing schools**, the Environment Criteria for Road Traffic Noise (ECRTN) guidelines recommend an internal base noise level criterion of $L_{Aeq,1hr}$ = 45dBA within the classroom. It is assumed this applies to a typical worst case hour during normal school times. For **school building facades** that contain windows that can be opened (as in this case), the equivalent external noise goal is 55dBA.

The guidelines also recommend a base criterion of $L_{Aeq,15hr}$ = 55dBA for school playgrounds. For active recreation areas, assumed to include the playing fields at Woonona High School, the guidelines recommend a base criterion of $L_{Aeq,15hr}$ = 60dBA.

6.3 Project Description

The EIS Proposal for the proposed NDE involves construction of a four-lane dual carriageway distributor road with controlled access from Bellambi Lane to the Princes Highway near Molloy Street.

Figure 6.1 shows the EIS Proposal in summary, **Figure 6.2 to 6.7** show detailed aspects of the proposed NDE. **Figures 6.8** shows selected cross sections of the route and the relationship between height of the proposed NDE and adjacent land uses. Typical engineering sections are shown in **Working Paper 1**. **Figure 6.9** shows the long profile of the route.

The main features of the proposed NDE are summarised below (moving north to south):

Princes Highway / Molloy Street: An at-grade four-way signalised intersection with pedestrian access for all movements.

Farrell Road (east) and Molloy Street: a new local road connection from Farrell Road east to the Princes Highway via Molloy Street.

Farrell Road (west): Creation of a cul-de-sac in Farrell Road, with a new pedestrian overbridge across the proposed NDE linking Farrell Road east and west.

A new **roundabout** at the junction of Farrell Road and Thompson Street.

Russell and Hopetoun Streets: Both streets proposed to become cul-de-sacs at their eastern end. Retain current access to the Princes Highway.

Farrell Road & Campbell Street: Construction of a new pedestrian footpath and bicycle link on the western side of the proposed NDE.

Campbell Street: A grade separated interchange with the proposed NDE bridging over Campbell Street and incorporating south facing on and off-ramps. Maintain existing east-west vehicular and pedestrian/bicycle access.

Thompson Street: The northern end of Thompson Street would connect to Farrell Road east via a new roundabout. A cul-de-sac north of Campbell Street would provide access to existing properties. A cul-de- sac south of Campbell Street would be created to provide access to three properties affected by the southbound on-load ramp from Campbell Street. The southern section of this street would be linked to Park Road and a southbound access to the proposed NDE.

Park Road / Gray Street: A new vehicle and pedestrian overbridge at Park Road connecting Gray Street via Mitchell Street and provision for southbound access and egress to the Distributor. Northbound access to Park Road and Gray Street from the proposed NDE would be via a new intersection between Alice Street and Doris Avenue and Mitchell Road.

Mitchell Road would become one way northbound for traffic between Park Road and Rose Street.

Access Road: South of Park Road on the eastern side is required to service three properties.

York Road area: A signalised at-grade intersection midway between Alice Street and Doris Avenue serving the local residential area west of the Distributor and a service road connecting to the eastern industrial area. This would allow full turning movement and facilitate access to/from the railway station, beach, local shops, school catchment east of the proposed NDE and community facilities. The southern end of York Road would contain a cul-de-sac.

Watts Lane: A short extension to Watts Lane is required to service the light industrial area east of the proposed NDE.

Bellambi Lane intersection: Provide right (north) turns from Bellambi Lane intersection onto the Distributor.

Figure 6.1: EIS Proposal Summary

Legend

EIS Proposal

Source: RTA

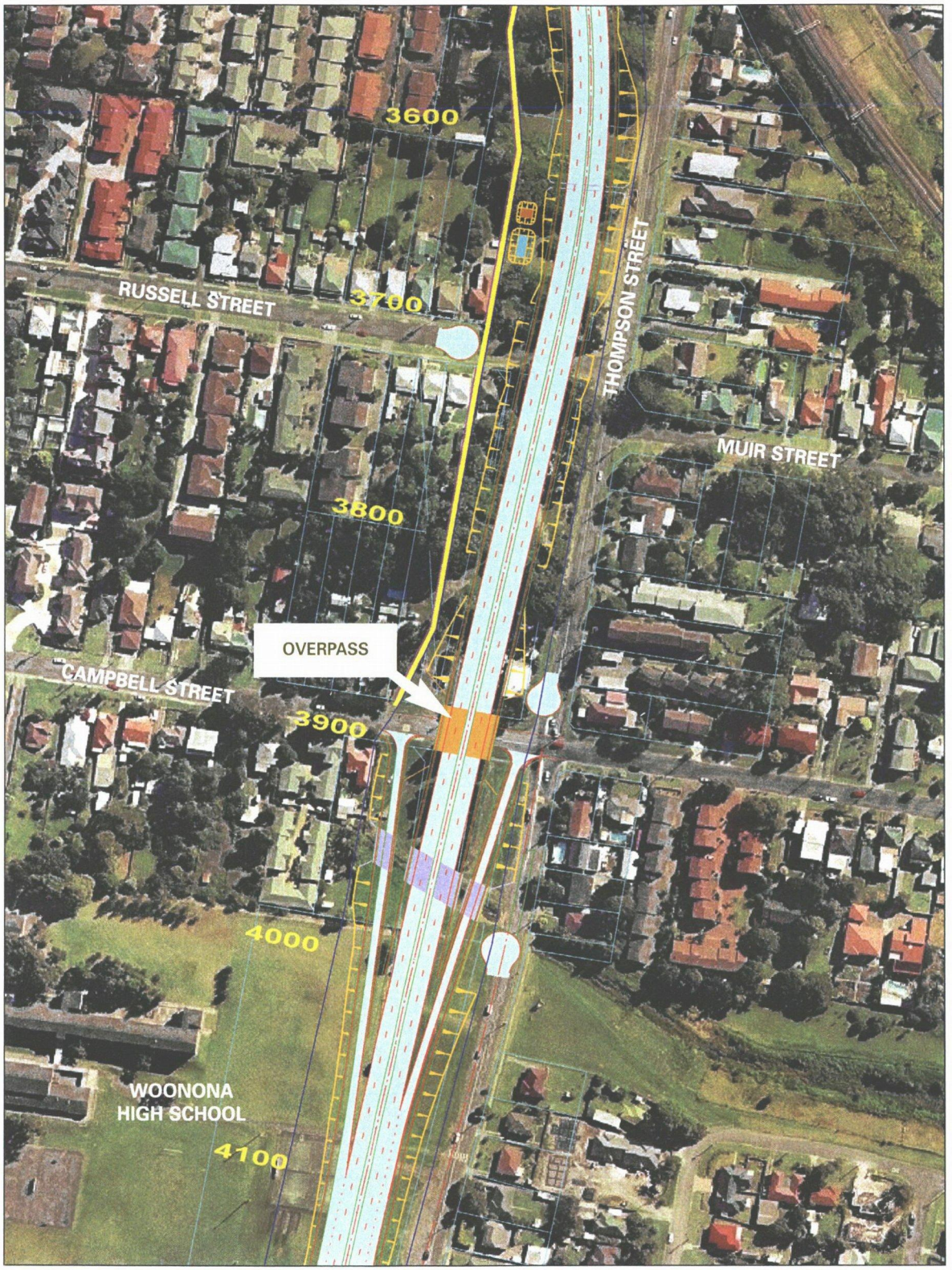
Figure 6.2: Northern End: Princes Highway, Molloy Street and Farrell Road

Legend

- Proposed NDE
- New foot path/cycle path
- 3500 Chainage (distance metres)
- Cutting
- Embankment
- On site detention basin and spillway trap
- Drainage structure

Source: RTA

Figure 6.3: Campbell Street Intersection



Legend

- Proposed NDE
- New foot path/cycle path
- 3500 Chainage (distance metres)
- Cutting
- Embankment
- On site detention basin and spillway trap
- Drainage structure

Source: RTA

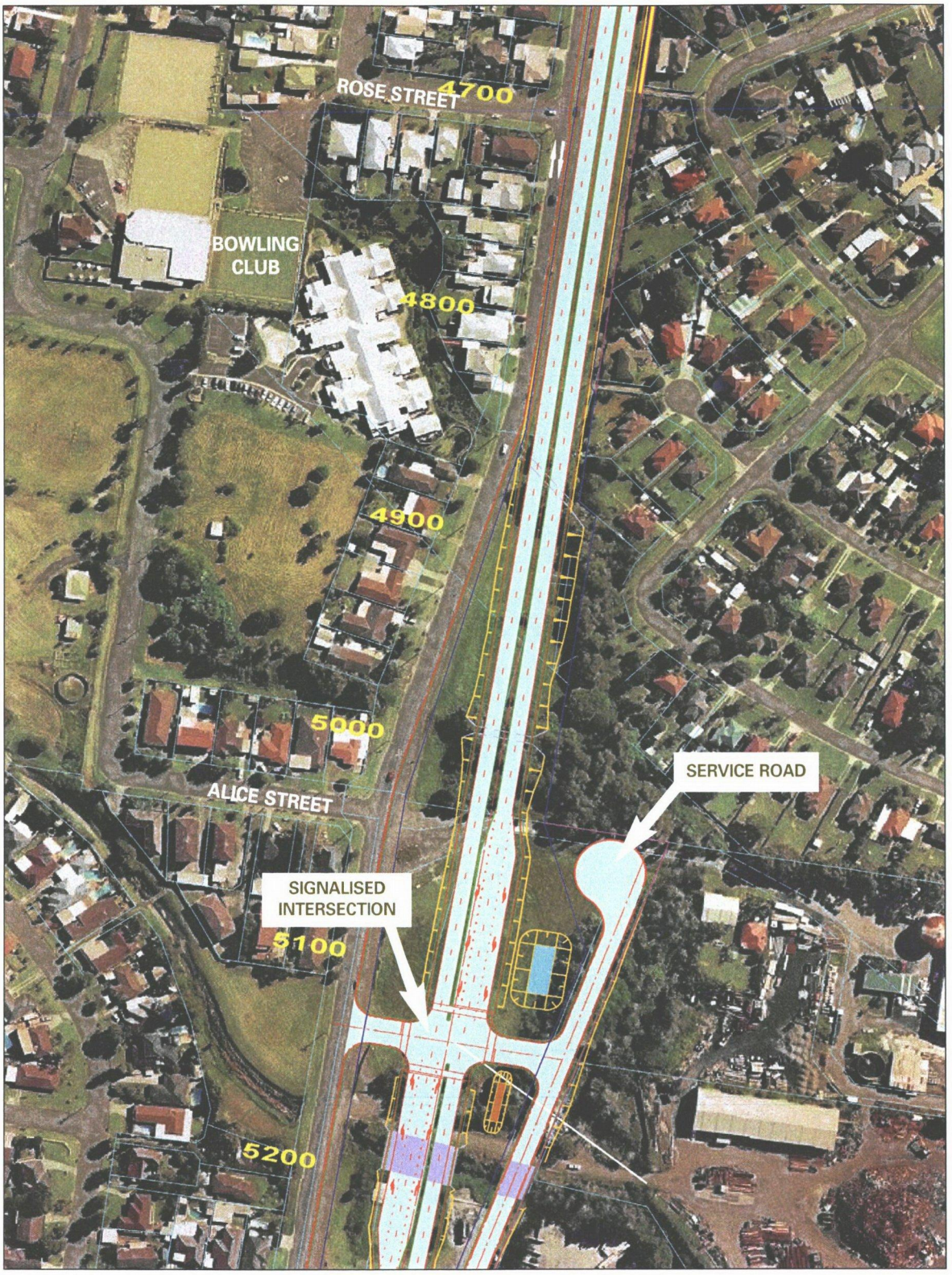
Figure 6.4: Gray Street and Park Road Intersection

Legend

- Proposed NDE
- New foot path/cycle path
- 3500 Chainage (distance metres)
- Cutting
- Embankment
- On site detention basin and spillway trap
- Drainage structure

Source: RTA

Figure 6.5: Rose Street and Alice Street



Legend

Proposed NDE
New foot path/cycle path
3500 Chainage (distance metres)
Cutting
Embankment
On site detention basin and spillway trap
Drainage structure

Source: RTA

Figure 6.6: Doris Avenue Intersection and Service Road

Legend

- Proposed NDE
- New foot path/cycle path
- 3500 Chainage (distance metres)
- Cutting
- Embankment
- On site detention basin and spillway trap
- Drainage structure

Source: RTA

Figure 6.7: Southern End: Bellambi Lane Intersection

Legend

Proposed NDE
New foot path/cycle path
3500 Chainage (distance metres)
Cutting
Embankment
On site detention basin and spillway trap
Drainage structure
N

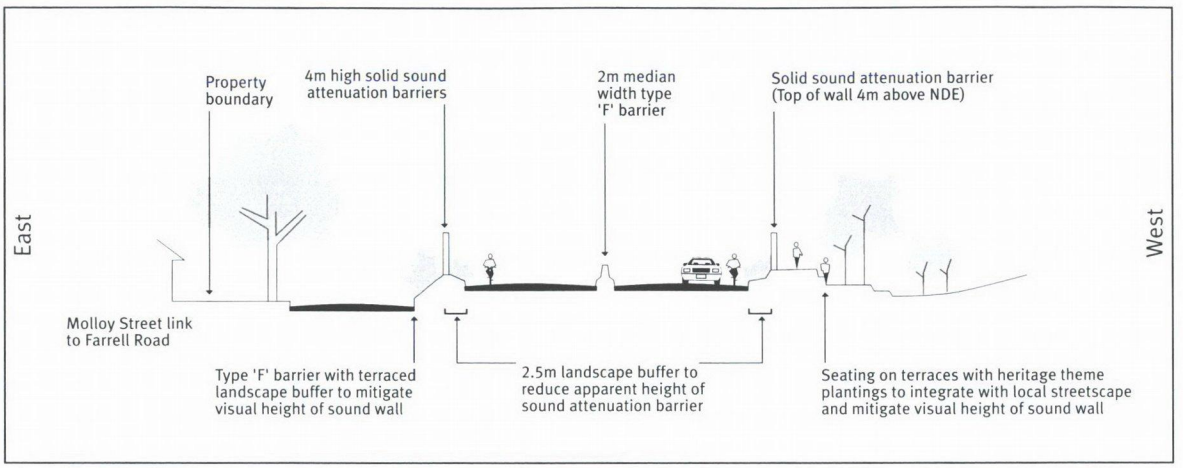
Source: RTA

Figure 6.8: Selected Cross Sections of EIS Proposal

Source: RTA

Figure 6.8a: Typical Cross Sections (travelling south to CBD)

(A)



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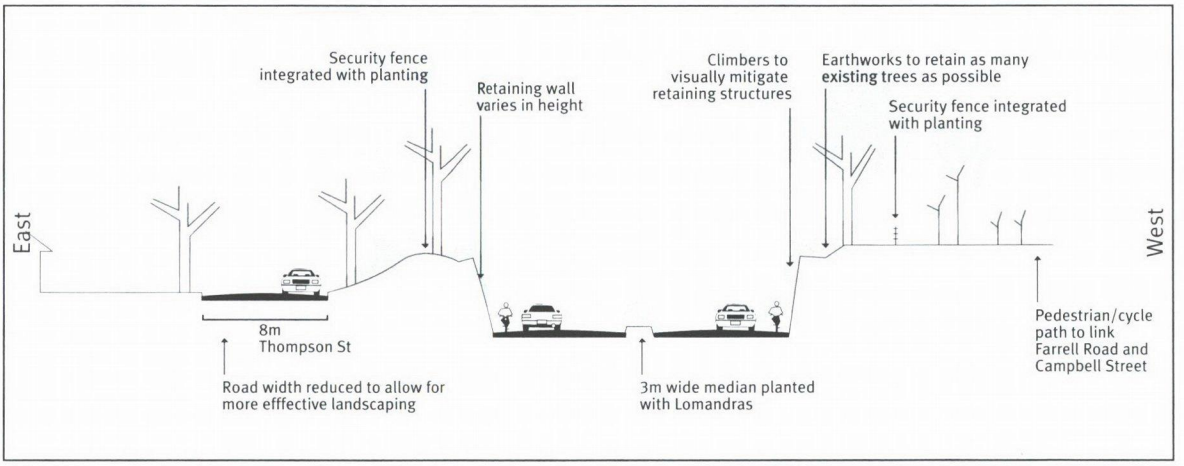

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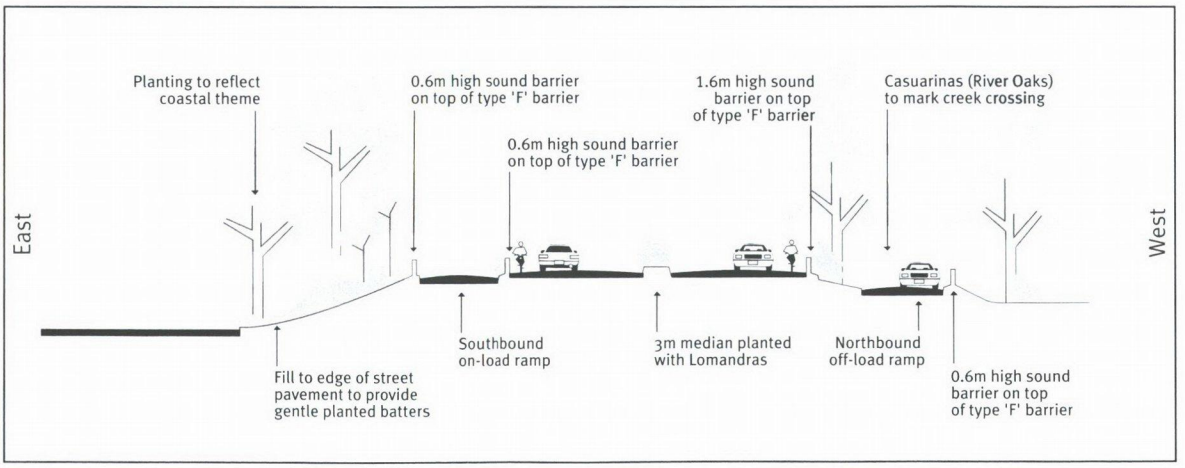

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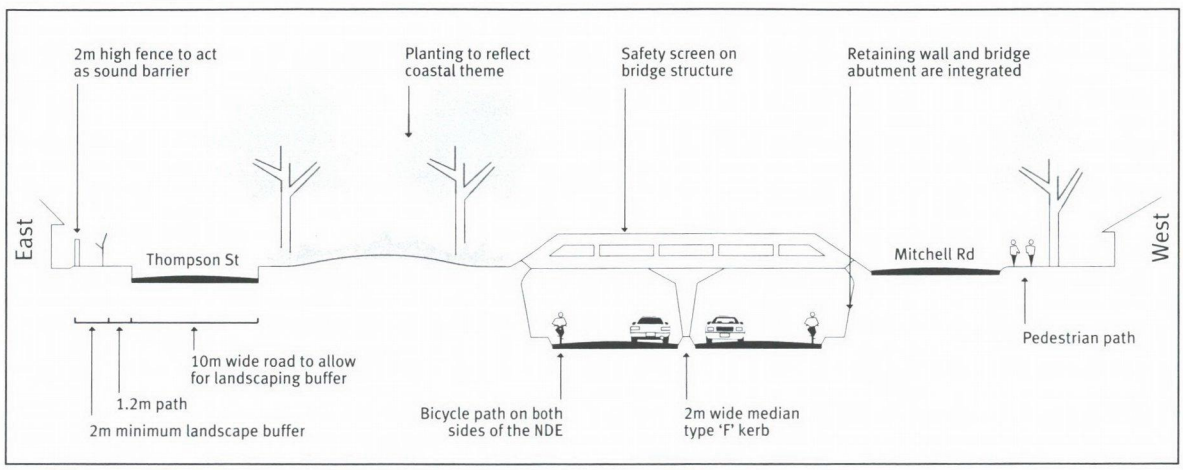
Source: Infranet/Kiah

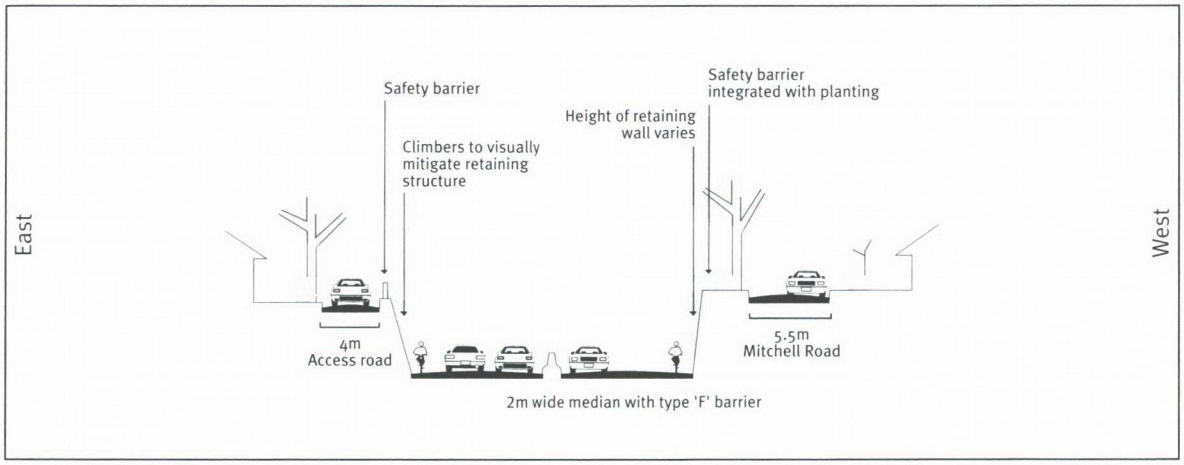
Figure 6.8b: Typical Cross Sections (travelling south to CBD)

(D)



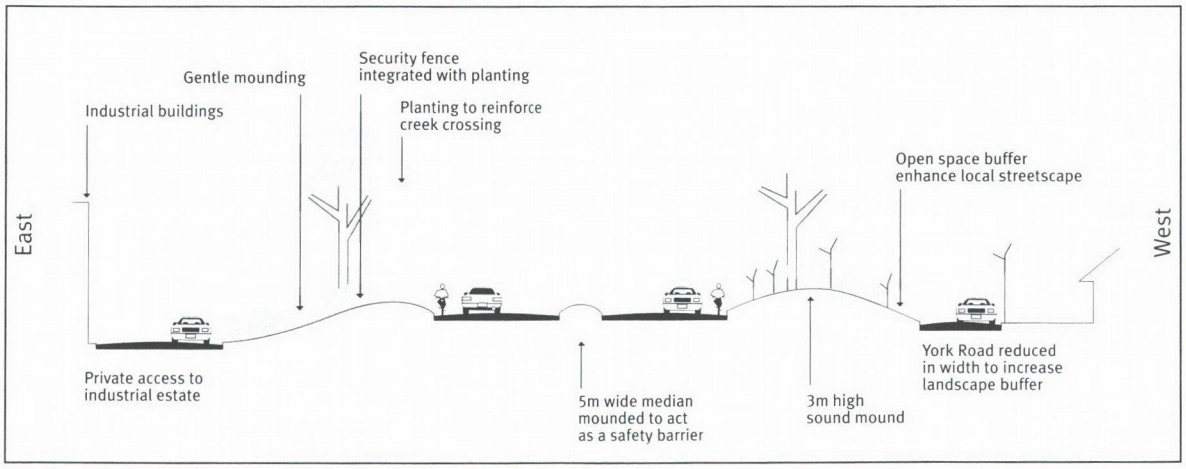
Chainage 4470

(E)



Chainage 4600

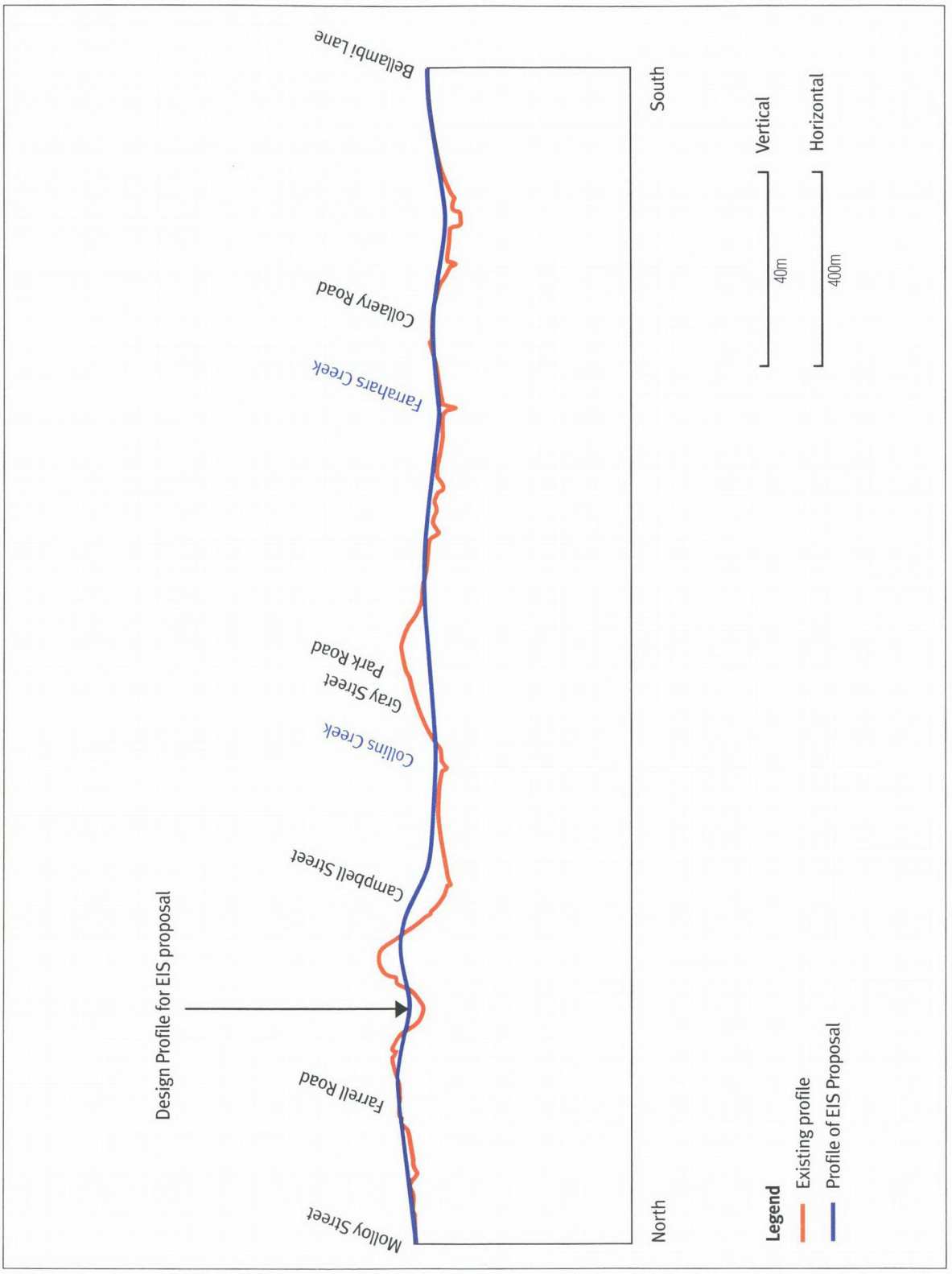
(F)



Chainage 5500

Source: Infranet/Kiah

Figure 6.9: EIS Proposal Design Profile



Source: RTA

6.4 Detailed Description of NDE Design Elements

6.4.1 Road Alignment

This term refers to both horizontal and vertical alignment of the road.

The **horizontal alignment** would remove all of the existing bends in the current north/south street system and provide a generally straight route in comparison. The northern tie-in to the Princes Highway at Molloy Street occurs on an interim curve of 105m radius which is suitable for 60km/hr.

The **vertical alignment** proposed for the NDE represents a substantial change to the alignment of existing streets and would provide a safer, more environmentally friendly, quieter and easier to use solution. The new alignment would also be more efficient due to fuel cost savings.

The main engineering elements are as follows:

- A substantial cut into the ridge north of Campbell Street;
- A substantial cut between Gray Street and Rose Street; and
- A short section of embankment or fill above existing ground level between Campbell and Gray Streets.

6.4.2 Earthworks and Pavement

Topsoil has been assumed to be 150mm thick and boxing depth adopted as 700mm. The assumed boxing depth comprises 300mm selected material, 350mm pavement and 50mm asphalt.

Material from cut sections of the route will be utilised for fill sections. A maximum haul length for this materail of approximately 400m appears likely.

6.4.3 Retaining Walls

Walls would be provided at the following locations:

- Through the cutting north of Campbell Street.
- Approaches to the overbridge at Campbell Street.
- Through the cutting between Gray Street and Rose Street. It would be incorporated with noise walls near the ends of the cutting.

6.4.4 Intersections and Local Access

There are five (5) intersections along the proposed NDE as summarised in **Table 6.1.**

Table 6.1: NDE Intersections

Name	Description
Princes H'way & Molloy Street	A signalised at-grade intersection with full turning movements
Campbell Street	The proposed NDE passes over Campbell Street. There is a north bound off-ramp and a south bound on-ramp at this intersection
Park Road & Gray Street	The proposed NDE passes under the current alignment of Park Road
Doris Avenue/Alice Street	A signalised at-grade intersection with full turning movements
Bellambi Lane	Existing signals remain but right hand turn movement permitted from Bellambi Lane east

Source: RTA

6.4.5 Median Strips

- The new alignment contains a median which varies in width between 2.0m and 5.0m to prevent head-on vehicle accidents. Median design comprises the following:
- 2.0m width 850m long with a concrete New Jersey Barrier.
- 3.0m width 700m long with landscaping and safety barrier.
- 5.0m width 1310m long with landscaping and safety barrier.

6.4.6 Bridges and Major Culverts

Although subject to a separate study, the proposed structure sizes for bridges and major culverts are shown in **Table 6.2**.

Table 6.2: Bridges and Major Culverts

Location	Item	Dimensions
Whartons Tributary	Bridge	6m long bridge
North of Russell Street	Box Culvert	2400mm x 900mm box culvert
South of Campbell Street	Bridge	15m long bridge
Collins Creek	Bridge	35m long bridge
South of Rose Street	Box Culvert	2700mm x 1200mm box culvert
North of Alice Street	Box Culvert	3300mm x 1500mm box culvert
Farrahars Creek	Bridge	18m long bridge
South of Collaery Road	Bridge	9m long bridge
North of Terania Street	Bridge	15m long bridge

Source: Connell Wagner (Working Paper 5)

6.4.7 Stormwater Management

The EIS design incorporates the use of dual-basin stormwater management facilities (one dry and one wet) at the outlet of each pipe system prior to discharge into the adjoining water course.

The first (ie. upstream) basin in each facility is an On Site Detention (OSD) basin for the purpose of reducing peak flows in accordance with Council's Draft OSD policy. The basin is fed directly by the proposed piped road drainage and roadside table drain system. OSDs are typically designed to have a full dynamic storage and do not hold any water during dry weather.

The second (ie. downstream) basin is a standard RTA design and is generally rectangular in shape and formed by an embankment on the low side. The primary basin outlet is a 100mm diameter PVC pipe with a negative grade to provide for capture of accidental oil or fuel spills. The outlet of the pipe is set so that the dry weather depth of water in these ponds is no more than 1.5m.

6.4.8 Sedimentation and Spillage

All roadway water would be collected via a piped system and connected initially to an **on-site detention basin**. Flow would then be transferred via an appropriately sized pipe to a **combined sedimentation/spillage trap** located adjacent to the waterway.

The spillage traps would be able to contain a spill of at least 60,000 litres.

The adopted water quality controls for the EIS Proposal incorporate the use of dual-basin stormwater management facilities (one dry and one wet) at the outlet of each pipe system prior to discharge into the adjoining watercourse. A total of 5 such facilities are currently proposed, one next to each of the major creeks and an additional facility next to the small northern tributary of Collins Creek.

6.4.9 Service Roads and Local Access

A new service road on the eastern side of the NDE between Alice Street and Collaery Road is proposed to service the light industrial area. Extension of Watts Lane to service local industrial traffic would also be required. A second minor service road is also proposed for access to housing immediately south of Park Road on the eastern side of the proposed NDE.

Once the proposed NDE is constructed, the following streets that currently carry through traffic would revert to local streets:

- York Road;
- Mitchell Road; and
- Thompson Street.

The pedestrian underpass originally proposed in Thompson Street for the Woonona High School has been removed from the project due to safety, flooding, legal responsibility and litigation concerns. These issues were raised initially by the State Emergency Services particularly in regard to flooding, as well as by the Education Department.

Wollongong City Council has a plan to upgrade Liddle Street and Nicholson Lane to provide formal bus bays and widen the bridge to accommodate pedestrians. School sport and excursion buses would be encouraged to utilise this improvement prior to the proposed NDE being constructed.

At present parents drop off and pick up students in Thompson Street. This would continue until the proposed NDE is constructed and an **LATM scheme** is implemented in Campbell Street which includes provision for set down and drop off for students adjacent to the current school access point.

6.4.10 Noise Barriers

Noise barriers take a number of forms including road cuttings, earth mounds and concrete walls. They are proposed for about 80% of the route to protect all residential and community facilities. These have been designed to ensure compliance with the base noise criteria recommended by the EPA.

Figure 6.10 and 6.11 show the location and size of these barriers along the route.

Working Paper 10 provides a table showing details of barrier heights from natural ground levels and road levels.

The noise mitigation measures incorporated in the project are as follows:

- Speed limit 80km/h;
- The use of quiet road surface, equivalent to open graded asphalt;
- Use of vertical retaining walls at the edge of the major cuts near Gray Street and Campbell Street;
- Roadside noise mounds and barriers; and
- Reduced vertical alignment.

Where practicable, landscaped earth mounds have been used to provide noise shielding. This includes a strip of land between York Road and the EIS Proposal. Roadside noise barriers have been used only where insufficient space is available for mounding, and where the road is not in cut.

6.4.11 Pedestrian and Cyclist Facilities

There would be no provision for pedestrian movement on the proposed NDE for safety reasons. However, the EIS Proposal includes the following pedestrian movement facilities:

- Signalised pedestrian crossing at the Princes Highway near Molloy Street;
- A new pedestrian bridge over the proposed NDE at Farrell Road;
- A new pedestrian pathway connecting Campbell Street, Russell Street , Hopetoun Street and Farrell Road on the immediate western side of the proposed NDE;
- Unrestricted pedestrian movement under the proposed NDE at Campbell Street;
- A pedestrian walkway on the southern side of the new overpass at Park road;
- Pedestrian access at the new signalised intersection between Alice Street and Doris Avenue; and
- Pedestrian access to be retained at the intersection of Bellambi Lane and the proposed NDE.

The EIS Proposal would make provision for full on-road cycling facilities, with a line-marked lane in either direction. Sealed shoulders 2.5m wide adjacent to Type SA kerb and gutter have been incorporated into the design of the proposed NDE that would accommodate cyclists.

6.4.12 Public Transport Facilities

The proposed NDE would provide an opportunity for new commuter services to the Woonona area and beyond.

6.4.13 Lighting

Overhead safety lighting to normal RTA standards would be provided at all intersections along the route.

The proposed NDE would be provided with night time lighting according to the latest Australian standards. Areas lit would be approaches to intersections, intersections, on-load ramps and off-load ramps as well as any other areas considered necessary.

Local roads would be lit where necessary such as at roundabouts, including the roundabouts at Farrell Road and at Gray Street.

Pedestrian overpasses and their approaches would be appropriately lit, particularly special areas such as ramps, stairs etc. Pedestrian cycleways would be lit where necessary, particularly in isolated areas such as south of Farrell Road and north of Campbell Street on the western verge of the corridor.

Feature lighting would be located at key locations such as overpass structures, gateway features, sound attenuation features etc. This would add interest and identity to the area at night time.

6.4.14 Fencing & Safety Barriers

Where applicable, controlled access wire fencing 1.8m high would be provided to prevent unauthorised pedestrian movement across the proposed NDE. This fencing would be incorporated into the landscape treatment and noise attenuation as required. Where sound walls fulfill this function, no fences would be provided.

Safety Barriers would be provided at locations with high drops such as north of Campbell Street.

Figure 6.10: Noise Barrier Heights

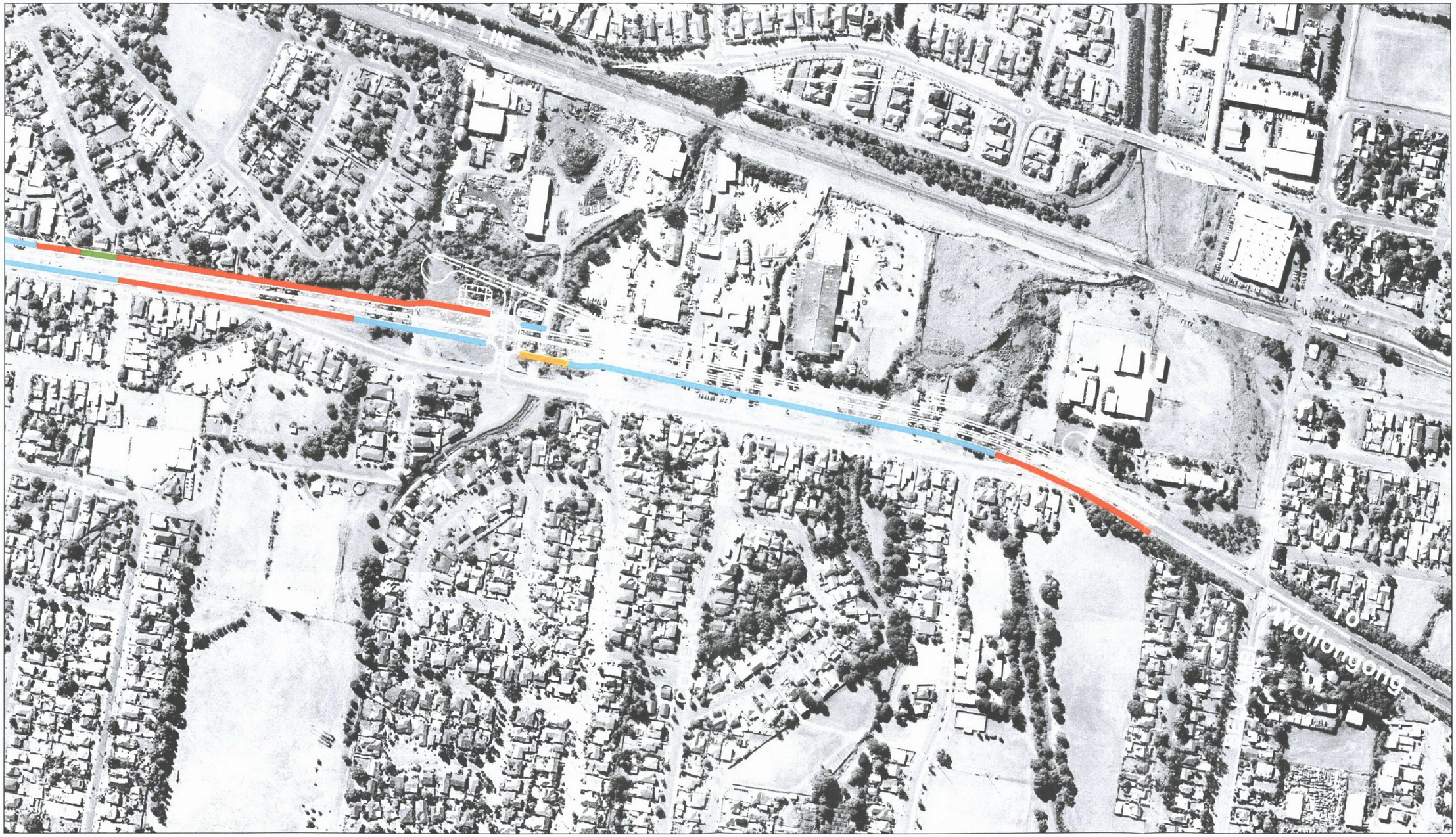
Legend

Barrier heights (from top of cut or top of fill)

- 0 to 1 metres
- 1+ to 2 metres
- 2+ to 3 metres
- 3+ to 4 metres

Source: Wilkinson Murray

Figure 6.11: Noise Barrier Heights



Legend

Barrier heights (from top of cut or top of fill)

- 0 to 1 metres
- 1+ to 2 metres
- 2+ to 3 metres
- 3+ to 4 metres

Source: Wilkinson Murray

6.4.15 Public Utilities

Details of existing utilities are shown in **Working Paper 1**. All utilities affected by the EIS Proposal have been identified by relevant utility companies and are summarised in **Table 6.3**.

Table 6.3: Utility Services

Type	Location	Impact/Treatment Required
Gas	Farrell Road, Hopetoun Street and Park Road areas.	Major relocation of both high and medium pressure lines
Water	between Doris Ave. and Terania Street, and Park Road area.	Major watermain adjustments
	Russell, Hopetoun Streets and Farrell Road	Minor adjustments
Sewerage	north of Park Road and at two locations near Terania Street	Concrete encasement
	Farrell Road, Collins Creek and near Woods Ave.	Minor sewer main adjustments
Electricity	Farrell Road and the Gray Street/ Park Road areas.	Major adjustments
	vicinity of the light industrial businesses opposite York Road and at all other affected side streets	Minor adjustments
Telecommunications	Junction of York Road and Collaery Road	Moderate impact
	Junction of Mitchell Road and Alice Street	Low impact
	The Park Road area	High impact
	Kialoa Street area	Very low impact
	Intersection of Thompson and Campbell Street	Low/moderate impact
	Farrell Road area	Low/moderate impact
	Molloy Street area	Very low impact

Source: RTA (Working Paper 1)

6.4.16 Signposting

Detailed design proposals for signage for the proposed NDE have not been prepared at this stage but the RTA has a commitment to provide appropriate signage where there is access to major localities along the proposed NDE.

Major destinations of the general area would be signposted such as Bulli Town Centre, Woonona Town Centre, Bulli Beach, Woonona Beach etc.

Street names would be signposted. At overpass structures they would be integrated within the superstructure's depth. In no case would signs be located on parapets, railings, screens etc.

Signage for traffic management such as speed limits, warning signs etc would be posted at key locations assuring good visibility for road users. The overall location of signage would be carefully considered and coordinated so as not to act as visual deterrents. Major signage that is located over the carriageway would be kept clear from other major infrastructure elements such as overpass structures. This would provide a better visual setting and avoid creating a cluttered effect of road components.

Signage would be kept away from vegetation so as to minimise potential visibility conflicts in the future which create maintenance problems.

The introduction of smart poles that integrate traffic signals, management signage and other elements would be pursued in order to minimise the cluttered effect created by these components.

Examples of locations with specific signposting include:

- Turn-off signs at the northern end of the route to Wollongong CBD, beaches, etc;
- Beach access at Park Road southbound;
- Industrial estate at Watts Lane;
- Industrial estate and beaches at Bellambi Lane;
- Hospital, schools, shops and beaches at Doris Avenue and Campbell Street northbound; and
- Hospital, schools, shops, northern suburbs and Sydney at Princes Highway northbound.

6.5 Design Themes

Concept design themes for specific sections along the route are outlined below and would be reviewed in the detailed design phase of the project:

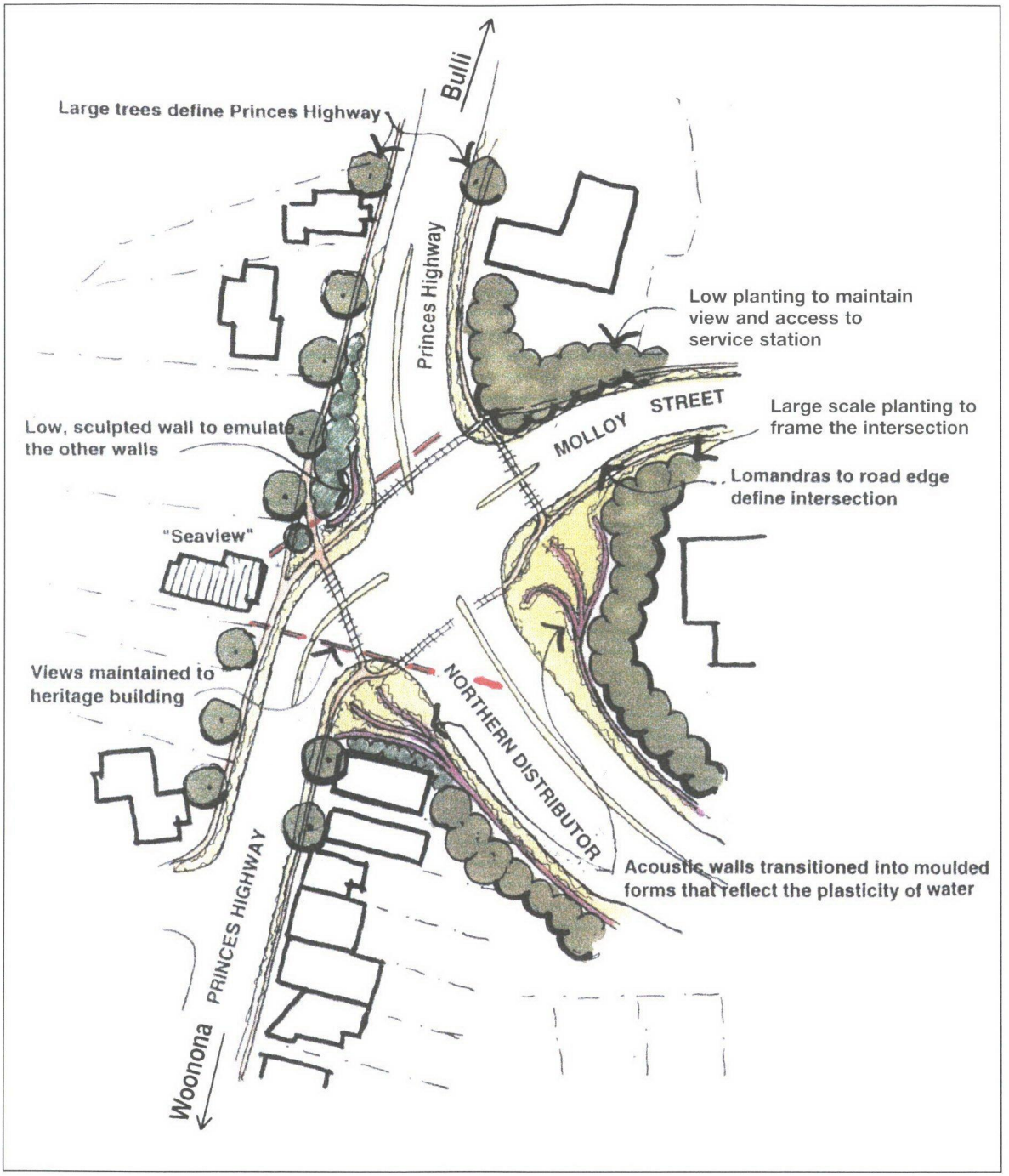
- Princes Highway/NDE
- Farrell Road/NDE
- Vicinity of Russell Street
- Vicinity of Campbell Street,
- Vicinity of Gray Street,
- Vicinity of Doris Avenue,

Princes Highway/NDE Intersection

This major entry onto the proposed NDE from the Princes Highway needs to be visually and spatially strong in the urban context **(Figure 6.12 refers)**. It would form the major "Gateway" onto the proposed NDE, but would require high noise attenuation requirements. It is proposed to integrate the sound barriers with a gateway treatment by sculpting the sound barriers as a visual feature to mark this location. This gateway treatment would also provide the opportunity to signal the entrance to Bulli and Woonona town centres.

The overriding character would reflect the local indigenous landscape character, with emphasis on a beach/coastal theme. The perspective shows how the design of the high sound walls reflects the curve of the waves of the beach, whilst the material finishes, panelling design and signage on the walls reflect the industrial nature of Wollongong.

Figure 6.12: Intersection of the NDE and the Princes Highway



Source: Infranet/Kiah Environmental Designers

Farrell Road Overpass, Roundabout and Adjacent Open Space

Key elements of this section of the EIS Proposal include **(Figure 6.13 refers)**:

- pedestrian overpass at Farrell Road;
- integration of ramps and stairs for overpass with sound attenuation elements;
- terraced seating area on Farrell Road west to compliment the streetscape character and reduce apparent height of sound attenuation elements; and
- incorporation of a roundabout at Farrell Road and Thompson Street to enhance street safety.

This area would become prominent to both pedestrians and to local vehicular traffic. As a result, it is proposed to carefully integrate the pedestrian overpass, the roundabout and the adjacent open space as a visual accent that is pleasant for the different user groups. Detailing of soft and hard surfaces would emphasise a slow speed environment for both pedestrian and vehicular traffic approaching the roundabout. The overpass ramps and stairs on the east side of Farrell Road would be positioned to avoid blocking potential views towards the escarpment for northbound travellers along the proposed NDE while also maintaining an open landscape character towards the local streetscape.

In Farrell Road west, the residual open space between the proposed NDE and the local residences would be treated as formal urban space due to its confined character. It is proposed to introduce small terraces to visually mitigate the height appearance of the noise walls. These terraces could be provided with benches as well as landscaping in a Victorian character fitting to the local streetscape. It is proposed to introduce native species that emulate a Victorian landscape character, rather than use exotic/Victorian style plants in the public domain due to the high maintenance cost.

Care has been taken to integrate the different road side elements so that there is a flow and continuity in the design language. Sound walls become retaining structures for the pedestrian overpass and so become the bridge abutment and then continue as part of the ramp structure. Ramps are articulated by introducing seating areas in order to break their length. The planting of climbers along the walls would 'soften' their appearance and minimise graffiti surfaces.

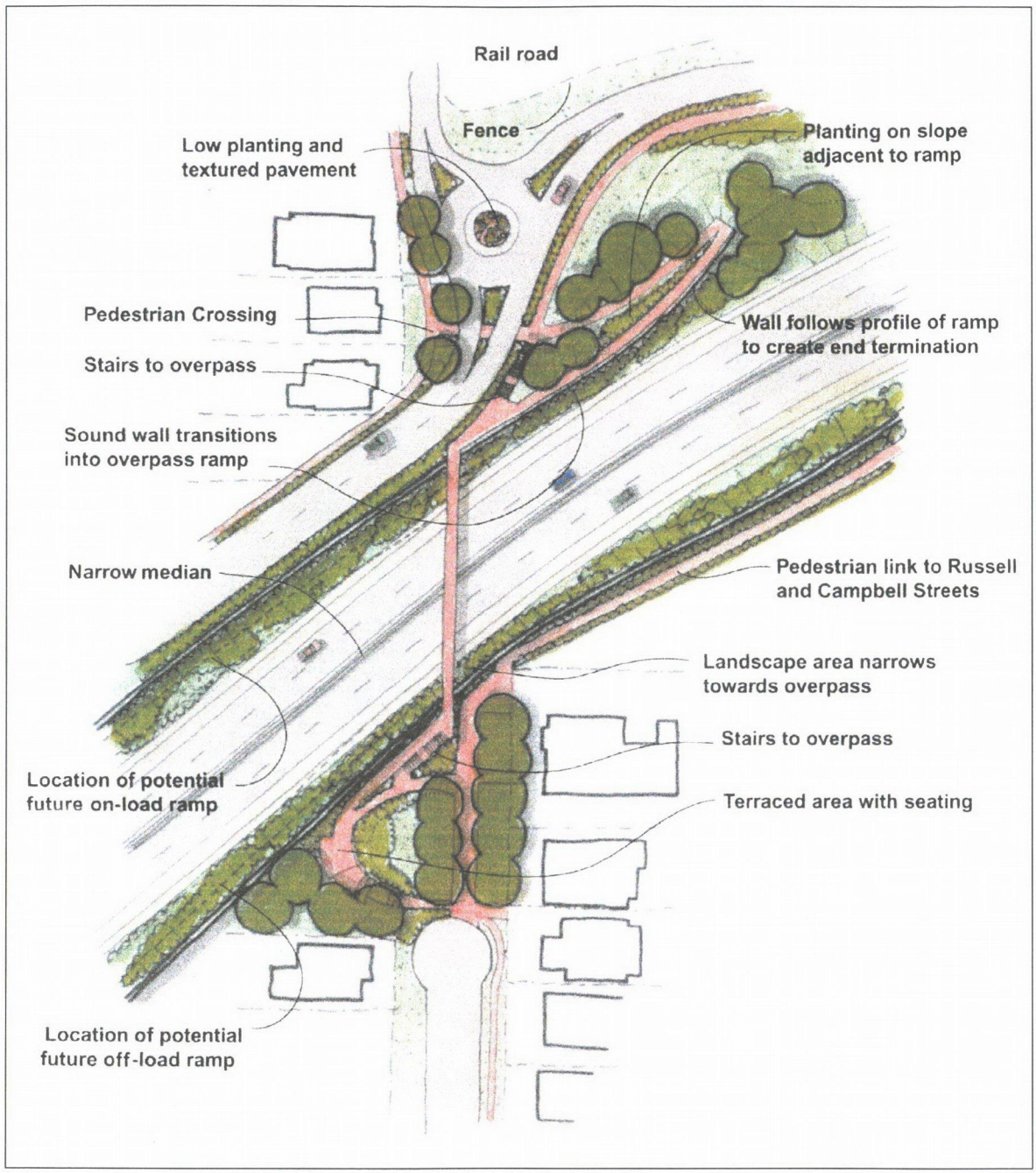
Significant Cut at Russell Street

Key elements of the EIS Proposal include:

- a road cutting between Russell Street and Campbell Street;
- retention of the majority of existing trees. An accurate survey would be required to determine the location of the mature eucalypts adjacent Thompson Street;
- a security fence integrated with the existing trees and new landscape on top of the cut;
- a narrow median to reduce the width of cut; and
- a retaining wall to reduce the width of the cut.

This area is both visually exposed, particularly when travelling in a northbound direction, and visually significant because it is a densely vegetated skyline ridge. It is desirable to minimise the cut width in order to retain as many of the mature trees along this area as possible.

Figure 6.13: Proposed Landscape Concept at Farrell Road and the NDE



Source: Infranet/Kiah Environmental Designers

By reducing the vertical extent of the cutting it is possible to minimise the visual impact and reduce its width.

The proposed cut is approximately 6 metres high at the ridge, and due to the unstable nature of the material, it is proposed to introduce retaining walls in order to further minimise the extent of the cut. Depending on the height, one of the most economical ways of treating these is with "shotcrete" as the stabilising material to the batter.

There are several possible treatments that could be used including:

- cast the shotcrete to resemble the sound walls;
- introduce precast concrete panels in front of the shotcrete; or
- introduce a wire mesh in front of the shotcrete filled with sandstone rocks to resemble the escarpment.

Climbers could be planted at the top of the cutting to visually aid in integrating the walls with the surrounding landscape. The exact height of the retaining wall would need to be determined in the detailed design phase after an assessment is carried out of the potential number of trees that can be saved. Its height would depend on the amount of trees that can be saved in relation to the costing of such a structure. Batters with a 2 to 1 slope would be introduced and densely landscaped to complement the setting.

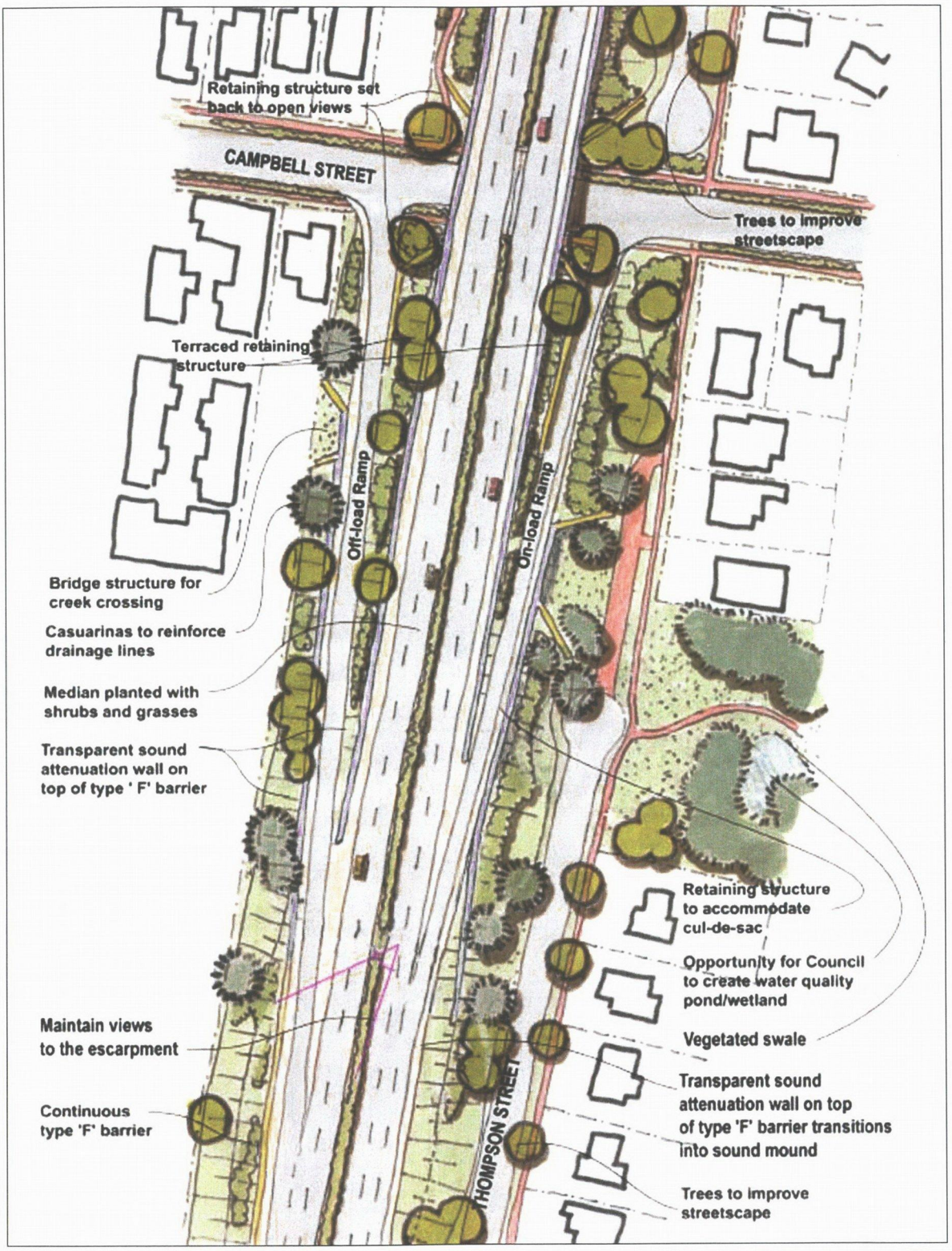
Campbell Street/NDE Intersection

A grade separated intersection has been proposed at this location by allowing Campbell Street to run beneath the proposed NDE **(Figure 6.14 refers)**. This provides a strong functional and visual continuity of Campbell Street underneath the proposed NDE and would enhance this important east-west link for the community.

The overpass would require the vertical alignment of the proposed NDE to be located on fill south of the intersection. However, the visual impacts are limited compared with an at grade intersection. This is because an at grade intersection would require a larger footprint of the intersection versus a grade separated one, excluding the ramps. As a consequence the horizontal alignment would be closer to private properties. In addition, an at grade intersection would still require some fill south of the intersection, which, combined with the necessary sound attenuation on the eastern side of 3m versus 1.5m for a grade separated intersection, limits its benefits.

The sound attenuation runs as prefabricated panels from the cut north of Campbell Street and extends up to approximately chainage 4010, where the main carriageway meets the nosing of the on-load/off-load ramps. These panels would run directly adjacent to the road mounted on top of type "F" kerbs. This would articulate the height of the walls while also integrating other necessary roadside furniture. It is proposed as a mitigating measure to introduce transparent panels providing a more open feeling and improving views to the escarpment for residents on Thompson Street.

Figure 6.14: Grade Separated Intersection at Campbell Street



Source: Infranet/Kiah Environmental Designers

The on-load/off-load ramps would also require sound barriers. The western side would require a height of 1.5m from station 3950 to approximately station 4060 where it meets the main carriageway. The east side requires 1.5m high sound walls from station 3960 to about 4020. To the south of station 4020, the design proposes the introduction of 2m high sound mounds between the proposed NDE and Thompson Street.

On the western side of the corridor sound mounds with a height between 2.5m and 3.5m are proposed. In order to provide more gentle slopes and introduce sound attenuation walls where the corridor is limited in width for mounding, the type 'F' barriers are proposed as continuous elements on the western side of the corridor in a southern direction. The introduction of transparent panels as a mitigating measure is desirable in order to maintain the open feeling of the setting as well as retaining as much as possible the views to the escarpment while reducing the apparent height of the wall.

Thompson Street would be converted into a cul-de-sac configuration that would eliminate through traffic for the local residents. In addition, this configuration would also provide an improved connectivity for the potential pedestrian link along the reserve.

Key Elements of the EIS Proposal include:

- Introducing retaining walls parallel and along the proposed NDE in the vicinity of the overpass, allowing for more open views and gentler slopes of the embankment at critical locations;
- Setting back the retaining walls at a 45 degree angle to the overpass along Campbell Street, creating a more spacious entry to the underpass, more open views and provides a planting buffer to the structure;
- Introducing a minimum 3m wide median along the proposed NDE to allow for landscaping;

NDE Overpass at Campbell Street.

- Providing *Brifen Barrier* to maximise exposure of landscaping along the median and to maintain open views of the corridor; and
- Considering introduction of transparent sound attenuation barriers as a mitigating measure to reduce visual impact of barriers and maintain views out from the road.

Park Road/Gray Street Overpass

Key elements of the EIS Proposal include **(Figure 6.15 refers)**:

- overpass at Park Road to provide good local urban connectivity;
- retaining walls to integrate with abutments for overpass; and
- maintaining a landscaped buffer to properties at Thompson Street.

The superstructure of the overpass would be maintained as shallow as possible by use of a central pier supporting the bridge to minimise any additional cutting requirements.

A single span is slightly more desirable than one with a central pier, due to the improved visual permeability towards the escarpment and other significant ridgelines, particularly when travelling in a northbound direction. However, the general enclosed character of the setting provides limited visual permeability and the additional costs and impacts do not seem to justify such an undertaking. Instead, the visual restriction provided by the cutting and the overpass can also perform as a threshold to a new visual catchment with prominent views and hence increase the awareness and travel sequence of the road user.

Area South of Park Road

The cut at Park Road reduces the need for sound attenuation walls and provides a good spatial transition to the overpass at Park Road.

Doris Avenue/Alice Street Intersection

With the introduction of a signalised intersection, this area would become visually more prominent to "through" traffic as well as local traffic, including pedestrians **(Figure 6.16 refers)**. As a consequence, the opportunity exists to reinforce the natural creek setting as part of an accent feature that performs a minor gateway function for the local community.

The entry into Doris Avenue off the Distributor needs to create an identifiable character for the local neighbourhood. The signage wall entry is integrated with the acoustic mounding and the indigenous creek vegetation (Casuarinas) would provide strong landscape character definition to this major creek crossing.

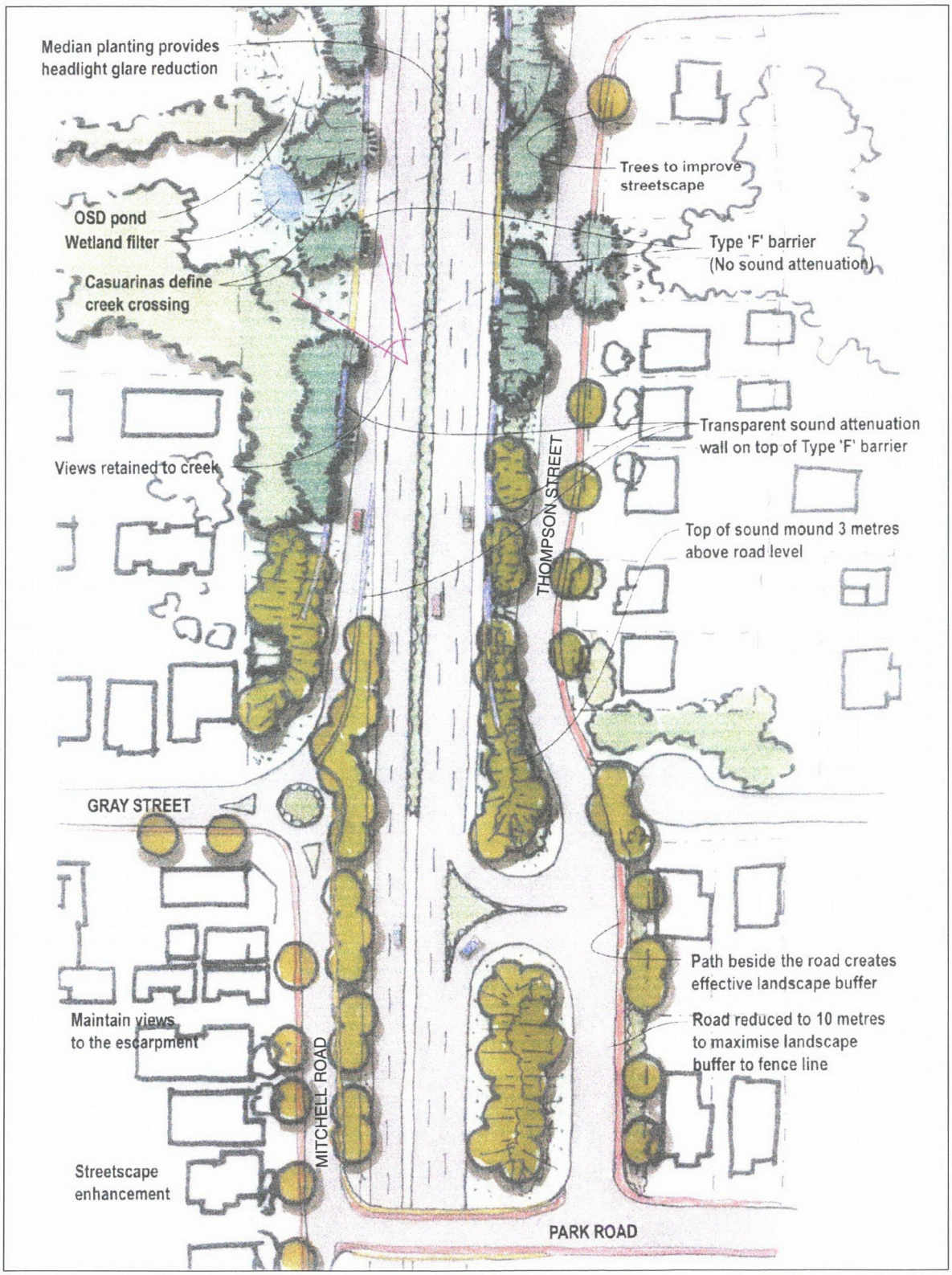
6.6 Landscaping

The proposed NDE corridor would be fully landscaped on both sides using a mixture of native grasses, shrubs and trees. Main landscape design themes for parts of the EIS Proposal are outlined below.

Cultural Heritage

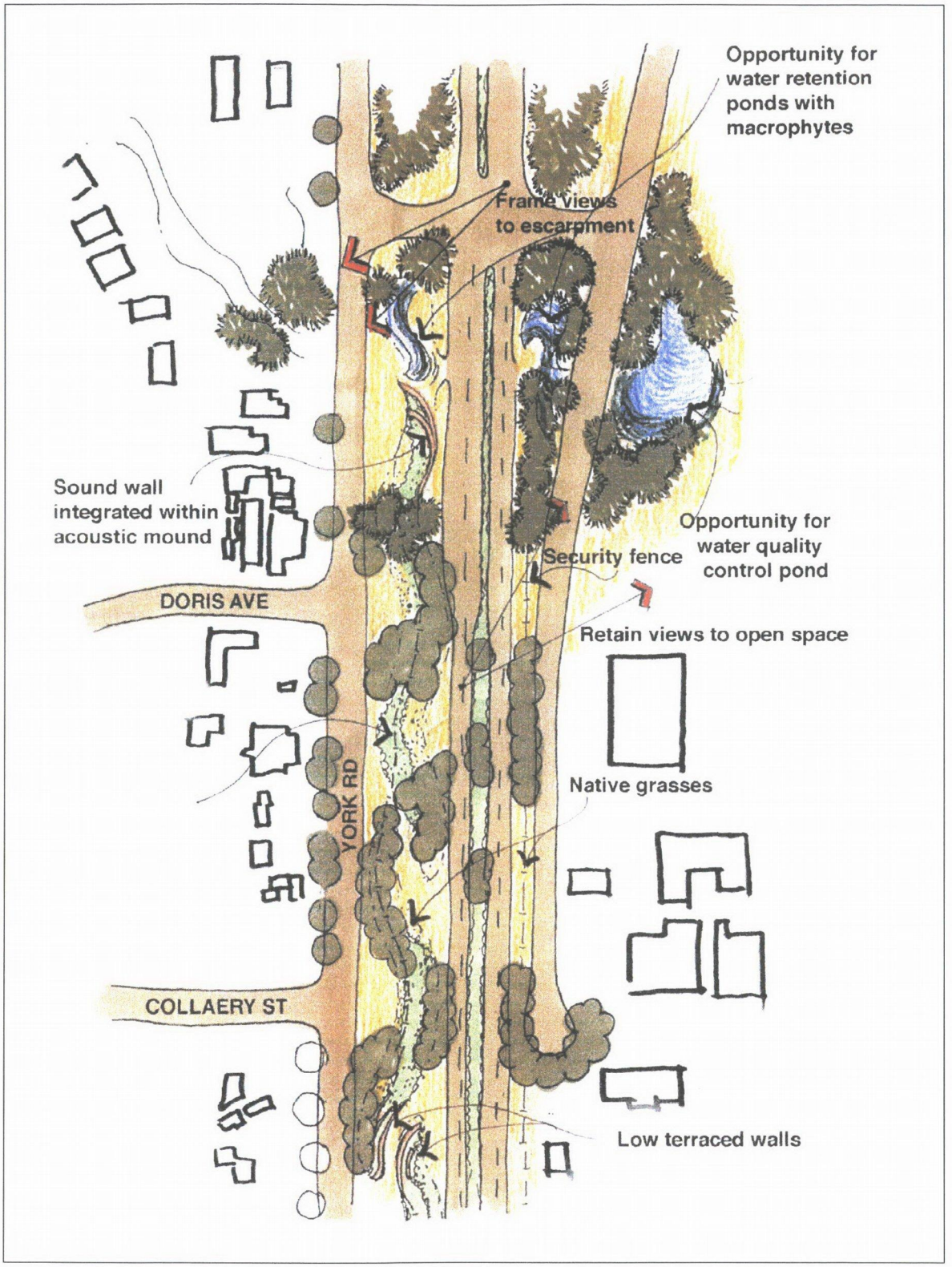
This area surrounds the proposed NDE/Princes Highway junction. The heritage character of the houses along Farrell Road, and the remaining buildings with cultural heritage value along the Highway provide visual references to this area.

Figure 6.15: Proposed Design Concept in the Vicinity of Gray Street and Park Road



Source: Infranet/Kiah Environmental Designers

Figure 6.16: Proposed Landscape Concept in the Vicinity of Doris Avenue



Source: Infranet/Kiah Environmental Designers

The main entry into the proposed NDE should maintain the indigenous landscape character of the overall setting and the streetscapes of Farrell Road could reflect a cultural heritage theme.

The Hills

These are the higher northern areas of the site which encompass skyline ridges between Campbell and Russell Streets, along Hopetoun Street and the eastern section of Farrell Road. The landscape theme for these areas should reflect the indigenous species typical to this elevation and microclimate. Examples include:

Acacia binervata
Acacia maidenii
Acacia mearnsii
Acacia melanoxylon
Eucalyptus globoidea
Eucalyptus longifolia
Eucalyptus maculata
Eucalyptus paniculata
Eucalytpus pilularis
Melaleuca decora
Melaleuca linariifolia
Melaleucs stypheliodes

Beach/Coastal

These areas offer the opportunity to reinforce the beach connection, in an east/west direction. Campbell Street and the Gray Street/Park Road connection would provide direct east/west links for vehicles, pedestrians and cyclists to the beach/coast line. There is potential to reinforce this coastal theme through the design of acoustic walls, urban design elements and landscape themes, especially with plants. Examples of appropriate species include:

Acacia maidenii
Allocasuarina littoralis
Angophora floribunda
Banksia integrifolia
Banksia serrata
Casuarina glauca
Elaeocarpus reticulatus
Eucalyptus botryoides
Eucalyptus robusta
Eucalytpus tereticornis
Leptospermum laevigatum
Melaleuca stypheliodes
Myoporum acuminatium
Pittosporum undulatum

Creek/Riverine

These areas cover the creek crossings, in particular Collins Creek and Farrahars Creek, and the smaller intermittent creeks to the south. The proposed landscape theme at these crossings, and for the areas extending along the drainage lines and creeks, is to reinforce the riverine character.

Acmena excelsa
Backhousia myrtifolia
Casuarina cunninghamiana
Ficus macrophylla
Ficus obliqua
Livistonia australis
Pittosporum undulatum
Lomandra species
Dianella species

Wetland/Estuary

These areas encompass the creeks and drainage lines in the lower part of the site, to the south, where the original estuary into the ocean would have been. Most of the land to the east has now been filled for residential development. There is great opportunity for the landscape design to reinforce the estuarine character, both adjacent to the proposed NDE corridor and to the east. Wetlands and retention ponds in this area would help clean the stormwater before it enters the ocean. These ideas would need to be discussed with Council at the later design stage.

Examples of plant species include:

Acacia maidenii
Allocasuarina littoralis
Angophora floribunda
Banksia integrifolia
Banksia serrata
Casuarina glauca
Eucalyptus paniculata
Leptospermum laevigatum
Wetland plants around ponding areas

6.7 Land Acquisition and Property Boundary Adjustments

The general corridor for the Northern Distributor Extension has been established for over 60 years. The corridor has been shown on planning instruments since 1968. The current arterial road reservation was first shown on LEP38 in 1984. Details of land acquisition are contained in **Working Paper 1**.

The current proposal requires whole or partial acquisition of another 28 properties. Ten of these properties are not zoned for arterial road. Included within the properties proposed to be acquired are 9 residences and one combined commercial/residential building.

All road boundaries required for the proposed NDE would be controlled access. All others for local road connections and accesses would be normal road boundaries. Additional boundaries required outside the current LEP are shown in **Table 6.4**.

The current proposal does not require acquisition of 5 properties (excluding those in RTA ownership) that are zoned for arterial roaduses.

Land to be acquired for the EIS Proposal would be acquired in accordance with the *Land Acquisition (Just Terms Compensation) Act, 1991*. The RTA's Land Acquisitions Policy Statement reflects the procedures stipulated by the Act. The policy sets out the procedures for partial acquisition and the special conditions, which apply to acquisition, compulsory acquisition and hardship acquisition.

The RTA would be responsible for adjustment of improvements to the new road boundary. Adjustments may include the reconstruction of fences, driveways, landscaping and the relocation of utilities. However, each acquisition would be subject to negotiations with the property owner. The negotiated agreement would supersede anything that may be indicated in this EIS regarding that acquisition.

After construction any surplus properties would be identified and assessed for disposal in accordance with government policy. The RTA would assess each property on its merits to determine a suitable end use.

Table 6.4: Land Acquisition

Location	Required Action
Corner of Shell Service Station at Molloy Street	Required for temporary connection back to the existing highway
Lot 1 DP 193919	Veterinary Clinic. Required for temporary connection back to the existing highway.
Lot 11 Rixon Ave	Required for connection to Farrell Road.
Lots 6 & 8 Farrell Road	(RTA owned) — Required for connection to Farrell Road.
Lot 7 Farrell Road	Required for connection to Farrell Road.
Lot 30 Campbell Street	(RTA owned) — Required for off-load ramp.
Lot 51 Campbell Street	(RTA owned) — Required for off-load ramp.
DP 38497 — Corner Thompson and Gray Streets	(RTA owned) — Required for OSD and Sed/Spill traps.
Lot 24 Kialoa Road	Acquisition of residential property — Required for Thompson Street connection to Park Road.
Lots 3 & 4 Park Road	Acquisition of two residential properties — Required for Thompson Street connection to Park Road.
Lot 7 Mitchell Road	Acquisition of residential property — End of access requires three point turn.
Lots 90, 91 & 92 Cotterill Ave	Creek area — Required to contain fill batter.
Lot 1 DP 243946	Light industrial area east of Alice Street — Required for service road.
Lot 2 DP 624800	Wollongong City Works Depot — Required for cul-de-sac.
Lot 1 DP 217179	Reserve at southern end of York Road on the western side — Required for cul-de-sac.

Source: RTA (Working Paper 1)

6.8 Construction Activities

6.8.1 Materials

The project envisages reuse of some materials obtained locally from the site (eg. rock and soil from excavation works; mulched landscape materials) as well as use of imported materials from other parts of the Illawarra.

6.8.2 Site Compounds

The contractor(s) for the project would require one or more site compounds along the route for the following uses:

- Offices and meeting rooms for site personnel;
- Reception and general administration area;
- Amenity and first aid facilities;
- Storage for light equipment and tools;
- Material storage areas; and
- Communication facilities and parking areas.

These facilities would require connection to electricity and communications networks and water supply, as well as appropriate stormwater management measures. Fencing with security points to control access would enclose the site compounds. Appropriate security lighting would also be required around the compound.

An examination of the EIS Proposal corridor has identified four suitable sites for the establishment of associated infrastructure:

1 Vacant land between Hopetoun Road and Farrell Road between the proposed corridor and railway;

2 Land west of the corridor associated with Woonona High School, between Collins Creek and Campbell Street;

3 Land situated between York Road and proposed corridor opposite RTA Bellambi District Works Office; and

4 Bellambi District Works Office.

At this stage the most likely site for the works compound is site 1. Bellambi District Works Office could also be utilised.

There would not be any on site batch plants required during construction. Diesel fuel is not expected to be stored on site. Fuel supply for the construction equipment would be delivered by tankers. Storage of hazardous or other inflammable goods required for construction would occur in a bunded area, constructed to the approved design standard for fire safety.

Traffic light, street lighting and Variable Message Signs (VMS) requirements would be determined at the detailed design stage. Connection points for these services would also be determined at this stage.

The RTA has a commitment to limit the environmental impact in all its operations including site compounds in accordance with its Environment Policy Statement (February 2001).

Location guidelines for site compounds include:

- More than 50m from waterways;
- Sites with low conservation significance for flora, fauna and indigenous and non-indigenous heritage;
- Sites requiring no substantial clearing of native vegetation would be required;
- Liaison with service providers to determine the need for any disruption to services resulting from the construction process. Any parties affected by service disruptions would also be notified.;
- Where required, temporary noise barriers would also be erected around the compound to mitigate noise generated from the compound. Noise from the compound site located between would need to be monitored due to the proximity of nearby residences;
- Street lighting and VMS systems would be assessed for energy conservation and life cycle, and alternative fuel sources would be investigated; and
- Operational lighting for the EIS Proposal would be designed to minimise impacts on nearby residents.

Where required, temporary noise barriers would also be erected around the compound to mitigate noise generated from the compound. Noise from the compound site would need to be monitored due to the proximity of nearby residences. Of particular concern are houses near the proposed compound site.

Operational impacts of associated infrastructure such as lighting and signage relate to the use of non-renewable resources on and off site. It is not anticipated that the EIS Proposal would deplete any resources that are currently or likely to be in short supply. Street lighting and VMS systems would be assessed for energy conservation and life cycle, and alternative fuel sources would be investigated.

6.8.3 Staging and Construction Period

The EIS Proposal would take approximately 18-24 months to construct depending upon weather and other contingencies. Most of the project can be completed without disruption to existing traffic flow because of the location of the alignment running parallel to existing roads. It would also be possible to work on several parts of the route simultaneously.

The work is generally adjacent to the local road system but some staged work would be necessary at the tie-ins at each end of the proposed NDE, and at the crossings of Farrell Road, Campbell Street and Park Road.

Prior to severing Farrell Road, the connection to Molloy Street via Rixon Avenue would need to be constructed together with the roundabout at Thompson Street.

6.8.4 Public Utilities

Utility modifications would generally involve the excavation of trenches, installation of conduits, pipes and the construction of service access pits. The modifications may also involve the relocation of street lighting and overhead services. Consideration may need to be given to relocating the existing aerial services to below ground. Liaison with service providers would occur to determine the need for any disruption to services resulting from the construction process. Any parties affected by service disruptions would also be notified.

Houses to be demolished are assumed to have connection to gas, water, electricity and telephone services. These services would need to be surveyed and decommissioned before the commencement of works. The Contractors Environmental Management Plan (CEMP) would address environmental issues regarding the decommissioning of these services.

The contractor would carry out a detailed survey and identify all utilities affected prior to the commencement of construction. Modifications to the affected utilities would be in accordance with the design and construction methods approved by the relevant service authorities.

6.9 Cost Estimates

The current project cost estimate for the EIS Proposal is $58 million including land acquisition and construction works. (Refer to **Working Paper 1**).

The approximate breakdown of total project cost elements are summarised in **Table 6.5**:

Table 6.5: Indicative Project Costs

Item	Percentage
Project Development	4%
Property Acquisition	17%
Publication Utility Relocation	7%
Detail Investigation and Design	2%
Construction Cost	68%
Total Handing Over of Project	2%
Total	**100%**

Source: RTA (Working Paper 1)

7. Transport and Traffic Impacts

This section describes the current transport and traffic conditions in the study area and makes an assessment of the impact of the EIS Proposal on this transport system.

Working Paper 3 by Forbes Rigby and Gabites Porter provides details of the transport and traffic impacts and background information.

7.1 Existing Conditions

7.1.1 Strategic Context

Movement of people and goods occurs through and within the study area, reflecting its strategic location in the narrow coastal plain north of Wollongong CBD, and the mixture of land uses within and adjacent to the area. Access to and from Bulli pass as an alternative route to Sydney is an important determinant of traffic movement through the study area, as is the daily commuter flows from suburbs north of Bulli. There are also substantial east west movements within the study area reflecting desire lines from the local community to access schools, shops, community facilities, local employment and recreation.

Figure 7.1 shows the volume of traffic on the regional road network. **Figure 7.2** shows current traffic volumes on the local road network in the study area. **Figure 7.3** shows the local network of roads and key traffic generators.

The **Princes Highway** is a state highway and the major arterial road in the study area. The section between Bellambi Lane and Bulli is a four-lane undivided urban road. Shopping development is located along both sides of the Highway in the suburbs of Woonona and Bulli. Parking is permitted on both sides in kerb lanes during off-peak hours. During peak periods, a clearway is enforced on this section of the Highway.

The **Northern Distributor** is another state arterial road parallel to the Princes Highway in the study area, between Flinders Street interchange and Bellambi Lane. It is a four-lane divided urban road, and was progressively opened to traffic between October 1990 and May 1993. The section between Towradgi Road and Bellambi Lane has traffic signals at major local roads to provide access.

Bellambi Lane is a four-lane undivided urban road. It currently functions primarily as the link between the north end of the Northern Distributor and the Princes Highway.

York Road, Mitchell Road, Thompson Street, Pioneer Drive, Gray Street, Park Road, Campbell Street and Farrell Road are two-lane two-way local streets, also functioning as collector roads to a degree. In particular, York Road, Mitchell Road and Thompson Street carry a significant amount of north-south through traffic. Traffic on this route approaches sub-arterial road levels, due to the connection with the Northern Distributor at Bellambi Lane. This has resulted in safety and amenity concerns from the local community.

7.1.2 Existing Traffic Volumes

Traffic Counts

The existing traffic flows are summarised in **Figure 7.1** and **Figure 7.2**, as well as **Table 7.1**.

The Princes Highway carries the largest volume of traffic in the study area.

A number of local streets including York Road, Mitchell Road, Thompson Street, Pioneer Drive, Gray Street, Park Road, Campbell Street and Farrell Road also carry significant traffic volumes especially in peak times, but are only two-lane two-way local streets. Existing traffic volumes on these streets mean they function as local collector roads rather than local streets.

Table 7.1: Existing Traffic Flows

Location	Average Daily Traffic Flow (2000)
Mt Ousley Road	33,700
Bulli Pass	9,300
Princes Highway South of Lawrence Hargrave Drive	25,000
Princes Highway South of Hobart Street	24,000
Princes Highway South of Park Road, Bulli	20,000
Princes Highway North of Hillcrest Avenue	21,000
Princes Highway South of Stanhope Street	20,000
Princes Highway North of Bellambi Lane	23,000
York Road North of Bellambi Lane	14,100
Pioneer Drive North of Bellambi Lane	4,870
Thompson Street South of Campbell Street	10,640
Campbell Street East of Princes Highway	3,510
Campbell Street East of Robert Street	4,770
Campbell Street East of Thompson Street	2,780
Gray Street East of Princes Highway	1,280
Gray Street East of Sussex Street	3,290
Park Road East of Mitchell Road	5,570
Park Road West of Kulgoa Road	4,450
Collaery Road East of Princes Highway	1,760

Source: Forbes Rigby/Gabites Porter (Working Paper 3)

Local and Through Traffic

Results from a two-day origin-destination survey indicate that a significant proportion (up to 55%) of the traffic passes through the study area, especially in the peak directions, namely southbound traffic in the morning and northbound traffic in the evening.

Figure 7.1: Existing Regional Daily Traffic Flows (2002)

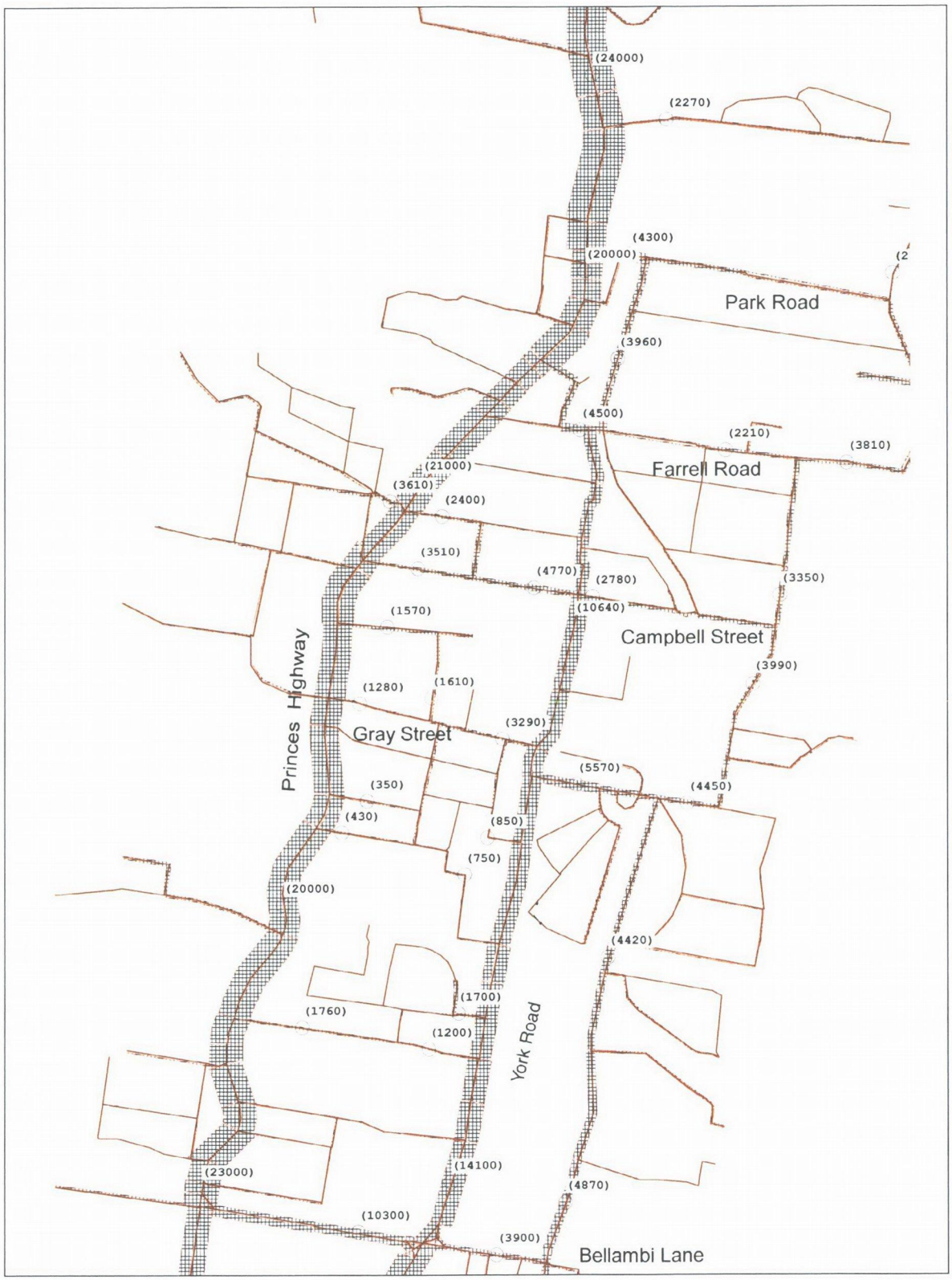
Legend

Traffic density

33700 — Average Annual Daily Traffic Flow

Source: Forbes Rigby/Gabites Porter

Figure 7.2: Existing Traffic Volumes (2002)



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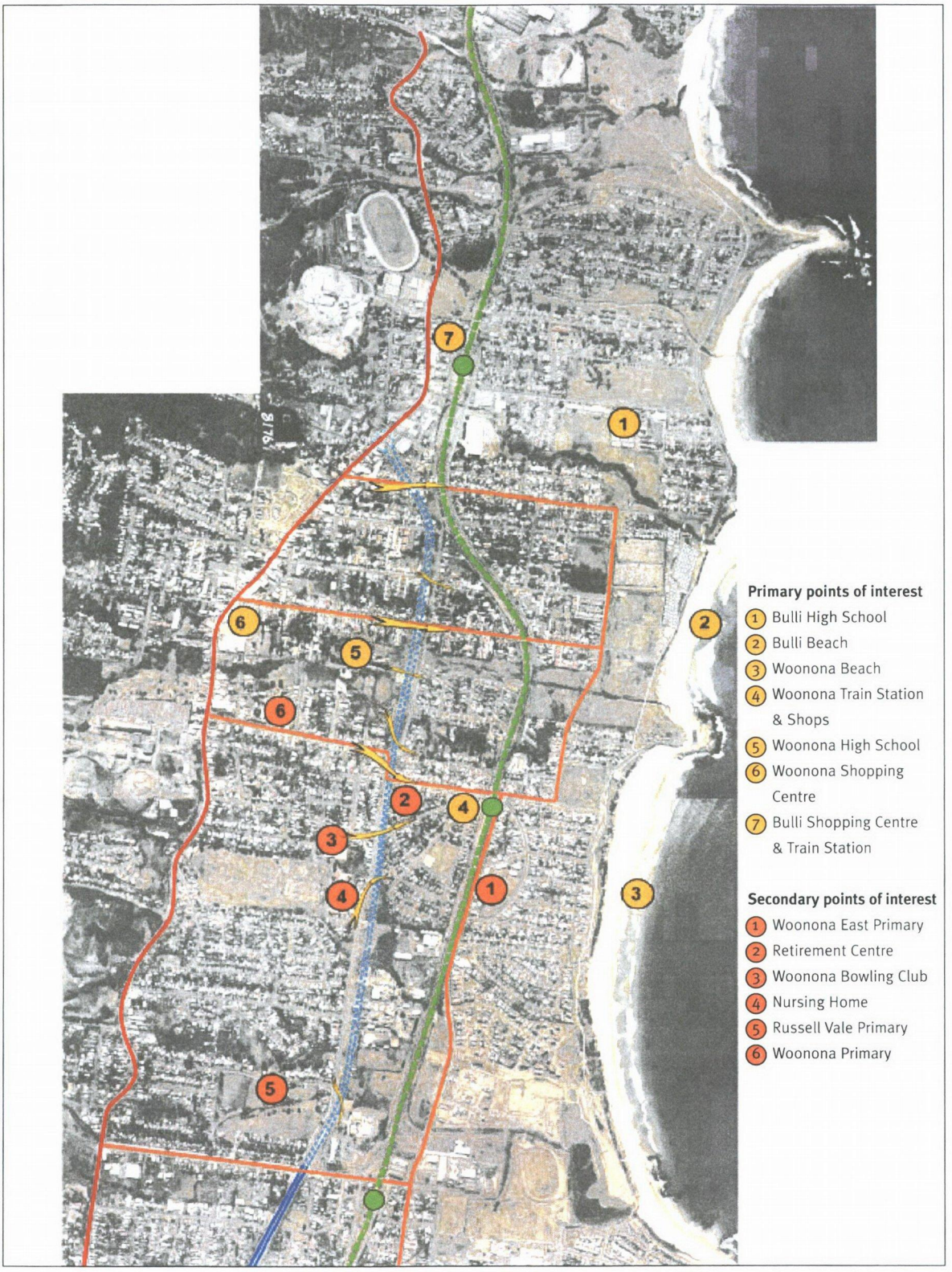
Traffic density

20,000 — Average Annual Daily Traffic Flow

Source: Forbes Rigby/Gabites Porter

Figure 7.3: Existing Local Road Network and Activity Nodes



Source: Infranet/Kiah

The Princes Highway attracts the bulk of the through traffic, though York Road is particularly attractive to southbound traffic in the morning peak. The majority of morning peak southbound traffic is from the north-western suburbs with very little commuter traffic coming in from Sydney. Conversely the majority of northbound traffic is commuter traffic to Sydney with a smaller number of through trips heading up Lawrence Hargrave Drive.

In the evening peak, 26% of through traffic travels to and from Sydney for both northbound and southbound traffic. This indicates an even mix of commuter traffic to and from Sydney unlike the morning peak. Though a considerable amount of through traffic continues past Bellambi Lane via Princes Highway, approximately 35% of southbound traffic switches from Princes Highway to the Northern Distributor and more than 50% of all through traffic makes the same switch in the northbound direction to avoid using York Road.

The extension of the Northern Distributor would most likely discourage this traffic from switching routes at Bellambi Lane. Far less traffic switches from York Road to Princes Highway. In these cases it is suggested that much of the through traffic may have a brief drop-off/pick-up stop in Bulli or Woonona.

7.1.3 Traffic Accident History

The existing Northern Distributor has a relatively low crash rate. The latest available 3-year period of accident data (1/1/1997 and 31/12/1999) in the area between Bellambi Lane and Bulli Pass/Lawrence Hargrave Drive indicates that there is a high concentration of accidents occurring at the following intersections:

- Princes Highway and Lawrence Hargrave Drive;
- Princes Highway and Bellambi Lane;
- Princes Highway and Point Street; and
- Campbell Street/Thompson Street.

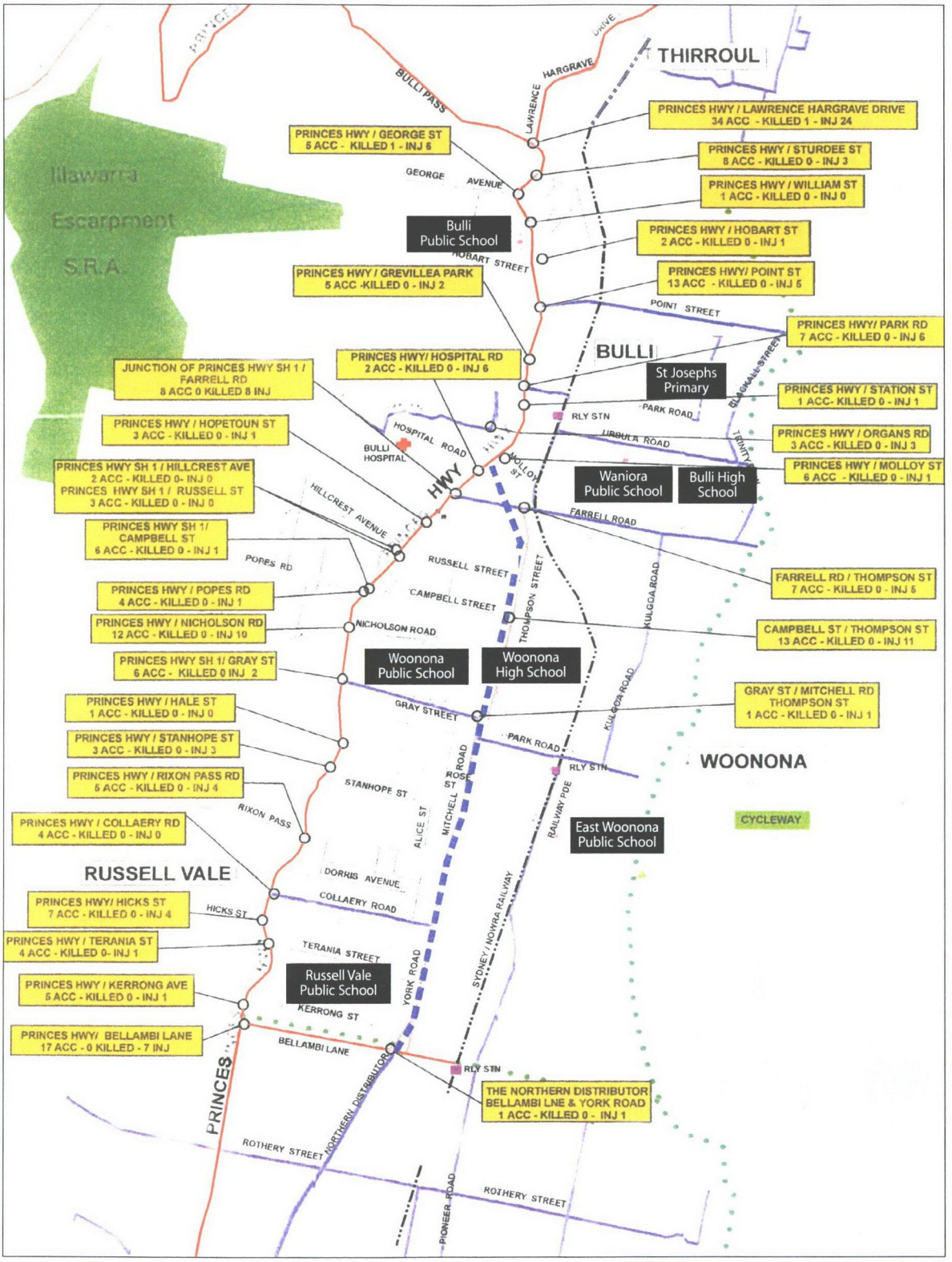
The highest frequency of accidents occurs along the Princes Highway between Bellambi Lane and Lawrence Hargrave Drive, reflecting the length of road, traffic volumes and number of intersections.

Figure 7.4 summarises recent accident statistics in the study area. A total of 199 accidents were reported for the study period. Of these accidents, 2 involved fatalities and 121 involved injuries. Note this data predated the pedestrian fatality at Hobart Street.

The EIS Proposal will create a new cul-de-sac at Farrell Road west.

A high concentration of accidents at the intersection of Thompson and Campbell Streets has been reported, due to the current poor intersection treatment, this is the cause of significant concern in the local community. Accidents at the intersection of Point Street and the Princes Highway are also a cause of some concern.

Figure 7.4: Traffic Accident Locations (1997–1999)



Source: Forbes Rigby/Gabites Porter

The RTA appraises vehicle accidents in terms of crash rates per 100 million vehicle kilometres travelled (100MVKT) and severity indices. The severity index is a means of attributing greater weight to more severe accidents at varying accident locations. The index devised by the RTA weights fatal accidents three times more than tow-away accidents, with intermediate weighting for injury accidents. Thus the lower the severity index, the better the performance for that section of the road.

Crash rates and severity indices have been calculated for road sections in the study area, as shown in **Table 7.2**. All road sections in the study area have crash rates and severity indices higher than the regional average figures for undivided roads.

Table 7.2: Crash Rates and Severity Indices (1/10/95 to 30/9/00)

Location	Total Crashes	People Killed	People Injured	Crash Rate per 100MVK	Severity Index
Princes Highway/ Bellambi Lane to Molloy Street*	173	1	97	131.08	1.21
Princes Highway/Molloy Street to Lawrence Hargrave Drive**	116	4	71	160.42	1.30
York Road***	25	0	12	108.82	1.22
Mitchell Road****	16	1	9	104.29	1.38
Thompson Road*****	46	0	36	437.03	1.28
Intersection of Thompson Street and Mitchell Road	4	0	3		1.38
Intersection of York Road and Mitchell Road	0	0	0		0.00
Intersection of York Road and Northern Distributor and Bellambi Lane	17	0	6		1.15
Intersection of Princes Highway and Molloy Street	4	0	1		1.13
Intersection of Princes Highway and Lawrence Hargrave Drive	45	0	34		1.26
1995–1997 Regional Average Undivided Road				**101**	**1.06**
1995–1997 Regional Average Divided Road				**68**	**1.16**

Source: Forbes Rigby/Gabites Porter (Working Paper 3)

Notes

* Includes intersection with Bellambi Lane and includes intersection with Molloy Street

** Excludes intersection with Molloy St and Excludes intersection with Lawrence Hargrave Drive

*** Includes intersection with Bellambi Lane and Northern Distributor

**** Includes intersection with Thompson Road

***** Includes intersection with Farrell Road

Thompson Street, Mitchell Road and the Princes Highway between Molloy Street and Lawrence Hargrave Drive have the highest severity indices. These locations, along with the section of the Princes Highway from Bellambi Lane to Molloy Street, have the highest crash rates.

Campbell Street and Farrell Road have the highest crash rates in the area, but relatively low severity indices. Bellambi Lane and Pioneer Drive/Railway Parade have the highest severity indices, although for the later the number of accidents is very small and includes a fatality.

7.1.4 Public Transport, Pedestrian and Bicycle Networks

The study area contains a good public transport network comprising rail and bus services, as well as extensive pedestrian and bicycle facilities. These networks are shown on **Figure 7.5 and 7.6**.

Trains

The Illawarra Railway Line links Sydney to Wollongong and Nowra along the South Coast. It runs through the study area immediately east of the Northern Distributor Extension route. As well as passenger services, the railway provides a freight transport link, mainly to Port Kembla. One of the most important transport tasks in the region is the movement of coal by rail (and to a lesser extent, road) through the region to Port Kembla.

There are three railway stations within or adjacent to the proposed NDE study area that are frequently used by local residents. Maintaining use of pedestrian and vehicular access between residential areas and the stations is an important objective for the proposed NDE.

Bus Network

The major bus operators include Dions Bus Service and Greens Northern Coaches.

There is a concentration of bus routes along the Princes Highway, together with a number of routes through local streets.

Bus routes in the region serve three main functions:

- Local, short distance public transport;
- Links between residential areas and railway stations; and
- Longer-distance services (to a much lesser extent).

Local bus services are dominant in the region, with the longer-distance role undertaken primarily by rail services. Bus routes tend to converge on routes leading to railway stations, while being relatively dispersed in residential areas further away from the stations.

Pedestrian and Bicycle Networks

The existing network of pedestrian and cycling facilities, as well as numbers of people using these facilities has been the subject of surveys and field observations for the EIS.The major local generators of cyclists and pedestrians include:

- Schools (Woonona High School, Bulli High School, Russell Vale Primary School, Woonona East Primary School, Woonona Primary School and Waniora Public School);
- Sporting and social clubs;

- Beaches at Bellambi and Woonona;
- Railway stations at Bellambi, Woonona and Bulli;
- Local shops, especially at Woonona, Bulli and The Circle;
- Parks and ovals;
- Churches; and
- Aged Care facilities.

Local streets accommodate some pedestrian and cycle movements. The formal pedestrian crossing facilities in the study area include:

- A pelican crossing in front of the RSL club on Princes Highway;
- A zebra crossing in front of Woonona High School on Thompson Street; and
- Intersection crossings at signalised intersections such as Russell Street/Princes Highway, Princes Highway/Bellambi Lane and Bellambi Lane/Northern Distributor intersections.

Existing cycle and pedestrian routes are slightly restricted by the railway line. However it is still reasonably convenient for pedestrians and cyclists to freely select their routes.

Currently pedestrian/cyclist access to Woonona High from east of the proposed NDE is from a variety of areas. Students are encouraged to cross Thompson Street at the pedestrian crossing near Kialoa Road, but informal student crossings occur throughout the current road system. The dominant area for crossings to occur is between Campbell Street and Rose Street. There is also local pick up and set down of children by parents and for school excursion and sports buses at the Thompson Street pedestrian crossing.

The railway station located along Railway Parade near Park Street is also a generator of pedestrian traffic. Rail commuters often use the intersection of Rose Street and Mitchell Road as a means of crossing from east to west.

Walking is more prominent for Woonona High School students than other modes of transport.

Pedestrian infrastructure within the study area consists primarily of the local street system augmented by some purpose-built cycle and pedestrian walks and an informal structure of trails through vacant public and private lands.

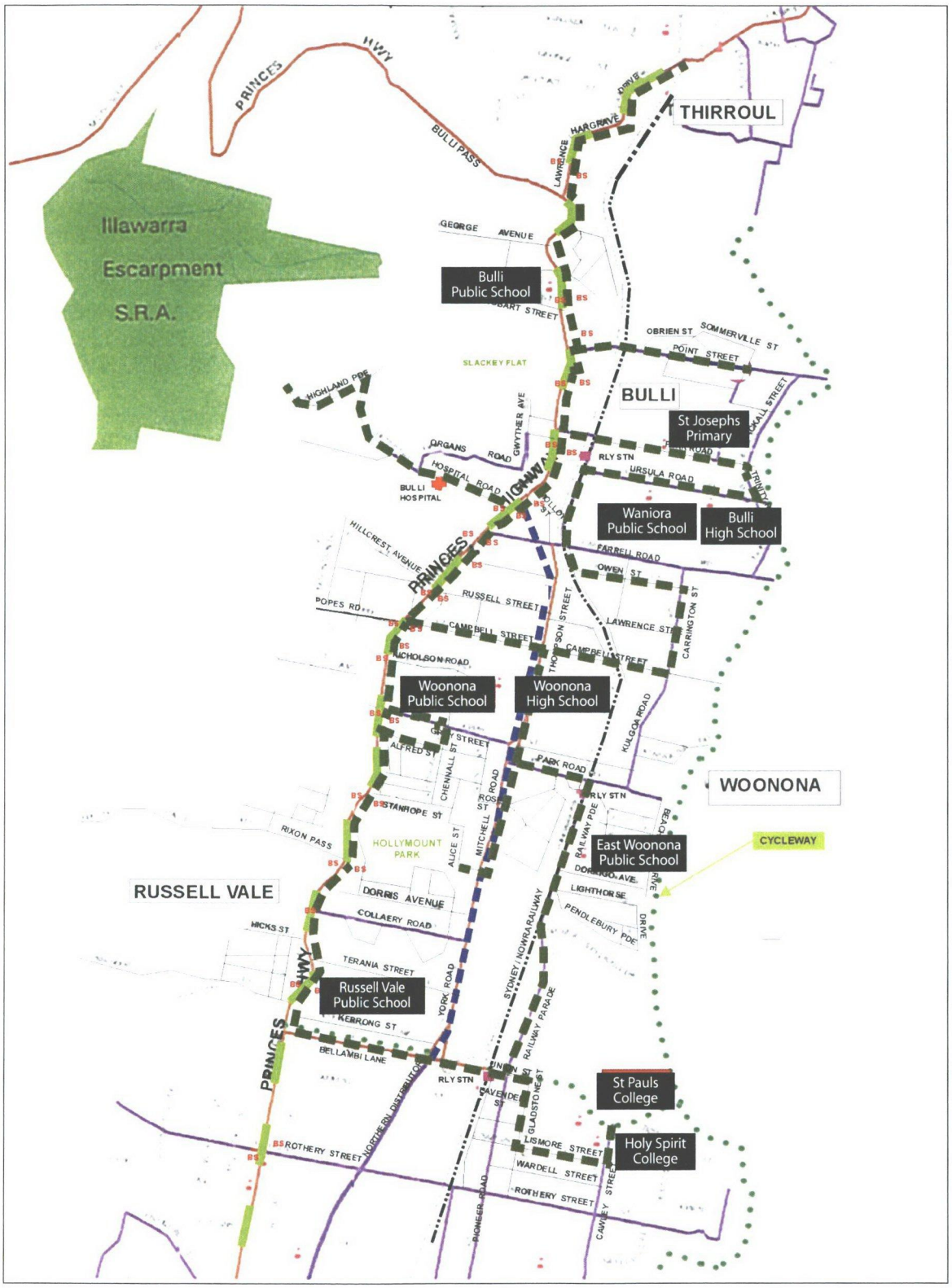
There is evidence of extensive bicycle usage in the study area for work, school and leisure use.

The Wollongong City Council Cycleway Plan (1994) lists the following roads as cycle routes in the vicinity of the study area:

Major roads:

- Bellambi Lane between Northern Distributor and Francis Street;
- Pioneer Drive;
- York Road and Mitchell Road;
- Davidson Avenue, Rose Street and John Street to Woonona High School; and
- Cooper Avenue to Woonona High School and then Nicholson Street.

Figure 7.5: Northern Bus Routes — Greens



Legend

- Green's Northern Bus Service – North suburbs general services
- Green's Northern Bus Service – School services
- BS Bus Stops

Source: Forbes Rigby/Gabites Porter

Major footpaths include:

- Cooper Avenue to Woonona High School and then Nicholson Street;
- Bellambi Lane between Northern Distributor and Princes Highway; and
- Princes Highway between Bellambi Lane and Nimbin Street, and between Nicholson Street and Campbell Street.

Much of the Hollymount Estate area (e.g. Terania Street, Collaery Street and Doris Avenue) is well used by cyclists.

7.1.5 Parking

The study examined parking supply and demand along the Princes Highway through both Woonona and Bulli shopping centres. Within this general section of the Highway there are a variety of parking restrictions including peak-period clearways, full time or part time "No Standing" provisions, bus zones, "No Stopping" provisions and statutory restrictions at intersections.

Highway parking restrictions apply to both Woonona and Bulli shopping centres. Traders and customers in each centre are concerned about the lack of street parking and the impact of growing traffic congestion especially from through traffic. Both centres appear to have adequate off-street parking.

7.1.6 Summary

Within the study area the main journeys are made by local residents travelling to or from their homes and trip attractions such as local shops, schools, railway stations, local employment centres, the beach, cycle-ways, playing fields or the local licensed clubs for recreation purposes.

Local residents as well as commuters and other vehicles use the Princes Highway and local street network for journeys through the area.

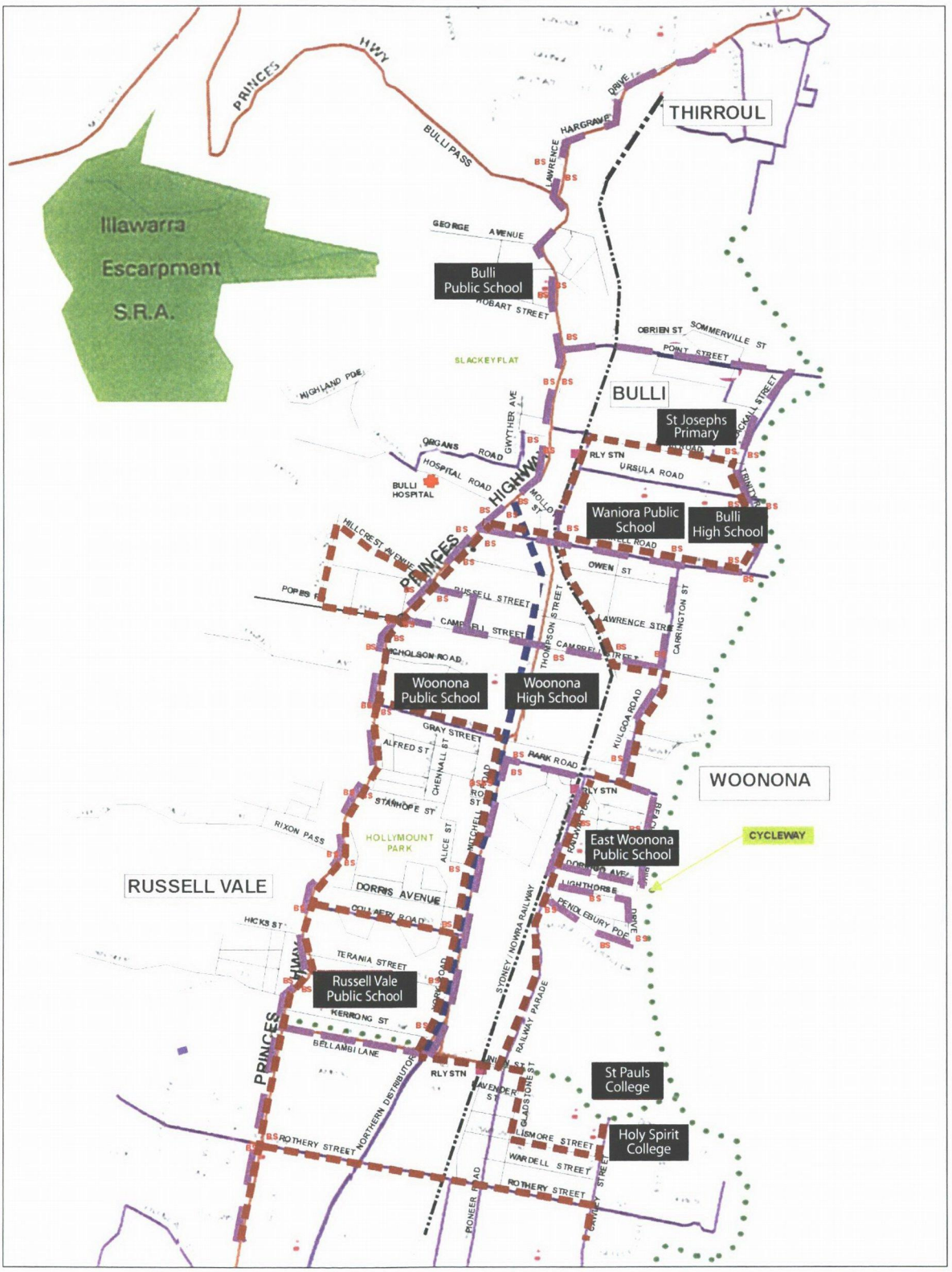
The most frequently raised transport issues during community consultation were:

- The need to provide for safe access to and from local schools for all modes of transport;
- The need to maintain or improve all existing east-west movement corridors;
- The importance of the local collector roads i.e. Gray Street, Bellambi Lane, Park Road and Campbell Street for east-west bicycle and car movements;
- The importance of the north-south local collector roads such as Mitchell/Thompson Street and Railway Parade for both bicycle and car movements; and
- Safe vehicle access/egress to residential properties along busy streets.

7.2 Traffic Projections

Extension of the Northern Distributor as per the EIS Proposal would generate changes in traffic flows at several different levels in the road hierarchy. There would be some change to the use of routes between Wollongong and Sydney with effects on Mount Ousley and Bulli Pass. There would also be changes on a more local level.

Figure 7.6: Northern Bus Routes — Dions



Legend

- Dion's Bus Service Wollongong – Austinmer general services
- Dion's Bus Service – School services
- BS Bus Stops

Source: Forbes Rigby/Gabites Porter

The EIS Proposal runs parallel to Pioneer Drive and the Princes Highway, and could be expected to attract significant volumes of traffic as a result of reduced travel times and fewer intersections.

There would be consequential effects from these changes. Termination of the Northern Distributor at any point would produce a concentration of traffic at the end of the construction stage. There would also be changes in the local road system depending on the intersections provided along the Northern Distributor route. These would affect how people from the local area use the Northern Distributor and whether any through traffic is introduced to the local road network.

There would also be changes in traffic patterns due to roads that are cut by the provision of the Northern Distributor. This restricts the access provision to several of the local areas and would concentrate traffic on the remaining roads into these areas.

Changes in traffic flows are evaluated using the 24-hour transport model based upon 1996 census land use patterns. The corresponding traffic flows have been validated to represent the current traffic counts in 2002. The resultant traffic flows are reported in this document as "existing" traffic flows.

Only a few businesses will be directly affected by the EIS Proposal.

Projections of the land use expected to occur in 2016 have then been used to prepare the expected traffic flows in the future. Should changes to landuse occur earlier or later than 2016 then the predicted traffic flows would also change. The future traffic projections are based on proposed development sites in the Northern suburbs and surrounding areas and have assumed 492 additional houses around Sandon Point, 467 houses west of Gray Street and 561 additional houses west of Bellambi Lane. The modelling process uses the all day (24 hour period) for volume projections and the morning peak (7–9am) and evening peak (4–6pm) to check intersection performance.

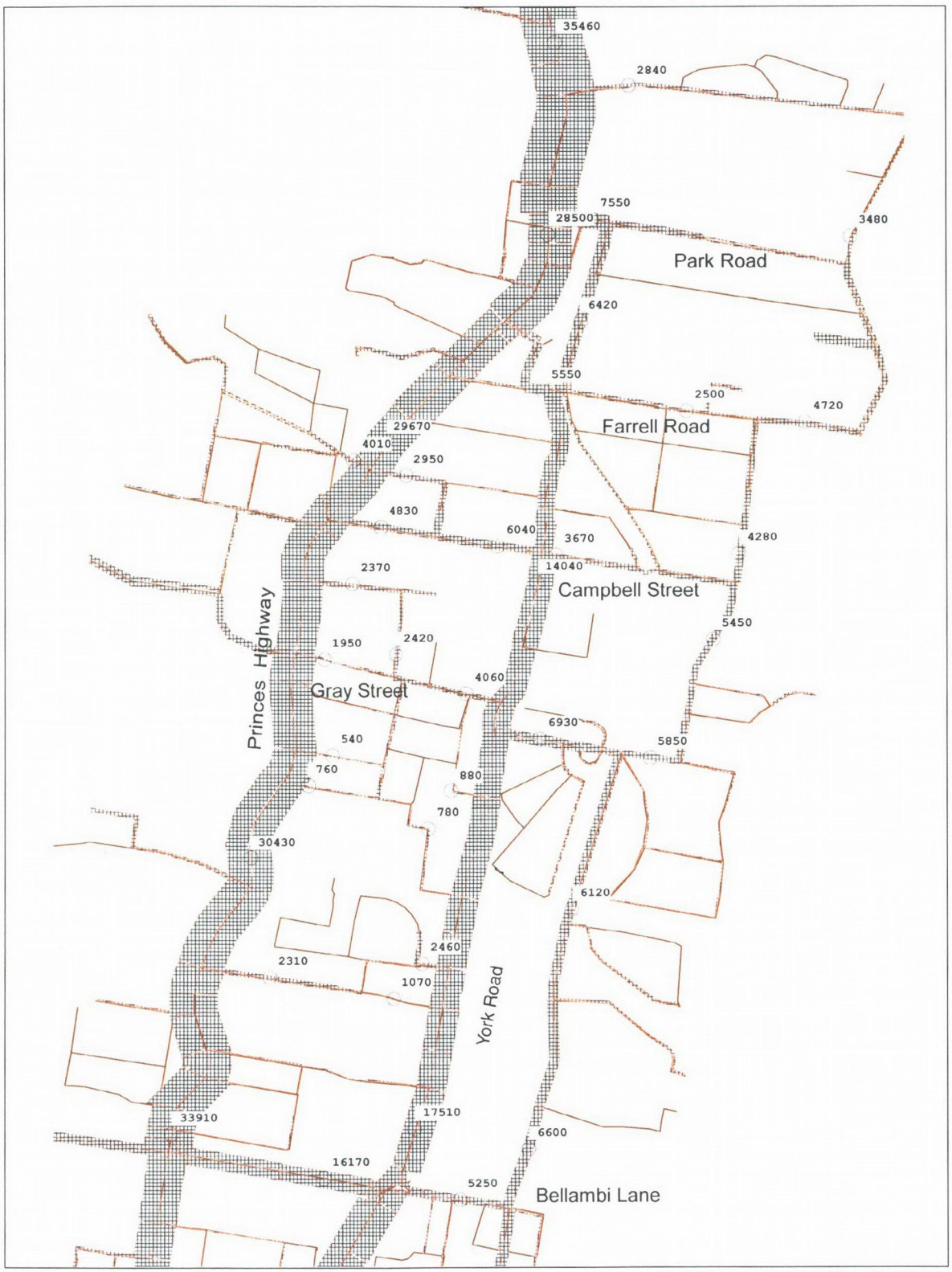
Traffic projections have been undertaken for the period to 2016 to examine the impact of the EIS Proposal against a "do nothing" option. The results are shown in **Table 7.3** as well as **Figures 7.7 and 7.8**.

The impact on overall movement patterns, intersection operations, land uses, and local street network are discussed below.

In summary, the main projected traffic changes in 2016 as a result of the EIS Proposal compared with a no NDE options are as follows:

- An increase in traffic along the new NDE
- Reductions in traffic volumes along Princes Highway south of Molloy Street
- An increase in traffic on Princes Highway north of Molloy street
- Reduced traffic volumes in York Road, Mitchell Rd, Pioneer Road, Thompson Street, Farrell Road, Russell Street and Hopetoun Street
- An increase in traffic along Campbell Street, Gray Street and Park Road; and
- A slight reduction in traffic using Mt Ousley and corresponding increase in traffic using Bulli Pass.

Figure 7.7: Projected Traffic Volumes (2016) — No NDE



Legend

Traffic density

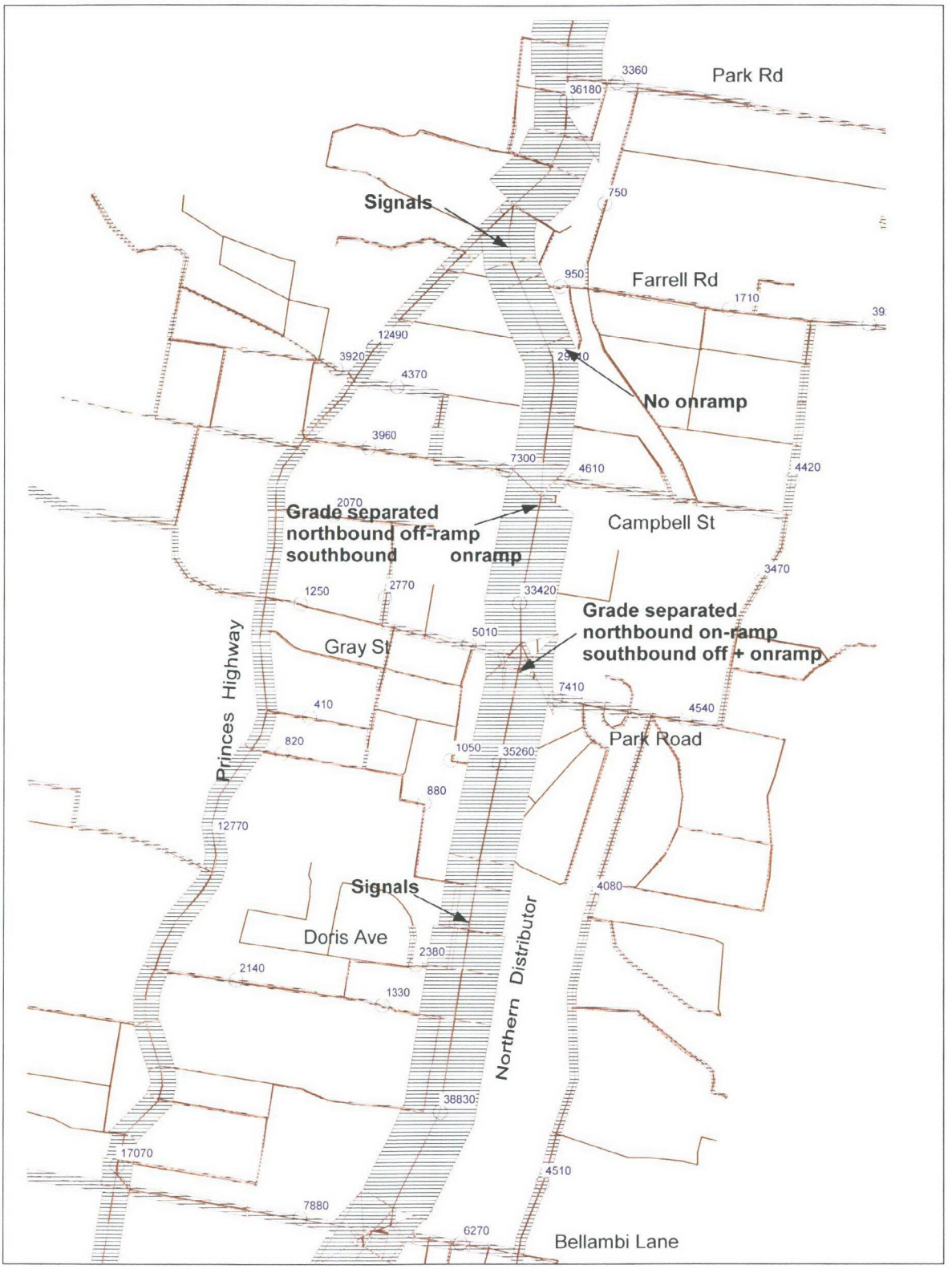
Source: Forbes Rigby/Gabites Porter

Table 7.3: Projected Traffic Flows for EIS Proposal and No Change Option

Location	Existing Traffic (2001)	Traffic on Existing Network (2016)	Existing Traffic with EIS Proposal (2001)	Traffic with EIS Proposal (2016)
Mt Ousley Rd	33,700	57,560	33,000	55,680
Bulli Pass	9,300	14,830	9,970	16,710
Princes Hwy s of Lawrence Hargrave Dr	25,000	36,030	25,700	37,930
Princes Hwy s of Hobart St	24,000	35,460	24,700	37,360
Princes Hwy s of Park Rd, Bulli	20,000	28,500	24,540	36,180
Princes Hwy n of Hillcrest Ave	21,000	29,670	10,670	12,490
Princes Hwy s of Stanhope St	20,000	30,430	10,080	12,770
Princes Hwy n of Bellambi Lane	23,000	33,910	13,830	17,070
York St n of Bellambi Lane	14,100	17,510	–	–
Pioneer Dr n of Bellambi Lane	4,870	6,600	3,580	4,510
Thompson St–S Campbell St	10,640	14,040	630	850
NDE s of Molloy St	–	–	20,090	29,510
NDE s of Campbell St	–	–	23,490	33,420
NDE s of Park Rd	–	–	22,490	35,260
NDE n of Bellambi Lane	–	–	25,750	38,830
Campbell St–E Princes Hwy	3,510	4,830	3,420	3,960
Campbell St–E Robert St	4,770	6,040	6,650	7,300
Campbell St–E Thompson St	2,780	3,670	3,550	4,610
Gray St–E Princes Hwy	1,280	1,950	910	1,250
Gray St–E Sussex St	3,290	4,060	4,020	5,010
Park Rd–E Mitchell Rd	5,570	6,930	5,600	7,410
Park Rd–W Kulgoa Rd	4,450	5,850	3,790	4,540
Collaery Rd–E Princes Hwy	1,760	2,310	1,620	2,140

Source: Forbes Rigby (Working Paper 3)

Figure 7.8: Projected Traffic Volumes (2016) — With EIS Proposal



Legend

Traffic density

38830 — AADT (traffic flow)

Source: Forbes Rigby/Gabites Porter

7.3 Overall Impacts

This section discusses the detailed changes in projected traffic flows as a result of the EIS Proposal and the impacts on various parts of the study area and movement patterns. Throughout the analysis it should be noted that traffic projections show an increase in traffic along the proposed NDE alignment regardless of which option is adopted including the "do nothing" option.

7.3.1 Strategic Impacts on Road Network

Traffic Diversion from Mt Ousley Road

Improvement in the Northern Distributor results in some traffic diverting to Bulli Pass from Mount Ousley Road. This change is due to the improved travel time of the Northern Distributor and fewer signal controls compared to the existing Princes Highway route. The extent of this shift depends to some extent on the options chosen along the Northern Distributor and the length of the roadwork being considered.

View west of Thompson Road showing the road reserve.

The level of this diversion is not particularly sensitive to the option chosen. This is due to the fact that the Northern Distributor project only affects up to 3 kilometres of the 14km route from Wollongong to the top of the Bulli Pass. If the Northern Distributor Extension was built tomorrow terminating at Molloy Street, with two signals between this point and Bellambi Lane, an additional 700 vehicles per day from Mt Ousley Road would be diverted to existing traffic flows (1,350 vehicles per day in 2016) and pass through the Northern Suburbs to use Bulli Pass. This is approximately 8% of the total volume using Bulli Pass or 3% of the 25,000 vehicles per day currently on the Princes Highway south of the Lawrence Hargrave Drive.

The amount of diverted traffic would increase marginally if there were fewer signals on the Northern Distributor or the Northern Distributor was extended to Lawrence Hargrave Drive. The diversion is expected to increase to 1,380 vehicles per day in 2016 if there were one less signalised intersection along the Northern Distributor and to 1,800 vehicles per day at 2016 with an extension to Lawrence Hargrave Drive.

Park Road/Bulli to Lawrence Hargrave Drive

The traffic increases through this section of the Princes Highway are only relatively small if the Northern Distributor is extended to Molloy Street. If the first section of the Northern Distributor were connected at present traffic volumes, the additional traffic through this route would be approximately 700 vehicles per day with the increased use of the Bulli Pass. This percentage increase of approximately 3% is the equivalent to approximately one year of annual growth projected over the section.

Farrell Road to Park Road through Bulli shopping centre

There would be a significant increase in traffic through the Bulli shopping centre with the extension of the Northern Distributor to Molloy Street. This change occurs because motorists are currently using a number of routes between the northern end of Thompson Street and the Princes Highway north of Park Road. The extension of the Northern Distributor to Molloy Street would concentrate all of this traffic onto the Northern Distributor. It would result in the traffic currently bypassing the Bulli shopping centre (by using Park Road and Franklin Avenue) diverting back to the Princes Highway and continuing through the shopping area.

If the Northern Distributor were extended to Molloy Street at the current traffic volumes, this increase would be around 4,500 vehicles per day on the existing 20,000 vehicles through the Bulli shopping area, an increase of 23%. The projected traffic by 2016 through the Bulli shopping area of 28,500 vehicles per day could be expected to increase to 37,360 vehicles per day with the EIS Proposal.

The additional flows through the Bulli shopping centre would require changes in parking restrictions when the Northern Distributor was extended to Molloy Street. The Princes Highway north of Park Road currently has full time no standing restrictions with an afternoon clearway for northbound traffic and a morning clearway for southbound traffic. These traffic volumes through the Bulli shopping area with the extension of the Northern Distributor to Molloy Street would be similar to the current volumes north of Park Road. This would require similar parking restrictions. The new restrictions would require the removal of six parking spaces on the western side of the road and 15 parking spaces on the eastern side of the road by 2016. These would be replaced by full time no stopping restrictions. The afternoon clearway for northbound traffic and morning clearway for southbound traffic would still be required.

The increase of traffic in the future following the extension of the Northern Distributor to Molloy Street would require further parking restrictions by 2016. A flow of 30,000 vehicles per day could be reached by 2008 and extension of the clearway hours may be required on both sides of the Princes Highway. Provisions for indenting the bus bays clear of the through traffic lanes could be required by 2016.

There would be further parking restrictions required through the Bulli shopping centre even if the Northern Distributor were not extended past Bellambi Lane. The projected traffic through the Bulli shopping area is 28,500 vehicles per day in 2016 without the Northern Distributor extension. This volume is greater than the current volume north of Park Road and could require similar parking restrictions to the no standing restrictions (which in any case would be replaced with no standing restrictions following the adoption of the uniform Australian Road Rules by all States) and clearways currently in place north of Park Road.

The extension of the Northern Distributor to Lawrence Hargrave Drive would substantially reduce the traffic volumes through the Bulli shopping centre. The projected volume would be approximately 5,000 vehicles per day in 2016 with the full extension of the Northern Distributor. At this level of traffic, parking restrictions would not be required and the existing "no stopping" restrictions and clearways could be removed and replaced with period parking restrictions. It should be noted however that such an extension to the Northern Distributor is not part of this EIS.

7.3.2 Increased traffic flow along the proposed NDE from Bellambi Lane to Molloy Street

A four lane Northern Distributor built today would carry around 23,500 vehicles per day south of Campbell Street (33,400 vehicles per day by 2016). The Princes Highway north of Bellambi Lane would carry 14,000 vehicles per day (17,000 vehicles per day by 2016) and Pioneer Drive would carry 3,600 vehicles per day (4,500 vehicles per day by 2016).

7.3.3 Individual Intersections

Working Paper 1 provides details of the engineering options and assessment associated with each intersection along the proposed NDE. This should be read in conjunction with **Working Paper 3** (Traffic Assessment)

Princes Highway/Northern Distributor Intersection Options

The intersection of the Northern Distributor with the Princes Highway was considered with a number of intersection control options during the evaluation stage. The possibility and implications of a northern connection of the proposed NDE across the Princess Highway as part of a continuation of the proposed NDE was also considered, as was the need for continuity of pedestrian access along the Princes Highway and convenient access at Hospital Road.

View south towards Farrell Road showing road reserve.

The EIS Proposal contains a signalised at-grade four way intersection connection the Princes Highway and Molloy Street to the new NDE.

Whilst not as efficient in traffic movement terms as a roundabout, the signalised intersection treatment was adopted in the EIS Proposal because it provided a reasonable flow of traffic whilst permitting continued safe pedestrian movement along the Princes Highway and continued use of the traffic lights at Hospital Road. They are also compatible with other signalised intersections in the study area.

Traffic signals at the **Princes Highway/NDE** favour traffic movement along the proposed NDE, which means that there are delays to traffic on the southern portion of the Princes Highway and accessing via Molloy Street with more traffic using the Northern Distributor.

Molloy Street to Campbell Street

Although the EIS Proposal involves creating a cul-de-sac west of the rail bridge on Farrell Road, access between the western suburbs and the beach is maintained with both the Molloy Street/Farrell Road and Campbell Street connections across the railway line.

The truncation of Farrell Road would reduce traffic volumes in Farrell Road East, which is a narrow two lane street. There is no access from Farrell Road east to the proposed NDE. Vehicles in this area would be required to use Dickson Street and Campbell Street for access/egress to the proposed NDE.

Truncation of Russell and Hopetoun Streets with cul-de sac west of the proposed NDE would retain low vehicle movements in both streets. Access to and from the proposed NDE from this area would be via Campbell Street and or the Princes Highway.

A cul-de-sac on Thompson Street north of Campbell Street would reduce traffic flow along this section of the road but maintain access/egress to existing residential properties. Access to and from the proposed NDE would be via Muir Street in this area.

The EIS Proposal involves an overpass for the proposed NDE at Campbell Street with on and off ramps on the southern side of Campbell Street. This arrangement would allow normal traffic and pedestrian movement along Campbell Street in both directions.

The grade separated intersection at Campbell Street would provide a substantial improvement to traffic flow along the proposed NDE. Projected traffic volumes in 2016 for the EIS Proposal show a small increase along Campbell Street over the no NDE option. This situation is caused by use of Campbell Street as a connector to the proposed NDE for traffic coming/going east and west. Campbell Street is currently a major east-west connector in the local area and would continue to play this role under the EIS Proposal.

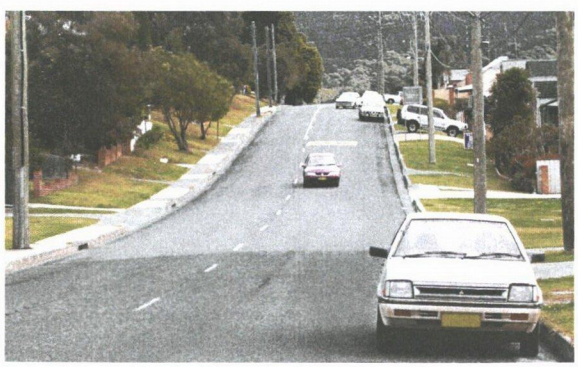
Some traffic management solutions are possible to address the future situation and these are outlined below. The area adjacent to Woonona High School is also included in a 40km school access zone.

An alternative to the EIS Proposal raised by local residents was to locate the northbound off ramp at Russell Street rather than Campbell Street. Whilst this arrangement had the effect of redistributing some traffic away from Campbell Street it increased traffic on Russell Street and did not solve the problem of morning traffic flows along Campbell Street.

Campbell Street to Gray Street and Park Road

The EIS Proposal involves creation of a cul-de-sac on Thompson Street south of Campbell Street, and a new intersection in the vicinity of Park Road, Gray Street.

The overpass of local streets was considered to be substantially more beneficial in terms of traffic movements and pedestrian safety than an at-grade-signalised intersection in this locality.



Traffic calming is proposed for Campbell Street west of the EIS Proposal.

Traffic volumes along the southern part of Thompson Street would be substantially reduced as a result of the EIS Proposal, although access/egress for residents in this small area would be provided via north and south bound access to the proposed NDE at Park Road.

East west movement would be provided at the new Park Road/Gray Street overpass, together with south and north bound access to the proposed NDE.

This new intersection would generate small increases in local traffic volumes along both local streets by 2016. This increase can be offset by traffic calming devices along each street. Much of Gray Street is covered by a 40km school access zone.

Gray Street to Bellambi Lane

The EIS Proposal contains several changes to current traffic arrangements in this section of the route including:

- A one-way section for Mitchell Road, a new residential service road on the eastern side of the proposed NDE south of Park Road;
- An extension of Watts Lane industrial service road;
- An at-grade signalised intersection between Doris Avenue and Alice Street; and
- A right hand turn lane at the existing Bellambi Lane intersection for north bound right turning traffic.

These new arrangements make provision for efficient and convenient access/egress to residential and industrial properties in the local area but introduce a new set of traffic signals that reduce the efficiency of the proposed NDE as a through route.

The new arrangements create a substantial reduction in through traffic currently using York Road and Mitchell Road, but do not generate any increase in traffic through the local residential streets in Russell Vale.

7.3.4 Buses

Maintaining or improving public transport is an important objective of the EIS Proposal.

The EIS Proposal would provide an opportunity for fast commuter bus services to and from as well as through the study area.

It would be possible to provide set down and pick up areas at the main east-west routes of Campbell Street, Gray Street, Park Road and Bellambi Lane, to facilitate use of the proposed NDE as a public transport corridor.

The EIS Proposal would have no significant affect on the existing local bus routes in adjacent suburban areas and would improve the level of service along the current Princes Highway as a result of reduced traffic congestion. However, the construction of several cul-de-sacs on local streets would create the need for some minor changes to local bus routes.

Consultation with bus service providers has indicated that this would not be a problem and suitable alternative routes would be able to be defined, given the availability of east-west crossings of the proposed NDE at Molloy Street/Rixon Avenue/Farrell Road east, Campbell Street and Gray Street/Park Road.

7.3.5 Pedestrian and Bicycle Movements

Maintenance or improvement of pedestrian and bicycle facilities is an important objective of the proposed NDE.

The EIS Proposal provides for on-road bicycle lanes in both directions along the proposed NDE route. It also makes provision for safe pedestrian and bicycle access across the proposed NDE at a number of locations as follows:

- Princes Highway/Molloy Street intersection;
- Farrell Road overbridge;
- Campbell Street;
- Gray Street/Park Road;
- Doris Avenue; and
- Bellambi Lane.

These measures cater for the most popular east-west pedestrian and cyclist movements and are consistent with the project goal of ensuring that all road transport users are catered for in the improved network.

By reducing traffic volumes along a number of existing local streets the EIS Proposal also allows safer pedestrian and bicycle movement in a north south direction in York Road, Mitchell Road, Thompson Street, Russell Street, Hopetoun Street, Farrell Road and the Princes Highway. There is also a new pedestrian connection proposed for the eastern side of the proposed NDE connection Campbell Street, Hopetoun Street, Russell Street and Farrell Road.

These measures cater for all north-south pedestrians and cyclists movements consistent with the project goal of ensuring that all road transport users are catered for in the improved network.

7.3.6 Schools

Most of the popular routes to and from Woonona High School would be unaffected, as pedestrians and cyclists would still be able to access the school via the proposed NDE at Campbell Street or at Gray Street/Park Road. Most of the popular routes to and from Russell Vale Primary School (i.e. York Road onto Terania Street) would be unaffected.

All modes of transport would be able to access the schools as they do now via the new pedestrian-activated traffic control signals at Doris Avenue or the existing pedestrian-activated traffic control signals at Bellambi Lane. Most of the popular routes to and from Woonona Primary School (i.e. Gray Street onto Gordon Street then onto Stewart Street) would also be unaffected.

A minor change to current access arrangements would result from removal of the set down/pick up point in Thompson Street. However, the High School has agreed to new arrangements involving the use of Campbell Street and construction of an upgraded bus setdown in Liddle Street to address this change.

It is concluded that the EIS Proposal would not adversely affect access to schools in the local area or adversely affect existing school catchment zones.

7.3.7 Impact on Local Shopping Centres

Woonona Shopping Centre

The current traffic volumes through the Woonona shopping centre require sections of full time no standing areas and the areas of on-street parking removed during the peak hours. There is an afternoon clearway for northbound traffic and a morning clearway for southbound traffic. The projected traffic increase to 30,000 vehicles per day if the Northern Distributor is not extended would require replacement of on-street parking by extension to the clearway hours. It would also be likely that full time no stopping restrictions following the adoption of the uniform Australian Road Rules would be required by 2016.

Extension of the Northern Distributor to Molloy Street would reduce the present day traffic volumes passing the Woonona shopping centre from 21,000 vehicles per day to 11,000 vehicles per day. At these traffic levels the road could operate with one lane in each direction even at peak hours and there would be no need for the current peak hour clearways. The present full time no standing restrictions could be reduced in extent to the approaches to the main intersections. This would allow extensions to the existing parallel parking areas.

Traffic volumes on the Princes Highway at Woonona with the Northern Distributor extended to Molloy Street are projected to rise to 12,500 vehicles per day by 2016. This is lower than the present traffic volumes through the shopping area but some of the parking restrictions may need to be re-imposed towards the end of the 20 year period.

Woonona shopping centre would benefit from the reduced traffic flow and would present a range of urban design opportunities that could be explored by the local business community and Council.

The present Princes Highway between Molloy Street and Bellambi Lane would most likely be deproclaimed as a State Highway (as has occurred through Corrimal) and the road would come under the care, control and management of Wollongong City Council. This may enable the removal of the current Clearway and No Standing restrictions, and possible introduction of Main Street Improvements, such as "S" lane facilities at say Hillcrest Avenue, Campbell Street to facilitate right turn movements with corresponding short sections of No Standing restrictions opposite. The need for Clearway, No Standing and No Stopping Restrictions between Gray Street and Bellambi Lane would be diminished.

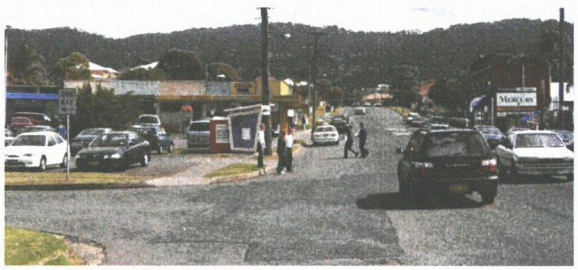
Bulli Shopping Centre

Bulli shopping centre would experience an increase in traffic flow. The existing Clearways would likely need to be replaced with full time No Stopping Restrictions, as the RTA Guideline requires that a Clearway be greater than 5 kilometres long. This would mean the removal of on street parking through the shopping centre and their replacement with No Stopping Restrictions.

The following restrictions would be needed to enable the Princes Highway to carry the predicted increase in traffic volume as a result of the EIS Proposal:

- From the Bulli Pass / Lawrence Hargrave Drive junction to the Princes Highway / Park Road junction on the eastern and western alignments a Full Time No Stopping Restriction would be required.
- From the Princes Highway / Park Road junction to the Princes Highway /Organs Road junction No Stopping Restrictions operative between the hours of 6.30am to 9.30am and from 3pm to 6pm on both of the Eastern and Western alignments. These restrictions being necessary to allow the Highway to carry the AM and PM peak movements in both the southern and northern direction.
- In the above area the kerbside space available between 9.30am and 3.00pm to be used for period parking possibly retaining the existing 1/2 hour and 1 hour period parking restrictions.
- From the Princes Highway / Organs Road junction to the proposed Northern Distributor / Princes Highway intersection a No Stopping Restriction operative between the hours of 6.30am to 9.30 am and 3.00pm to 6.00pm on both of the eastern and western alignments.

7.4 Traffic Movements During Construction



Access to local shopping centres will be maintained.

The majority of the proposed NDE can be constructed on land to the east of York Road and west of Thompson Street while allowing the existing road network to carry daily traffic. Some construction phases including the Campbell Street and Park Road bridges would affect the ability of the local road network to carry the existing traffic volumes. These have been evaluated using the traffic model for the existing volumes.

The general construction sequence and the effect on the existing road network are as follows:

- **Construction of Rixon Avenue** on a new alignment connecting with the roundabout at Farrell Road and the intersection of the proposed NDE/Princes Highway. These works could be constructed in parts to allow the existing road network to function for the majority of the day. It is assumed that these construction delays can be programmed to avoid the peak hours and no significant diversion would be expected.
- **Construction of the Farrell Road pedestrian overbridge**. This stage is likely to follow the construction of the link between Molloy Street and Thompson Street. Construction delays would affect the western portion of Farrell Road.
- **Construction of the Campbell Street overbridge**. The construction of this bridge may require closure of one traffic lane in Campbell Street near Thompson Street, for limited periods for safety reasons to allow placement of bridge spans. The results of this closure have been modeled and show temporary changes to traffic flows in local streets. Some traffic would relocate to the Princes Highway from Mitchell Road but the majority of traffic, approximately 1,200 vehicles in either direction, would use Russell Street to connect with Thompson Street instead of Campbell Street. This assumes that the present right turn ban

from Russell Street to Thompson Street south is allowed during periods of the Campbell Street closure. The right turn ban is currently required because of the restricted sight distance available from Russell Street. Traffic management control during the construction period would alleviate these problems on a temporary basis.

- Divert **Gray Street and Park Road** to clear the area for the bridge across Park Road. The connection of Park Road with Mitchell Road can be retained through a temporary construction access built between Park Road and Kialoa Road. This would replace the present function of Park Road.
- Construct access east of **York Road** opposite the light industrial area. This access can be constructed while retaining the traffic function of York Road. The individual property access points would then be shifted to the new access road.

7.5 Summary

The impact of the EIS Proposal would introduce significant changes to the study area but would have demonstrable net benefits in the following ways:

- Attraction of through traffic onto the proposed NDE and away from local Roads and the current Princes Highway;
- Improved regional access for local residents
- Maintenance of safe and convenient east-west movement patterns for vehicles, pedestrians and bicycles
- Retention of safe and convenient access to schools and other land uses;
- Savings in travel distances and associated environmental benefits
- Reduced accident rates and severity rates; and
- Improvements to the amenity of the Woonona shopping centre through return of the Main Street to the business houses and residents of the local area, and the creation of urban design opportunities to revitalise the local centre.

The above improvements are also broadly consistent with key issues raised during community consultations and stakeholder discussions

Notwithstanding the above, there would be some negative traffic impacts associated with the EIS Proposal including:

- Increased traffic volumes along the Princes Highway through Bulli shopping centre;
- Small increases in traffic volumes by 2016 along a few local streets including Campbell Street, Gray Street and Park Road;
- Minor inconvenience caused by some street closures; and
- A small increase in traffic diverted from Mount Ousley Road.

7.6 Mitigation Measures

Some of the impacts of the EIS Proposal could be addressed by appropriate mitigation measures for the affected areas, as outlined below.

7.6.1 Local Area Traffic Management

The NDE concentrates traffic to the few east-west streets that are important collectors of local traffic. This is because there are few opportunities between Bellambi Lane, Bellambi and Park Road, Bulli to cross the South Coast Railway Line. These opportunities are limited to Farrell Road, Campbell Street and Gray Street/Park Road and consequently these streets experience increases in traffic volumes (generally in the order of 20% in 2016 volumes).

Local Area Traffic Management (LATM) is proposed in these areas to provide for both the traffic service function and the local amenity function, recognising the inherent conflict between the two.

The treatments are designed to control the behaviour of those motorists who must use these streets, while discouraging those who can use the arterial roads as an alternative.

The street treatments are based on restricting the available and apparent width of the streets to control speeds and discourage excessive traffic. This recognises that restrictions on vertical alignment, such as road humps or platforms, create undesirable noise and amenity effects when used in streets with a traffic service function. Where possible, these treatments have been located close to popular pedestrian movements to provide both a safe crossing as well as the traffic calming function.

The use of traffic calming is proposed to manage the traffic service function while minimising the amount of additional traffic on the local streets. The suggested treatments are based on Australian Standard — 1742.13 — 1991, AMCORD (1999), RTA Road Design Guide (People Characteristics), AUSTROADS, and Guide to Traffic Engineering and Management.

Figure 7.9 shows streets nominated for LATM treatment. The suggested treatments are detailed in **Working Paper 3 (Section 6)** on Transport and are summarised below:

Farrell Road (east of NDE)

- Double white offset separation lines between Waterloo Street and Carrington Street;
- Roundabout at the intersection of Farrell Road and Carrington Streets; and
- Plans to widen Farrell Road may need to be re-considered given the reduction in traffic volumes on this road.

Russell Street/Hillcrest Street

- Opportunity to remove the current right turn at Russell Street northbound from the Princes Highway; and
- Opportunity to permit right turns (northbound) at Campbell Street via a new set of Traffic Control Signals in this location Review traffic volumes in Haddon Lane as part of an overall urban design study of the Woonona CBD.

Hillcrest Ave

- There is opportunity to provide a dedicated right turn southbound lane from the Princes Highway into Hillcrest Avenue with an option for "S" turning facilities and No Stopping adjacent on the western alignment of the Princes Highway.

Campbell Street (West of NDE to Princes Highway)

- A new set of traffic control signals at the intersection of Campbell Street and Princes Highway Woonona. The new signals would provide for all turning movements and allow "green phasing" to control traffic in Campbell Street;
- Realign Campbell Street line marking square to Princes Highway;
- Reduce kerb width by 1m to permit large vehicles;
- Create threshold kerb-side pedestrian refuges to Campbell Street immediately east of Haddon Lane with landscaping entry statement and signage;
- Raised threshold kerb-side pedestrian refuges to Campbell Street east of Robert Street
- double white separation lines from Princes Highway to NDE;
- Offset line markings to allow kerbside parking along one side only of sections of Campbell Street;
- A pedestrian footpath on both sides of Campbell Street;
- Maintain the current 40km/h schools speed zone and elsewhere 50km/h in Campbell Street; and
- A small roundabout at the intersection of Robert Street and Campbell Street.

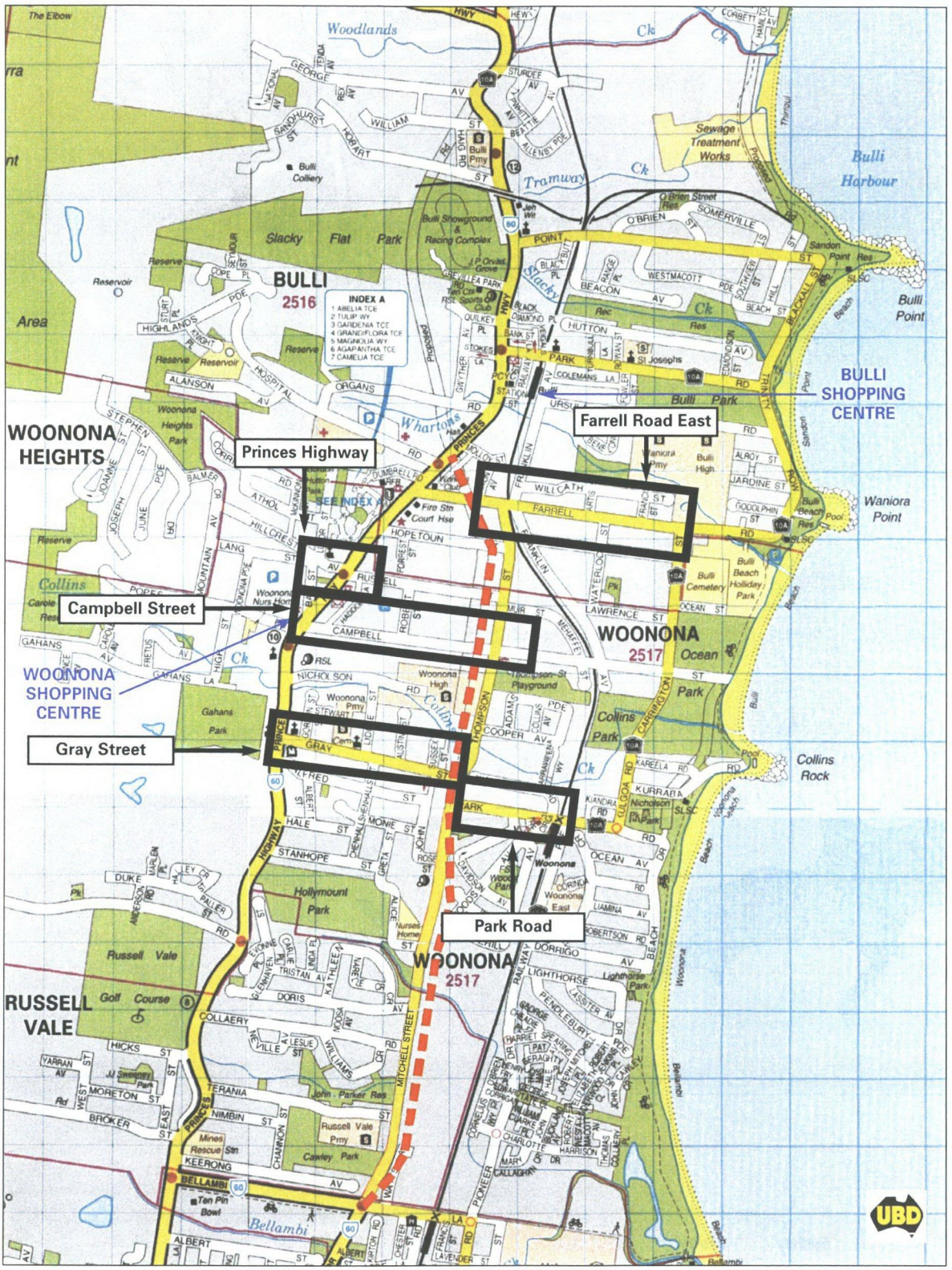
Campbell Street (east of NDE to Bridge over South Coast Railway)

- Double offset white separation lines from Campbell Street to the Railway Bridge.

Gray Street (NDE to Princes Highway)

- Retain existing traffic management devices;
- An additional raised pedestrian crossing east of Austin Street and west of Sussex Street East. The preferred location is between the two trees. With removal of eastern tree the obstruction to the east would be resolved;
- A pedestrian footpath from its current termination at Chenhall Street east to the proposed pedestrian overbridge at NDE;
- Maintain the 50km/h speed limit with a 40km/h school speed zone should be continued in this location;
- Traffic calming devices on Gray Street east of Gordon Street and west of Liddle Street;
- Provision of a double barrier marking in the centre of the road alignment;
- Continuation of roadside parking on either side of Gray Street;
- Double white offset separation lines along Gray Street from the proposed NDE to Princes Highway with appropriate breaks for side streets; and
- Broken centreline markings between Chenhall Street and the pedestrian crossing to the east on Gray Street.

Figure 7.9: Local Area Traffic Management Locations



Legend

EIS Proposal (indicative route)

Source: RTA (base map from UBD)

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Park Road

- Double white separation lines along the entire length of Park Road from the proposed NDE to the South Coast Railway Line with appropriate breaks for side streets; and
- Threshold kerb-side pedestrian refuges west between The Circle and Cotterill Ave, directly adjacent to The Circle.

Impact of LATM Measures on Local Traffic Volumes

The total daily traffic volumes in 2016 with the installation of the traffic calming measures have been modelled in **Working Paper 3** and show some minor improvements especially along the western end of Campbell Street.

The majority of the changes are due to the installation of a new set of traffic signals at the intersection of the Princes Highway and Campbell Street. The phases allowed at the traffic signals mean that the delays increase for motorists exiting and entering Campbell Street. The result is a reduction of approximately 1,400 vehicles on Campbell Street between the Princes Highway and Robert Street. Approximately 770 vehicles per day shift to Russell Street but the remainder find other routes in the road network. Installation of another set of traffic signals on Campbell Street also increases the delays to the Princes Highway and results in 1,700 vehicles per day that shift from the Princes Highway to the proposed NDE.

8. Topography, Geology, Soils & Borrow Materials

This section provides details of the geology solids and landforms in the study area, including the presence of acid soils and other contaminated land, and looks at the implications for the EIS Proposal.

Working Paper 4 was prepared by Coffey Geosciences Pty and provides details of all site investigation, soil testing and results.

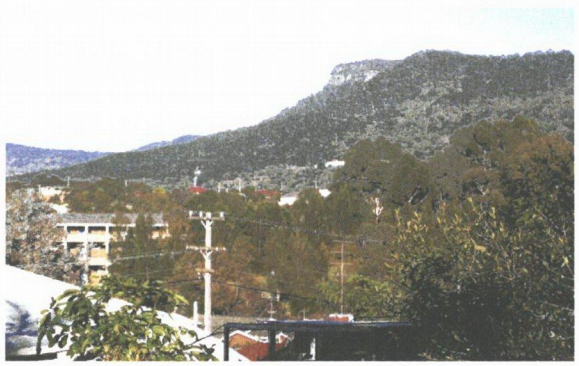
The geotechnical investigation, environmental and acid sulfate soil sampling and testing was confined to accessible areas of the site generally beneath the proposed NDE Route. No subsurface investigation work was carried out beneath the existing road pavements. The proposed development includes several minor access roads.

8.1 Existing Conditions

8.1.1 Topography

The NDE Route is located largely on the coastal plain between the Illawarra escarpment to the west and the Tasman Sea (Pacific Ocean) to the east. **Figure 8.1** refers.

The topography over the route of the proposed NDE Route and its immediate vicinity generally comprises slightly undulating alluvial plain over most of the route with two elevated ridge areas in the northern part of the site. The route crosses a number of permanent or intermittent natural or altered (manmade) watercourses.



Escarpment views along the EIS Proposal provide an attractive outlook for motorists.

The coastal plain in the vicinity of the proposed NDE Route is intersected by several east-west trending ridgelines. There are several broad to moderately incised valleys along the proposed NDE Route and nine east-west trending watercourses cross the proposed NDE Route.

Drainage from the site would generally flow in an easterly direction in the southern portions (between Hopetoun Street and Bellambi Lane) and would generally flow in a north-easterly direction in the northern portions (between Hopetoun Street and Molloy Street).

8.1.2 Soil Landscapes

The 1:100000 Wollongong-Port Hacking Soil Conservation Service Sheet indicates the proposed NDE Route is underlain by two Soil Landscape Groupings. These two groupings are designated 'Gwynneville' and 'Fairy Meadow', with each divided into different soil types.

The upper soil unit, described as 'Gwynneville', comprises footslopes of the Illawarra Escarpment and isolated rises of the Wollongong Plain, with local relief of 10-70m. The upper soil unit is generally located on east-west trending ridgelines that lie generally perpendicular

to the alignment of the proposed NDE Route. The Soil Conservation Service Sheet describes the Gwynneville unit as either 'Friable brown sandy loam — topsoil', 'Friable Sandy Clay Loam — topsoil or subsoil' or 'Brown Pedal Clay — subsoil'.

The upper soil unit is intersected by several east-west trending creeks or alluvial plains, floodplains or valley flats below the Illawarra Escarpment. These east-west trending features and low-lying areas comprise the lower soil unit, described on the Soil Map as 'Fairy Meadow'. The Fairy Meadow unit is described as being variable depending on whether soils are located within upper floodplains and terraces or on valley flats. The soils described as being part of the Fairy Meadow unit are 'Brownish black loose sandy loam, generally occurs as topsoil', 'Brown sand — subsoil', 'Yellowish brown clay — subsoil' and 'Olive brown clay — subsoil'.

8.1.3 Local Geology

Reference to the Geological Sheets prepared by Bowman in the 1970s and the 1:50000 Wollongong Geological Sheet indicate the site is generally underlain by quaternary Alluvium and/or rocks belonging to the Illawarra Coal Measures. The Park Road cutting appears to lie within the sandstone of the Erins Vale Formation, whilst the cutting to the north of Campbell Street appears to lie within the Sydney Sub-Group of the Illawarra Coal Measures.

A disconformity is mapped as lying between the base of the Sydney Sub-Group and the top of the Erins Vale Formation. The Woonona Sheet indicates that the east-west trending Woonona Fault occurs about 100m to 200m north of the intersection of the proposed NDE Route and Collins Creek. The Thirroul Sheet indicates that the Waniora Fault occurs near the northern end of the proposed NDE Route (near the intersection with the existing Princes Highway at Molloy Street).

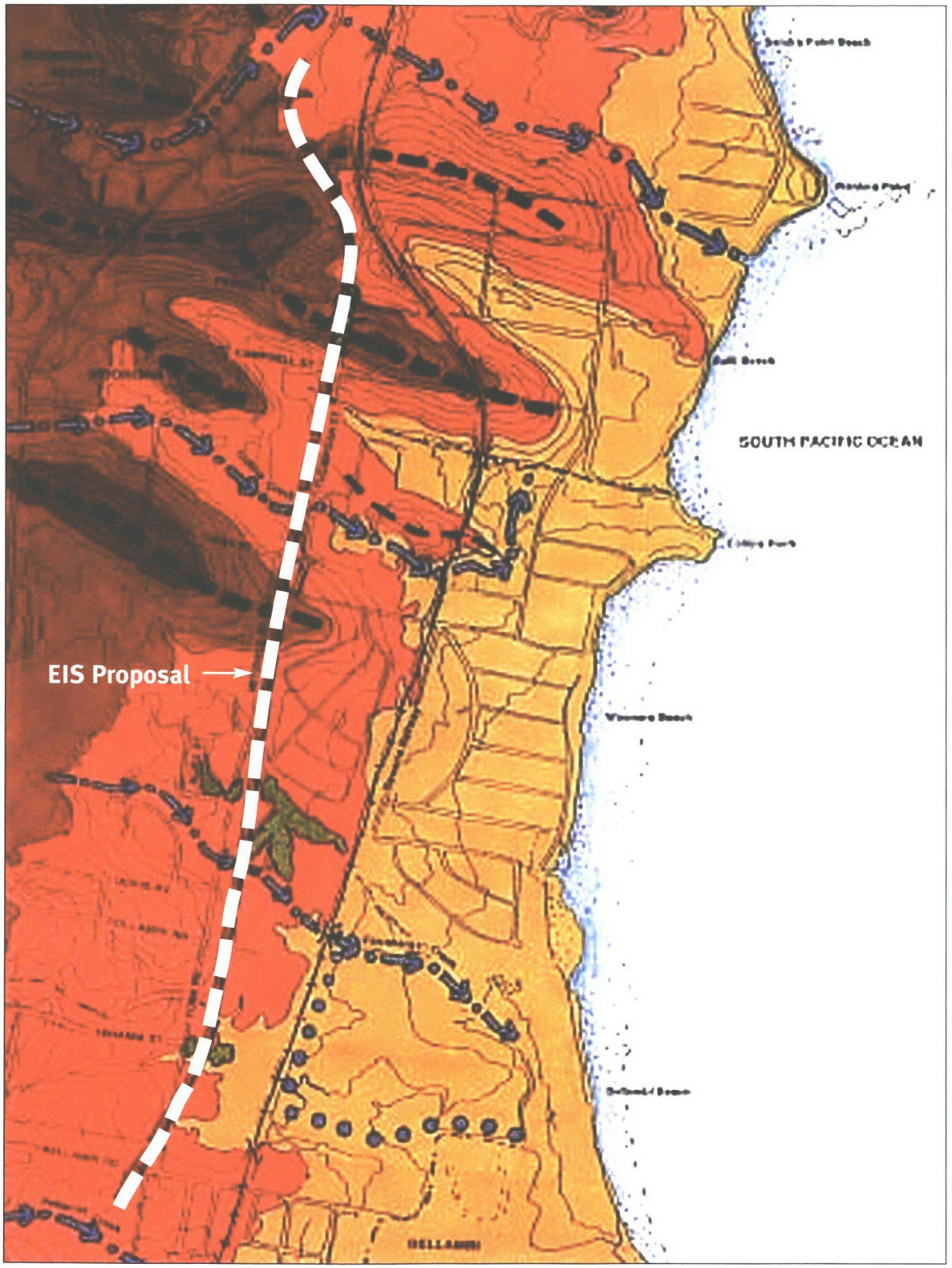
The Land Instability Sheets prepared by H.N. Bowman in the 1970s indicate the proposed route is underlain by 'stable land — no landslip problems'.

8.1.4 Hydrogeology and Groundwater Use

Along sections of the proposed NDE Route where the road is to pass over alluvial soils, groundwater is expected to be located within 3m to 5m of the ground surface and flow in an easterly direction toward the Pacific Ocean. Groundwater is expected to occur at greater depths along the east-west trending ridgelines, and there is some possibility of encountering locally perched water tables.

A survey of groundwater bores registered with the Department of Land and Water Conservation (DLWC) within 500m east and west of the site indicated that there was one bore registered as a recreation (groundwater) well. This well was drilled to 30m below ground surface level and indicated a water bearing zone (within the weathered rock) between 23m and 24m below ground surface. The registered bore lies hydraulically up gradient, about 300m west of this site.

Figure 8.1: Topography and Drainage



8.2 Acid Sulfate Soil Assessment

The proposed road alignment passes through two low probability zones around Collins Creek where acid sulfate soils (ASS) are expected to occur at a depth of greater than 3.0m below the ground surface. There is also a low risk that ASS would be encountered in excavation in the vicinity of the creek that lies at about CH3980m. This creek lies about 260m north of Collins Creek. Subsurface information gathered from the site indicates that is a very low risk that ASS materials would be encountered by excavations within 3m of the ground surface at this location.

The field screening and laboratory results have indicated the presence of potential acid sulfate soils in the vicinity of Collins Creek at a depth of about 2.0m (NDE-TP25).

The ASS layer at this location is about 1.0 to 1.5m thick and comprises grey, low plasticity, sandy silty clay with a soft consistency. The lateral extent of the ASS layer has not been assessed at this stage.

Acid sulfate soils that have formed along the NSW coastline generally occur below 5.0m AHD (Australian Height Datum) and in most cases, given the link to tidal influences, occur at or below 2.0m AHD. The DLWC ASS Risk Map indicates that there is a low probability of ASS occurring within 4.0m of the ground surface.

It appears that the ASS layer is probably located above 8.0m AHD, though it should be noted that, as yet, there has been no accurate survey carried out for the test pit locations. The current information therefore indicates that the ASS layer has probably not formed in-situ and may be fill from dredging operations further downstream.

Collins Creek may be realigned depending on the outcome of future catchment studies by WCC. Where ASS is encountered during construction, the mitigation measures outlined in **Section 8.4.7** would be adopted.

Overall, the likelihood of significant deposits of ASS is minimal along the route, and does not constitute an environmental hazard.

8.3 Contaminated Land Assessment

The Contaminated Land Assessment consisted of a detailed Site History Study including analysis of land use history, review of government agency databases and site inspections, as well as a targeted soil sampling program. The Contaminated Land Assessment does not constitute a full Environmental Site Assessment, however the scope of work for this preliminary assessment conforms to the relevant sections of the NSW EPA (1997) Guidelines for Consultants Reporting on Contaminated Sites.

The site history indicates that there is a low level risk of contaminated land being encountered along the route of the proposed NDE, with the most likely site being the RTA Bellambi Works Depot adjacent to the proposed NDE route.

8.3.1 Areas of Environmental Concern (AEC)

Based on the site history information and site observations, four areas of potential environmental concern (AEC) have been identified at the site as follows:

- AEC 1: Ch 4950m to Ch 5840m which includes land currently or previously zoned industrial such as the RTA Depot, Baines Concrete, former agricultural area of land (market garden?) and the former railway line;
- AEC 2: At locations where existing roads are adjacent to, or form part of, the existing road corridor where there is a potential for fallout from car exhaust fumes;
- AEC 3: Ch 3000 to Ch 3250 where existing industrial land borders the proposed road corridor; and
- AEC 4: The entire road corridor from imported fill of unknown origin.

8.3.2 Chemicals of Concern (COC)

The likely chemicals of concern (CoC) associated with the past activities, as identified by site observations and site history study include:

- Total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAH), heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), volatile halogenated compounds (VHCs) from the storage of chemicals, solvents and fuel at the RTA Depot (AEC 1) and associated with the former railway line. Organo chlorine/Organo phosphorous (OC/OP) pesticides from the agricultural area of land (AEC 1);
- Lead from car exhaust fumes and fallout along the existing roadside verge (AEC 2); and
- Total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAH) and heavy metals in fill of unknown origin (AEC 3 and 4).

8.4 Mitigation Measures

This section lists a range of mitigation measures required in relation to management of geotechnical issues associated with the EIS Proposal for the proposed NDE.

8.4.1 Blasting in Cuttings

A geotechnical investigation has been carried out at the site of the two deep road cuttings by the RTA. These cuttings are located between Campbell St and Farrell Road, and in the vicinity of Park Road/Gray Street.

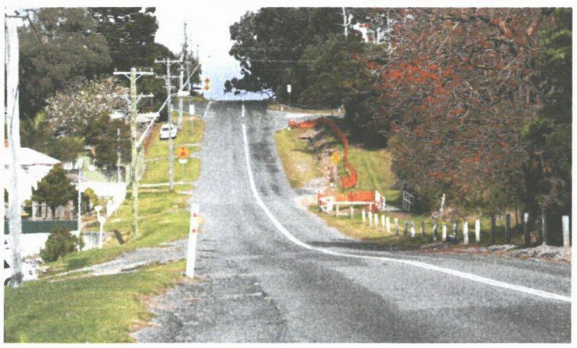
Blasting of the rock in the cuttings would not be required, however rock breaking (eg. rock hammer, rock sawing) of higher strength materials may be required to provide economic production rates for excavations in the cuttings. In any case, due to the close proximity of existing buildings, blasting would not be recommended in this area.

8.4.2 Stability of Cut and Fill Batters

There is a low to very low risk of slope instability over the existing land within the proposed NDE corridor. The low risk areas include the side-slopes of the elevated ridge areas on the northern part of the route. The very low risk areas include all of the slightly undulating low relief land to the north and south of the diverted area. Local instability of creek banks over-steepened by erosion would be expected.

Structural support and protection would be required for steep batters (vertical or near vertical), with possible options including soil nailing with shotcrete protection, bored pile retaining walls possibly with tie back anchors or rock bolting with shotcrete protection.

In view of the limited area available in the vicinity of the Park Road cutting unsupported stable batters in the weak rock and clay soils would generally not be feasible. In the other deep cut areas between Campbell Street and Hopetoun Street unsupported batters may be feasible in some areas where there is sufficient open space available between the top of the batters and the road reserve boundary. A combination of supported and unsupported sections of the cut batter may be feasible.



Thompson Street north of Campbell Street.

Unsupported cut batters of 2H:1V in stiff to very stiff clay soils or weak rock that deteriorates when exposed to moisture or air should be feasible, provided the following mitigation measures are implemented:

- Runoff from above the batters is drained away from the batter surface;
- Any seepage encountered in the cut batter is properly drained and additional support provided if required;
- Erosion control measures including use of geofabrics; and
- Toe support is provided where weak erosion prone soils occur in the lower part of the batter.

It may be feasible to provide flatter unsupported batters in the upper 1m to 2m of some cut batters with structural support over the remainder of the batter, assuming there is sufficient space available.

Unsupported fill batters of 2H:1V composed of compacted clay soils or weathered rock placed within the road formation should be feasible provided the following mitigation measures are implemented:

- Careful selection and placement of fill materials in the 2H:1V batters occurs on-site during construction;
- Erosion control measures including use of geotextiles, such as Biomat, are placed over the unsupported fill batters to promote vegetation growth;
- Toe support is provided where clays are prone to erosion or slumping; and
- Soils are stabilised where necessary using lime or other stabilising agent.

Fill batters comprising highly to moderately weathered rock should not be steeper than 1.5H:1V. Borrow materials that are essentially well graded granular material of low plasticity or non plastic nature should have batters no steeper than 1.5H:1V.

As some of the fill materials are potentially dispersive trenching through fill batters would be avoided. Where fill batters are to be supported, retaining walls would be either reinforced concrete or concrete block, or alternatively a gravity wall design that incorporates drainage but minimises migration of fines through the wall would be suitable.

8.4.3 Potential Erodability and Dispersion of Soils

There is no clear means of visually distinguishing between the soils that are erosion resistant (or non dispersive), and highly dispersive soils. However the source of the material could be identified and tracked during excavation, transport and placement of fill. Erosion prevention measures should be implemented around areas subject to runoff as discussed below.

The results of the laboratory tests on the soil samples taken from the proposed cut areas indicate high dispersion or potential dispersion in only 5 of the 16 samples tested.

The potential for erosion of these soils may increase where they are exposed to surface flows after drying significantly below optimum moisture content.

8.4.4 Soil Erosion

The areas where erosion control would be most important would be in cut or fill batters, banks of watercourses, or drainage channels and hillsides. Stockpiles of materials would also be prone to erosion if not properly managed.

Erosion mitigation measures would be introduced as soon as possible after batters have been formed. In the case of interceptor drains these may be implemented before cut batters are formed to mitigate erosion during the earthworks as well as on completion.

The following erosion mitigation measures would be implemented in these areas as required:

- The use of temporary and permanent surface water interceptor drains above cut and fill batters. For slopes steeper than 5% permanent interceptor drains should be concrete lined and temporary drains may be protected by bituminous sprays, biomat, or other similar methods. Interceptor drains should be set back at least 2m from the top of batter and should have regular discharge points to stormwater drains or tailout drains to existing undisturbed flow paths where possible;
- Unsupported cut and fill batters would be protected by facing walls, turfing, seeding or geotextile materials;
- Stockpiles would be placed outside of flood plains and associated erosion control measures would include the selection of well drained sites for stockpiles generally on near level grades, away from flow paths, track rolling of the stockpiled material during placement, particularly the outer layers and forming a smooth compacted surface from which water can shed readily. Silt fencing should be provided around the downstream side of stockpiles. Longer term stockpiles that are not self seeding may need to be topdressed and seeded;

Batter slopes for stockpiles would be in accordance with RTA QA specification R44, titled Earthworks (1997);

- For creeks or man-made drainage channels disturbed by earthworks or where flow conditions change as a result of the proposed NDE construction, erosion mitigation may include rock armouring, gabion walls, revegetation or similar methods of bank protection;
- For roadworks, the road formation should be always well drained during the earthworks and pavement construction by regular grading of the surface to promote runoff and sealing of the surface at the end of each day to minimise infiltration should rain occur.

In the hillside areas and above cut and fill batters, control of runoff would be by use of temporary and permanent interceptor or catch drains. In the steeper areas (slopes greater than 5%), concrete lining for permanent catch drains and for temporary drains, bituminous sprays, biomat or other similar methods would be implemented for the protection of the drains. Catch drains would be set back at least 2m from the top of batters and would have regular discharge points to stormwater drains or tail outs to existing undisturbed flow paths where possible.

Cut and fill batters would be protected by topdressing and seeding for batters that are flatter than 2H:1V. For Cut and Fill batters equal to or steeper than 2H:1V, Geotextile fabrics would be used in conjunction with some lining materials such as a rock facing wall. Alternatively, retaining structures as described in Section 3.5.2, above, may be used.

8.4.5 Cut Materials

It is intended that cut materials from the proposed NDE earthworks would be used as fill to raise the road formation in the areas indicated on the preliminary design drawings. Some borrow materials may also be necessary from outside the road alignment to achieve the design levels for the road formation.

Material from the cut areas would require testing before use as road fill on the proposed NDE. Where this material does not meet appropriate strength standards it can be used primarily as fill in non-structural areas of the proposed NDE Route such as noise mounds and vegetation mounds on the edges or in the middle of the road corridor.

If these materials are to be used beneath the road formation, construction planning would be required to minimise the ingress of surface water, as these materials would soften significantly when exposed to ingress of moisture.

The materials from the cut areas within the road corridor would generally be sensitive to moisture changes, and the clays and weak rock may soften significantly if water infiltrates the soils or water is allowed to pond over the surface of the prepared fill areas. All exposed areas would be continually well drained and sealed with a flat drum roller to prevent the ingress of water.

8.4.6 Borrow Materials

If there is a shortfall in suitable materials from the cut areas, then borrow materials would need to be considered from locations external to the proposed NDE Route.

In the past products such as coalwash and crushed slag have been used in construction of major roads in the Illawarra area. Coalwash is now not as readily available due to the recent closure of South Bulli Colliery. Coalwash, if available, would be subject to testing to assess combustibility, grading, compaction and behaviour during compaction. Coalwash (if well graded and non plastic) has formed a working platform for many heavy duty pavements in the Port Kembla Industrial area and under some major roads including parts of the earlier stages of the Northern Distributor.

Well graded crushed slag with a maximum particle size of 100mm may also be considered, however the behaviour of the various products would be carefully assessed particularly in relation to self cementing and cracking of the material over the long term.

Imported quarry products such as a well-graded shotrock (maximum particle size 100mm) would be suitable for use as a select fill material or bulk fill material.

8.4.7 Acid Sulfate Soils

Confirmation of the nature and extent of the ASS layer at Collins Creek cannot be made without a further subsurface investigation, sampling and analysis. The following will be undertaken in relation to additional ASS investigation:

- Current and additional sampling locations will be surveyed to AHD to confirm the likelihood that the ASS did not form in-situ;
- Additional test pits are excavated and soil samples collected, to assess the lateral extent of the ASS on either side of Collins Creek;
- Additional ASS screening and POCAS tests are carried out to aid in the identification and subsequent management of the ASS.

Depending on the results of the additional testing, it may be necessary to prepare an **ASS Management Plan (ASSMP)** prior to commencement of the creek diversion work. If required, the ASSMP would be prepared by a suitably qualified environmental consultant in general accordance with the relevant sections of the ASSMAC (1998) Acid Sulfate Soil Manual.

Where ASS is encountered during construction any excavated soil, suspected of being ASS would be temporarily stockpiled in a bunded area and preferably covered, if unattended for a period longer than two or three days.

Where testing of the stockpiles shows that ASS exists the material should be managed appropriately. The range of management options include:

- Neutralisation with lime using a lining rate based on the laboratory results and a factor of safety greater than 1.5;
- Disposal of the material below water level;
- Disposal of lime neutralised material to a landfill, licensed to accept solid waste;
- Re-use the lime neutralised material as fill in appropriate areas.

8.4.8 Contaminated Land

The road corridor would resume part of the RTA Bellambi Works Depot. Further investigation to confirm the presence of contaminated soils is required at this site. As a minimum, this would include testing for the Chemicals of Concern outlined above. These investigations would also be performed by a suitably qualified environmental consultant in accordance with the relevant NSW EPA guidelines.

Should contaminated soils be encountered at the above location, a **Contaminated Soils Management Plan (CSMP)** would be required and included as part of an Environmental Management Plan (EMP). The preparation of the CSMP would be carried out in accordance with the relevant NSW EPA guidelines under Section 105 of the Contaminated Land Management Act 1997 and the State Environmental Planning Policy 55 — Remediation of Land.

Although no soil contamination was encountered at the sampling locations, further sampling and analysis of fill soils would be carried out during construction in order to assess the waste classification and/or the suitability for re-use, from a contamination point of view. Testing for the presence of OC/OP pesticides in surface soils around CH4950 (former agricultural land) may be required as part of this waste classification process. Waste classification would be performed by a suitably qualified environmental consultant in accordance with the relevant NSW EPA guidelines.

9. Drainage and Flooding

This section describes the current hydrological conditions in the study area and examines the impact of the EIS Proposal on water flow and flood potential. The flood study considered flows from upstream catchment and also effects of backwater from downstream catchment, including any tidal effects. The study focussed on the proposed road corridor and the potential impact on the existing flooding and drainage conditions in the area.

Working Paper 5 provides details of the **Flooding and Drainage Study** completed by Connell Wagner Pty Ltd for the EIS. The Study involved a detailed hydrologic and hydraulic investigation of the area impacted upon by the Distributor.

The key issues addressed by the Study are summarised as follows:

- The hydrologic and hydraulic conditions on the proposed Northern Distributor Extension route for existing conditions;
- The impact on the hydrologic and hydraulic conditions caused by the proposed Northern Distributor Extension;
- The impact of provision of the proposed new road on flooding characteristics in the area; and
- Measures to mitigate impacts.

Details of the proposed hydraulic structures included in the EIS Proposal and subject to assessment below are provided in **Section 9.5.4**. These bridges and culverts along the proposed NDE have been designed to ensure that residences along the route would be no worse off after construction of the proposed NDE.

A number of data sources were utilised in the study including:

- RTA road designs;
- Wollongong Council records;
- Meteorological data from local sources;
- Discussions with local residents;
- Rail Services Australia;
- Department of Public Works; and
- Field surveys and site inspections by Connell Wagner.

9.1 Existing Conditions

9.1.1 Study Corridor and Catchment Area

The flood study corridor is defined as the overall road reservation width that includes the Distributor and the parallel existing road: York, Mitchell or Thompson Streets, as the case may be. **Figure 9.1** shows the extent of water catchment relevant to the proposed NDE corridor. **Figure 9.2** shows the location of local creeks within the study area.

The EIS Proposal is located between the Princes Highway and the main north-south railway line. It is downstream of the existing confluence of creeks 1 to 5 inclusive, is upstream of the existing confluence of creeks 6 to 9 inclusive, and merges into the existing Princes Highway before creek 10 (Whartons Creek). The project terminates before creek 10, and the existing hydraulic structure at this location would be retained.

The main catchment boundaries are the escarpment (west) and the coast (east). The overall catchment extends from Bellambi Lane in the south and approximately 500m north of Molloy Street at the northern end.

Urbanised areas have been determined from aerial photos and orthophotomaps of the catchments. Typically the heavily vegetated areas are located towards the head of the catchment at the foot of the Escarpment. The urbanised areas tend to be concentrated around the Princes Highway and eastwards towards the ocean. Areas with slopes tending towards the higher values are also located towards the head of the catchment at the foot of the Escarpment. The catchment tends to flatten out in the vicinity of the proposed Northern Distributor Extension, in particular around York, Mitchell and Thompson Streets.

9.1.2 Drainage Lines

There are a total of 9 creek catchments traversed by the EIS proposal, and one immediately north of the corridor (**Figure 9.2 refers**). The two major creeks crossing the proposed NDE Corridor are:

- Farrahars Creek; and
- Collins Creek.

In addition there are seven unnamed minor creeks. Catchment characteristics for all creeks are summarised in **Table 9.1**.

Although Whartons Creek is included in the Study considerations, proposed road works for the Distributor Extension would terminate well before the creek. The existing hydraulic structure under the Princes Highway on this creek is therefore considered "to remain" under the Study.

The existing hydraulic structures on creeks 1 to 9 inclusive would be replaced under the Study. New structures to replace existing are proposed in this report.

9.1.3 Floodprone Areas

Existing data for flood flows have been based on urbanised areas determined from aerial photos and orthophoto maps of the catchment. An impervious component of 60% has been adopted in the hydrologic model used to predict flood levels.

The existing flood levels to be matched by the proposed NDE have been determined based on 100% blockage of existing hydraulic structures on the ten creeks within the study extents. This is consistent with the latest guidelines from Wollongong Council and DLWC.

Figure 9.1: Water Catchments and Drainage Lines

Legend

- Watercourses
- Catchment boundary
- Proposed route

Source: Connell Wagner

The adoption of the 100% blockage criteria is based on historical evidence gathered following past storm events, in particular the August 1998 floods. This experience shows that culverts and other hydraulic structures, with a clear dimension less than 6 metres across the diagonal, may be fully blocked during major storm events. This 1998 experience forms the basis of Wollongong City Council's Draft Guidelines, and has been adopted as a key performance criteria for this Study.

Table 9.1 shows the existing 100-yr flood levels upstream and below the proposed NDE Corridor, as well as the existing hydraulic structures passing through the Corridor. **Figure 9.3** shows the flood profile for the 1:100 flood level and the probable maximum flood level (PMF).

Table 9.1: Existing Flood Levels and Hydraulic Structures

Creek		Existing Hydraulic Structure		Flood Levels (m AHD) 100yr ARI	
No.	Location/Name	Under Cross Road	Type	Upstream of Corridor	Down-stream of Corridor
1	North of Terania Street	York Road	2 x 1200 dia + 900 dia	10.75	9.41
2	South of Collaery Street	York Road	2 x 3900 x 2160 BC	12.25	9.63
3	Farrahars Creek	Mitchell Road	4x 1500 dia	12.47	9.88
4	North of Alice Street	Mitchell Road	3x 1050 dia	14.79	12.68
5	South of Rose Street	Mitchell Road	1050 dia + 1200 dia	15.46	12.71
6	Collins Creek	Thompson Street	3x 3010 x 1000 BC	13.46	12.38
7	South of Campbell Street	Thompson Street	2110 x 585 BC	11.90	9.22
8	North of Russell Street	Thompson Street	1050 DIA	18.57	11.35
9	Under Rixon Avenue	Rixon Avenue	1050 dia	20.79	17.24
10	Whartons Creek	Princes Highway	Existing hydraulic structure to remain — outside extent of construction works.		

Source: Connell Wagner (Working Paper 5)

Notes:

- 2 no.: indicates number of cells of culvert structure.
- dia: indicates nominal diameter (in 'mm') of pipe culvert.
- BC: indicates box culvert — width x height (in 'mm')
- Flood levels shown are taken at network model nodes immediately upstream of the inlet and downstream of the outlet of the overall road corridor that includes both the Distributor and the parallel existing streets: York, Mitchell & Thompson.
- Flood levels shown are in 'm' to Australian Height Datum (AHD).
- Creeks are numbered commencing from the southernmost creek located towards the Bellambi Lane end.

Figure 9.2: Local Drainage Lines

Legend

- Schematic Creek Line
- Catchment boundary
- Proposed NDE
- (A) Cross Section Number
- (6) Stream Number

Source: Connell Wagner

9.2 Key Performance Criteria

9.2.1 Draft Blockage Guidelines

The draft blockage guidelines provided by Wollongong City Council have been used in this assessment. Council's guidelines for "Hydraulic Design of Watercourses" are attached to **Working Paper 5** and outline Council's blockage requirements in relation to the analysis and design of hydraulic structures. The guidelines were based on historical evidence gathered following past storm events, in particular the 1998 storm event.

The following key Council requirements in relation to flooding are noted:

- 100% blockage for structures with a major diagonal opening width of <6m;
- 25% bottom up blockage for structures with a major diagonal opening width of >6m;
- For bridge structures involving piers or bracing, the major diagonal length is defined as the clear diagonal opening between piers/bracing, not the width of the channel at the cross section; and
- 100% blockage for handrails over structures covered in (dot point 1) and for structures covered in (dot point 2) when overtopping occurs.

Since existing hydraulic structures within the study extents are less than 6m (across the diagonal) existing flooding conditions have to be modelled with openings 100% blocked, in order to comply with Council's guidelines.

New hydraulic structures proposed as part of the Distributor works would also need to comply with the guidelines.

Wollongong City Council proposes to undertake further water catchment studies over the next few years including Whartons Creek, Collins Creek, Farrahars Creek, Bellambi Gully and Bellambi Lake. The results of these studies would be reviewed by the RTA at that stage to ensure consistency with the final design of hydraulic structures for the proposed NDE.

9.2.2 Other Criteria

Following consultation with stakeholders and the community a number of key performance criteria were identified for the proposed Distributor Extension as summarised below:

- Adoption of the 100-year ARI (or 1% AEP)[2] event as the design flood for the proposed Distributor Extension — to provide for acceptable flood immunity and use as safe emergency route/access;
- Existing flood levels and extents to be matched for flood events up to and including the 100-year ARI event & Peak Maximum Flood (P.M.F); and
- Existing overland flow paths and distribution of flows to be maintained for events up to and including the PMF.

2 ARI and AEP are the two probability terms adopted for use in Australia and documented in Australian Rainfall & Runoff 1997. ARI or 'Average Recurrence Interval' is the average or expected value of the period between exceedances of a given discharge. AEP or 'Annual Exceedance Probability' is the probability of exceedance of a given discharge within a period of one year. A 10% AEP event is equivalent to a 10-yr ARI event, 5% AEP to 20-yr ARI, 2% AEP to 50-yr ARI and a 1% AEP event to a 100-yr ARI event.

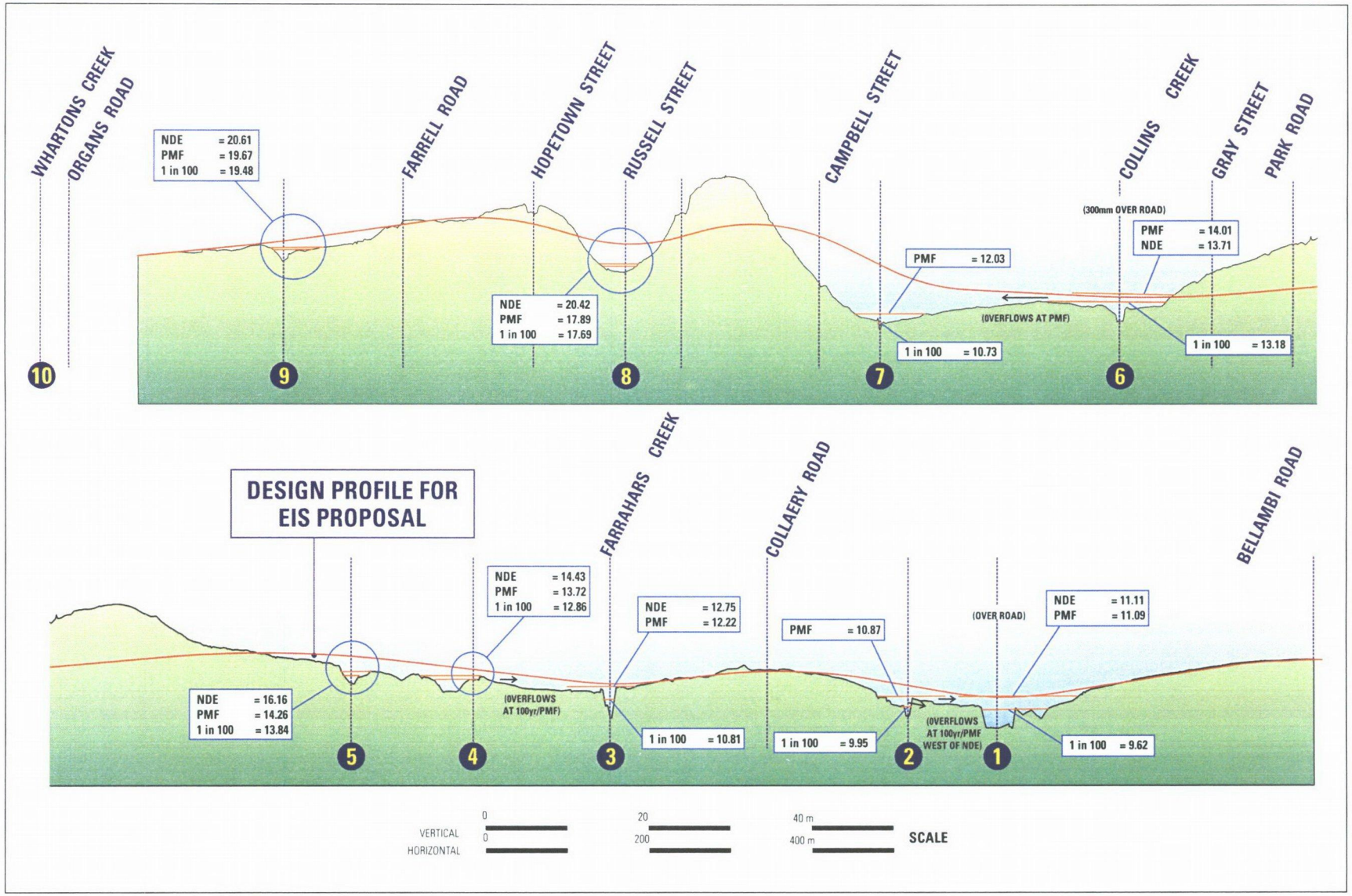


Figure 9.3: Flooding Profile for EIS Proposal

Source: Connell Wagner

9.3 Community Consultation and Model Development

As part of the EIS Study, Connell Wagner prepared a flood model to simulate the major flood event that affected the study area in August 1998. Information was also sought from a number of local residents with direct experience of the flood event. This information, combined with other data sources, provided valuable input to verification of the model.

Details of community input are summarised in **Working Paper 5 (Section 6)**.

9.4 Hydrological Analysis

9.4.1 General

The purpose of the hydrologic analysis is to determine the volume of rainfall, the proportion that would be absorbed or occur as runoff, and the contribution of incremental flows from upstream sub-catchments to the overall flow down each creek. The diversion of flow into adjacent roads or creeks when the water level is high is also determined.

The modelling included 10, 20, 50 and 100 year Average Recurrence Interval (ARI) storm events as well as the Probable Maximum Flood (PMF). The 10 watercourses traversed by the proposed NDE were separately modelled to enable a more accurate prediction of design flow hydrographs at the proposed NDE itself.

The catchments are well defined upstream of the proposed NDE, with the topography allowing little potential for inter-catchment flows. Downstream, as the natural topography becomes flatter towards the coastline, inter-catchment flows occur and some of the watercourses join prior to discharge to the ocean.

The validity of the parameters used in the modelling was confirmed by comparing flood levels generated from a known rainfall event (1998 flood) to recorded levels.

9.4.2 Existing and Future Catchment Conditions

Existing urbanised areas have been determined from aerial photos and orthophoto maps of the catchments. An impervious component of 60% has been adopted for the urbanised areas, for input into the RAFTS model.

There is little change in analysis when considering future catchment conditions. Essentially there is no redistribution of catchments. Some minimal change to existing catchment boundaries and catchment conditions result from the proposed Distributor Extension due to location of crests and sags on the vertical alignment.

There would be an increase in total volume runoff from existing conditions due to the impervious area of road. In terms of flooding the increase in flow is minimal. There is negligible effect on the instantaneous runoff from the catchment as all road drainage goes through On Site Detention (OSD) ponds that are part of the EIS Proposal. These ponds are designed to limit maximum flow, which would have occurred in an undeveloped catchment. In relation to the overall catchment area the road area represents only a very small percentage. The more significant impact would be on the smaller catchments where flooding is generally less of a concern. This issue is of more concern for the design of the pavement drainage system.

It is expected that future development throughout the overall catchment would result in an increase in urbanisation of the creek catchments. This would obviously increase runoff and hence design flows in the creeks. However, it is important to note Council's requirement that the proposed Distributor Extension is designed such that existing flooding conditions are matched and not exacerbated. This requirement would also be applied to any future development within the creek catchments, and would be enforced under Council's On-Site Detention (OSD) policy. Therefore under this policy, regardless of the type of development that may occur in the future, the peak runoff from the future catchment conditions should not exceed the existing catchment flows.

The current EIS flooding and drainage study has assumed that the management of future catchment conditions would be a matter for Council and developers to address via the OSD policy at the appropriate time. In any event the requirement remains that the existing flood conditions are matched and not worsened.

9.4.3 Impact of Road Pavement on Local Drainage

The EIS Proposal would increase the volume of stormwater runoff to the catchment during a local storm event due to the increase in impervious area, which is represented by its paved surface. The paved surface would be an approximately 30m wide strip over the total length of the new road

Wollongong City Council's policy is that existing flood conditions are to be matched and not exacerbated for a new development.

The Permissible Site Discharge (PSD) is the amount of water that runs off the proposed distributor surface, prior to development. Any difference between the runoff from the developed Distributor Extension and the PSD would need to be captured as On Site Detention (OSD).

On Site Detention (OSD) was determined to be required to detain excess runoff at seven (7) of the nine (9) creek systems investigated. (Note that proposed road works for the Distributor Extension would terminate well before Wharton's Creek, hence it would be unaffected by the proposed works). Changes to the peak runoff and required OSD volume for a 100 year ARI event are shown in **Table 9.2**. Due to site constraints and economy of design some OSD's should be omitted and storage combined with the adjacent catchments. This would only be done where the streams would normally join naturally downstream of the Distributor Extension so that no catchment is burdened by water that it would not normally receive.

Table 9.2: OSD Volumes for Various Events

		Area Existing Ha	Area Developed Ha	100 year ARI			Total Volume m^3
No.	Creek Name	A_e	A_d	Q_e	Q_d	V	OSD
1	Sth of Terania St	1.154	1.240	0.55	0.96	210	210
2	Sth of Collaery Road	0.560	0.404	0.29	0.34	2	25
3	Farahars Creek	0.90	1.020	0.41	0.85	214	220
4	Nth of Alice St	0.310	0.270	0.16	0.23	20	25
5	Sth of Rose St	0.730	0.351	0.35	0.30	-43	0
6	Collins Creek	1.047	1.902	0.50	1.38	804	850
7	Sth of Campbell St	1.052	0.470	0.63	0.40	-106	0
8	Nth of Russell St	0.500	0.770	0.31	0.65	158	160
9	Rixon Ave	0.764	0.540	0.35	0.45	22	25

Source: Connell Wagner (Working Paper 5)

Notes:
A: indicates local catchment area (in 'Ha').
Q_d: indicates developed flow rate with Northern Distributor Extension in place (in 'm^3/s').
Q_e: indicates existing pre-developed flow rate (in 'm^3/s').
V: indicates OSD volume required (in 'm^3').
Creeks are numbered commencing from the southernmost creek located towards the Bellambi Lane end.

Based on the above analysis, it is concluded that the proposed OSDs included in the EIS Proposal are adequate in size to accommodate a 1:100 year flood event, taking into account both upstream flow and run-off generated by the new road pavement.

The OSD's have been positioned where there is adequate area as outlined in the concept plans. The depths of these detention ponds have been assumed to be at least 1m, for this initial sizing, but can be modified during detailed design.

As water runoff from the road surface of the proposed NDE may contain impurities, Gross Pollutant Traps (GPT's) are to be used in conjunction with the OSD system as spill containment so that these impurities such as oil, grease and fuel, do not discharge down stream.

Flow is diverted from the small culvert between Hopetoun road and Farrell road (as this culvert is assumed to be 100% blocked) and is carried through an easement to an OSD on the western side of Rixon Avenue. The flow through this easement is relatively small. This OSD has been sized to allow for the extra flow from this catchment.

It is expected that the highest runoff would occur for a combined runoff from the road surface and the upstream catchment.

Parameters required for the calculation of blockage were calculated using Wollongong City Council Drainage Design Code 1994. The design capacity of OSD volumes used in the EIS Proposal were based on rainfall intensity values corresponding to a 100 year ARI storm event.

9.5 Hydraulic Analysis

9.5.1 General

The hydraulic analysis investigates the hydraulic performance of the network of culverts, bridges and overland flow paths within the boundaries of the catchment area covered in the study. The analysis focuses on the additional structures required to service the Northern Distributor Extension, and the effect of these structures on the flow through and around the proposed NDE. The structures are designed to minimise the impact resulting from the new development on the relative flood heights upstream and downstream of the proposed NDE.

Hydraulic modelling has been used to assess the effectiveness and impact of the bridges and culverts included in the EIS Proposal. The network model was developed using data acquired during the study. In particular, detailed survey work was undertaken of the channels in the vicinity of the proposed Distributor Extension route.

The hydraulic network comprises a mixture of open channels and piped culverts. Where catchment inter-flows are possible, these are modelled as weirs so that cross flows would not occur until the water level reaches a certain height. Flows crossing roads are modelled as a multi-conduit in the SWMM software, comprising a low level pipe culvert with an open channel (simulating the road pavement and corridor) at a higher level.

Initially, a model of the existing flow network and conditions was developed. The model was calibrated against recorded flood levels for the August 1998 flood event. The calibrated model was subsequently modified to include the proposed Northern Distributor Extension. Hydraulic structures beneath the proposed NDE were sized to prevent the development having a negative impact on the flood levels. An iterative procedure based on the model results was used to obtain the final design dimensions for the structures.

9.5.2 Existing Flood Characteristics

Flood flows are derived from the hydrologic analysis discussed above.

Most of the existing hydraulic structures along the ten creeks within the study area are relatively small and, according to the Wollongong City Council's Draft Blockage Guidelines, are likely to be blocked by debris during storm events. The guidelines are based on historical evidence gathered following past storm events, in particular the 1998 floods, and indicate that culverts and other hydraulic structures with a clear dimension less than 6m across the diagonal are likely to be fully blocked during major storm events. Consequently, when calculating design flood levels a blockage factor of 100% must be applied to all such structures, while 25% bottom up blockage must be applied to structures greater than 6m across the diagonal.

Application of this criteria to the existing case is not seen as critical for the calculation of flood levels, as the hydraulic capacity of the existing culverts is relatively small when compared to the maximum design flow events.

Flood levels resulting from 100 year ARI and PMF flood events, calculated for the existing case scenario, are listed in **Table 9.3**.

Table 9.3: Existing 100yr ARI and PMF Event Flood Levels

Creek No.	Location / Name	Existing Hydraulic Structure Under Cross Road	Type	Flood Levels (m AHD) 100 year ARI US of Corridor	100 year ARI DS of Corridor	PMF US of Corridor	PMF DS of Corridor
1	Nth of Terania St	York Rd	2 no. x 1200 dia + 900 dia	10.75	9.41	11.97	10.32
2	Sth of Collaery Rd	York Rd	2 no. x 3900 x 2160 BC	12.25	9.63	12.87	10.45
3	Farrahars Creek	Mitchell Rd	4 no. x 1500 dia	12.47	9.88	12.70	11.32
4	Nth of Alice St	Mitchell Rd	3 no. x 1050 dia	14.79	12.68	14.88	12.77
5	Sth of Rose St	Mitchell Rd	1050 dia + 1200 dia	15.46	12.71	15.52	12.82
6	Collins Creek	Thompson St	3 no. x 3010 x 1000 BC	13.46	12.3	14.14	12.67
7	Sth of Campbell St	Thompson St	2110 x 585 BC	11.90	9.22	11.97	11.15
8	Nth of Russell St	Thompson St	1050 dia	18.57	11.35	18.62	12.66
9	Under Rixon Ave	Rixon Ave	1050 dia	20.79	17.24	20.91	18.77
10	Whartons Creek	Princes Hwy	Existing hydraulic structure to remain — outside extent of construction works.				

Source: Connell Wagner (Working Paper 5)

Notes:

1. 2 no.: indicates number of cells of culvert structure.

dia: indicates nominal diameter (in 'mm') of pipe culvert.

BC: indicates box culvert — width x height (in 'mm')

US indicates Upstream

DS indicates Downstream

Flood levels shown are taken at network model nodes immediately upstream of the inlet and downstream of the outlet of the overall road corridor that includes both the Distributor and the parallel existing streets: York, Mitchell & Thompson.

Flood levels shown are in 'm' to Australian Height Datum (AHD).

Creeks are numbered commencing from the southernmost creek located towards the Bellambi Lane end.

W: indicates width (in 'm') of bridge structure.

H: indicates height (in 'm') of bridge structure.

Changes in flood levels shown are taken at network model nodes immediately upstream of the inlet and downstream of the outlet of the overall road corridor that includes both the Distributor and the parallel existing streets: York, Mitchell & Thompson.

Creeks are numbered commencing from the southernmost creek located towards the Bellambi Lane end.

9.5.3 Impact of the Council's Draft Blockage Guidelines

The implications of the blockage criteria were taken into consideration when sizing the culverts for the Distributor Extension. The culverts were sized to prevent overtopping of the road during the 100 year ARI design event. This includes areas where a blockage of 100% is applied to the culverts.

The size of minor culverts on the proposed NDE have been designed to assume 100% blocked in accordance with Council policy. This was considered acceptable when the total design flow was small enough to be contained upstream of the distributor (creek 8), or if the flow could transfer to other streams without having a detrimental impact on flood levels. Cross-catchment transfer was allowed from creeks 4 and 5, which overflow into creek 3 (Farrahars Creek). These creeks normally merge just downstream of the proposed Distributor Extension route, so there would be negligible impact on the downstream flood levels along Creek 3.

The culverts/bridges through the railway line east of the Distributor Extension were modelled allowing a range of blockage factors. The flood levels between the railway line and the proposed NDE are likely to be controlled from downstream (ie the railway line culverts), and are largely independent of the culvert sizes underneath the distributor. Considering that the culverts at the railway line are 'existing', the selection of blockage factor for these culverts should have negligible impact when examining the changes in flood height resulting from the proposed NDE development.

9.5.4 Proposed Hydraulic Structures

Modelling of proposed hydraulic structures was based on the following key criteria:

- The vertical alignment of the Distributor Extension used in the model is that adopted by the RTA as the EIS Proposal;
- The requirements specified by the Wollongong City Council's draft blockage guidelines;
- The Distributor requires immunity from a 100 year ARI flood event;
- The development must cause no worsening of existing case flood levels.

All proposed hydraulic structures have a minimum clear diagonal span of 6m, with the exception of creeks 4, 5 and 8. The structures utilise the full leg height available based on the clearance presented by the vertical alignment adopted by the RTA, allowing for a deck thickness of 0.5m. A 25% bottom up blockage is applied to structures with a minimum clear diagonal span, while smaller structures are considered fully blocked when calculating design flood levels.

The proposed hydraulic structure dimensions, and the impact on 100 year ARI and PMF flood levels are summarised in **Table 9.4**.

Table 9.4: Impact of Proposed Hydraulic Structures

Creek No.	Location/Name	Proposed Hydraulic Structure	Change in Flood Levels (m AHD) 100 year ARI Node	RL	Change	PMF RL	Change
1	North of Terania Street	15m W x 3.6m H	1-1500	10.75	0.00	11.93	-0.04
			1-1350	9.42	+0.01	10.32	0.00
2	South of Collaery Rd	9m W x 3.5m H	2-0196	12.25	0.00	12.87	0.00
			2-0080	9.63	0.00	10.47	+0.02
3	Farrahars Creek	18m W x 3.6m H	3-0836	12.47	0.00	12.70	0.00
			3-0633	9.88	0.00	11.32	0.00
4	North of Alice Street	3.3m W X 1.5m H	4-0303	14.79	0.00	14.88	0.00
			4-0186	12.67	-0.01	12.76	-0.01
5	South of Rose Street	2.7m W x 1.2m H	5-0259	15.46	0.00	15.52	0.00
			5-0078	12.70	-0.01	12.80	-0.02
6	Collins Creek	35m W x 3.3m H	6-1543	13.42	-0.04	14.23	0.09
			6-1300	12.39	0.01	12.63	-0.04
7	South of Campbell Street	15m W x 2.85m H	7-0623	11.88	-0.02	12.04	0.07
			7-0435	9.22	0.00	11.22	0.07
8	North of Russell Street	2.4m W x 0.9m H	8-1106	18.57	0.00	18.62	0.00
			8-0960	11.35	0.00	12.67	0.01
9	Under Rixon Avenue	6m W x 1.8m H	9-0360	20.79	0.00	20.91	0.00
			10-1110	17.23	-0.01	18.75	-0.02
10	Whartons Creek	Existing hydraulic structure to remain — outside extent of construction works.					

Source: Connell Wagner (Working Paper 5)

9.5.5 Maximum Velocities

The maximum velocities of the floodwaters through the various bridges and culverts are listed in **Table 9.5** below. Note that the velocities listed in the section across the proposed NDE under the developed case are culvert velocities, and should not be compared directly to the existing case velocities at that location. The velocities through culverts with a clear diagonal span greater than 6m are determined assuming the culvert to be partially blocked (ie 25% bottom up blockage).

For smaller culverts, which are considered to be fully blocked during the flood level calculations, the velocity is calculated using the fully open cross section. It is assumed that significant erosion does not occur while the culvert is in the process of becoming blocked.

Good design practice would provide for energy dissipaters downstream of the culvert where required to prevent erosion. In general, where the grade on the downstream side of the culvert is not excessive, velocities of up to three metres per second (3m/s) can be

accommodated without major erosion concerns. This is dependent upon a range of issues such as soil type, vegetation, and treatment of the downstream area, and should be considered on a site by site basis. The velocities shown in Table 9-5 are typically less than 3m/s, with the exception of creek 5. Protection works may be required on the downstream side of these culverts.

Table 9.5: Summary of Maximum Velocities for Various Events

Creek No.	Location / Name	Proposed Hydraulic Structure	Maximum velocity through proposed hydraulics structures 100 year ARI m/s	PMF m/s
1	North of Terania Street	15m W x 3.6m H	1.59	2.86
2	South of Collaery Rd	9m W x 3.5m H	2.04	2.25
3	Farrahars Creek	18m W x 3.6m H	1.69	2.14
4	North of Alice Street	3.3m W X 1.5m H	1.66	3.19
5	South of Rose Street	2.7m W x 1.2m H	3.53	4.21
6	Collins Creek	35m W x 3.3m H	1.63	2.79
7	South of Campbell Street	15m W x 2.85m H	1.62	2.56
8	North of Russell Street	2.4m W x 0.9m H	2.66	3.14
9	Under Rixon Avenue	6m W x 1.8m H	2.54	2.77

Source: Connell Wagner (Working Paper 5)

9.6 Impact Assessment

9.6.1 Council's Draft Blockage Guidelines

At the time of writing, Council's guidelines were still under review. Ongoing changes to the guidelines would need to be addressed at the detail design stage and hydraulic structures amended where appropriate by the RTA.

9.6.2 Downstream Controls

The invert levels of the creeks at the location of the Distributor Extension vary from a minimum of 7.0m (AHD) at Creek 1 to a maximum of 18.0m (AHD) at Creek 9. These levels are significantly higher than mean sea level at 0.0m (AHD), and as such tidal backwater effects are considered to be negligible. This was confirmed during initial runs of the model.

The model has been extended downstream of the Distributor Extension and past the railway line to the east. The existing hydraulic structures under the railway line form the downstream control on the model. The analysis was undertaken with the existing hydraulic structures under the railway line assumed to be unblocked. The proposed hydraulic structures have been

sized on this basis. A sensitivity analysis was conducted to assess the effect on flood levels caused by blockage of the railway line culverts, as discussed in **Section 9.6.3** below.

9.6.3 Blockage of Railway Structures

The effect of blockage of the existing railway structures on flooding at the Distributor Extension has been considered in this study. Model runs have been undertaken for the 100 year ARI and PMF events with a 25% and 100% blockage factor applied in accordance with Council's draft blockage guidelines.

The analysis indicates that 25% blockage of the rail structures has no real effect on the levels around the proposed NDE. A further run was undertaken with 100% blockage of the rail structures. The results show that the effect of increasing blockages on the rail structures fails to have any noticeable effect on flood levels at the proposed NDE except for creek 7.

The blockage factor which should be applied to the rail structures during modelling of the proposed NDE has not been resolved, considering the anomalies associated with relating blockage as a percentage of structure opening. These issues were discussed with Council during the Study and no firm blockage factor was resolved for the rail structures. This Study has assumed that all rail structures are sized in excess of the 6m diagonal requirement under WCC Blockage Guidelines.

9.6.4 Impact on Downstream Catchments

There would be an increase in the volume of runoff due to the construction of the proposed NDE due mainly to the increased areas of impervious road pavements proposed. The impact of this increased runoff would be controlled by the provision of mitigation measures such as On Site Detention (OSD) facilities.

Runoff from the proposed NDE would first pass through the proposed OSD facilities before entry into the downstream catchment. Provision of OSD facilities to perform this function is widespread throughout the industry, and is conventional technology. Wollongong City Council currently has in place an OSD policy that is intended to ensure that new developments do not worsen existing conditions by ensuring that post-development flows match pre-development levels.

The exact arrangement and location of the OSD facilities would be determined at the detail design stage. The facilities can take the form of either below-ground tanks or above-ground basins depending on the available space requirements and interface with other road elements such as cut & fill batters, noise walls, traffic barriers, construction staging etc. These elements would dictate whether a single above ground or below ground basin was appropriate for each road catchment, or whether a number of smaller facilities would be more practical.

9.6.5 Catchment Cross Flow Considerations

The vertical alignment of the Distributor Extension has been examined under the PMF flood event to determine impacts on the distribution of overland flows, and whether NDE would cause water ponding resulting in flow between catchments that may not have previously occurred. The results are discussed below.

Farrahars Creek Main Catchment

Creeks 1, 2, 4 & 5 are all tributaries of Farrahars Creek (Creek 3). Creeks 1 & 2 form one sub-catchment located south of the ridgeline along Collaery Rd and Creeks 3, 4 & 5 form another sub-catchment north of the Collaery Rd ridgeline. The northern boundary of this catchment comprises the Park St ridgeline.

The EIS Proposal will bridge Collins Creek near Thompson St.

The vertical alignment of the proposed NDE follows this catchment definition with crests located at the Collaery Rd (RL14.6) and South of Park St (RL16.26) ridgelines and sags at the creek locations.

The PMF level at the proposed NDE is at approximately RL11.2 and RL10.9 for creeks 1 & 2 respectively which are significantly lower than the Collaery Road ridgeline. Similarly, the PMF level at the proposed NDE are approximately RL12.2, RL13.7 and RL14.3 for creeks 3, 4 & 5 respectively which are also lower than the Collaery Road and Park Road ridgelines. This indicates that all PMF flows would be contained within the existing catchments and no cross-catchment flow occurs.

Collins Creek Main Catchment

Creek 7 is a tributary of the main creek Collins Creek (Creek 6). These two creeks form one catchment located between the Park St ridgeline to the south and the Campbell St ridgeline to the north.

The vertical alignment of the Distributor Extension follows this catchment definition with sags located at the creeks and a crest at RL16.6 South of the Park Road ridgeline. To the north the vertical alignment continues north on a rising grade through the Campbell St ridgeline to finally crest at RL22.8 south of Russell Street.

The PMF level at the proposed NDE are at approximately RL14.0 and RL12.0 at creeks 6 & 7 respectively which are significantly lower than the catchment boundaries and NDE levels.

Creek 8 Catchment

The controlling level for inter-catchment flows on this creek is at the road location on the southern boundary at RL22.8 & RL23.6 respectively.

The PMF level for creek 8 at the proposed NDE is predicted at RL18.62 which is lower than the controlling points at the boundaries. Therefore all PMF flows would be contained within this sub-catchment as per existing conditions.

Creek 9 Catchment

There is an opportunity for inter-catchment flows on creek 9 due to the falling grade of the EIS Proposal from south to north across the creek in the direction of Whartons Creek. The controlling level for inter-catchment flows on this creek is at the road location on the northern boundary of the catchment at RL20.3.

The PMF level for creek 9 at the Distributor Extension is predicted at RL20.91 which is lower than the controlling RL20.3. Therefore, as for the other creeks, all PMF flows would be contained within this sub-catchment as per existing conditions.

Summary of Crossflows

Although the proposed NDE crosses a total of 9 streams, there are ultimately only 4 major stream catchments. The EIS Proposal does not cause crossflows between these catchments due to ponding. Some crossflows may occur between streams within a catchment, however this is not exacerbated by the construction of the proposed NDE.

Road catchments formed by the vertical alignment of the proposed NDE typically match the stream catchments, with the exception of the alignment near creek 8. Where overtopping of the road is predicted under the PMF event, crossflow between major stream catchments along the road does not occur.

9.7 Conclusions

The Flood Study has considered the impact of the proposed Distributor Extension on flooding conditions in the vicinity. Catchments extending upstream to the escarpment and downstream to the ocean have been examined in determining design flood flows and flood levels. The impacts of future catchment conditions and Council's OSD policy have also been considered.

Discussions with key stakeholders and Council were undertaken to determine appropriate performance criteria and key issues to examine. These issues and criteria were incorporated into the hydrologic and hydraulic modelling carried out for the study.

An extensive community consultation and visitation was undertaken to ensure that, as much as reasonably possible, all relevant comments have been addressed and observed analogies during the 1998 flood, together with recorded flood levels, have been considered in the model. Calibration of the model indicates that it represents a reasonable mathematical interpretation of how the total catchment would behave.

The EIS Proposal includes hydraulic structures and OSDs that have been based on Council's draft blockage guidelines and key performance criteria. The structures have been sized to ensure flood levels in the vicinity of the proposed NDE do not exceed existing flood levels.

The impact of the proposed NDE on downstream catchments has been considered in terms of both runoff flow rates and water quality. Appropriately sized OSD facilities are proposed to help mitigate impacts on downstream catchments due to the increased paved areas associated with the Distributor Extension. In addition, water quality measures are discussed and appropriate measures identified for further consideration at the detail design stage.

The effect of the proposed NDE alignment on overland flows during the PMF event has been investigated. Appropriate location of sags and crests along the alignment, in conjunction with appropriate sizing of the proposed hydraulic structures, ensures that no inter-catchment flows occur during the PMF event.

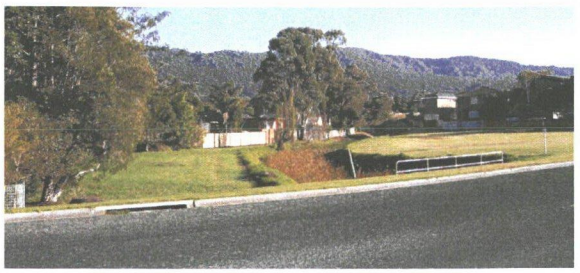
Based on the analysis by Connell Wagner, it is concluded that:

- The construction of the proposed NDE with bridges and culverts used in the EIS Proposal would provide negligible effect on flooding levels from about 60m upstream or downstream of the proposed NDE and no residential dwellings would be worse off from flooding due to the proposed NDE;
- The worst potential flood would occur when the railway structures fully block. The backwater effect on flooding is felt back as far as the proposed NDE. In a PMF only creek 7 has an increase in level upstream of the proposed NDE due to the proposed structure;
- Little useful recorded information had been previously available with regard to the 1998 floods within the study area. Extensive community interviews and a door knocking campaign was undertaken, which resulted in a collection of good quality information and actual levels from the 1998 floods. These were used to verify the model used in the study. This allowed a high level of confidence in the historic results;
- In the study it became apparent that during bigger floods there is cross flow between minor catchments of the same main creek catchments;
- The NDE does not cause any streams to cross flow that did not before. In some cases, streams which cross flowed immediately downstream of the proposed NDE now may cross flow upstream. However local flooding to residencies is not affected;
- The NDE would not be overtopped by the 100 year ARI flood;
- During the PMF flood the road pavement is overtopped to a minor extent in 3 locations;
- To allow the flood to pass over the proposed NDE, noise barriers were eliminated over some bridges;
- There is no situation where cross flow between major catchments can occur by water flowing along NDE.

9.8 Mitigating Measures

A number of items not addressed in the design of the EIS Proposal should be taken into account to improve water flow in the vicinity of the proposed NDE. Not all items are the responsibility of the RTA. The following mitigation measures should be further investigated in the detailed design phase of the proposed NDE:

- The alignment of Collins Creek immediately upstream of the bridge should be investigated. There may be some value in straightening the main channel in this area; and
- Inclusion of a workable trash rack upstream of the culvert for creek 8. In accordance with WCC draft blockage guidelines this culvert has been assumed to be fully blocked. Due to the realistic small size of the catchment, a well designed trash rack would assist in maintaining at least some flow through this culvert.



Farrahars Creek.

10. Water Quality

This section examines the impact of the EIS Proposal on downstream water quality during the construction phase and the on-going operational phase. The assessment has been carried out in accordance with the RTA's Water Policy which calls for use of the most appropriate water management practices in the planning, design, construction, operation and maintenance of the roads and traffic system to conserve water, protect the quality of water resources and preserve ecosystems.

Working Paper 6 on **water quality** has been prepared by Forbes Rigby for this study.

10.1 Catchment Description

10.1.1 Watercourses and Land Use

The Northern Illawarra district contains numerous small catchments draining directly to the Pacific Ocean. The upper reaches of these catchments are steep and heavily forested, with the middle and lower sections grading from moderately steep to relatively flat. Individual catchments are characterised by long tapering wedges of coastal land. Urban development is generally confined to the middle and lower section of the catchments.

Typical catchment dimensions are approximately 500 m x 1,500 m (equivalent to an area of 75ha). They exhibit rapid response times, high runoff and are generally ephemeral, although baseflows are in some cases supplemented by minewater discharge from local collieries.

The relatively high annual rainfall of the region (averaging 1,100 – 1,600 mm) creates numerous small high velocity streams that have steep origins on the Escarpment before entering flat and relatively narrow floodplains with small terminating estuarine lagoons. These streams are relatively steep, and can produce comparatively large peak flows with little warning. The creek channels have a limited discharge capacity carrying only about 20% of peak flood flows, overflows being carried in the floodplains.

Seasonal variation in rainfall is quite strong, with most rain occurring in the summer-autumn seasons as shown in **Table 10.1**.

Flood patterns are complicated because the rivers run generally west to east, whereas the numerous crossings associated with the Illawarra Railway Line, Princes Highway (Lawrence Hargrave Drive), and local roads run north to south. Creeks discharge a considerable amount of erosional material down the slopes and into the ocean during storms.

The proposed NDE from Bellambi Lane to the Princes Highway at Molloy Street Bulli crosses 4 main creek systems (**Table 10.2** below from south to north). In addition to the main creek channels, the route also crosses 5 smaller tributaries.

Most of the natural landscape within these catchments has been altered in some form or another to make way for urban and rural development. The forests at the foot of the Escarpment were similarly cleared of timber and planted with exotic grasses for pastoral and grazing activities. Much of the early cleared lands have been progressively urbanised with subsequent declines in water quality, increases in land degradation and loss of biodiversity.

Table 10.1: Average Seasonal Rainfall at Wollongong University

Season	Month	Av. Rainfall (mm)
Summer	December — February	420mm
Autumn	March — May	444mm
Winter	June — August	248mm
Spring	September — November	294mm

Source: Bureau of Meteorology (1999)

Table 10.2: Study Area Creek Systems

Creek	Description
Bellambi Creek	This catchment begins at the top of the escarpment and discharges into the ocean just north of Bellambi Point. Total catchment area is 427 ha. Farrahars Creek joins this catchment near Pioneer Beach Estate. The upper catchment includes the South Bulli Colliery, Russell Vale Coalwash Emplacement Area (RVEA) and the former Russell Vale Waste Disposal Depot (now Russell Vale Public Golf Course).
Farrahars Creek	This is a long narrow catchment that commences at the top of the escarpment (at Rixons Pass) and joins Bellambi Creek at Pioneer Beach Estate (Near Holy Spirit College). Total catchment area is 164 ha and includes the southern precinct of the Edgewood residential development.
Collins Creek	Collins Creek comprises some 391 ha extending from the escarpment to the ocean where it discharges via an estuarine lagoon. The catchment is heavily urbanised and includes the northern precinct of the Edgewood residential development.
Whartons Creek (southern tributary)	The northern distributor traverses a small southern tributary of Whartons Creek. This tributary has a limited catchment (less than 15 ha) extending to the Princes Highway. The catchment is completely urbanised and most of the watercourse has been piped.

Source: Forbes Rigby (Working Paper 6)

Wetlands in the northern suburbs are few, and mainly confined to the small estuarine lagoon complexes that are created by sandy barriers where the streams meet the ocean, such as Bellambi Lagoon.

Within the Illawarra Region, broad scale land use consists of natural vegetation 38%, rural 35%, urban 21%, industrial 4% and wetlands 2% (Chafer, 1997). The distribution of these land uses across the study area however suggests a larger percentage of urban and industrial land use than elsewhere in the region as evident in **Table 10.3**. The NDE Study Area is heavily developed with the eastern half of the catchment almost fully urbanised, with residential development slowly expanding into the foothills along the western fringe of present development.

Despite the extent of urbanisation, the escarpment and foothills are still heavily wooded, with some of the more inaccessible areas in a near natural condition. It is also interesting to note that main roads land use make up less than 1% of the study area catchments.

Table 10.3: Distribution of Land Use

Catchment	Area	Urban	Industrial	Rural	Open Space	Forest	Main Roads	Railways	Totals
Whartons Creek*	(ha)	117	12	0	15	61	2	4	211
	(%)	56	6	0	7	29	1	2	100
Collins Creek	(ha)	180	25	0	13	168	2	5	391
	(%)	46	6	0	3	43	0	1	100
Farrahars Creek	(ha)	72	34	0	12	42	2	3	164
	(%)	44	21	0	7	25	1	2	100
Bellambi Creek	(ha)	168	92	0	67	92	3	5	427
	(%)	39	21	0	16	22	1	1	100

* Including southern tributary traversed by the NDE

Source: Forbes Rigby (Working Paper 6)

10.1.2 Existing Water Quality

There is only a limited amount of prior water quality information for the proposed NDE study area. Two surface water baseline water sampling campaigns were undertaken for this study, involving dry weather and wet weather periods. Samples were taken in Bellambi Creek, Farrahars Creek, Collins Creek and Whartons Creek close to the proposed NDE crossings.

No sampling of groundwater was undertaken as groundwater impacts of the proposed NDE were considered negligible if appropriate environmental management measures are observed. Also use of groundwater in the areas downstream of the proposed NDE are non-existent as evidenced by the presence of only one old licensed bore on the Department of Land and Water Conservation bore register located upstream of the proposed NDE on Alice Street.

The water quality outcomes from the EIS sampling campaigns are tabulated in **Table 10.4.** Note that Pb denotes Lead — a measure of contamination from leaded fuels and industrial activity; TSS denotes Total Suspended Solids — a measure of water turbidity and total insoluble pollutant load; and O&G denotes Oil and Grease — a measure of fuel and oil contamination from construction sites, roadway transport and industrial activity.

The data suggest that the dry weather water quality in these creeks is quite good but is noticeably impacted by upstream activities, either of a permanent (e.g. traffic on Princes Highway and urban streets) or temporary nature (e.g. cut and fill operations associated with the new large-scale residential development affecting Collins and Farrahars Creeks).

However, the wet weather quality in these creeks was poorer in two of the creeks than observed for the dry weather sampling campaign. Residential development in the catchments could contribute to the suspended solid loadings in Collins Creek and Farrahars Creek,

despite the implementation of Soil and Water Management Controls. It is noted however that it is anticipated that residential development within the catchment would be completed by the time the proposed NDE is commenced, if it proceeds.

Oil and grease levels were low and probably reflected washoff from Princes Highway and urban streets. It is not likely that soils or oil/fuel from earth working machinery in the residential development area would have penetrated as far as the sampling locations.

As far as it is known, no spill occurrences were reported for Princes Highway during the periods just preceding either the dry or wet weather sampling campaigns, hence the results obtained may be regarded as good background benchmark levels that should be attained at least by the post-construction installed water quality controls.

Table 10.4: Baseline Water Quality

Watercourse	Dry Weather			Wet Weather			
	Pb mg/L	TSS mg/L	O&G mg/L	Pb mg/L	TSS mg/L	O&G mg/L	Comments
Whartons Creek Tributary	0.003	15	1	0.006	4	<1	Lead levels probably reflect proximity to, and washoff from Princes Highway.
Collins Creek	0.002	31	<1	0.008	41	2	Clay turbidity probably originating from upstream residential development Lead levels reflect native lead component of high TSS.
Farrahars Creek	<0.001	4	<1	0.011	80	1	Clay turbidity probably originating from upstream residential development. Lead levels reflect native lead component of high TSS
Bellambi Creek Tributary	<0.001	19	<1	0.004	16	<1	Possible fine coal wash turbidity from coalwash emplacement upstream. Lead levels reflect washoff from urban streets.
ANZECC & ARMCANZ (2000) trigger guideline for protection of 80% of all aquatic species	0.009			0.009			
Typical NSWEPA Industrial or Mine Site discharge limits		50	10		50	10	

Source: Forbes Rigby (Working Paper 6)

10.2 Possible Sources of Pollution

Possible sources of pollution in the study catchments comprise a combination of diffuse and point source loads. Diffuse pollutant sources can include runoff from urban areas, roadways, commercial areas and playing fields. Point sources include specific industrial facilities, treatment plants, waste depots and sewer overflows. Each of these pollutant types is described below, along with a description of road-based pollutants that could be potentially associated with the proposed NDE.

Of particular relevance to this study is the potential pollution arising from **wash off from new road surfaces** created by the proposed NDE. The primary pollutants derived from road surfaces include:

- Fine grained sediment (TSS) (e.g. abraded highway surfacing, spilled coal and other truck load materials, rubber tyre dust etc);
- Oil & Grease (O&G) derived from leakage from vehicles and spillage from industrial machinery being transported by trucks; and
- Lead (Pb) from engine exhaust dust fallout and from fuel leakages.

Other pollutants such as nutrients, heavy metals and toxins have also been found in road surface runoff and are often attached to the finer fraction of TSS. This was confirmed in a recent study by Muthukaruppan et al (2002) who found that increased concentrations of nutrients (nitrogen and phosphorus) were associated with finer sediment types collected from roadways. For this reason it was suggested that treatment measures should be particularly designed to target the fine (clay sized) sediment fraction.

The NDE would provide an alternate route for existing traffic and would therefore not by itself generate additional pollutants (as the increase in traffic along the proposed NDE would be offset by a reduction in traffic along the Princes Highway). Nevertheless it would in the longer term facilitate the growth in traffic and hence a potential increase in polluted run off.

The NDE would also increase the amount of impervious surfaces in the local area.

However, it is noted that water quality controls have been integrated into the proposed NDE design (which do not currently exist along the Princes Highway), therefore the overall level of treatment should improve with a corresponding improvement to existing water quality.

10.3 Sensitive Water Bodies

There are four sensitive water bodies downstream from the proposed NDE route:

- A lagoon on Bellambi Creek, which contains a major freshwater barrier dune wetland ecosystem that is a significant amenity for, and recreational feature of Pioneer Residential Estate;
- The lower reaches of all the creeks that are unlined, where substantial stretches of aquatic macrophytes growth have become established and perform the important role of providing assimilative and extenuative capacity for pollutants loads from the upper reaches of each catchment; and

- The small estuarine areas near the mouths of Whartons Creek and Collins Creek that are fish nursery areas.

No SEPP 14 wetlands would receive water draining from the proposed NDE.

Each of these watercourses have been subject to pressures associated with urban and industrial development and are generally in a degraded state with limited natural riparian vegetation. This overall level of environmental 'stress' has previously been appraised by DLWC — South Coast Region (1998) in a pilot project to develop a method for such assessment.

Under this preliminary assessment, the Bellambi Creek watercourse was ranked as the 9th most 'stressed' creek in the Illawarra region (Stoney Creek at Coalcliff was ranked as the most environmentally stressed watercourse).

With respect to water quality it is noted that the coastal creeks and lagoons in the study area (where data is available) generally do not meet ANZECC guidelines for the protection of aquatic ecosystems or primary contact recreation. Faecal coliform levels also generally do not meet ANZECC guidelines for primary and secondary contact recreation. Poor water quality has been recorded during both dry and wet weather in these creeks and wetlands.

The Illawarra Catchment Management Committee (ICMC) has prepared an inventory of the wetlands of the Illawarra Region. This work (Chafer, 1997) found that the wetlands of the Illawarra Catchment contain a surprising diversity of life, with over 700 species of macroscopic flora and fauna having been recorded.

The creeks that are traversed by the proposed NDE are characterised by relatively short, incised watercourses that do not contain a wide flood plain and are subject to intense urban pressures. Consequently, wetlands are few, and are mainly confined to the small estuarine lagoon complexes that are created by sandy barriers where the streams meet the ocean (eg: Bellambi Creek Lagoon) (Chafer, 1997).

Table 10.5 below lists each of the important wetlands identified in the study catchment as recorded in the ICMC inventory.

The main conclusions that can be drawn from Chafer (1997), with reference to the proposed NDE study area (and northern Illawarra wetlands in general), are that:

- The few remaining wetlands within the area are mainly confined to the small estuarine lagoon complexes created by sandy barriers where the streams meet the ocean;
- These wetlands are under threat from urban pollution;
- The wetlands can provide habitat for rare or endangered species of flora and fauna;
- There is a recent history of ongoing wetland loss in the region;
- Further research is required into the region's wetland biodiversity; and
- Catchment-based management plans are required for wetlands.

Table 10.5: Potential Areas of Environmental Sensitivity

(IWP Project No.[a])	Location	Type	Size (ha)	No. Species [c]	Comment
Whartons Ck Lagoon (15)	Whartons Ck, Bulli	Estuarine Lagoon	0.1	No Data	
Collins Ck Lagoon (16)	Collins Ck, Bulli	Estuarine Lagoon	0.5	90	
Farrahars Ck Lagoon [b]	Farrahars Ck, Bellambi	Estuarine Lagoon	1.7	No Data	
Bellambi Creek Lagoon (18, 40, 132, 242)	Bellambi Creek, Bellambi	Estuarine Lagoon	5.6	122	Regionally significant. Supports alluvial forest and provides habitat for threatened bird species

Source: Forbes Rigby (Working Paper 6)

Notes:
[a] Illawarra Wetland Project Number
[b] IWP No. is included with Bellambi Creek
[c] Total number of recorded plant and animal species

10.4 Possible Pollution 'Sinks'

Each of the main creeks contain sinks (receptor ecosystems) for downstream pollution from the proposed NDE although their assimilative capacity varies as follows (highest to lowest):

- Collins Creek;
- Whartons Creek;
- Farrahars Creek;
- Bellambi Creek Tributary.

It is important to note that the lower stretches of Farrahars and Bellambi Creek Tributary are also subject to potential and likely sporadic pollution from the industrial area along York Road, which contains a number of industries such as Baines Concrete Plant and Metals Recycler.

The downstream assimilative/attenuative capacity for pollutants such as suspended solids, fuels and oils and metals between the proposed NDE route and the nearest recognised receptor ecosystem would be largely a function of the length of any unlined, least channelised, macrophyte-colonised reach.

On this basis the main impact management/mitigation effort would be concentrated in the lower catchment of Farrahers Creek and Bellambi Creek tributary.

10.5 Mitigation Measures

10.5.1 Water Quality Controls

Having regard to the potential impacts of construction and operation described above, it is necessary to establish an appropriate water management system. This would cover all facets of the EIS Proposal from short-term construction phase soil and water management to longer-term operational phase water quality controls.

The RTA has adopted a water policy that requires the adoption of appropriate water management practices in order to:

- Conserve water;
- Protect the quality of water resources; and
- Preserve Ecosystems.

More specifically the RTA has developed a Code of Practice for Water Management (1999) that provides broad principles with regard to construction and operational phases water management. The following two sections describe proposed water quality controls that meet the principles and objectives of this code.

Construction Phase

The general principle for construction phase water management as described in the RTA Code of Practice for Water Management is that: *"Effective water management practices and procedures would be implemented, in accordance with the Contractors Environmental Management Plan and Soil & Water Management Plan, as an integral part of on-site construction management to ensure that water quality and quantity impacts to the environment are minimised".*

This is an important principle as often the major impact that results from the development of new infrastructure is the potential for sediment-laden runoff during construction. To meet this objective the following general Soil and Water Management Controls would be adopted. These have been based on current best industry practice and 'Managing Urban Stormwater, Soils and Construction' (the 'Blue Book') produced by the NSW Department of Housing.

Identifying those areas required to be disturbed by construction activity and ensuring that disturbance is limited to only those areas.

- Staging of construction activity as necessary to ensure good environmentally sensitive construction practices are followed and minimising the area disturbed at any one time;
- Maintain controls after completion of the construction until the land is fully stabilised and vegetation re-established;
- Utilising a suite of sediment control measures to suit each specific site. Appropriate measures would typically include a combination of:
  - Diversion drains to channel clean runoff away from construction areas.
  - Silt fences to filter runoff from disturbed areas and from around stockpiles.
  - Hay bale sediment traps in areas of concentrated flow to trap sediment and reduce scour.

- Geotextile filter rolls upstream of kerb inlets
- Designing drainage through and from disturbed areas to minimise surface flow velocities.
- Diverting surface and road runoff away from fill batters and into drainage lines.
- Using temporary sediment basins to treat sediment-laden runoff. Where possible these basins would be constructed in the location of proposed long term water quality ponds.
- Stabilising bare areas within 14 days of the completion of construction activities. Temporary stabilisation techniques such as erosion matting, mulching and grass species establishment would be implemented on disturbed areas.
- Undertaking regular inspection and maintenance of all works and rehabilitated areas.
- Installing all sediment control measures as detailed on the approved management plans before the commencement of construction.

A typical detention basin.

In addition, and where possible, construction of major watercourse crossings would need to be carried out in an environmentally sensitive manner. Excavation for the placement of culvert or bridge structures would need to be kept to a minimum with low flows temporarily diverted around the work site. No materials would be stockpiled within the bed of the creek. In particular fuel storage for construction machinery would be positioned well away from the creek and stored within a bunded and secure area to contain spillage. Where practical, the existing creek invert would be maintained and additional armouring provided to batter slopes and bridge abutments in order to minimise scour. Structures would also be designed to minimise velocity and concentration of flow against the creek bank.

Water would be used during the construction stage for the purpose of dust suppression and moisture conditioning of fill materials. It is anticipated that this water would be drawn from the existing town water supply and therefore would not impact in any way on the natural flow regime.

Air cooled slag products would not be used in the lower layers of embankment fills. This would ensure that potential adverse impacts on groundwater (and surface water) from alkaline leachate containing sulfide can be avoided. This should be incorporated into the Environmental Management Plan for the project.

Operational Phase

The longer-term impacts of the proposed NDE would be mitigated through implementation of appropriate water quality controls.

Many of the primary pollutants in road runoff are those associated with finer sediment particles. These would be removed through:

- Source control (street sweeping, litter control);
- Landscaped buffer strips (to provide coarse filtration of runoff prior to entering the drainage system);
- Water Quality Ponds (also referred to as a sediment pond); and

- Water Quality Wetlands (similar to a water quality pond but provides enhanced filtration of finer particles).

Each of these measures has particular applications and target different sediment particle sizes and flow rates. They are also different in the amount of land they require, which is a critical consideration for a project such as the proposed NDE that is highly constrained with respect to area. In this regard, it is noted that although there are many water quality control methods available, not all are suitable for application in the proposed NDE design.
The selection of appropriate controls for the proposed NDE are governed by:

- *Availability of land:* Due to the narrow corridor available and limited scope for altering the alignment of the proposed NDE there is generally a limited amount of land available;
- *Fragmented catchment structure:* There are several separate catchments that are traversed by the proposed NDE route. It is difficult and undesirable to undertake extensive diversion of flows between these catchments;
- *Soil Type:* Clay soils in the area are generally less suitable for controls such as vegetated swales. To work effectively a relatively wide and shallow swale would be required which is not compatible with the narrow corridor available;
- *High Rainfall:* Due to the high rainfall in the Illawarra and intense storm bursts which can occur, there is potential for scour of typical measures such as open channel drainage systems. Given the narrow corridor width there would be difficulties in designing these structures to minimise this problem; and
- *Maintenance Requirements:* Major public infrastructure projects such as the proposed NDE are likely to require more intensive maintenance. This already significant burden should not be increased further by installation of maintenance intensive water quality controls.

The adopted water quality controls for the EIS Proposal incorporate the use of dual-basin stormwater management facilities (one dry and one wet) at the outlet of each pipe system prior to discharge into the adjoining watercourse. A total of 5 such facilities are currently proposed, one next to each of the major creeks and an additional facility next to the small northern tributary of Collins Creek.

These measures are considered adequate to protect down stream water quality.

10.5.2 Water Quality Monitoring

The effectiveness of the water quality controls is to be monitored through a water quality monitoring program consistent with RTA guidelines on water quality monitoring. The following water quality monitoring program is proposed:

- Pre-construction water quality monitoring program comprising sampling campaigns during 3 wet weather events, with a range of antecedent rainfall depths (e.g. typical range of 10, 20 and 40mm in the preceding 24 hours) at or immediately downstream of the highway crossings of the four main waterways;
- Construction phase water monitoring program comprising sampling at Sedimentation Basin outlets, upstream and downstream of nominated creek crossings, during one event/month of magnitude >20 mm in the previous 24 hours. The construction phase

water monitoring program would incorporate a defined Emergency Response Plan mechanism involving rapid feedback/response from project management to large storm events, fuel or oil spills so that in the event the monitoring indicated serious downstream pollution impact from any specific water quality controls an appropriate corrective action can be quickly taken;

- Operational (post construction) phase water monitoring program comprising performance assessment of the two basins in Farrahars and Bellambi Creek catchments. These locations were selected on the basis of the highest environmental sensitivity of the receiving water (Bellambi Creek Lagoon) and the poor on-stream assimilative capacity of the two creeks, that feed to the Lagoon. Testing should be conducted once every 3 months (dry weather) and for at least 6 rainfall events with a 24 hour antecedent rainfall depth greater than 10 mm (wet weather) during the following 12 month period.

10.6 Conclusions

10.6.1 Existing Environment

Previous studies indicate that existing water quality environment within the study catchment is generally poor with recorded high levels of nutrients and suspended sediment exceeding accepted criteria.

Soils in the catchment are likely to be highly dispersible and would therefore require careful management during construction of the proposed NDE.

Other sources of pollution in the catchment are likely to include a combination of industrial point sources, sewer overflows and diffuse pollution from urban areas.

The principal area of environmental sensitivity is considered to be the Bellambi Creek Lagoon because this ecosystem is important in terms of the number of aquatic species that it supports and the fact that the streams that enter it have a limited capacity to assimilate pollutants.

Conversely, the least sensitive area which is considered to be most capable of assimilating pollutants is Collins Creek. This is due to the increased downstream assimilative capacity within this system, which is a function of its length and dense macrophyte population.

10.6.2 Water Quality Impacts

The NDE would involve significant construction activities and ultimately represent a potential source of pollution.

During construction, the principal threat to water quality is that of increased sediment load. This would be managed through implementation of best practice soil and water management principles.

During the operational phase of the proposed NDE, it is anticipated that there would only be a very small increase in pollutant generation.

Long term water quality controls including sedimentation and spill capture basins would be implemented as part of the proposed NDE. These controls would reduce the transfer of pollutants into downstream waterbodies by as much as 80%.

Groundwater is not considered a significant issue in either the construction or operational phases given the limited reliance on groundwater resources in the area, the limited opportunities for recharge in the proposed NDE corridor, and the relative proximity to the ocean.

Further significant benefits would be realised through relocation of traffic away from the existing Princes Highway, which has no water quality controls onto the proposed NDE which would have permanent water quality controls incorporated into its design.

The proposed NDE could be constructed without any significant cumulative impacts through the application of adequate maintenance of long term water quality controls.

11. Air Quality

The purpose of this section is to assess air quality impacts that may arise from the construction and operation of the EIS Proposal. It examines existing air quality and meteorological conditions and considers the potential impacts at the regional as well as the local level.

Working paper 7 on Air Quality Assessment has been prepared by Holmes Air Sciences for this EIS.

The air quality assessment is based on the use of a computer dispersion model to predict pollutant concentrations in the vicinity of the proposed road. To assess the effect that the pollutant emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality goals.

11.1 Traffic Pollutants and Air Quality Goals

Air pollutants emitted from traffic include:

- carbon monoxide (CO);
- nitrogen oxides (NO_x) comprising mainly a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2);
- particulate matter with aerodynamic diameter less than 10 microns (PM_{10}) including polycyclic aromatic hydrocarbons (PAHs), and;
- hydrocarbons (including Benzene, Toluene, Ethylene & Xylene [BETX] compounds and odours).

Thompson Street north of Campbell Street. EIS Proposal in cutting to left.

Other pollutants such as sulfur dioxide and lead are also emitted from motor vehicles, but because of the low sulfur[3] content of motor vehicle fuels the resulting ground-level concentrations of sulfur dioxide are too low to justify detailed analysis. Since the introduction of unleaded petrol, there has been a steady and unambiguous decline in lead air levels in Australian cities. The new National Standard for Fuel Quality has resulted in a ban on the supply of leaded petrol containing more the 0.005 g/l of lead from January 1 2002. Lead levels in urban areas, without other local sources of lead, would therefore continue to decline. Lead has therefore not been considered in this assessment.

Other emissions, such as carbon dioxide and water vapour also occur but these are generally not considered to be air pollutants although carbon dioxide needs to be assessed in the context of greenhouse effects.

As well as these primary pollutants, motor vehicle emissions are associated with the formation of photochemical smog primarily composed of ozone (O_3). Ozone is formed through a complicated set of reactions involving reactive hydrocarbons, oxides of nitrogen and light.

3 It is relevant to note that legislation to reduce the sulfur content of diesel fuels in Australia is likely to be introduced in the near future. This is being done to assist in reducing the emissions of particles from diesel vehicles rather than to deal with a sulfur dioxide problem. It will of course have the benefit of further lowering the ambient concentrations of sulfur dioxide and although this will be beneficial it is not the primary motive for the action.

The net result of these reactions is to produce ozone and nitrogen dioxide and other oxidation products, which are collectively referred to as photochemical smog. As noted above nitrogen oxides are comprised mainly of NO and NO_2. Generally NO is not considered to be harmful to human health at the concentrations typically found in urban environments, including heavily trafficked areas. Nitrogen dioxide however is a recognised air pollutant and has the potential to cause adverse effects on health at concentrations that sometimes occur within urban environments.

The hydrocarbons in vehicle exhaust comprise a variety of substances. Those of most concern are benzene, xylene, toluene and 1,3-butadiene.

Air quality standards or goals are used to assess the potential for ambient air quality to give rise to adverse health or nuisance effects. In NSW the Environment Protection Authority (EPA) notes air quality goals for nitrogen dioxide (NO_2), carbon monoxide (CO) and particulate matter (PM_{10}) determined by the World Health Organisation (WHO), the United States Environmental Protection Agency (US EPA) and the National Health and Medical Research Council of Australia (NHMRC).

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, 1998a**), the NSW EPA has proposed new air quality goals for particulate matter and nitrogen dioxide, some of which are designed to ensure that the NSW air quality standards and goals are consistent with the NEPM standards.

Table 11.1 lists the air quality goals noted by the NSW EPA, including historical goals and newly adopted goals. The goals that have been applied in assessing options for this project are shown in bold print.

11.2 Existing Environment

This section describes the dispersion meteorology, general climate and air quality in the study area. Air quality issues relating to emissions from motor vehicles are also discussed.

11.2.1 Dispersion Meteorology

The roadway dispersion model used for this study requires information about the dispersion characteristics of the area. In particular data are required on wind speed, wind direction, atmospheric stability class[4] and mixed-layer height[5]. The data available for this study were collected by Holmes Air Sciences in 1996 for Corrimal Coke Works. These data consist of

4 In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

5 The term mixed-layer height refers the height of the turbulent layer of air near the earth's surface, into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

hourly records from Corrimal for 1996. Corrimal is located approximately 1 km aerially to the south of the proposed NDE. The Corrimal data are considered to contain wind and dispersion patterns that would be representative of those experienced along the proposed road route.

The wind data have been compiled into annual and seasonal wind-roses. Annually the most predominant winds are from the southern to western sectors (clockwise) with winds from the north-northeast also common. This pattern is evident in most seasons with the exception of winter where westerly winds are the most common.

Table 11.1: Air Quality Goals and other relevant goals adopted for the study

Pollutant	Goal	Averaging Period	Agency
Carbon monoxide (CO)	87 ppm or 108 mg/m^3	15-minute maximum	WHO
	25 ppm or 31 mg/m^3	1-hour maximum	WHO
	9 ppm or 10 mg/m^3	8-hour maximum	NHMRC, NEPM
Nitrogen dioxide (NO_2)	16 pphm or 320 µg/m^3	1-hour maximum	NHMRC
	5 pphm or 103 µg/m^3	Annual mean	US EPA
	12 pphm or 245 µg/m^3	1-hour maximum	NEPM, NSW EPA
	11 pphm or 200 µg/m^3	1-hour maximum	WHO, NSW EPA long-term reporting goal
	3 pphm or 60 µg/m^3	Annual mean	NEPM, NSW EPA
Total suspended particulate matter (TSP)	90 µg/m^3	Annual mean	NHMRC
Particulate matter < 10 µm (PM_{10})	50 µg/m^3	Annual mean	US EPA
	30 µg/m^3	Annual mean	NSW EPA
	150 µg/m^3	24-hour maximum	US EPA
	50 µg/m^3	24-hour maximum	NEPM, NSW EPA
Benzene	5 ppb or 16µg/m^3	Annual average	UK

Sources: Holmes (Working Paper 7)

11.2.2 Existing Air Quality

No ambient air quality monitoring has been undertaken specifically for this project. The EPA has a network of monitoring sites in the Illawarra area including a site at Wollongong (Gipps St). Data from the EPA's Wollongong site are shown in **Table 11.2**.

The annual average CO concentration at the Wollongong site was 0.3 ppm (0.4 mg/m^3) in 2000 with a maximum 1-hour average concentration of 4.5 ppm (5.6 mg/m^3). Annual average and maximum 1-hour NO_2 concentrations were 1.0 pphm (21 µg/m^3) and 6.5 pphm (133 µg/m^3) respectively in 2000. The annual average PM_{10} concentration was recorded at 15 µg/m^3 with 49 µg/m^3 being the maximum 24-hour PM_{10} concentration. The measured CO, NO_2 and PM_{10} concentrations at the Wollongong site were all below their respective air quality goals.

Since the proposed NDE would be essentially replacing an existing road, predicted ground-level concentrations due to emissions from the road (as determined by dispersion modelling) should not always be simply added to the existing background concentrations. When assessing air quality impacts due to an upgraded road or road which is replacing an existing road it is important to consider the change in local air quality that the EIS Proposal introduces. This is discussed later in **Section 11.4**.

Table 11.2: Ambient air quality monitoring from EPA's Wollongong site

	CO (1-hour : ppm) show in µg/m³		**NO_2** (1-hour : pphm) shown in µg/m³		**PM_{10}** (24-hour : µg/m³)	
Wollongong	Average	Highest	Average	Highest	Average	Highest
Jan 2000	0.3	2.4	0.6	3.0	16	22
Feb 2000	0.3	2.3	0.8	4.3	27	49
Mar 2000	0.4	2.3	1.1	6.5	19	33
Apr 2000	0.4	2.1	1.2	3.9	12	16
May 2000	0.5	3.7	1.2	3.7	12	19
Jun 2000	0.4	4.5	1.2	3.3	9	12
Jul 2000	0.2	2.5	1.2	3.1	8	11
Aug 2000	0.3	1.5	1.0	4.5	11	16
Sep 2000	0.2	2.0	1.0	4.7	15	23
Oct 2000	0.4	3.8	1.0	6.4	16	38
Nov 2000	0.2	2.9	0.9	3.6	15	19
Dec 2000	0.2	2.2	0.8	4.9	20	33
Annual 2000	0.3	4.5	1.0	6.5	15	49

Source: EPA (2000)

11.3 Estimated Traffic Volumes and Emissions

The most significant emissions produced from motor vehicles are CO, NO_x, hydrocarbons and PM_{10}. Associated emissions of these pollutants are required as input to the computer dispersion model to predict ground-level concentrations in both the study area and close to the proposed roadway.

Traffic volumes for two years in the operation of the proposed road (2006 and 2016) have been provided as Annual Average Daily Traffic (AADT) by Gabites Porter (**Working Paper 3**). The data also include estimates Figure 11.1: Annual and Seasonal Wind Roses for Corrimal for morning and afternoon peak hours on four sections of the proposed NDE. Hourly estimates of the total traffic volumes northbound and southbound have been derived by applying a similar daily profile to those measured by the RTA in Sydney (Lane Cove area). Northbound traffic has

been assumed to have a similar profile to traffic travelling away from the central business district in Sydney whereas the southbound traffic has been based on a traffic profile travelling into the central business district.

Vehicle emission factors have been drawn from the Permanent International Association of Road Congress (PIARC) tables (**PIARC, 1995**). The tables have been modified to take account of the age, vehicle mix and emissions control technology of the New South Wales vehicle fleet. Hydrocarbon emissions are assumed to be approximately 10% of carbon monoxide emissions.

11.4 Assessment of Impacts

This section examines the impact of the EIS Proposal on climatic conditions, health, and Greenhouse emissions, as well as its impact specifically during the construction and operational stage of the project.

11.4.1 Climatic Assessment

Local climatic conditions are recorded by the Bureau of Meteorology at the Wollongong University and wind data at Corrimal. These data have been used for the EIS Proposal assessment.

Temperature, humidity and rainfall data collected from the Wollongong station are presented in **Table 11.3**. The temperature data show that January and February are typically the warmest months with a mean daily maximum of 25.6°C. July is the coldest month with a mean daily minimum of 8.4°C. Rainfall data collect at Wollongong show that March is the wettest month with a mean rainfall of 176 mm over 14 rain days.

Table 11.3: Study Area Climate Data

Wollongong	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Daily Max Temp (deg C)	25.6	25.6	24.5	22.5	20	17.5	16.9	18.2	20.1	22	22.8	25	21.7
Mean Daily Min Temp (deg C)	17.9	18.3	16.8	14.2	11.9	9.5	8.4	8.8	10.6	12.7	14.4	16.6	13.3
Mean Rainfall (mm)	141.5	156.4	176	129.4	111.6	117.6	58.2	92.7	69.1	106.1	117.5	97.3	1374
Mean no. of Rain days	14	14	14	11	11	10	8	8	9	12	13	13	137
Mean no. of days with frost	0	0	0	0	0.1	0.2	1	0.8	0.3	0	0	0	2.5
Mean no. of days with fog	0.1	0.1	0.1	0	0	0	0.1	0	0	0	0	0	0.4

(Wollongong: Station number 068188, Latitude 34.4033 S, Longitude 150.8772 E, Elevation 30 m, 1970 to 2001)
Source: Bureau of Meteorology (2002) (Working Paper 7)

Data on frost occurrences in the area suggest that frost occur mainly during the cooler months (May to September). Fog events appear to occur during the warmer months in Wollongong but have been recorded in mid winter. The area is not regarded as having a high incidence of fogs that could cause traffic safety problems.

York Road north of Bellambi Lane.

Roadway projects are not known to have a significant effect on climate in the area. In some cases it is possible that very localised changes in wind patterns could occur if the project were to significantly alter the surrounding terrain. This is unlikely for the current NDE alignment and design.

Therefore, in relation to the principles of **ecologically sustainable development**:

- There are no threats of serious or irreversible environmental damage through climate change
- Intergenerational equity would be preserved
- While the impacts of the project on flora and fauna may have been considered elsewhere, in the context of climate change it is unlikely that there would be any significant effect on biodiversity
- There is unlikely to be any economic effects.

11.4.2 Greenhouse Issues

The temperature of the earth's atmosphere is determined by the balance between incoming solar radiation and the loss of heat energy by radiation from the earth and atmosphere to outer space. This balance is in turn affected by a complex set of processes, acting on a global scale, which control the way in which heat is transported around the earth by winds and ocean currents, and by the quantities of energy that are reflected and absorbed by the earth's surface. While the broad principles of the way in which these processes work to control the temperature of the earth's atmosphere are understood, the details, which may well be very important in determining the final temperature that is achieved at the earth's surface, are still the subject of scientific research.

One of the important factors in determining the amount of radiant energy absorbed in the atmosphere is the concentration of **carbon dioxide**. Changes in this concentration are likely to cause changes in the temperature of the earth's atmosphere near the earth's surface. Increases in carbon dioxide concentration are expected to cause increases in temperature.

Australia is signatory to the "International Frame-work Convention on Climate Change" (Rio Convention), which commits Australia to programs of monitoring and reporting on greenhouse gas emissions. A target of the Rio Convention is that signatory countries should attempt to reduce greenhouse gas emissions to the levels that applied in 1990. At the Kyoto meeting the convention agreed that the target for Australia was to limit growth in greenhouse gases to 8% above the 1990 level by 2008–2012.

The RTA is committed to ensuring that its environmental goals and policies are consistent with those outlined in the 1992 Intergovernmental Agreement on the Environment. This agreement addresses a number of globally important environmental issues including the greenhouse effect. This commitment is facilitated through the RTA's environmental vision which addresses greenhouse gas emissions and also energy consumption.

Approximately 14% of NSW's total carbon dioxide emissions are estimated to come from the transport sector (**EPA, 1995**). At a broad level, the RTA has been involved in and implemented several strategic initiatives to address the issue of road transport related greenhouse gas emissions. These are:

- National Greenhouse Response Strategy;
- RTA Greenhouse Reduction Plan;
- Enhancing the State's vehicle emissions enforcement resources;
- Continuing its role on MVEC (Motor Vehicle Environment Committee) to encourage the early implementation of more stringent Australian Design Rules;
- Playing a key role in the development of the Diesel National Environment Protection Measure (NEPM), which came into effect 29 June 2001.

Emissions of carbon dioxide from motor vehicles are directly proportional to fuel consumption. They cannot be reduced by emission control technologies except where they result in an improvement in fuel consumption.

In terms of the construction of the EIS Proposal for the proposed NDE, the new route is likely to result in better traffic flow and hence better fuel economy and therefore reduced greenhouse emissions.

11.4.3 Health Effects of Roadway Pollutants

This section identifies the health effects of the various pollutants and compounds assessed in the report.

There are four main types of chemical pollutants generated by vehicle traffic that are potentially harmful to humans.

Carbon Monoxide

Carbon monoxide can be harmful to humans because its affinity for haemoglobin is more than 200 times greater than that of oxygen. When it is inhaled it is taken up by the blood and therefore reduces the capacity of the blood to transport oxygen. This process is reversible and reducing the exposure would lead to the establishment of a new equilibrium with a period of three hours being the approximate time required to reach 50% of the equilibrium value.

The 15-minute, 1-hour and 8-hour goals noted by the EPA provide a significant margin for safety, however this is appropriate for this type of guideline, which is designed to protect a wide range of people in the community including the very young and elderly.

Oxides of Nitrogen

Nitrogen oxides (NO_x) emitted from combustion sources are comprised mainly of nitric oxide (NO, approximately 95% at the point of emission) and nitrogen dioxide (NO_2, approximately 5% at the point of emission). Nitric oxide is much less harmful to humans than nitrogen dioxide and is not generally considered a pollutant with health impacts at the concentrations normally found in urban environments.

Concern with nitric oxide relates to its transformation to nitrogen dioxide and its role in the formation of photochemical smog. Nitrogen dioxide has been reported to have an effect on respiratory function although the evidence concerning effects has been mixed and conflicting. The EPA has not set any air quality goals for nitric oxide, however it has set 1-hour and annual average goals for nitrogen dioxide.

In June 1998, the National Environment Protection Council of Australia (NEPC) ratified a new set of air quality standards for adoption at a national level, which are part of the National Environment Protection Measures (NEPM). The NEPM standard for NO_2 has been set at 0.12 ppm and the EPA has now adopted this level. It would also adopt the WHO 1-hour goal of 0.11 ppm or 200 $\mu g/m^3$ as a long term reporting goal.

Particulate Matter

The presence of particulate matter in the atmosphere can have an adverse effect on health and amenity. The health effects of particles are largely related to the extent to which they can penetrate the respiratory tract. Larger particles, that is those greater than 10 (g, generally adhere to the mucous in the nose, mouth, pharynx and larger bronchi and from there are removed by either swallowing or expectorating. Finer particles can enter bronchial and pulmonary regions of the respiratory tract, with increased deposition during mouth breathing which increases during exercise. The very fine particles can be deposited in the pulmonary region and it is these which are of particular concern.

The health effects of particulate matter are further complicated by the chemical nature of the particles and by the possibility of synergistic effects with other air pollutants such as sulphur dioxide.

The NSW EPA has historically noted the US EPA 24-hour air quality standard of 150 $\mu g/m^3$ and annual average standard of 50 $\mu g/m^3$ for PM_{10}. It would now adopt the NEPM 24-hour standard of 50 $\mu g/m^3$ and reference a new annual average of 30 $\mu g/m^3$ as a long-term reporting goal.

The NSW EPA also continues to note the NHMRC's 90 $\mu g/m^3$ annual average goal for total suspended particulate matter (TSP). This level is recommended as the maximum permissible level in urban environments.

Hydrocarbons

Hydrocarbons alone do not generally pose a problem at the concentrations commonly experienced. However, some hydrocarbons such as benzene are known to have an adverse effect on human health but the effects are thought to occur at concentrations higher than the levels of exposure found at roadsides from traffic emissions.

Hydrocarbons do play a significant role in photochemical smog formation and until recently the air quality standards adopted by the US EPA for non-methane hydrocarbons have been applied in NSW. However it has been recognised that this goal does not distinguish the reactive species which are involved in smog formation from the total hydrocarbon concentration and this air quality goal has been abandoned by the US EPA and the NSW EPA.

There is growing concern about the amount of benzene released in motor vehicle emissions, especially in Europe where fuel has a higher benzene and aromatic content than in Australia. At present NSW has no ambient air quality goals for benzene. The Australian draft air quality goal for benzene is 5 ppb (16 $\mu g/m^3$).

11.4.4 Construction Impacts

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the road construction. The total amount of dust generated would depend on the silt and moisture content of the soil, wind speed and direction, the types of operations being carried out, exposed area, frequency of water spraying, as well as the type and speed of machinery. For the purposes of this assessment an estimate has been made of emissions during typical roadway construction activity.

The most likely equipment to be used in the project includes backhoes, rollers, excavators, pavers, concrete trucks, jackhammers and haul trucks. The major sources of dust would be wind erosion of exposed surfaces from action by the bulldozers, excavators, scrapers, trucks and wind erosion during construction.

An estimate of the amount of dust generated by each operation per day is summarised below, but it should be noted that the emission estimates relate to an area which would impact individual residences, not emissions from the entire length of the roads.

- Dust from loading of material by excavator to trucks assuming dust is generated at the rate of 0.01 kg/t and that 50 x 15 cubic metre trucks loads are removed in a ten-hour day, making a total of approximately 750 m^3 or approximately 1125 t of material removed per day gives a total dust generation of 11.25 kg/day.
- Dust from trucks travelling on the unsealed road surface assuming a 400 m round trip distance, five movements per hour and 2 kg of dust/vehicle/km (after taking account of dust suppression by watering of the trafficked areas) would generate 40 kg during a ten-hour working shift.
- Dust from wind erosion from an exposed area of 200 m long by 30 m wide (the exposed area may be greater than this but the area which could contribute significant amounts of dust to a particular residence would be unlikely to be larger) assuming an erosion rate of 0.4 kg/ha/hour gives a total of 2.4 kg in ten hours.
- Thus the total dust generated in a ten-hour working day could be as high as approximately 50–60 kg. On a hot, dry, windy day (worst case emission conditions with respect to dust) the amount of dust from wind erosion could be much higher, and should be controlled using water sprays. It is possible that under some extreme wind conditions, construction activities would be stopped or relocated to areas removed from sensitive receptors.

Since dust emitted during construction activities would be of crustal origin it is likely to contain only a small fraction of $PM_{2.5}$ which is the particulate fraction of concern. Previous studies indicate that high levels of dust generation associated with road construction work can result in short-term dust impacts.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces of adjacent dwellings and equipment.

Table 11.4 shows the maximum acceptable increase in dust deposition over the existing dust levels. These criteria for dust fallout levels are set to protect against nuisance impacts.

Table 11.4: NSW EPA criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Source: Holmes (Working Paper 7)

As construction is likely to continue for at least one year, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. It is desirable that monitoring be carried out during the construction phase of the project to assess compliance with EPA goals. A minimum of three deposition monitors would be installed at the closest residences or other sensitive receptors.

11.4.5 Operational Impacts

Dispersion modelling results for the operation of the proposed road show both regional concentrations and near roadway concentrations due to emissions from the proposed road.

Regional Concentrations

Predicted regional pollutant concentrations in the study confirm that expected **carbon monoxide** around the proposed road would be low.

Similarly for NO_2, maximum and annual concentrations due to emissions from the proposed road would not cause exceedances of the air quality goals.

Annual average PM_{10} concentrations are predicted to be only a fraction of the annual average air quality goals for PM_{10}.

Benzene concentrations due to the operation of the proposed road are also a fraction of the relevant air quality goal.

There is very little difference in predicted outcomes between 2006 and 2016 traffic flows.

Near Roadway Concentrations

The most relevant concentrations to assess are those predicted at 10 m or further from the road as there are no residential areas which would be within 10 m of the proposed roadside.

Concentrations of CO, NO_2, and benzene due to emissions from the proposed road would be low both in 2006 and in 2016.

The maximum 24-hour average and annual average PM_{10} concentrations 10 m from the road would be approximately equal to the air quality goal, but this estimate is based on the maximum ambient level (49 µg/m³) from **Table 11.2**. In addition the ambient data was obtained from a more densely populated area than the study area, where ambient levels of PM_{10} are expected to be less than 49 µg/m³.

Given such factors as the improved travel times and potential improvements in emission and fuel standards it is likely that the overall change in concentrations in the area would be similar if not lower than those currently experienced.

In the case of benzene no ambient air quality monitoring is available however the predicted benzene levels at 10 m from all sections of the road would be a small fraction of the air quality goal.

11.5 Conclusions

The results of the assessment conclude that:

- Predicted concentrations of air pollutants due to the operation of the proposed road are low in comparison to relevant air quality goals;
- It is unlikely that air quality goals would be exceeded due to motor vehicles using the proposed NDE; and
- Predicted concentrations of benzene (and other pollutants) are not at levels that would pose health effects. However it is recognised that there may be no safe level for exposure to benzene.

The proposed road is expected to improve travel times which directly affects vehicle emissions. This assessment has been based on current vehicle emission and fuels standards. It is likely that, with the introduction of further standards and potential improvements in vehicle technology, pollutant concentrations predicted for 2006 and 2016 would be lower than those presented.

11.6 Mitigation Measures

Air quality mitigation measures during the construction of the road include:

- Daily watering of unsealed roads to ensure that they are damp when significant dust generating activities are taking place;
- Reducing vehicle speeds on unsealed roads;
- Stabilising stockpiles that are not required to be used frequently;
- Exposed areas be stabilised as quickly as possible; and
- Appropriate dust suppression methods be used to keep dust impacts to a minimum;

Monitoring would be carried out during the construction phase of the project to assess compliance with EPA goals. A minimum of three deposition monitors would be installed at the closest residences or other sensitive receptors.

12. Biodiversity

This section examines the impact of the EIS Proposal on existing flora and fauna in the immediate study area.

Working Paper 8 on Biodiversity has been prepared by Lesryk Environmental Consultants for this EIS study. The studies included desk-top research and field surveys conducted during the period April and May 2002, and included the proposed road alignment as well as likely areas for ancillary activity during construction.

12.1 Environmental Setting

The study area is located within the Wollongong Local Government Area, north of the existing Northern Distributor.

The EIS Proposal would be located within an established residential area and would generally follow the alignments of the existing road network (eg York, Mitchell and Thompson Streets). Excluding several residential properties, a number of creek crossings and a small patch of remnant vegetation in the vicinity of Russell Street, the proposed Northern Distributor would be located within an existing, regularly maintained, cleared road reserve. As such, much of the natural vegetation which would originally have been present within the study area has been largely cleared or fragmented as a result of past landuse practices.

Land uses adjacent to the study area include, light industrial areas and horse paddocks to the east, residential properties to the west, north and north east and commercial developments to the north west. Woonona High School is present to the west of the proposed Northern Distributor Extension alignment, south of Campbell Street. At this site, a number of playing fields and tennis courts are also present. The light industrial areas include waste recycling facilities, fabrication factories and a RTA works depot. The horse paddocks appear to be located entirely within the Northern Distributor Extension road reserve.

Nine drainage lines traverse the study area. All of these drainage lines flow in an easterly direction, eventually draining into the Tasman Sea. All of the drainage lines have been disturbed by past landuse practices including road construction and/or urban developments. A number of the drainage lines investigated during the field surveys appeared to have been maintained and cleared by Wollongong City Council, these works presumably undertaken at regular intervals to permit the flow of water during periods of heavy rainfall.

The conservation reserves that occur in the vicinity of the study area are the Illawarra State Recreation Area and Metropolitan Catchment Area, these covering an area of 1266 and 13000 hectares respectively. These two areas of protected lands occur west of the study area. In addition to these major conservation areas, a number of smaller Council owned and managed reserves are also present within the study region.

12.2 Existing Flora

Plant Species

A list of plant species recorded within the study is included in **Working Paper 8**.

No species of national or state conservation significance, as listed on the Schedules to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and the NSW Threatened Species Conservation Act 1995, or as a ROTAP species (Rare or Threatened Australian Plant, Briggs and Leigh 1996), were located during the field survey in April and May 2002.

None of the species recorded within the study area are considered to be of regional or local conservation significance. All native species recorded are considered to occur frequently within similar habitats throughout the study region.

Eight species recorded within the study area have been designated as environmental weeds. In addition, Blackberry (Rubus fruticosus), and Prickly Pear (Opuntia spp.) which have been identified within the study area, are listed as Noxious Weeds within the Wollongong Local Government Area.

While there exist no legal requirement for land-holders to eradicate environmental weeds, under the Noxious Weeds Act 1993, all private land owners/occupiers must take action to control these listed species.

Plant Communities

A description of local vegetation communities/habitats, and the dominant plants within each vegetation stratum or layer, are provided in **Working Paper 8**. **Figure 12.1** shows the locations of each community.

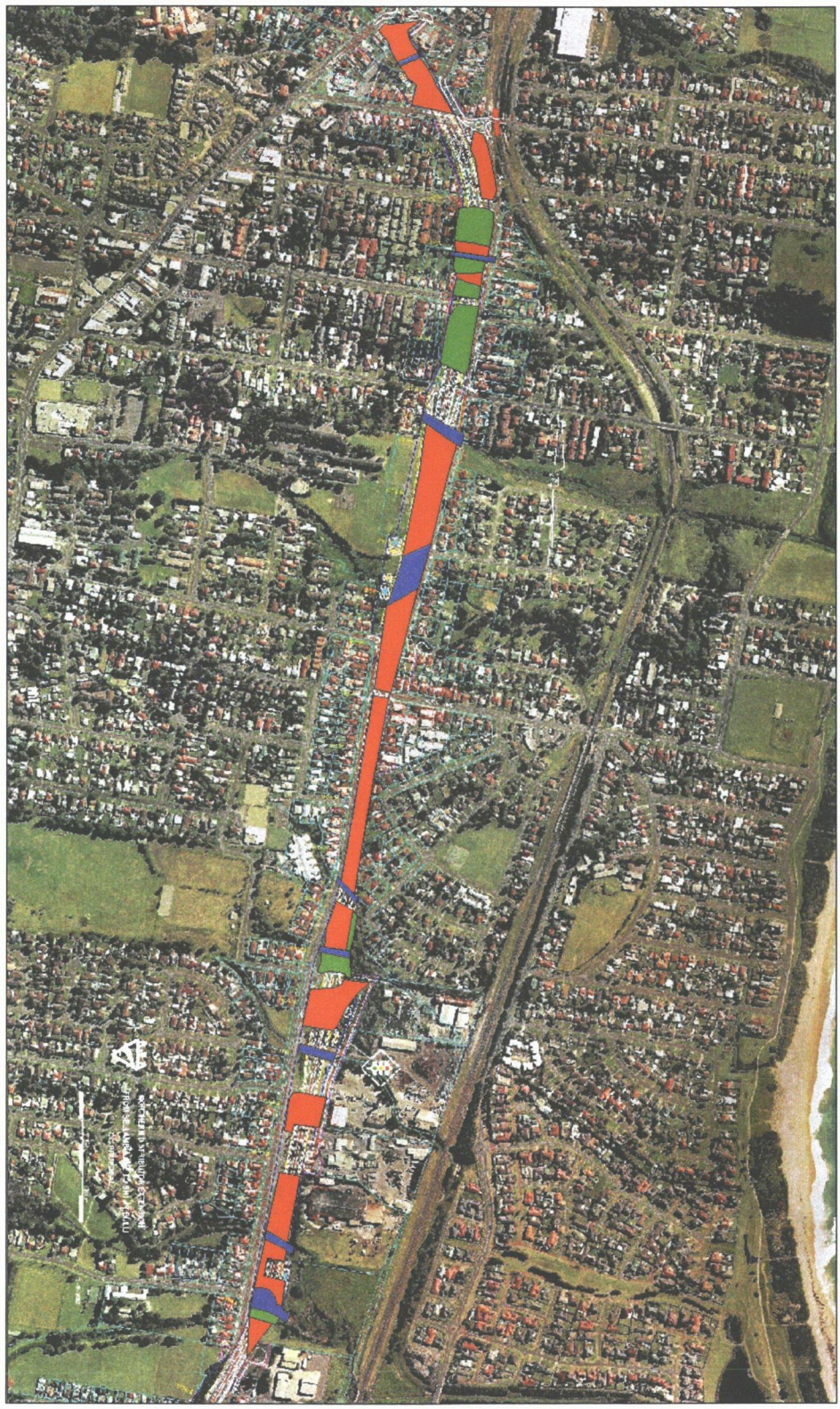
The entire study area has been modified by human activities. The proposed extension is predominantly located within an area of cleared land vegetated by exotic grasses with small stands of degraded remnant native and exotic vegetation and aquatic habitats.

Within the study area, there are three vegetation communities/habitats as follows:

- **Creeks and Floodplains** — nine drainage lines traverse the study area, flowing in an easterly direction;
- **Cleared Grassland Areas** — Covers most of the proposed development footprint; and
- **Remnant Vegetation Stands** — The majority of remnant native vegetation exists to the west of Thompson Street, between Campbell and Hopetoun Streets.

It is noted that an estuarine wetland (Bellambi Gully Wetland) exists approximately 1 km downstream of the proposed development (refer to **Figure 12.2**). This wetland is considered to be of regional conservation significance and represents the oceanic outlet for Bellambi Gully and Farrahars Creeks. It would not be directly impacted upon by the works. Mitigation measures would ensure that there are no indirect impacts associated with any sediment runoff from the EIS Proposal.

Figure 12.1: Vegetation Communities and Fauna Habits



Legend

- Cleared/Exotic grassland
- Creeks and Floodplain (Aquatic Environment)
- Remnant/Exotic Woodlands

200m

N

Source: Lesryk Environmental

There is also a creek swamp (vegetated channel of a minor watercourse) that is a tributary of Collins Creek. The creek swamp occurs along an unnamed drainage line approximately 150 metres downstream of the study area (south of Campbell Street). However, there appears to be no biodiversity value possessed by this drainage line.

Significance of the Plants and Vegetation Communities Recorded

No plant species of regional, state or national conservation significance were located within or adjacent to the study area. Similarly, no vegetation communities listed under either the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 or NSW Threatened Species Conservation Act 1995 were identified.

Hopetoun Street looking east.

None of the plants or vegetation communities are currently being considered for listing under either the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 or NSW Threatened Species Conservation Act 1995.

The plants and vegetation communities recorded during the field survey are all commonly recorded throughout the study region, none being restricted to the Northern Distributor Extension road corridor. The undertaking of the EIS Proposal would not result in any of these species becoming locally extinct, nor would the project result in a reduction in the region's biodiversity.

Expected Impact on Threatened Flora

Construction of the EIS Proposal would require the clearing of around 2.5 hectares of vegetation, the large majority of which would be exotic plants. To offset the loss of this vegetation removal, the RTA proposes to undertake extensive revegetation using locally collected seeds within and adjacent to the road reserve.

It is considered that the proposed extension of the Northern Distributor would not have an impact on any threatened plant species, populations or ecological communities. Within the area surveyed, no threatened plants or vegetation communities were recorded. As such, it is considered that a flora Species Impact Statement is not required as part of the EIS Proposal.

Existing Fauna

Three habitat types available for use by native species are present within the study area. Descriptions of the structure and value of these fauna habitats for native species are provided in **Working Paper 8** and shown on below. Habitats include:

- **Exotic grasslands** — these are the dominant habitat type within the study area. This habitat type includes the regularly mown and maintained sections of the proposed NDE road reservation, as well as several residential and industrial properties and horse paddocks. The exotic grasslands are considered to be of minimal value for native species;
- **Exotic and native woodlands** — The main occurrence of this habitat type is between Campbell Street and Farrell Road, west of Thompson Street. The woodlands would be of limited value for native species; and

Figure 12.2: Fauna Corridors and Survey Locations

Source: Lesryk Environmental

- **Aquatic environments** — The nine creek lines that traverse the study site are the main aquatic environments present within the study area. All of the creek banks are earthen, and most support high infestations of exotic grasses and weeds.

Although the creek lines within the study area are considered to be of limited ecological value, one wetland associated threatened species has been previously recorded in the study region. The Australasian Bittern, which is listed under Schedule 2 of the NSW Threatened Species Conservation Act 1995, has been recorded downstream of the study site, within the Bellambi Gully Wetland (Wollongong City Council 2001).

Based on a chemical analysis of the water quality within those creek lines traversed by the proposed NDE, it is considered that the aquatic habitats are not of any significant ecological value, particularly from the perspective of any sensitive water associated species.

Riparian vegetation is composed of either the exotic and native woodlands previously described or exotic trees, shrubs and weeds, these being of a medium to high density and 5 metres in height.

The presence of exotic fish and the weed species, combined with Council's flood mitigation works and the urban catchments in which the creeks occur, is considered to limit the value of this habitat type, particularly for any sensitive native water associated fauna.

12.3 Wildlife Corridors and Vegetation Links

The main movement of fauna species in the vicinity of the study area would be east — west across the proposed alignment of the Northern Distributor Extension, along those drainage lines which support riparian vegetation. **Figure 12.2** refers.

Within the study area, due to their size and vegetation structure, the main fauna dispersal and movement corridors are considered to be along Collins and Farrahars Creeks and the two unnamed drainage lines which run into Bellambi Gully. These corridors currently provide for the dispersal of animals, linking bushland remnants to the east with the Illawarra State Recreation Area and Bellambi Gully to the west.

Given the development history of this region, it is not considered that any of the larger macropods or several of the medium sized mammals, are present within the surrounding lands. Due to the development of this area, these animals are considered to be locally extinct within the study region. Therefore, based on the results of the field surveys, combined with the habitat assessments and literature search, the only species expected to traverse along the four identified fauna corridors are birds, flying animals, aquatic species and the small to medium sized ground and lower shrub traversing animals.

Ongoing flood mitigation works undertaken by Wollongong City Council also results in the removal of debris and aquatic vegetation from within several of the drainage lines, thereby reducing the value of these for the movement patterns of native species.

As part of the proposed construction and operation of the proposed NDE, bridges are proposed to be located across Farrahars and Collins Creeks, and four of the unnamed drainage lines. They would be approximately 3 metres in height and between 6 and 36 metres long.

The lengths of the bridges would be wider than the existing creek channels, thereby providing for the movement of fauna species. Appropriate landscaping with species, detailed in **Section 6.6** above, would ensure that the bridges act as fauna underpasses, thereby permitting the movement of the ground and lower shrub traversing species.

Revegetation works are a component of the development proposal. Landscaping proposals detailed in **Section 6.6** would ensure that these works enhance and maintain the connectivity of any corridors which traverse the study area for flying species. Appropriate landscaping with species detailed in **Section 6.6** and limiting the physical barriers would also permit the movement of several of the highly mobile and tolerant ground and lower shrub traversing species.

Of those animals recorded by the completion of the Lesryk field survey:

- the **Cattle Egret** (*Ardea ibis*) is listed as a migratory bird under the Schedules to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999; and
- the **Common Bentwing-bat** (*Miniopterus schreibersii*) is listed as a Vulnerable species under Schedule 2 on the NSW Threatened Species Conservation Act 1995. This bat is also listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Protected Species Consideration

The remainder of the native species recorded are protected, as defined under the NSW National Parks and Wildlife Act 1974, though expected to be common to abundant throughout the region. Based on the observations made during the field survey, and the information provided within the documented literature, these species would mainly be dependant and associated with the woodlands, exotic grasslands and aquatic environments, all of which are well represented beyond the limits of the study area and within the surrounding region. The species recorded are considered to be urban tolerant animals, species that have adapted to and exploited modified environments. Post-construction, the species recorded are expected to be readily detected close to the study site and within the surrounding region.

To enhance the local environment for those native species recorded, thereby ensuring their long term presence, appropriate revegetation works would be undertaken. These works would include the provision of a variety of pollen and nectar producing locally occurring native species, as well as the inclusion of natural ground debris features. With the revegetation and habitat restoration works included as part of the Northern Distributor Extension, which assists connectivity beyond the study area, it is considered that the long term presence of those native species recorded in the study region would be ensured.

Based on the results of earlier field studies it has been concluded that no locally viable populations of these species would be present within or adjacent to the proposed NDE corridor. Similarly, due to the extent of urban expansion, a number of the threatened species identified as having been previously recorded in the study region are considered to be locally extinct within the Woonona – Bulli areas (eg Southern Brown Bandicoot, Heath Monitor).

No locally viable resident populations of the eight (8) potentially occurring threatened species are considered to occur within the study area. Based on the results of the field investigation, the study site is not considered to constitute a significant resource for any of these animals.

Table 12.1 lists species that could potentially have a presence in the study area. Some may traverse the study site on occasion, particularly the flying animals. However, in view of the above, it is considered that the proposed road works would not significantly remove habitats necessary for the life cycle requirements for these species. Similarly the works would not present a barrier to the movement patterns of these species, thereby isolating populations and their habitat areas.

Table 12.1: Threatened Species potentially present in Study Area

MAMMALS	
Grey-headed Flying Fox	*Pteropus poliocephalus*
Large-eared Pied Bat	***Chalinolobus dwyeri***
Eastern False-Pipistrelle	***Falsistrellus tasmaniensis***
Large-footed Myotis	***Myotis adversus***
Greater Broad-nosed Bat	***Scoteanax rueppellii***
Eastern Freetail-bat	***Mormopterus norfolkensis***
BIRDS	
Great Egret	*Ardea alba*
Black Bittern	***Ixobrychus flavicollis***
Australasian Bittern	***Botaurus poiciloptilus***
Glossy Ibis	*Plegadis falcinellus*
White-bellied Sea-eagle	*Haliaeetus leucogaster*
Superb Parrot	*Polytelis swainsonii*
Swift Parrot	*Lathamus discolor*
Turquoise Parrot	*Neophema pulchella*
Powerful Owl	*Ninox strenua*
Barking Owl	*Ninox connivens*
Sooty Owl	*Tyto tenebricosa*
Masked Owl	*Tyto novaehollandiae*
White-throated Needletail	*Hirundapus caudacutus*
FROGS	
Green and Golden Bell Frog	***Litoria aurea***
Littlejohns Tree Frog	*Litoria littlejohni*

Source: Lesryk (Working Paper 8)

Note: (Species highlighted in **BOLD** could potentially occur as resident animals within or in close proximity to the study area based on the structure of the habitats present.)

12.4 Ecological Assessment

12.4.1 Commonwealth Legislative Considerations

During the field investigations, the Cattle Egret (*Ardea ibis*), a wetland bird listed as migratory under Commonwealth Environment Protection and Biodiversity Conservation Act 1999, was recorded. Giving consideration to the habitat requirements of this species, it is considered that no individuals or populations of this animal would be adversely affected by the EIS Proposal. The Proposal would not remove any significant foraging, roosting or breeding sites, nor would it present a barrier to the movement patterns of this species.

The Cattle Egret is known to easily traverse open spaces and, when looking at the abundance of suitable foraging habitats within the surrounding region, it is considered that no individuals or populations of this species would be significantly affected as a result of the construction and operation of the Northern Distributor Extension. As such, the works are considered not to have a significant impact on this species of National Environmental Significance. Therefore, it is considered that the matter would not require referral to the Federal Minister of the Environment for further consideration or approval.

12.4.2 State Legislative Considerations

State Environmental Planning Policy No. 44 — Koala Habitat Protection

The Wollongong Local Government Area is identified under Schedule 1 — Local Government Areas of State Environmental Planning Policy No 44 (SEPP 44) — Koala Habitat Protection. This policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas.

Within, and adjacent to the study area, two species of eucalypt were recorded, these being Blackbutt, *Eucalyptus pilularis* and Mahogany, *Eucalyptus saligna x botryoides*. Of these Eucalyptus saligna x botryoides has the potential to be utilised as a Koala Feed Tree. Within the study area, this species does not make up 15% of the total tree canopy and therefore, giving consideration to the assessment criteria provided under SEPP 44, the study site is considered to be neither Potential nor Core Koala habitat. Therefore the proposed extension of the Northern Distributor would be considered as not significantly affecting any Koala populations or their habitat areas, and therefore a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of the EIS Proposal.

Section 5A of the Environmental Planning and Assessment Act 1979

The potential for the impacts associated with the proposed extension of the Northern Distributor to have an adverse impact on threatened species has been considered using the 'eight part test' as provided under Section 5A of the Environmental Planning and Assessment Act 1979. These criteria are designed to determine "whether there is likely to be a significant effect on any threatened species, their populations, ecological communities, or habitats", and consequently, whether a Species Impact Statement is required.

Eight Part Test

The eight part test is usually only undertaken if a threatened species has been recorded during a field investigation, or if habitats suitable for the needs of a threatened species is likely to be removed as part of a proposal. For this EIS, the eight part test has been undertaken on the **Common Bentwing-bat** *Miniopterus schreibersii*, the only Scheduled species recorded during the field survey. **Working Paper 8** refers.

The eight part test has concluded that a species impact statement for threatened fauna species is not required for the EIS Proposal.

The eight part test concluded that within the study area, no caves or suitable cave substitutes were recorded. As such, the site is not considered to offer any roosting or breeding opportunities for this species. The loss of 2.5 hectares of exotic and native woodland from the study site is not considered to reduce the availability of this species' foraging resources, or present a barrier to it's movement patterns. The works are therefore not considered to disrupt the viability of a local population of this species that is placed at risk of extinction.

No populations of threatened bats are listed as endangered under Schedule 1, Part 2 of the *Threatened Species Conservation Act 1995*. At a regional level, the small portion of woodland proposed to be removed is not considered to constitute a significant area of habitat for this species. No areas of known habitat available for the foraging needs of this species are likely to become isolated or fragmented.

The area is not listed as critical habitat. The Common Bentwing-bat has also been recorded within Royal National Park, Seven Mile Beach National Park and the Woronora Catchment Area. Within all of these conservation reserves and other protected lands suitable habitat for this species' life cycle requirements are present. The Common Bentwing-bat does not reach the limit of its known distribution range in the vicinity of the study area.

Fisheries Management Act 1994

Based on a qualitative and quantitative assessment of the drainage lines which traverse the study area, combined with a literature search, it is considered that no threatened fish species would be present within the study area.

The "installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams" has been listed as a Key Threatening Process under Schedule 6 of the NSW Fisheries Management Act 1994. This threatening process applies to all NSW waterways, not only those where listed threatened species are present. The proposed NDE would not have an adverse impact on the flows exhibited by those creeks traversed by the study area, as bridge structures as opposed to culverts would be established across the main drainage lines.

12.5 Assessment of Impacts

Based on the results of the flora and fauna surveys, and the consultation of known literature sources and databases, it is considered that there are no ecological constraints to the current proposed Northern Distributor extension proceeding as planned.

The proposed works would not significantly affect any populations of native plants or animals such that they are placed at risk of extinction. Similarly the works would not remove or significantly affect any habitats of local, regional, state or national conservation concern.

One species, the Common Bentwing-bat, *Miniopterus schreibersii*, listed Under the Schedules to both the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and NSW Threatened Species Conservation Act 1995, was recorded during the field survey. This species was considered to have been detected during its foraging periods, no suitable roosting or breeding habitat being present within, or in close proximity to, the study area.

Based on the assessment criteria listed Under Section 5A of the Environmental Planning and Assessment Act 1979, it is considered that the proposed NDE would not have a significant impact on this threatened species, its populations, ecological communities or habitats. Therefore, it is considered that the preparation of a Species Impact Statement would not be required. Similarly, it is considered that the matter would not require referral to the Federal Minister of the Environment for further consideration or approval.

It is considered that the proposed NDE would not affect, threaten or have an adverse impact on any of the Nationally significant species listed under the Schedules to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 that were recorded or could potentially occur within, or adjacent to, the study area. Therefore, it is considered that the matter would not require referral to the Federal Minister of the Environment for consideration or approval.

Within the areas of likely disturbance, the habitats and vegetation communities present are considered to be of low ecological value. These areas would not be important for any of the threatened species, populations or ecological communities listed under the NSW Threatened Species Conservation Act 1995 previously recorded in the study region.

The proposed NDE would not result in any of these threatened species, their populations, ecological communities, or habitats being significantly impacted upon such that a viable population of that species is placed at risk of extinction. Similarly, the works would not fragment, disturb or alter any movement or dispersal corridors, or isolate any proximate areas of suitable habitat. Therefore, giving consideration to the assessment criteria's listed under Section 5A of the NSW Environmental Planning and Assessment Act 1979, the preparation of a Species Impact Statement, which further considers the impacts of the EIS Proposal on threatened plants and/or animals, is not required.

The preparation of a Species Impact Statement, which further considers the impacts of the EIS Proposal on those threatened aquatic species previously recorded, or potentially occurring, in the region, is not required. No threatened fish are considered to occur in close proximity to the study area such that the drainage works associated with the proposed NDE would have either a direct or indirect impact on these animals, their habitats or populations.

No Koala populations are considered to occur in close proximity to the study area. The area is considered not to be Potential or Core Koala habitat. Giving consideration to the objectives of SEPP 44, it is not considered that the proposed works would require the preparation of a Plan of Management for Koalas, or the adoption of any other mitigative measures.

12.6 Mitigation Measures

Landscaping would be undertaken in such a manner that it meets the life cycle needs of those fauna species recorded. Landscaping would include the provision of locally occurring native trees, shrubs and ground cover plants, as well as natural mulch, debris (eg branches, logs) and leaf litter from the site. A list of relevant native species to include in the revegetation works is provided in **Working Paper 8**.

Landscaping and revegetation works would endeavour to provide linkages between the planted road reserves and adjacent habitats. The provision of these corridors/linkages would meet the dispersal and foraging needs of a number of native fauna species.

Landscaping and revegetation works would be maintained for a period of no less than twelve months. During this time any dead or dying plants would be removed and replaced.

A Bushland Plan of Management would be prepared. A component of this document would include the treatment of weed species, particularly the noxious plants recorded during the field survey.

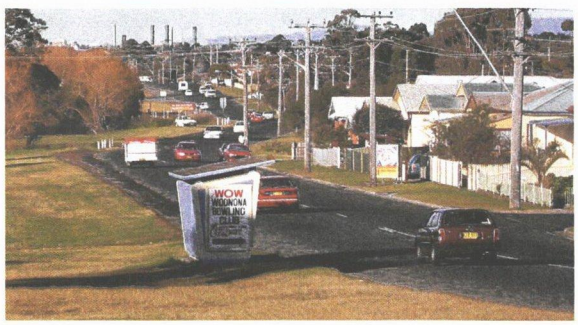
The Bushland Plan of Management would be prepared by a suitably qualified bushland regeneration organisation to control the future management of the landscaped areas.

A pre- and post-construction weeding program would be undertaken across the whole of the study area to minimise the spread of weeds into newly excavated areas.

To minimise any impacts on aquatic species, where possible, the proposed creek crossings would be bridged. In relation to this, no bridge piers would be located within any of the creek channels. Bridges would also be as wide and high as possible, thereby permitting the penetration of light into the creek channels.

Subject to other constraints of the road design the **waterway structures** would:

- Not have an adverse impact on the flows currently exhibited by those creeks traversed by the study area;
- Be box culverts as opposed to rounded pipes;
- Ensure that the water levels above and below the creek crossing remain the same;
- Ensure that there is no drop or waterfall at the end of any established structures;
- Not include the removal of any large woody debris outside of the construction area;
- Not result in the erosion of any creek banks;
- Not result in the significant increase of sediment loads beyond those currently exhibited by the creeks which traverse the study area;
- Not result in the restriction of any fish dispersal or movement patterns. The potential for the movement of fish species along the major creeks would not be prevented during, or after the roads construction;
- Minimise the disturbance of any aquatic habitat features; and
- Not reduce the extent of light penetration in to the main creek lines traversed by the proposed Northern Distributor Extension.



New bridge over EIS Proposal at Park Road will provide safe access for east-west movement of local residents.

The bridges and large box culverts would be designed in such away that the movement of ground and lower shrub traversing species are able to utilise these as fauna underpasses. The bridge abutments would be set back from the existing creek channels, thereby assisting the movement of native fauna. The inclusion of habitat features such as logs and boulders would also provide some species with shelter and protection as they pass under these structures.

The following measures would be undertaken to preserve the flora and fauna habitat values of drainage lines that occur within and adjacent to the study area:

- Erosion and sediment barriers be erected on the down slope boundaries of all construction zones;
- Regular inspection of erosion and sediment structures would be undertaken to ensure their adequacy and effectiveness. Where these are identified as being inadequate or in need or repair, this would be undertaken immediately;
- An Erosion and Sedimentation Control Plan would be prepared;
- During construction activities, construction vehicles would be restricted in their movements to the delineated construction zone;
- No polluted or sediment laden stormwater runoff from any work areas would be allowed to flow straight into any creek lines without first being filtered;
- Cleared native vegetation would be mulched and used in the project's rehabilitation works undertaken during and after construction;
- Weeds and seed bearing exotic plants that are removed would not be mulched but taken to an approved Council waste facility;
- Newly exposed surfaces would be stabilised as soon as possible in order to reduce the potential for soil erosion;
- Any site offices or work compounds would be located away from the creek line, within areas already cleared by past disturbance practices; and
- All contaminants would be collected and removed from the construction areas.

13. Noise Assessment

This section provides an assessment of the construction and operational noise impact of the EIS Proposal, and is based on **Working Paper 10** prepared by Wilkinson Murray Pty Ltd for this EIS.

The noise assessment has relied upon information provided by other Working Papers including:

- **Working Paper 1**: Concept Design Report;
- **Working Paper 3**: Traffic Study; and
- **Working Paper 11**: Urban & Landscape Design.

The assessment has been carried out in accordance with the Environmental Criteria for Road Traffic Noise (ECRTN), published by the NSW Government in May 1999 and the RTA Environmental Noise Management Manual (ENMM) December 2001. It describes the results of existing noise level measurements along the route and on other roads and streets likely to be affected by the development, as well as making predictions about future noise levels based on completion of the EIS Proposal. Both operational and construction noise issues are considered.

Noise attenuation measures have been incorporated into the EIS Proposal as part of the concept design (refer **Section 6** and **Figure 13.1**). These measures have also been the subject of initial community feedback at public displays during earlier stages of the planning process.

The design features incorporated into the EIS Proposal include:

- Limiting road traffic speed to 80km/h
- The use of retaining walls at cuts to maximise noise shielding
- Control of the vertical alignment to minimise acceleration
- The minimisation of *at-grade* intersections to reduce stop/start noise
- The use of a quiet road surface, such as open graded asphalt
- The construction of earth mounds and roadside noise barriers to provide noise shielding to nearby residences and schools.

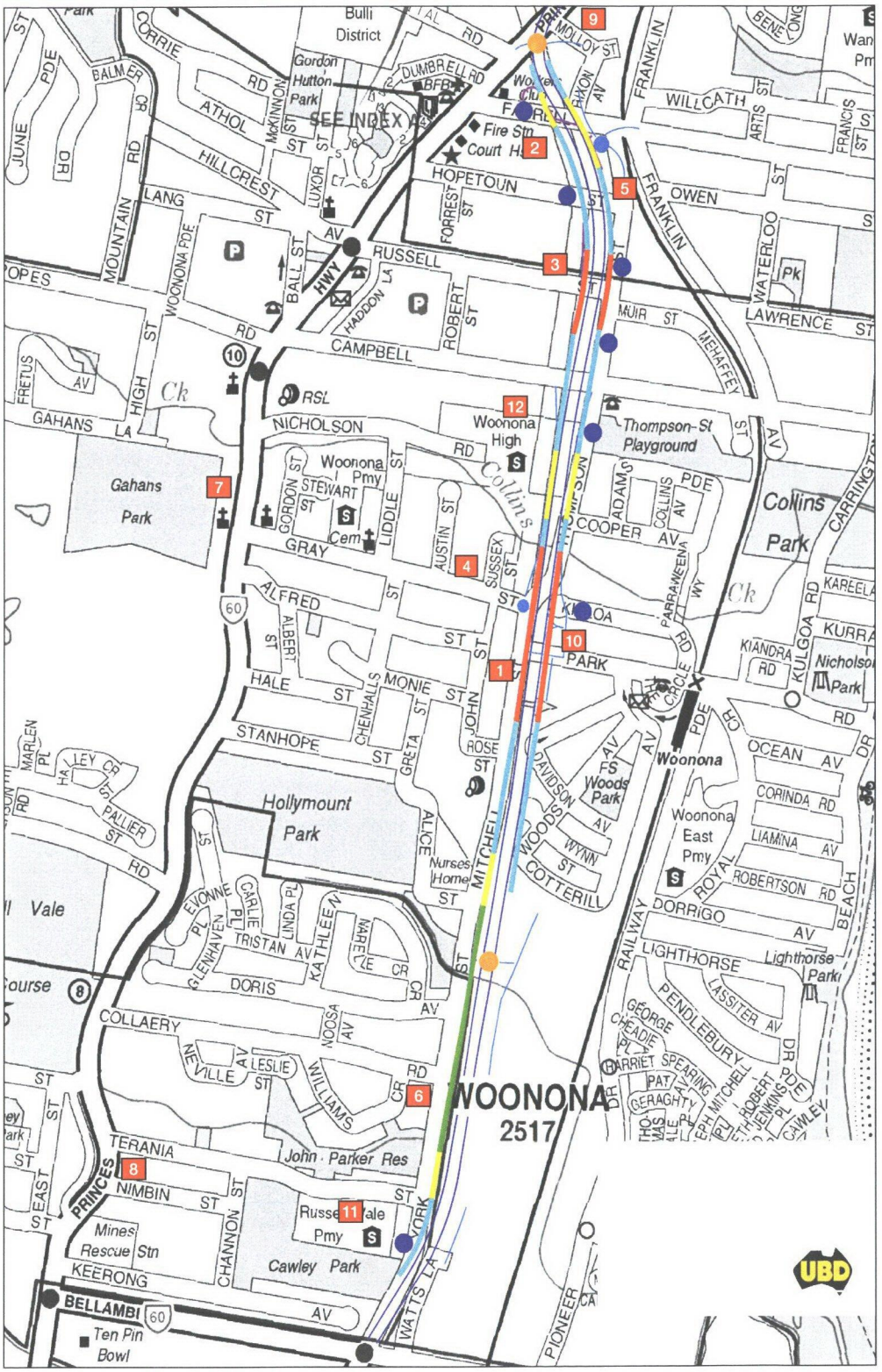
13.1 Existing Noise Levels

A noise survey was undertaken for this EIS to determine existing noise levels along the length of the proposed NDE route, the Princes Highway and other roads and streets which may be affected by the EIS Proposal. **Table 13.1** and **Figures 13.2** and **13.3** refer.

As a result of the measurements, the noise descriptors referred to in the *ECRTN* have been determined at residential locations. The results of the survey were also used to determine background noise levels, primarily for the assessment of construction noise. In addition, more detailed measurements have been carried out at some locations to determine the existing maximum noise levels of loud noise events at night time.

The base noise criteria for road traffic was provided in **Section 6** above and have been adopted as the target for the project.

Figure 13.1: Noise Barrier Locations and Noise Measurement Locations for the proposed NDE



Source: Wilkinson Murray (base map from UBD)

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Existing L_{Aeq} Noise Levels

Monitoring of L_{Aeq} noise levels was carried out over a 14 day period at 10 residential locations and at 2 locations within the existing schools. **Table 13.1** shows the locations of noise monitors and the dominant source of traffic noise for each location. A summary of the road traffic noise levels at residential locations is shown in **Table 13.2**. The detailed results of measurements are available in **Working Paper 10** and contained on the CD.

Figure 13.2 and **Figure 13.3** show recorded noise levels.

The LAeq,1hr noise levels measured at the two schools in the vicinity of the proposed NDE, are shown in **Table 13.3**. Since the ECRTN requires measurements inside schools, the noise level at the Russell Vale Public School has been estimated inside a classroom with windows open. The estimated LAeq,1hr noise level is 47dBA, 10dBA less than the external level.

All of the measured LAeq levels are dominated by existing road traffic. Most of the levels measured adjacent to the proposed NDE and the existing Princes Highway, exceed the base noise criteria discussed in **Section 6**. The only exception is at 15 Thompson Street where the measurement location was slightly shielded from the road.

In those streets that cross the EIS Proposal, existing noise levels are varied. Levels in Gray Street are below the noise criteria for a collector road, whilst those levels in Campbell Street, Farrell Road and Park Road are above.

The internal noise levels determined at the two schools are both currently over the 40dBA base noise criterion.

Table 13.1: L_{Aeq} Monitoring Locations & Periods

Monitoring Location	Monitoring Period	Dominant Road
1. 16 Mitchell Road	28 March – 11 April 2001	Mitchell Road
2. 87 Farrell Road	28 March – 10 April 2001	Farrell Road
3. 70 Campbell Street	28 March – 11 April 2001	Campbell Street
4. 31 Gray Street	28 March – 11 April 2001	Gray Street
5. 15 Thompson Street	28 March – 11 April 2001	Thompson Street
6. 42 York Road	11 May – 21 May 2001	York Road
7. 492 Princes Highway (Woonona)	11 May – 21 May 2001	Princes Highway
8. 635 Princes Highway (Bellambi)	11 May – 21 May 2001	Princes Highway
9. 242 Princes Highway (Bulli)	9 May – 18 May 2001	Princes Highway
10. 49–53 Park Road	9 May – 17 May 2001	Park Road
11. Russell Vale Public School	2 May – 17 May 2001	York Road
12. Woonona High School	2 May – 14 May 2001	Thompson Street

Source: Wilkinson Murray (Working Paper 10)

Figure 13.2: Existing & Projected Noise Levels

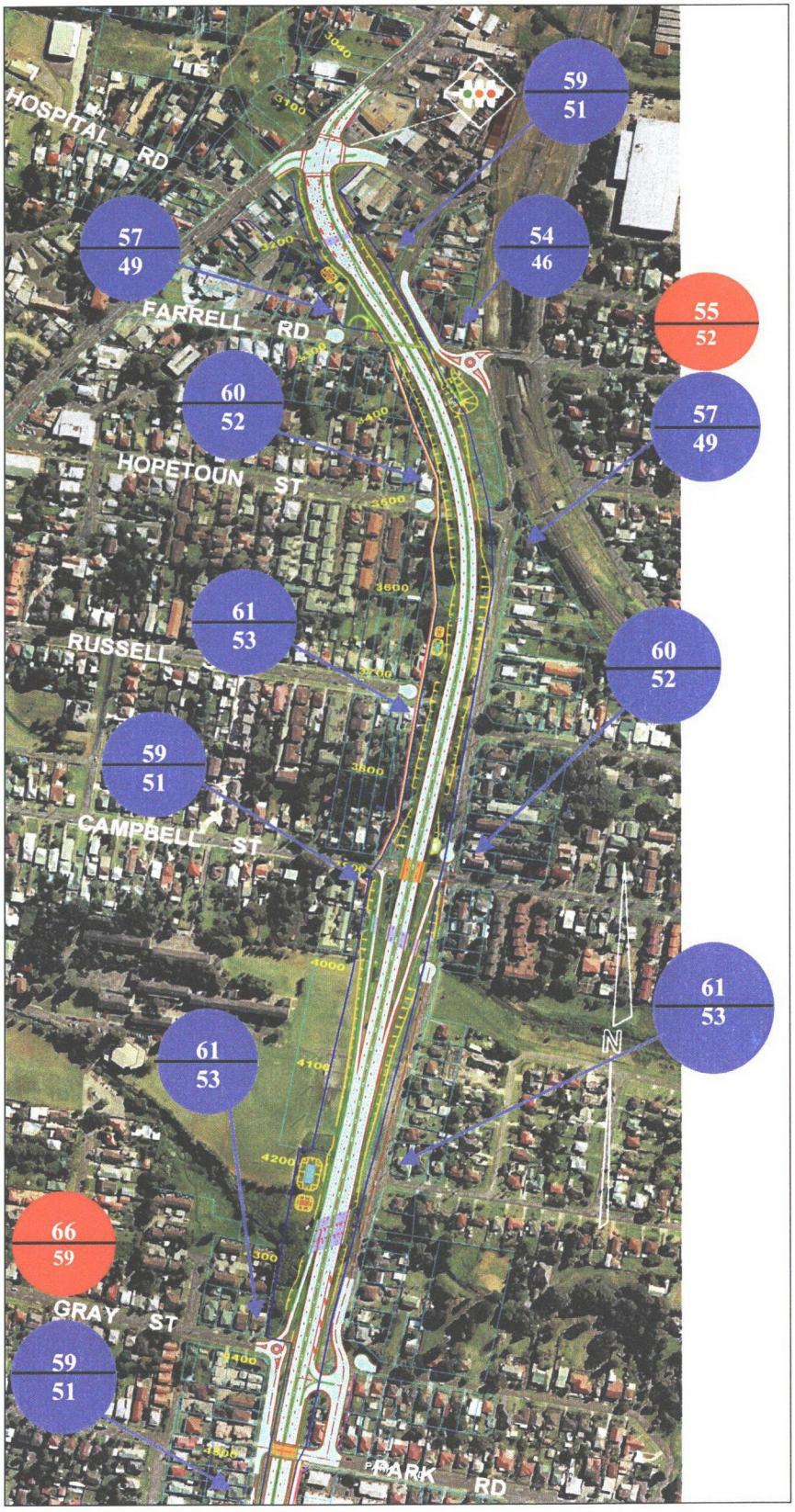


Figure 13.3: Existing & Projected Noise Levels

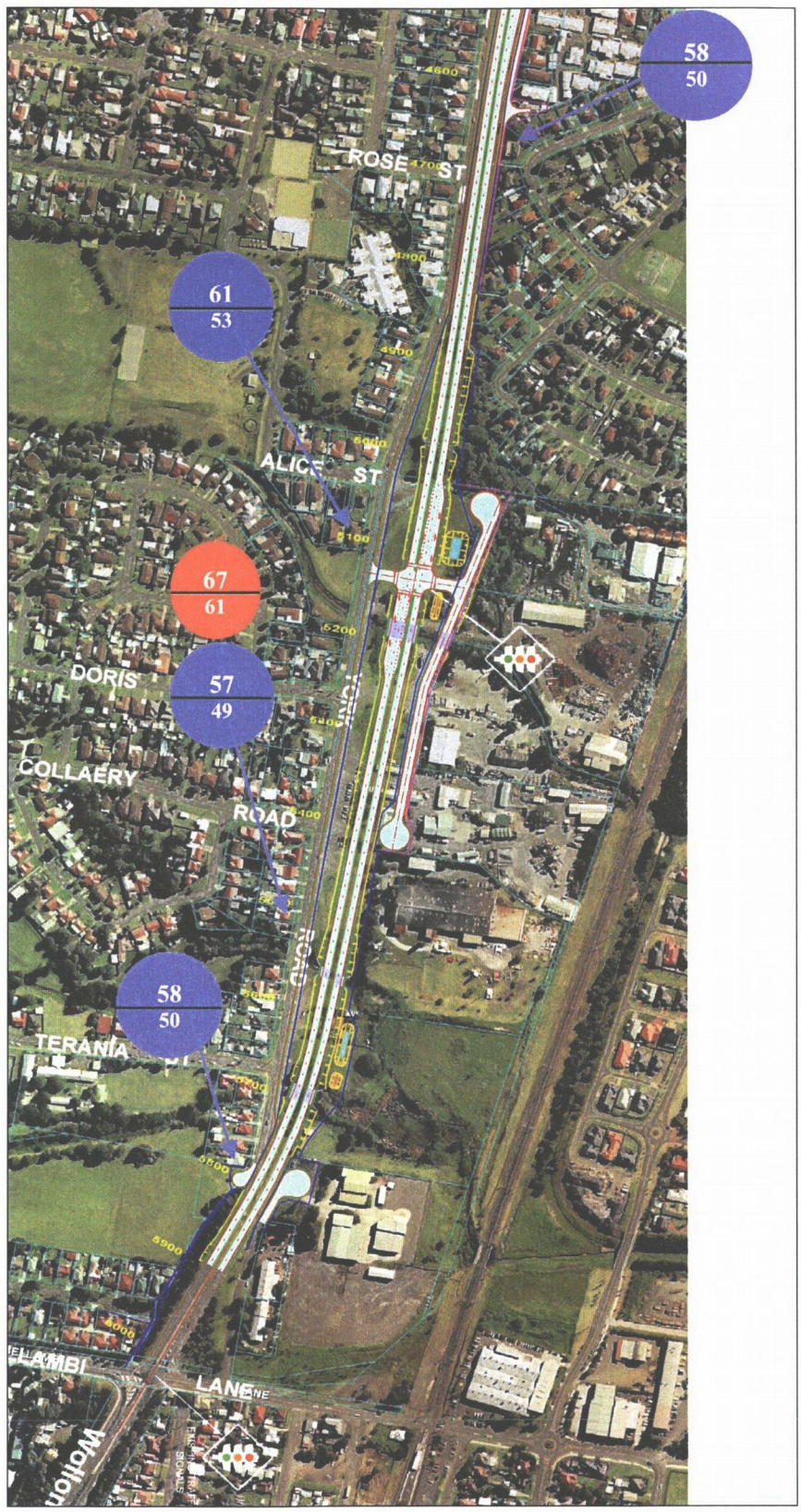


Table 13.2: Existing Day and Night Noise Levels at Residential Locations

	Noise Levels (dBA)			
	Daytime		Night Time	
Location	L_{Aeq},15hr	L_{Aeq},1hr	L_{Aeq},9hr	L_{Aeq},1hr
16 Mitchell Road	66	–	59	–
87 Farrell Road	–	62*	–	57*
70 Campbell Street	–	63	–	56
31 Gray Street	–	58	–	53
15 Thompson Street	55	–	52	–
42 York Road	67	–	61	–
492 Princes Highway (Woonona)	68*	–	61*	–
635 Princes Highway (Bellambi)	73*	–	67*	–
242 Princes Highway (Bulli)	62	–	58	–
49–53 Park Road	–	67	–	61

Source: Wilkinson Murray (Working Paper 10)

Note: * 2dB added to estimate facade level

Table 13.3: Existing Noise Levels at Schools

School	Measurement Condition	L_{Aeq}, 1hr (dBA)
Woonona High School	Inside, windows open	46
Russell Vale Public School	Outside (roof)	57

Source: Wilkinson Murray (Working Paper 10)

Maximum Noise Level at Night Time

The maximum noise levels generated by vehicle movements at night have been measured at eight of the residential locations. The measurements were made using the Wilkinson Murray *MadMax* Noise Measurement System, which includes an environmental noise logger connected to a lap top computer running software custom developed to record noise levels which meet the criteria below.

The maximum noise levels measured are the maximum noise levels occurring during the night time period (10.00pm – 7.00am) defined as follows:

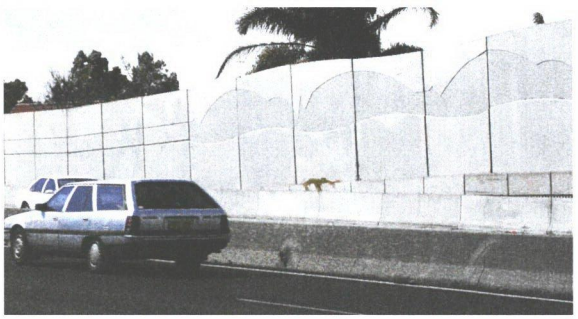
- Exceeding 65dBA
- Exceeding the $L_{Aeq,1hr}$ level by more than 15dBA
- Separated from any other maximum by at least 3 seconds, and
- Separated from any other maximum by a drop of at least 5dBA in noise level

Whilst the events measured on the Princes Highway were generated primarily by the passage of heavy vehicles, the events measured on all other streets, including the proposed route of

the proposed NDE, were dominated by the passage of light vehicles, particularly including noisy cars and 4WD vehicles. On the other streets many light vehicles exceeded the criteria for an event (greater than 65dBA and greater the L_{Aeq} plus15dBA) due to the low ambient noise level and the proximity of the measurement locations to the streets. However, the noise from light vehicles generally did not exceed the criteria on the Princes Highway due to the higher ambient noise on this road. This interpretation of the results is important when comparing the graphs for the Princes Highway with the graphs for other streets.

13.2 Assessment of Operational Traffic Noise

During the concept design phase of the proposed NDE, projected noise levels were identified and used as the basis for design of noise barriers along the route. These measures were designed to ensure that the base noise criteria in the *ECRTN* would be achieved where practicable.



Existing noise barriers on F6 Freeway, Wollongong.

Noise levels with the noise mitigation measures in place were then determined to allow an overall assessment of the noise impact of the project.

In general terms, the assessment concludes that the noise generated by traffic on the proposed NDE would have less impact than current noise levels along the route because of the new noise protection measures installed as part of the EIS Proposal. Noise levels along the existing Princes Highway would also decline because of a transfer of traffic to the proposed NDE.

13.2.1 Noise Catchment Areas

There are a substantial number of existing residences adjacent to the proposed NDE EIS Proposal. From Bellambi Lane in the south, there are a number of residences on York Road to the west of the proposed NDE (mostly set back from the proposed NDE) up to approximately Alice Street. An industrial area currently exists on the eastern side of the proposed NDE in this Section.

From Alice Street to approximately Gray Street, there are residences relatively close to the proposed NDE on both sides. From Gray Street to Campbell Street, whilst there are only a few residences on the western side, there are a number of residences fronting Thompson Street on the eastern side which are set back from the proposed NDE. From Campbell Street to the Molloy Street/Princes Highway intersection, there are residences on both sides of the proposed NDE, except for the far northern end where industrial and commercial premises exist.

There are also two schools near the proposed NDE, but set back some distance. West of the proposed NDE near Terania Street is Russell Vale Public School. This school is a considerable distance from the proposed NDE and is shielded to some degree by residences between it and the EIS Proposal. Between Gray Street and Campbell Street is Woonona High School which is to the west and set back some distance across a playing field from the proposed NDE.

13.2.2 Traffic Flows

Traffic volumes used in the noise assessment were based on the analysis of existing and forecast traffic flows for the EIS Proposal carried out by Forbes Rigby Pty Ltd and Gabites Porter (NZ). **Section 7** of the EIS refers.

Traffic volumes were split into heavy and light vehicles and daytime and night time numbers. In accordance with The *ECRTN*, daytime is defined as 7.00am – 10.00pm and night time as 10.00pm – 7.00am.

Details of the projected traffic volumes and splits are also provided in **Working Paper 10**.

13.2.3 Traffic Noise Criteria

EPA Traffic Noise Criteria for Residences

The NSW Government has proposed traffic noise guidelines[6] which have been supported by the RTA. These guidelines are non mandatory and suggest that *"...in some instances the criteria may only be achievable 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"*.

The relevant residential noise criteria recommended by the new guidelines are shown in **Table 13.4**. The base criteria for new arterial roads are $L_{Aeq,15hr}$ 55dBA for daytime and $L_{Aeq,9hr}$ 50dBA for night time. For redevelopment of an arterial road, the base criteria are $L_{Aeq,15hr}$ 60dBA for daytime and $L_{Aeq,9hr}$ 55dBA for night time.

The NDE is considered to be a redevelopment of an existing arterial road between Bellambi Lane and Farrell Road. This assessment is based on the *ECRTN*.

The NDE involves construction of an arterial road within a road reserve. The reserve follows existing roads, being York Road, Mitchell Road and Thompson Street, and the proposed NDE essentially involves a realignment of these roads.

The *ECRTN* defines the redevelopment of an existing arterial road as works to upgrade an *arterial or sub-arterial corridor where it is proposed to increase traffic-carrying capacity, change the traffic mix or change the road alignment through design or engineering changes.*

According to the document, arterial roads include sub-arterial roads *and refers to roads handling through-traffic with characteristically heavy and continuous traffic flows during peak periods. Through-traffic is traffic passing through a locality bound for another locality.*

York Road, Mitchell Road and Thompson Street are currently functioning as arterial roads according to the definition. The Proposal is to redevelop these roads to provide the proposed NDE. The proposed works therefore involve redeveloping an existing arterial road.

Between Farrell Road and the Princes Highway, the proposed NDE is considered to be a new arterial road, since this section cuts through an existing residential area and does not follow any existing road.

6 *Environmental Noise Criteria for Road Traffic Noise* Environment Protection Authority of NSW, May 1999.

Table 13.4: Road Traffic Noise Criteria for Residential Land Use

Type of Development	Criteria Day (7am–10pm) dBA	Night (10pm–7am) dBA	Where Criteria are already Exceeded
New freeway or arterial road corridor	$L_{Aeq,15hr}$ 55	$L_{Aeq,9hr}$ 50	**The new road would be designed so as not to increase existing noise levels by more than 0.5dB**. Where feasible and reasonable, noise levels from existing roads would 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.
Redevelopment of existing arterial road	$L_{Aeq,15hr}$ 60	$L_{Aeq,9hr}$ 55	In all cases, the redevelopment would be designed so as not to increase existing noise freeway/ levels by more than 2dB. Where feasible and reasonable, noise levels from existing roads would be reduced to meet the noise criteria. In many 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. In all cases, the redevelopment would be designed so as not to increase existing noise levels by more than 2dB.
Redevelopment of existing collector road	$L_{Aeq,1hr}$60	$L_{Aeq,1hr}$55	Where feasible and reasonable, noise levels from existing roads would be reduced to meet the noise criteria. In many 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: Environmental Criteria for Road Traffic Noise (ECRTN), May 1999.

In view of the fact that York Road, Mitchell Road and Thompson Street have been functioning as arterial roads only since completion of the first stage of the Northern Distributor, it may be argued that the proposed NDE development involves construction of a new arterial road for the full length. If this were the case, then lower base noise criteria would need to be applied, but in practice similar noise control measures would be applied to the project, given the procedures recommended in the *ENMM*.

The Princes Highway is considered to be an existing arterial road. Other roads and streets potentially affected by the development are considered to be existing collector roads.

The EIS Proposal has been designed with the objective of meeting the base noise criteria. For much of the length of the road, road design and roadside noise mitigation measures have been used to meet these base criteria. Where these base criteria have not been able to be achieved, the procedures indicated in the *ENMM* have been adopted to determine the appropriate additional mitigation measures.

EPA Traffic Noise Criteria for Schools and active recreation areas

For existing schools, the *ECRTN* guidelines recommend an internal base noise level criterion of $L_{Aeq,1hr}$ = 45dBA within the classroom. It is assumed this applies to a typical worst case hour during normal school times. For building facades which contain openable windows (as in this case) an equivalent external goal would be 55dBA.

The guidelines also recommend a base criterion of $L_{Aeq,15hr}$ = 55dBA for school playgrounds. For active recreation areas, assumed to include the playing fields at Woonona High School, the guidelines recommend a base criterion of $L_{Aeq,15hr}$ = 60dBA.

13.2.4 Traffic Noise Model

Noise levels for the project had been calculated using *ROADent* incorporating the CORTN procedure. This model takes into account the following factors:

- Noise level generated by the road surface;
- The road traffic forecasts for light and heavy movements;
- The average speed of the traffic;
- Shielding provided by natural topography, road cuts, existing buildings and roadside noise barriers and mounds;
- The noise source heights, being:
  - Light vehicles 0.5m
  - Heavy vehicle exhausts 3.6m
  - Heavy vehicle engines 1.5m

Existing noise levels were measured on Wednesday 16 May 2001 at three residential locations on the Princes Highway, simultaneously with counting of road traffic flows (separated into heavy and light vehicle movements) to validate the model. The validation shows that the model is calculating levels to an accuracy of ± 2dBA. This accuracy is consistent with expectations.

Residential Noise Levels near NDE

Noise levels resulting from the proposed NDE have been calculated using the ROADent model and these are presented in this Section. The daytime and night time L_{Aeq} noise levels are shown in contour form in **Figure 13.4** and **Figure 13.5** for the proposed NDE for the Year 2016. These noise contours are based on the noise mitigation measures incorporated into the EIS Proposal.

Residential L_{Aeq} Noise Levels

Noise contours refer to noise levels at 2m above the ground, ie ground floor levels. These levels are also shown at a selected number of locations in **Figures 13.4** and **13.5**.

The noise levels due to the proposed NDE at nearby residential locations would be lower in 2016 than those levels which currently exist as a result of the existing streets, with the exception of one location in Thompson Street where existing noise levels are quite low. The reduced levels result from the noise mitigation measures incorporated into the EIS Proposal.

In most cases it is expected that the 2016 L_{Aeq} noise levels due to the proposed NDE would be equal to or less than the base noise criteria in the *ECRTN*. All exceptions are discussed below and consideration is given to additional noise mitigation measures. The predicted noise levels reflected in the contours are based on all roadside noise barriers being reflective in nature. This would allow flexibility in the design and construction of such barriers to ensure a good urban design outcome.

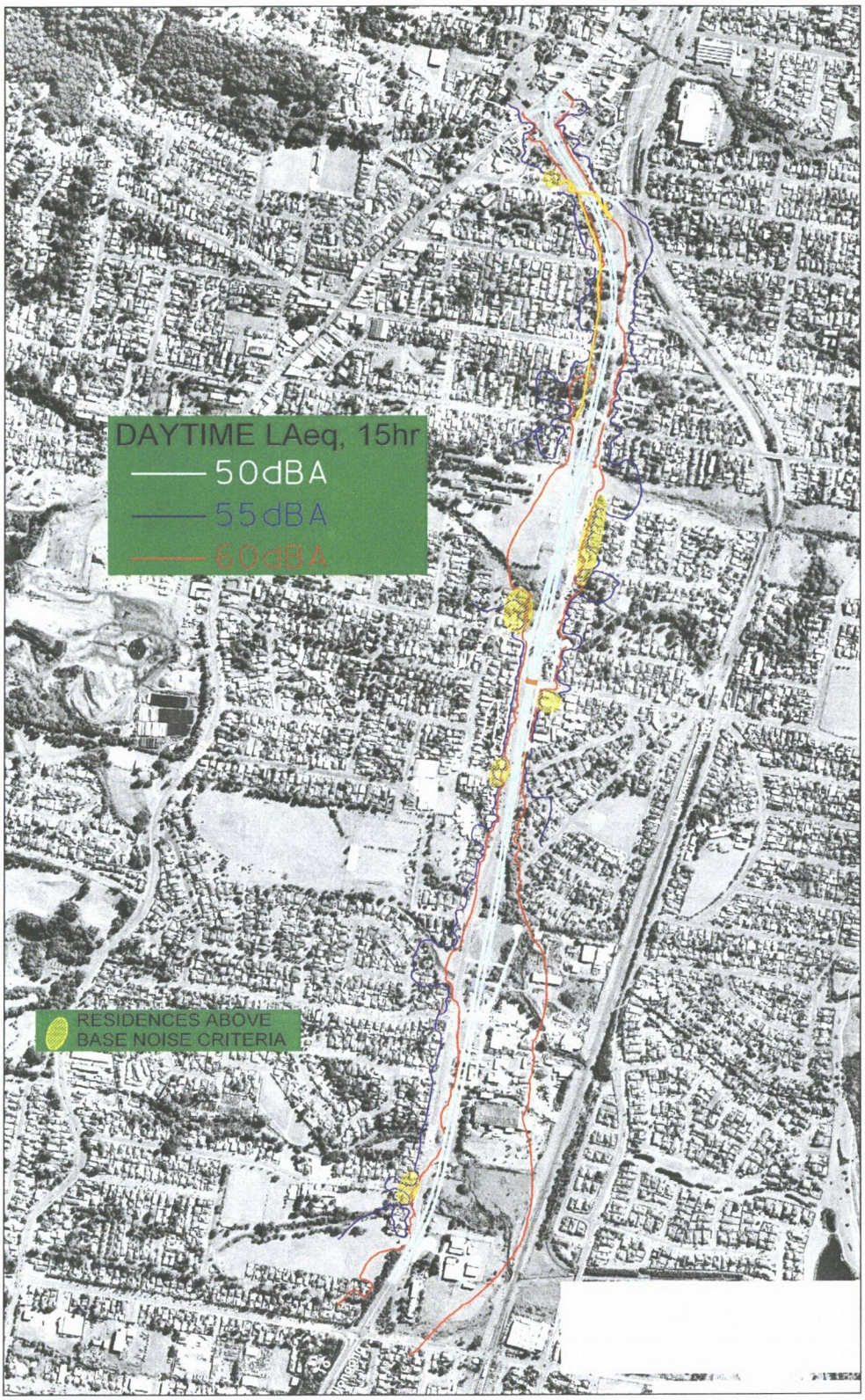
It is proposed to measure road traffic noise levels after opening of the proposed NDE and further consideration would be given to noise mitigation measures at the residences where measured noise levels exceed the base criteria. This consideration would be in accordance with RTA *Environmental Noise Management Manual (ENMM)*.

The noise contours shown in **Figures 13.4** and **13.5** are for noise generated by the proposed NDE alone. However, some of the residences near the proposed NDE would be affected by NDE noise as well as noise from existing streets. For this reason, the noise level at some residences would exceed the base noise criteria, sometimes dominated by noise from other streets. In particular, the noise levels at residences on the western side of the proposed NDE fronting York Road between Collaery Road and the proposed access to the proposed NDE at approximately Chainage 5,170m would be affected more by the traffic on York Road than the proposed NDE. The same may apply to residences on the eastern side of the proposed NDE facing Thompson Street at around Chainage 4,300 – 4,400m. For this reason, measurements after opening of the proposed NDE may reveal noise levels above the base noise criteria.

From the forecast of 2006 traffic flows with the proposed NDE in place noise levels have also been calculated for a time approximately equivalent to immediately after opening of the proposed NDE. The noise levels expected from the proposed NDE after opening would be approximately 1.5dBA less than those noise levels defined by the 2016 contours.

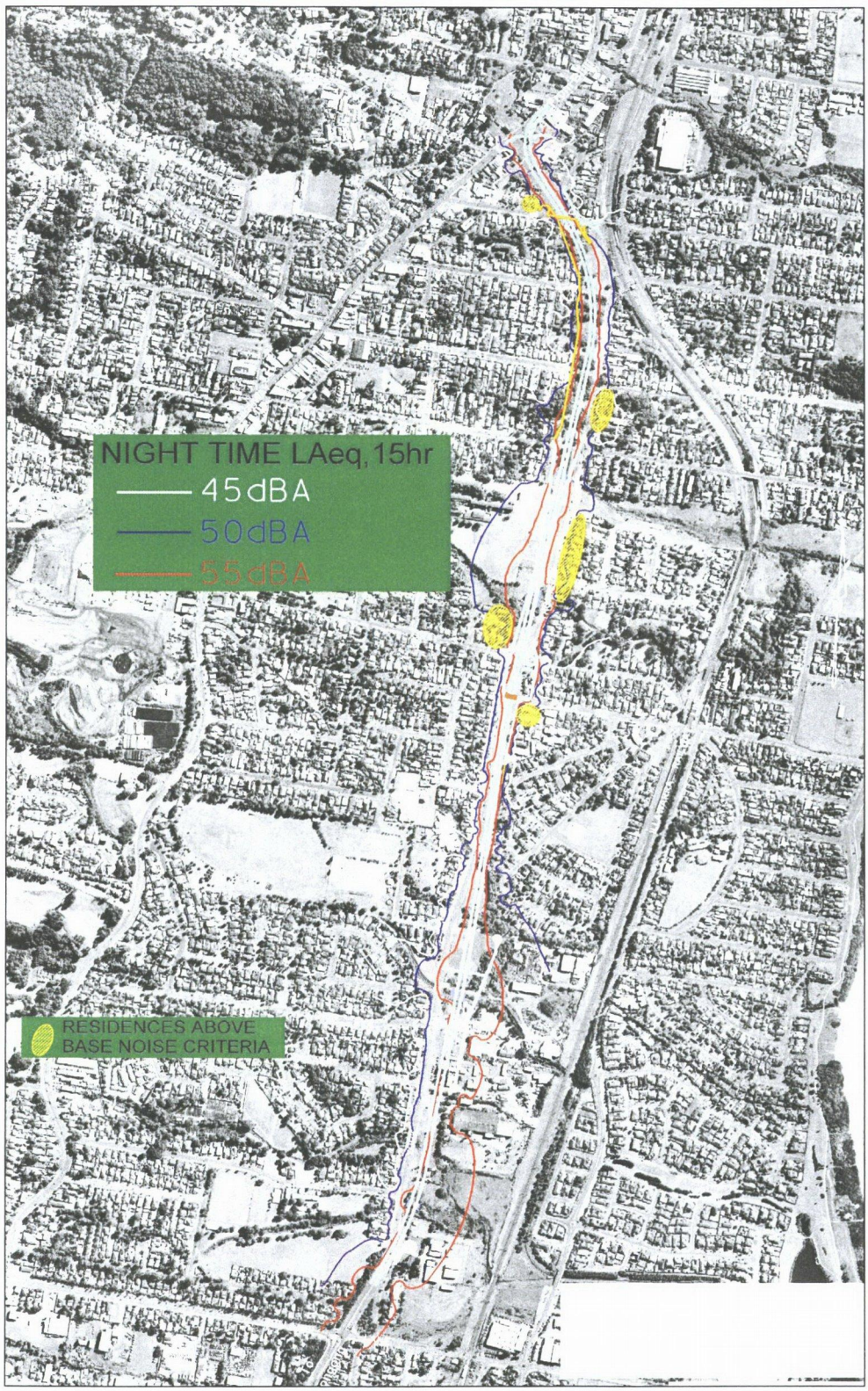
At a number of locations along the length of the proposed NDE, at-grade intersections result in **gaps in the noise barriers** to be constructed to mitigate the noise levels. Accordingly, some noise spillage in these areas would result in noise levels at some residences which exceed the base noise criteria. In addition, the same spillage would also occur where gaps in the barriers have been allowed for the purpose of allowing drainage over the road in the event of a significant flood.

Figure 13.4: Day Time Noise Contours



Source: Wilkinson Murray

Figure 13.5: Night Time Noise Contours



Source: Wilkinson Murray

Since the mitigation measures have been designed to meet the base noise criteria at ground floor levels within residences, some of the first floor levels would be subject to noise levels above the base criteria.

Table 13.5 shows those residential locations where 2016 noise levels would exceed the base noise criteria. The table also shows the anticipated daytime and night time LAeq noise levels and the criteria.

Table 13.5: Residential Locations where Base Noise Criteria would not be achieved

	NDE Road Traffic Noise Levels (dBA)			
	Daytime (L_{Aeq}, 15hr)		Night Time (L_{Aeq}, 9hr)	
Location	Predicted	Criterion	Predicted	Criterion
1 residence western side of NDE just north of Farrell Road.	60	55	55	50
Apartment buildings eastern side of NDE just north of Campbell Street, including 1st floor	62	60	56	55
7 residences east of the NDE and 2 west of the NDE between Chainages 4200 and 4320m	Max 64	60	Max 58	55
2 residences (including 1st floor) east of NDE just south of Park Road	65	60	59	55
2 residences west of NDE between Chainages 4700 and 4750m	61	60	55	55
2 residences west of NDE fronting York Road and just north and south of Terania Street	61	60	55	55

Source: Wilkinson Murray (Working Paper 10)

Most of these levels are only slightly over the base noise criteria and none of them are more than 5dBA over. Accordingly, further consideration of noise mitigation has not been necessary. This includes further mitigation measures at the road and residential treatment.

In respect of further consideration of noise mitigation, Step 3 (2) of Practice Note IV of the Environmental Noise Management Manual is the relevant section. This section states in part: "... the RTA believes it is generally not "reasonable" to apply additional treatments such as noise barriers/mounds, quieter pavement surfaces and architectural treatment of private dwellings if the predicted design year noise levels:

- do not exceed the ECRTN allowances over the "future existing" noise levels (the noise levels from the existing sources of road traffic noise predicted for the time of project opening);
- would not be acute, i.e. the noise levels are predicted to be less than 65dBA $L_{Aeq,15hr}$ (day) and 60dBA $L_{Aeq,9hr}$ (night)".

The noise levels expected from the EIS Proposal would meet this requirement and therefore further consideration of noise mitigation has not been carried out.

Residential L_{Amax} Noise Levels

The number of maximum noise level events generated by the proposed NDE have been predicted for the year 2016 at the three locations adjacent to the route which were previously monitored:

- 15 Thompson Street;
- 16 Mitchell Road; and
- 42 York Road.

The maximum noise level events monitored at the three locations were dominated by the passage of light vehicles along existing streets. However, calculations have shown that, with the proposed noise mitigation measures in place for the proposed NDE, future light vehicle maximum noise levels would be less than 65dBA at the three residential locations. On this basis, future LAmax levels from the proposed NDE would result from the louder truck movements whose number would increase after opening of the proposed NDE.

The number of truck maximum noise level events were determined at the three locations as follows:

- The typical truck noise levels at each location were calculated using *ROADent* and applying an average truck noise level;
- The distribution of truck noise levels at 492 Princes Highway relative to the *ROADent* prediction was applied to the level predicted at the three NDE locations; and
- The criteria for determining an event were again applied: 65dBA and $L_{Aeq,1hr}$ plus 15dBA. To establish the $L_{Aeq,1hr}$ noise levels at the 3 locations the overall night time L_{Aeq} was apportioned to the hours according to the profile of traffic and noise as measured at 492 Princes Highway.

By comparison, there would be fewer defined maximum noise events at night time after opening of the proposed NDE than currently exist at these locations. Again, this is due largely to the introduction of noise mitigation measures as part of the proposed NDE.

Noise Levels at Schools Near NDE

The worst hour for noise during the daytime is 8.00am – 9.00am and the noise levels for this hour at the two schools in 2016 are shown in **Table 13.6**. These levels are outside of the nearest classrooms and the levels expected inside are shown in **Table 13.7**.

The measured noise levels take into account the orientation of the classroom windows with respect to the proposed NDE. It can be seen that the levels expected inside the noisiest classrooms with windows open would comply with the base noise criterion.

The predicted noise levels for playgrounds and sporting fields are shown in **Table 13.8**. These noise levels also comply with the base noise criteria.

Table 13.6: Noise Levels at Schools from NDE In 2016

School	$L_{Aeq,1hr}$ (dBA)
Woonona High School	58
Russell Vale Public School	54

Table 13.7: Noise Levels from NDE Inside Classrooms In 2016

School	$L_{Aeq,1hr}$ (dBA)
Woonona High School	45
Russell Vale Public School	44

Table 13.8: NDE Noise Levels at School Playground and Sporting Fields In 2016

Location	$L_{Aeq,15hr}$ (dBA)
Woonona High School Sporting Oval	60
Russell Vale Public School Playground	53

Source: Wilkinson Murray, (Working Paper 10)

13.2.5 Change in Noise Levels on Other Roads

Opening the proposed NDE would create some changes to traffic flow patterns in the local area. For example, some traffic would be moved from the Princes Highway to the proposed NDE, traffic flow would reduce on those streets running parallel to the proposed NDE (York Road, Mitchell Road and Thompson Street), and traffic would increase on streets with connections to the proposed NDE (Gray Street, Park Road and Campbell Street).

The noise level changes have been calculated on representative streets affected by the proposed NDE, as shown in **Table 13.9**.

The increases represent the increases from the existing flow to the 2016 flow with the proposed NDE.

The noise level changes in the table may be interpreted by understanding the significance of the changes. A 2dBA change in noise level is only just noticeable, unless the traffic mix changes significantly. A change in noise level of 3dBA is likely to be noticeable.

Whereas a noticeable reduction in road traffic noise would be expected on the Princes Highway between Bellambi Lane and the proposed intersection with the proposed NDE, a just noticeable increase on the Princes Highway would be expected north of the intersection with the proposed NDE.

Table 13.9: Daytime and Night Time Noise Level Changes Expected on Other Roads

Street/Road	Change In Noise Level (dBA) Day $L_{Aeq,15hr}$	Night $L_{Aeq,9hr}$
Princes Hwy South of Hobart	1.9	1.8
Princes Hwy South of Stanhope	-3.4	-3.1
Pioneer North of Bellambi	-0.3	-0.3
Campbell East of Princes Hwy	1.9	1.9
Campbell East of Robert	1.9	1.9
Campbell East of Thompson	2.2	2.2
Gray East of Princes Hwy	0.5	0.5
Gray East of Sussex	2.0	2.0
Park East of Mitchell	1.2	1.2
Park West of Kulgoa	0.1	0.1
Collaery East of Princes Hwy	0.8	0.8
Mitchell South of Gray	-4.3	-4.3
Michell South of Park	-7.8	-7.8
York South of Alice	-5.4	-5.4
York South of Doris	-9.1	-9.1

Source: Wilkinson Murray, (Working Paper 10)

Notes:

Positive numbers represent increases and negative numbers represent decreases.

The increases represent the increases from the existing flow to the 2016 flow with the NDE.

Significant traffic flow reductions would result on York Road, Mitchell Road and Thompson Street as a result of construction of the proposed NDE. Accordingly, substantial reductions would be expected from these streets, but some of the residences fronting these streets would be subjected to noise from the proposed NDE as discussed above.

Just noticeable noise level increases are expected in Campbell Street, both east and west of the proposed NDE, and in Gray Street on the western side of the proposed NDE. A smaller increase (not noticeable) is likely to occur in Park Road east of the proposed NDE.

Consideration would be given to local area traffic management measures (LATM) for Campbell Street west of the proposed NDE.

13.2.6 Summary of Operational Traffic Noise Impacts

The EIS Proposal includes significant noise mitigation measures, particularly including roadside noise barriers and mounds. Accordingly, future noise levels generated on the road would be well controlled in the surrounding areas.

With a minor exception at a small area on the eastern side of the proposed NDE near Thompson Street, future noise levels with the proposed NDE in place would be less than existing noise levels along the route. These future noise levels would also generally be less than the base noise criteria recommended by the ECRTN. The exceptions are highlighted in **Figures 13.4** and **13.5**.

The following represents a summary of the noise impacts for different sections of the road (from north to south):

- From the Princes Highway to Farrell Road, high roadside noise barriers have been proposed in an attempt to meet the lower noise criteria for this section. With the exception of one residence, the base noise criteria would be achieved;
- From Farrell Road to Campbell Street, roadside noise barriers would provide noise shielding and the retaining walls proposed at the cut near Russell Street. Accordingly, the base noise criteria would be achieved at all residences, except at two apartment buildings on the eastern side, near Russell Street;
- Between Campbell Street and Gray Street, noise barriers are proposed on the through-road and also on the ramps. The base noise criteria would be achieved except for approximately seven residences on the eastern side and two residences just north of Gray Street on the western side. Noise levels expected at Woonona High School would comply with the appropriate criteria;
- Between Gray Street and Doris Avenue, there would be a range of noise mitigation measures. A couple of residences just south of Park Road would be affected by noise levels above the base criteria as a result of their exposure to the proposed road connecting Park Road to the proposed NDE. Noise levels would also affect a couple of residences on the western side approximately half way between Gray Street and Doris Avenue slightly over the base criteria; and
- Along the section from Doris Avenue to Bellambi Lane, an industrial area abuts the eastern side of the proposed NDE. On the western side, some mounding and some roadside noise barriers would shield the residences on the western side of York Road. Nevertheless, two residences near Terania Street are likely to be affected by noise levels above the base criteria.

13.3 Assessment of Construction Noise and Vibration

This section addresses construction noise and vibration likely to be associated with the project and appropriate methods of mitigation of these impacts.

Working Paper 10 sets out the detailed criteria and assessment made for both construction noise and vibration.

The *Environmental Noise Control Manual (ENCM)* published by the EPA recommends noise criteria for the assessment of construction noise. These criteria are based on normal daytime construction hours.

The most common form of vibration measurement is the peak particle velocity (ppv) in mm/s. In respect of building damage, a vibration level limit and frequency is normally specified, but in respect of potential annoyance to residents, a combination of vibration level, frequency and duration is not appropriate (dose value).

The RTA, as part of its environmental procedures (specification), recommends a ppv vibration limit of 2mm/s at the property boundary. This limit is considered to be very conservative in respect of building damage, but is a useful guide in respect of potential annoyance.

There is no current Australian Standard for assessing building damage due to vibration. However, there are a number of international standards that are commonly used and considered appropriate. The most appropriate standard is the British Standard, BS7583: 1993 *Evaluation and Measurement of Vibration in Buildings*. The EPA has published guidelines to avoid annoyance to residents and these are based on BS6472: 1984.

Daytime construction noise is considered for the period 0700hrs to 1800hrs.

Construction of the proposed NDE is likely to involve a number of activities and equipment that would generate noise. However, the actual construction methods and equipment would depend upon the contractor appointed to construct the proposed NDE and the exact methods and equipment would not be known until that time. This section therefore gives only an indication of the methods and equipment.

Typical sources of construction noise include:

- Construction of Bridges and Drainage Crossings;
- Excavation and construction of embankments;
- Placement of pavement;
- Laying of asphalt; and
- Construction compounds.

Vibration may be generated by such construction activities as compacting, rock breaking and ripping. The vibration may cause discomfort to occupants of nearby buildings and may, at higher levels, cause building damage.

13.3.1 Assessment of Construction Noise Levels

Noise levels associated with most stages of construction would exceed the noise criteria discussed above at the nearest residences. The Construction Noise and Vibration Management Plan discussed below would address practical methods of controlling the noise impact. It should be noted however that impact on schools would be minimised due to their distance from main points of construction activity.

13.3.2 Construction Vibration Levels

Ground borne vibration levels generated by typical construction activities would vary significantly, depending upon the type of ground. **Table 13.10** shows the highest anticipated vibration levels at a distance of 15m, being the closest residences to likely activity.

Table 13.10: Predicted Vibration Levels at 15m

	Vibration Level	
Equipment	**Velocity (mm/s)**	**Acceleration (m/s2)**
Vibratory Roller	4.0	0.3
Dozer (ripping)	1.5	0.15
Rock Breaker	0.15	0.015

Source: Wilkinson Murray, (Working Paper 10)

The vibration velocity levels expected at 15m are well below the damage criteria expressed above. Damage from construction vibration is therefore extremely unlikely. However, some discomfort may result from vibration associated with some construction activity. This particularly applies to the use of a vibratory roller and may also apply to ripping of rock and breaking of rock using a rockbreaker.

13.4 Summary

13.4.1 Operational Noise

At residences near the route of the proposed NDE, noise levels would generally reduce after opening of the proposed NDE. This results from the extensive noise mitigation measures proposed as part of the EIS Proposal. In addition, noise levels due to the proposed NDE at most residences are expected to comply with the base noise criteria recommended by the *Environmental Criteria For Road Traffic Noise (ECRTN)* published by the NSW Government.

At Woonona High School and Russell Vale Public School noise levels from the proposed NDE are expected to comply with the relevant noise criteria in the *ECRTN* for the classrooms, playgrounds and sporting fields.

Some other roads would be affected by operation of the proposed NDE. A noticeable decrease in noise level would result on the Princes Highway between Bellambi Lane and the proposed intersection with the proposed NDE near Molloy Street. North of this, there would be a small (probably not noticeable) increase in noise level.

The only other changes would be a possible noticeable increase in noise level in Campbell Street and Gray Street and a substantial decrease in noise level in much of York Road, Mitchell Road and Thompson Street. These changes to other roads represent the changes due to traffic growth between the existing situation and 2016 as well as the change due to the introduction of the proposed NDE.

Overall, the proposed NDE would bring significant noise level reductions in the area, with some negative effect on Campbell Street and Gray Street as a result of traffic entering the proposed NDE along these streets.

13.4.2 Construction Noise and Vibration

Relatively high noise levels are expected at the nearest residences during construction of the proposed NDE. Such noise levels are typical of construction of roads in metropolitan areas and are difficult to avoid.

Some vibration is expected at the nearest residences during construction. This is likely to result in discomfort to some residents, particularly from vibratory compaction equipment and ripping of rock, but damage is not expected to buildings as a result.

13.5 Mitigation Measures

A **Construction Noise and Vibration Management Plan** to control noise and vibration associated with construction, would be developed before the construction commences. This plan would address all issues which would limit the impact of construction noise and vibration. The following issues are to be addressed in the plan:

- Alteration of construction methods, where practicable, to reduce noise and vibration levels;
- Selection of quiet equipment for the construction process to limit construction noise at nearby residences and monitoring of noise emission levels from the equipment on a regular basis to ensure that the equipment is well maintained;
- Shielding of construction noise from nearby residences by practical means which are available;
- Monitoring of construction noise and vibration to provide information for decision making regarding construction equipment and methods.;
- Implementation of a community liaison program, involving advice as to construction progress and methods of registering a noise compliant;
- Procedures to be adopted in the event of a noise complaint being received; and
- Limiting high noise and vibration generating activities during examination periods at Woonona High School.

It has not been possible to locate noise barriers at specific locations where drainage over the road may be required under extreme flood conditions. Accordingly, noise spillage would occur in the vicinity of these areas and consideration may need to be given to further residential treatment.

14. Cultural Heritage

This Section examines the impact of the EIS Proposal on indigenous and non-indigenous heritage along the corridor, and draws on **Working Paper 12** prepared by Rod Howard Heritage Conservation and DIG International.

The assessment has been based on field inspections and reviews of relevant reports and government records.

14.1 Indigenous Heritage

Few archaeological assessments have been carried out in the proximity of the study area with a little over a dozen archaeological sites known within a 10km radius of the study corridor. No known Aboriginal archaeological sites have been recorded in the study area. From the observed patterning and frequency of Aboriginal archaeological sites recorded in the Illawarra and elsewhere on the east coast, and from ethnographic accounts, it is very unlikely that this is representative of the historical occupation of the area by Aboriginal groups. As detailed below it is very likely that Aboriginal peoples lived and ranged throughout the area and left remains of their occupation on most landforms including areas within the study corridor.

From cartographic, documentary and photographic evidence it appears, however, that the majority, if not at all, the study area has been significantly impacted by non indigenous occupation and activities over the last 150 years.

A predictive model of indigenous sites has been developed based on the characteristics of the landform and location and past and present land uses of the study area. This model predicts that:

- Occupation deposits such as open camp site (stone artefact scatters) and middens (collections of edible shellfish remains and other debris), rock shelters and art sites occur in the upper Illawarra area and on all land unit types. Predictive patterning would see the low coastal ridges, swamp margins and coastal dunes as well as the lower slopes of the escarpment containing potential archaeological sites and deposits. Within the study area European land uses have dramatically altered all the land. It is unlikely that occupation deposits have survived intact;
- There is no likelihood that Aboriginal scarred trees, axe grinding grooves, rock carvings, rock shelters or other art sites survive within the study area;
- Accidental findings of Aboriginal burials during activities such as sand mining, has resulted in predictive conclusions that burials most often occur in sand or soft soil deposits. However, there is no reliable way to find out whether burials remain or not, without disturbing them further.

The proposal will not affect any known indigenous archaeological remains and is unlikely to affect any potential archaeological deposits.

The Illawarra Local Aboriginal Land Council (ILALC) surveyed the proposed route in November 2001 and found no problems with the development.

14.2 Non-Indigenous Heritage

The study area only contains limited cultural heritage resources relevant to the EIS Proposal:

- The former Seaview (Oceanview) Guesthouse at 300 Princes Highway near Molloy Street
- A group of houses in Farrell Road west
- Norfolk Island pine tree near Gray Street and Park Road.

Figure 14.1 shows the location of local built heritage items.

14.2.1 Seaview Guesthouse

Existing Heritage Status

This two storey building is an identified heritage item of local significance in the Wollongong Local Environmental Plan. The State Heritage Inventory listing for this building states that it is important as *"a significant and rare large building on the highway contributing to the townscape and identity of Bulli"*.

The SHI listing indicates that the item has previously been assessed as having historic, landmark, townscape, cultural and social values, although no detailed explanations are given for these attributions. The only modification to the building's fabric mentioned on the SHI listing is a reference to *"original upper verandah missing"*, and the only recommended conservation action on the listing notes that *"reinstatement of original elements would greatly enhance"*.

Physical Condition

Recent inspection of the building carried out on behalf of the RTA for the purposes of preparing this report revealed that the building is in fact a greatly depleted entity. Numerous original and early building elements and features are missing, both internally as well as externally. Many of its early finishes have been disfigured and the aesthetic character of the place is now very different from how it appeared in the late nineteenth century. The nature and extent of the physical changes made to the building during the past sixty years or so has greatly compromised its architectural integrity and therefore its heritage qualities.

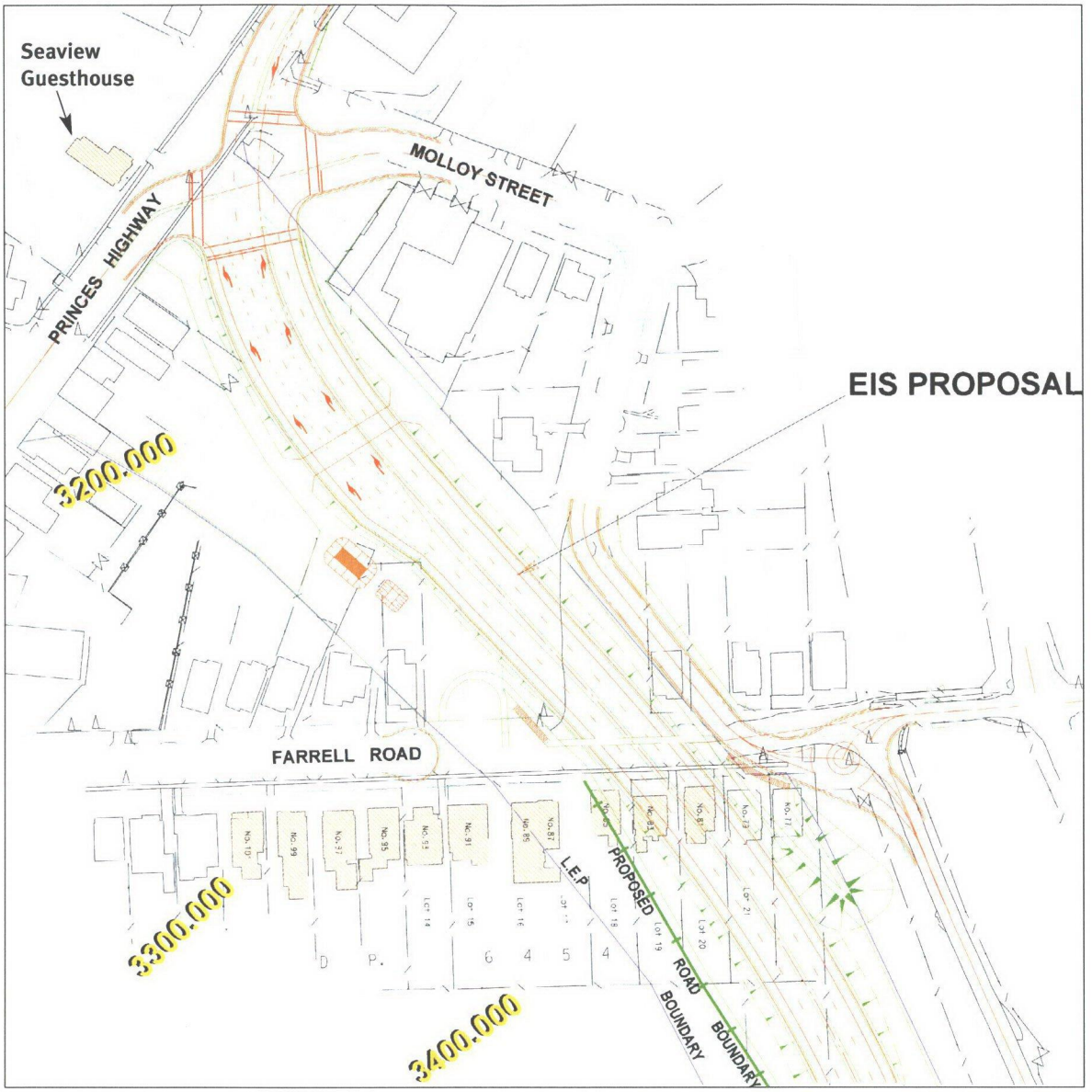
Conservation Potential

There is little doubt that the restoration of the building to its early appearance would be an uneconomic proposition since so much of its original fabric has been lost. Conservation of this item involving considerable reconstruction of missing architectural detail, is therefore considered to be questionable and probably unwarranted, despite the existence of clear photographic evidence of its earlier state that would aid such an endeavour. The significance of the place is not sufficiently high to warrant such treatment.

Heritage Significance

Analysis of relevant documentary and physical evidence relating to this building has led to the conclusion that the significance of the place (as previously identified in the City of Wollongong Heritage Study) is of limited heritage value.

Figure 14.1: Location of Heritage Items



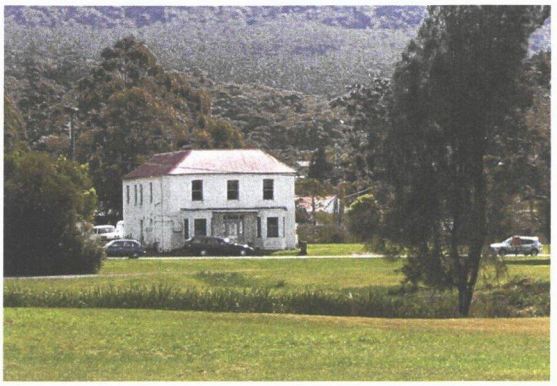
Legend

Heritage Houses
LEP Wollongong City Council

Source: RTA

14.1.1 Farrell Road Group of Houses

This group of houses is located at 81-101 Farrell Road, Bulli. Inspection of the properties for this EIS suggest that the architectural and aesthetic qualities of the individual buildings forming the 'group' are not of high heritage significance, although some are listed in LEP1990 (as amended) and have been assessed as a rare example of historic housing styles surviving in a group which create a significant street landscape. Their aesthetic and historical values are recognised by sections of the local community and are appreciated for their ability to illustrate various historical and educational attributes such as providing sense of place, exemplifying residential housing styles and streetscape of the early 20th century.



Seaview Guest House.

Local heritage buildings at northern end of EIS Proposal.

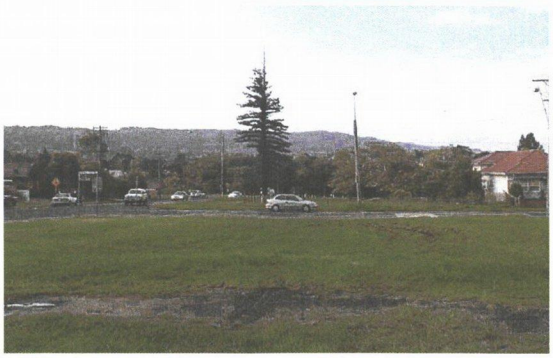
Two of the houses on the southern side of Farrell Road that are proposed to be demolished (nos. 77 and 79 Farrell Road) have not been identified as part of the 'group'. Three houses belonging to the identified group would be demolished as part of the EIS Proposal, thus affecting the intactness of the group. It is considered that this row of houses have only a low-moderate level of heritage significance on a local level due to numerous unsympathetic alterations and modifications that have taken place.

14.2.3 Norfolk Island Pines

The two Norfolk Island Pine trees have little local significance based on the information available at the time of this study. They represent neither rare species nor rare instance. There is no discernible association or connection with events, people or places within the local community and their only significant quality is their landmark value.

14.2 Impact Assessment

The EIS Proposal would involve demolition of three (3) heritage houses in Farrell Road (west) that are listed on the LEP 1990, and removal of the two Norfolk Island pine trees near the intersection of Park Road and Gray Street. The latter do not require further assessment prior to removal. The removal of the five houses at nos. 77 through to 85 Farrell Road would further erode the stock of early twentieth century houses remaining in the area, and will have some negative impact upon the streetscape qualities of this section of Farrell Road.



Escarpment views from EIS Proposal.

At this stage, the proposed NDE would not have a direct impact on the Seaview Guesthouse. A future extension of the Northern Distributor beyond Molloy Street may require demolition of this structure but this would be the subject of further design studies as part of a future possible extension of the Northern distributor.

This EIS assessment concludes that the cultural and heritage value of the immediate study area is not a restriction on the EIS Proposal.

Approval may be required from the NSW Heritage Office in relation to impacts (excavation or disturbance) to non-indigenous heritage items under the provisions of *the Heritage Act, 1977*, should any be unearthed during construction. Where heritage items are known to be present, an excavation permit would be required in the event of any disturbance.

14.3 Mitigation Measures

14.3.1 Indigenous Heritage

The Illawarra Local Aboriginal Land Council members would be given assistance to explore every opportunity available to assist with construction of the Distributor Extension.

Monitoring of excavation of topsoil on creek banks would be undertaken.

Should any archaeological site be located as part of the construction process, all work would cease and ILALC and the National Parks and Wildlife Service would be contacted to assess the situation.

14.3.2 Non-Indigenous Heritage

The possibility of relocating the heritage houses will be investigated before NDE construction. Any houses that are unable to be relocated would be recorded prior to demolition.

In the event of an unexpected find of a heritage item work would cease in the immediate vicinity and the NSW Heritage Office would be notified and advice on management sought.

15. Resource Management

This Chapter examines the resource management issues of input procurement, sources of construction material and waste management associated with the EIS Proposal for the Northern Distributor Extension

15.1 Input Procurement

15.1.1 Introduction

The purpose of this section is to:

- Note best practice by setting out how the purchase of materials and services needed for the EIS Proposal can be managed in order to comply with the RTA's Waste Reduction and Purchasing Policy (WRAPP);
- Provide information to contractors undertaking construction work on the EIS Proposal on how to buy construction and vegetation materials which meet the objectives of the WRAPP Plan; and
- Set out safeguards which would ensure that the requirements given in this section are carried out by the contractor.

15.1.2 Background

The RTA has made a commitment (RTA Environmental Policy Statement, June 2001) to undertake its activities in such a manner as to have the least effect on the environment. One aspect of this commitment involves the reduction of use of materials and waste throughout the organisation. This is underpinned by the RTA's (draft) Waste Reduction and Purchasing Plan (WRAP Plan), which is approved by the Environment Protection Authority (EPA).

The NSW Government's Waste Reduction and Purchasing Policy (WRAPP) was announced by the Premier in September 1997. The policy requires all state government agencies and state owned corporations to develop and implement a WRAP Plan to reduce waste in four scheduled areas:

- Paper products;
- Office equipment and components;
- Vegetation material; and
- Construction and demolition material.

The WRAPP also requires that priority be given to buying materials with recycled content where they are cost and performance competitive. The RTA's WRAP Plan provides information on strategies, which it would undertake to reduce waste and increase purchases of recycled content products and provide data on:

- Total quantities of scheduled wastes being generated and recycled; and
- Total quantities of materials being purchased which contain recycled content.

The WRAPP requires the RTA to periodically report progress in implementing its WRAP Plan to the NSW EPA.

Waste is a rich source of valuable resources. Materials such as paper, glass, steel and some demolition materials can be 'recovered' and used in new products. Use of recovered waste materials reduces demand for virgin resources and can reduce impact on the environment. More effective use and recovery of waste coupled with a greater focus on avoiding waste can significantly reduce the quantity of waste being generated by the community. It is these two principles that underpin the WRAPP. Input procurement is concerned with avoiding waste generation by managing the purchase of materials used in a project in an environmentally responsible and appropriate manner to minimise the generation of waste and to increase the recycled content of goods processed.

15.1.3 Need for Purchase of Recycled/Recyclable Products

In regard to the EIS Proposal, purchasing recycled and recyclable materials should be linked with the purchasing strategy of the contractor. This process is sometimes referred to as 'closing the loop'. This WRAPP "loop" of activities begins and ends with the purchase of recycled content materials:

Purchase: buying recycled and recyclable content products creates markets for recycled materials and ensures their use throughout the EIS Proposal.

Use: efficient use of valuable resources reduces waste, saving both money for the EIS Proposal and the environment.

Recover: recycling stops valuable materials being dumped and creates a new source of raw material for other RTA projects.

Remake: recovered materials are remade into new products for other consumers to buy.

Purchasing recycled content products by contractors has the added advantage of creating viable, long-term markets for recovered waste materials.

There are many advantages to the contractors purchasing recycled content products for the EIS Proposal. Contracts for supply of materials would allow recycled content where consistent with RTA specifications.

Construction and demolition (C&D) waste consists mostly of excavated material (soil and rock), concrete, bricks and masonry items, timber, plasterboard and packaging material. C&D wastes make up about 25% of the waste disposed of to landfill in NSW. In 1999 over 900,000 tonnes of C&D wastes were disposed of in NSW. Recycling of C&D wastes is on the increase in NSW. A huge range of materials is being recycled including soil and rubble, concrete, timber, tiles and metal. Figures from a recent government inquiry into waste suggest more than 1.5 million tonnes of C&D waste are recycled in NSW each year. Careful purchasing of C&D materials for this Proposal can help ensure that less waste is generated, and that any materials which are surplus to the needs of the EIS Proposal can be reused or recycled (www.wrapp.nsw.gov.au).

The NSW government, including the RTA, funds about a third of all construction activity in NSW, including roads, schools, hospitals and many other facilities. During the past few years, the government has used its purchasing power (nearly $10 billion a year) to effect changes in industry practice by implementing policies to improve safety, contractual relationships, innovation and environmental performance. These policies are set out in the 'Construct NSW' strategy (www.cpsc.nsw.gov.au/ConstructNSW/). The WRAPP complements this strategy and targets a range of construction and demolition materials, most of which are relevant to the EIS Proposal. These materials are shown in **Table 15.1**.

15.1.4 Design/Contract Specifications

In undertaking detail design and contract documentation for the EIS Proposal, the RTA would undertake the following measures:

- Contracts for the supply of materials would allow for the principles of input procurement.
- Tender advertisements and pre-tender meetings would demonstrate the need for consideration of input procurement principles.
- To allow for the development of input procurement guidelines, material use, energy and waste streams be monitored and documented.
- Any packaged material (construction or office use) received shall be recorded to see if it could be received in bulk for future projects.

Table 15.1: Construction and Demolition materials covered by the WRAPP

Material	Description
Landscaping materials	Bark, chips, soil amenders, soil mixes, mulches, compost etc.
Concrete	Mixture of cement, sand and aggregates (or substitutes e.g. fly ash).
Fill	Low cost material such as soil, sand, calcium carbonate etc.
Asphalt	Any materials containing bitumous hydrocarbons. May contain additives such as concrete. Includes recycled asphalt pavement.
Aggregates	Rock or other hard materials (e.g. concrete, ground up stone or bricks etc.) between 4.25mm and 100mm particle size. Meets Australian Standards specification.
Virgin excavated natural material (VENM)	Clay, gravel, sand soil or rock not mixed with any other type of waste excavated from natural areas which have not been used by human activities such as industry, farming or mining.
Timber	Wood materials used for formwork or other construction purposes.
Sand	Very fine hard aggregate between 75 µmm and 4.25 mm in size. Meets Australian Standards specification.
Other categories	The RTA can report on other major categories of materials they are purchasing e.g. glass, plasterboard, steel, non-ferrous metal etc.

Source: www.wrapp.nsw.gov.au

15.1.5 Purchase of Construction and Vegetation Materials

Construction materials including vegetation to be used in the EIS Proposal should be purchased by contractors in accordance with the RTA's WRAP Plan. Typical materials required for the EIS Proposal include:

- Cement
- Bitumen
- Lime
- Slag
- Aggregate
- Steel
- Perspex
- Pre-cast cement spun pipes
- Sand
- Glass beads
- Timber
- Paint
- Mulch
- Soil
- Seeds and Plants
- Office Material

The following general methods would be used by contractors to purchase the above materials:

- Recycled content products and materials would be used where these are cost- and performance-competitive with the non-recycled products.
- It would be made clear to suppliers/contractors that recycled content products are required, where these are cost- and performance-competitive with non-recycled products.
- Accurate estimates would be made of the quantities of materials required for the EIS Proposal to avoid over-supply. This would be undertaken during the detail design of the EIS Proposal.
- Over-ordering and damage to materials on-site would be avoided.
- All over-supplied quantities would be returned to the supplier or reused on other projects.
- Whenever possible, contractors in their tender documents would demonstrate how they would consider 'life-cycle' costs of materials.

A specific purchasing strategy for each input material is described in **Table 15.2**.

Table 15.2: Specific purchasing strategies

Material	Purchasing Policy
Vegetation	Cellulose fibre mulch must be produced from pinus radiata or similar plantation timber or from recycled paper.
Asphalt	Asphalt may be used with recycled materials up to levels allowed within relevant RTA specifications.
Aggregate	Where suitable, aggregate would be sourced as much as possible from non-virgin sources.
Cement	Cement should be purchased in bulk rather than in bags, where possible.
Concrete	Recycled crushed concrete products would be assessed for use within the Proposal. Slag and fly-ash blended cement should be used in concrete mixes where available and economically feasible.
Office Supplies	Recycled content office supplies e.g. paper, office equipment components etc. would be purchased where they are cost- and performance-competitive with the non-recycled product.

Source: RTA

15.1.6 NSW Waste Reduction and Purchasing Policy (WRAPP)

In 1999, the NSW EPA adopted the NSW WRAPP. The aim of WRAPP is to ensure that all NSW Government agencies contribute to the achievement of the State's aim to reduce the amount of waste disposed to landfill. WRAPP requires that all state government agencies and state owned corporations develop and implement Waste Reduction and Purchasing Plans aimed at reducing waste in the following four areas:

- Paper products;
- Office equipment;
- Vegetation material; and
- Construction and demolition material.

WRAPP also requires that priority be given to buying materials with recycled content where they are cost and performance competitive. The RTA's WRAP Plan provides information on strategies which it would undertake to reduce waste and increase purchases of recycled content products and provide data on:

- total quantities of scheduled wastes being generated and recycled; and
- total quantities of materials being purchased which contain recycled content.

The policy requires the RTA to periodically report progress in implementing its WRAP Plan to the NSW Environment Protection Authority. The following RTA specifications incorporate the principles of the NSW WRAPP:

- RTA Specification R116 — Asphalt, stipulates that asphalt may contain up to 15% reclaimed asphalt pavement material; and
- RTA Specification R3051 and R3052 — Surface Road Pavements, allows for use of recycled building material in road pavements.

15.1.7 Mitigation Measures

The following safeguards would be put in place to ensure that contractors comply with the purchasing strategies outlined in **Table 15.2**:

- The contract documents (RTA Specification G36) would incorporate the requirements, where cost effective, to use recycled products which meet quality specifications;
- The contractor must include in their CEMP a commitment to use recycled and recyclable products where cost-effective, and reflect this in their Waste Management Plan; and
- Contractors must be able to demonstrate that materials they intend to use are recycled, are from a non-virgin source, unless it is more cost effective to use alternative materials.

15.2 Sources of Construction Material

This section identifies the type and quantity of construction material required to complete the EIS Proposal and examines the impact of sourcing this material.

15.2.1 Quantities

Based on information obtained through the Concept Design process, it is anticipated that the following construction material types and volumes would be required for the EIS Proposal:

- Embankment (106,500 m^3) — Obtained from existing cut material;
- Selected Material (20,532m^3) — Crushed aggregate or slag (approximately 300mm thick);
- Base (23,765m^3) — Heavily bound slag or crushed aggregate stabilised with a mixture of ground slag or crushed aggregates/lime/cement (470mm thick);
- Wearing course (8,550 tonnes) — Open graded and dense graded asphaltic concrete;
- Noise walls (5,600m^2) — concrete;
- Retaining walls (2,690m^2);
- Bored piles with concrete facing (2 locations); and
- Reinforced earth (1,080m^2) for bridge work (7 locations).

15.2.2 On-Site Sources

The EIS Proposal has been designed to generally balance the cut and fill volumes for construction. No additional requirements for importation of fill material is anticipated. The areas of excavation on the site, proposed to supply fill material, are predominantly sedimentary and would be suitable for use as embankment material.

15.2.3 Off-Site Sources

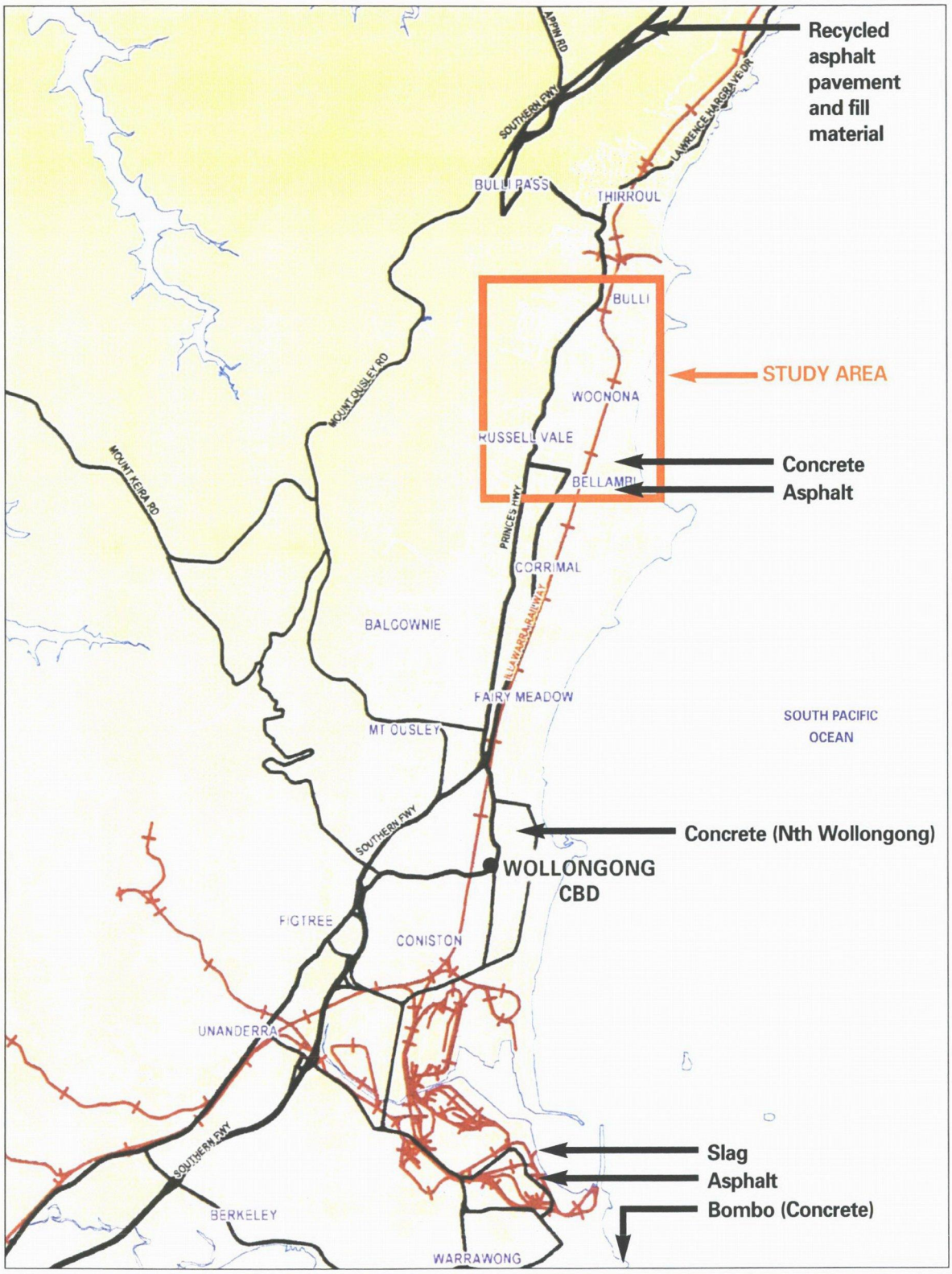
Figure 15.1 shows the location of possible sources of construction material. It is anticipated that the successful Contractor would obtain all concrete and asphalt products in the Wollongong / Port Kembla area. A summary of locally available existing sources of required material types is presented in **Table 15.3** below, along with radial distance from the source site. The list includes commercial sources, and the successful tenderer would need to ensure that the quality of material meets the RTA specifications and the quantities required are available. There are no suitable borrow sites containing materials suitable for construction located within the study area.

15.2.4 Haulage of Materials and Manufactured Items

It is anticipated that the successful contractor would obtain materials from a variety of different sources, depending on Contractual agreements.

Transport of imported materials from the south of Wollongong (places such as Bass Point, Shell Harbour, Port Kembla and Oak Flats) would be along local roads from the source and then the Princes Highway, F6 Southern Freeway, and Northern Distributor to designated access points determined by the contractor for its use in construction. Materials from the northern areas of Wollongong (Bellambi and North Wollongong) would use the Princes Highway and the existing Northern Distributor to access the works area.

Figure 15.1: Location of Construction Material



Legend

- Study Area
- Main road network
- Railway

Source: RTA

Table 15.3: Summary of Commercially Available Construction Material.

Material Type	Supplier and Location	Approx. Distance (km) from southern extent of the proposed works
Slag	BHP, Port Kembla	11km
	Incitec, Port Kembla	17km
Concrete	Nipicrete, North Wollongong	5km
	Boral, North Wollongong	5km
	Banes, Bellambi	<1km
	Cleary Brothers, Bombo	41km
Asphalt	Boral, Port Kembla	15km
	RTA Depot, Bellambi	<1km
Reclaimed Asphalt Pavement	Stockpile sites on the F6 Freeway	8km – 25km
Fill Material	Stockpile sites on the F6 Freeway and Appin Road	27km – 42km

Source: RTA

Note: This information was obtained from sources available at the time of publication.

Manufactured items such as pre-fabricated concrete panels for noise walls would be transported to the site along the same routes as identified above after haulage along local roads from their source. Spoil and waste materials such as demolition waste would be transported to a destination(s) based on available receival sites. Possible receival sites include the Whytes Gully Recycling and Waste Depot located at Kembla Range, Dapto. Additional information on recycling and waste depots can be found in **Section 15.3, Waste Minimisation and Management**.

15.2.5 Planning Approvals

It is anticipated that no planning approvals would be required in association with the resourcing of construction materials. It is unlikely that any new quarries would be developed as a result of the proposed works due to the high number of existing pavement materials sources surrounding the study area.

The contractor would be required to source materials from appropriately licensed quarries that would have prior planning approval from the relevant local government agency. The tender documents would include a stipulation that any quarry supplying material for the purposes of the EIS Proposal would be required to have all relevant environmental and planning approvals.

15.2.6 Sources of Water

It is anticipated that water would be sourced from local town-water supplies through standpipes located at the Bellambi works office or other locations agreed to by the successful contractor and the RTA. All water would be extracted from legally operating sources and would comply with standard operating procedures as outlined within the Contractor's Environmental Management Plan.

It is anticipated that water would not need to be sourced from local watercourses, but may be sourced from sedimentation ponds required as part of the works.

15.2.7 Sources of Recycled Material

It is anticipated that waste would be avoided by managing purchases in an environmentally responsible and appropriate manner. Construction and vegetation materials to be used in the EIS Proposal would be purchased in accordance with the RTA's Waste Reduction and Purchasing Policy. Where cut materials produce unsuitable fill material, the suitable fill will be arranged from the existing RTA stockpiles. Products with a recycled content would be used where possible after performance has been checked to ensure they meet engineering specifications. As part of the Environmental Management Plan (EMP) prepared for the EIS Proposal, the Contractor would be required to provide for the recycling of rubbish, and a suitably licensed recovery contractor would be engaged to remove recoverable materials from the site.

It is anticipated that the required mulch products would be sourced either from timber yard waste, or from the non-weedy vegetation cleared for road construction. Excavated topsoils would also be stockpiled and stored for post-construction landscaping.

Bituminous demolition products would be used in new asphalt, either by fowarding to batch plants or using them as a solid fill layer. Aggregate would be sourced from other RTA or non-RTA projects, and recycled concrete products would be used in road sub-base where available. It is anticipated that waste "slag" material from sources such as BHP would be utilised in the select fill material, heavy-bound pavement and wearing course asphaltic concrete.

15.2.8 Effect on Depletion of Resources

No substantial impact on the resources of the local area is anticipated as a result of the EIS Proposal. Balancing of cut and fill volumes would minimise the resources required for the construction of the EIS Proposal. Additional material required for use as select fill, pavement material and / or wearing course would be sourced from commercial suppliers in the local area. Quantities of these materials would be considered minimal and are not likely to impact or deplete the level of local resources available.

During the detailed design stage, accurate estimates would be made of the quantities of materials required for the EIS Proposal in order to avoid oversupply. Over-ordering and damage to materials on-site would be avoided.

The use of recovered waste materials including quarry overburden, demolition material and excess earthworks from other construction sites, would further reduce the demand on resources and have a positive impact on the environment.

15.2.9 Mitigation Measures

The following mitigation measures are proposed in regard to construction material:

- All water would be extracted from legally operating sources and would comply with standard operating procedures as outlined within the Contractor's Environmental Management Plan;
- Construction and vegetation materials to be used in the EIS Proposal would incorporate recycled content economically and technically viable;
- No water would be sourced from natural watercourses in the area;
- The contractor would be required to source materials from appropriately licensed quarries that would have prior planning approval from the relevant local government agency; and
- In accordance with Division 2 of Part 3 of the Road Transport (Mass, Loading and Access) Regulation, 1996, the contractor would be required to obtain a permit for over-dimensional vehicles.

15.3 Waste Minimisation and Management

The RTA is committed to ensuring the responsible environmental management of waste that cannot be avoided and to providing opportunities for promoting the reuse of these wastes through appropriate measures.

In undertaking this commitment the RTA is following the Resource Management Hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act).

The Resource Management Hierarchy principles of the WARR Act 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); and
- Disposal is undertaken as a last resort.

15.3.1 Phasing of EIS Proposal

The EIS Proposal involves the construction of a 4-lane dual carriageway distributor road with restricted access from Bellambi Lane to the Princes Highway near Molloy Street. The proposed works would be constructed over a period of 24 months.

The proposed construction methodology would be in three major phases:

Phase 1: Pre-construction activities including acquisition of properties, relocation of public utilities, clearing and establishment of site compounds;

Phase 2: Progressive construction of the EIS Proposal beginning with the construction of side tracks and service roads such as the extension to Watts Lane, construction of the grade separated intersection at Campbell Street, construction of vehicle and pedestrian overbridge at Park Road/Gray Street, undertaking of major earthworks and pavement construction. Implementation of traffic controls would be undertaken progressively with construction; and

Phase 3: Landscaping works and site restoration, including compound restoration.

The total volume of excavated material for the EIS Proposal would be 106,500m^3. This would be required to balance the anticipated fill required including allowance of 10,950m^3 to replace unsuitable material and 15,000m^3 for mounding.

15.3.2 Major Waste Streams

Each construction phase has the potential to generate waste. **Table 15.4** refers.

The key waste streams have been identified as:

- **Excavated Material** — As the EIS Proposal is dependent on a cut/fill balance, excavated material is not anticipated to be a major waste stream. However, there may be some waste associated with excavation if material encountered is unsuitable for reuse. Unsuitable material may also be reused in mounding and landscaping works;
- **Demolition Waste** — Building structure / material, concrete kerbs, sewer pipes, water mains, pavements and green waste;
- **Building Waste** — Packing material, scrap metal, pallets, plastic wrapping and cardboard;
- **General Waste** — Waste from construction compounds.

Phase 1 Works — Waste generated in this phase would consist of topsoil, green waste from vegetation removal and waste associated with pavement removal and demolition houses / buildings.

Phase 2 Works — This phase would generate the largest volume of waste and would include unsuitable excavated material (which may be reused in phase 3 works), building, packaging and general construction waste. Waste generated during this period would require on-going measures to reuse and recycle where possible, along with continuous transport and disposal from the construction site.

Phase 3 Works — Phase three would generate the least waste and would produce opportunities for reuse. Reuse opportunities could include respreading of topsoil removed in phase one and mulching of non weedy vegetation for use in landscaping works.

15.3.3 NSW Regulatory Environment

The following legislation and guidelines govern the management of waste for the EIS Proposal:

- *Waste Avoidance and Resource Recovery Act, 2001*;
- *Protection of the Environment Operations Act 1997*;
- *Protection of the Environment Operations (Waste Regulation) Act 1996*;
- *Protection of the Environment Operations (General) Regulation 1998*;
- *Environmental Planning and Assessment Regulation, 2000 Schedule 2*;
- *Construction and Demolition Waste Action Plan (EPA, 1999)*;
- NSW Waste Reduction and Purchasing Policy (WRAPP) (EPA, 1999);
- Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (EPA, 1997);
- Landfill Disposal of Industrial Wastes (EPA, 1989);

- Australian Standard (AS) 1940: The storage and handling of Flammable and Combustible Liquids 1993; and
- Waste Planning for Industry, A guide (Waste Management Authority of NSW, 1999).

Other legislation and guidelines relating specifically to the management and disposal of contaminated wastes and acid sulfate soils include:

- *Contaminated Land Management* Act, 1997;
- Contaminated Sites: Sampling Design Guidelines (EPA 1995);
- Health based soil investigation levels (National Environmental Health Forum, 1998);
- Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report (EPA, 1999);
- Contaminated Sites: Guidelines for the NSW Auditor Scheme (EPA, 1998);
- AS 4482.1-1997 Guide to the sampling and investigation of potentially contaminated soil — Part I: Non-volatile and semi-volatile compounds;
- Acid Sulfate Soil Guidelines (RTA, 1996); and
- Acid Sulfate Soil Manual, Acid Sulfate Soils Management Advisory Committee ((ASSMAC), 1998).

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* (PoEO) Act 1997 incorporates the major regulatory and enforcement provision of the former *Waste Minimisation and Management Act* 1995. The PoEO Act combines pollution control approvals and pollution control licences into a single process referred to as an Environmental Protection Licence (EPL).

Specific activities that would require a licence under the PoEO Act include:

- Any facility treating, processing, reprocessing or disposing more than 200 grams of hazardous waste per tonne of solid waste;
- Crushing or grinding of construction waste greater than 30,000 tonnes per year;
- Landfill sites; and
- Waste storage, transfer of recovery facilities processing over 30,000 tonnes per year.

Under Schedule 1 of the *Protection of the Environment Operations PoEO Act* 1997, the proposed works do not fall within the definition of 'freeway or tollway construction' nor is it anticipated that the EIS Proposal would generate large quantities of contaminated or general waste and therefore would not require an EPL.

15.3.4 Potential Wastes Generated from the EIS Proposal

There is very little anticipated waste as a result of the EIS Proposal. **Table 15.4** lists possible types and sources of waste.

The EIS Proposal is aiming for balanced cut and fill volumes. The estimated quantity of excavated material is 106,500m^3 and assuming suitability, this excavated material would be reused on the job for earthworks in filling which is estimated at 95,300m^3. The remainder

would be used in either landscaping works, noise mounds or stockpiled for future use on other RTA projects. The estimated daily rate of excavated material would be dependent on the number of plant items undertaking the operation, the nature of material being excavated, and the method of excavation. At this stage estimated daily rates of excavation would not be accurate.

Table 15.4: Details of potential wastes and their source

Stage	Phase	Waste	Source
Construction	Phase 1	Green waste	Clearing and grubbing
		Excavated Material (Soil and Rock)	Excavation works
		Concrete, Asphalt and Gravel	Removal of pavement, drainage and retaining structures
		Timber, asbestos, glass, brick, cement	Demolition of houses and other structures
		Contaminated Soil / Acid Sulfate Soils (ASS)	Topsoil stripping and excavation
	Phase 2	Excavated Material (Soil and Rock)	Excavation works
		Soil	Construction of bridges and drainage crossings
		Cardboard, timber, scrap metal	Packaging of materials and equipment
		Glass, paper, food waste	Construction compound
		Contaminated Soil / ASS	Excavation works
		Oils and grease	Fuelling and maintenance of equipment
	Phase 3	Green waste	Landscaping works
		Glass, paper, food waste	Construction compounds
Operation		General litter	Road

Source: RTA

Other forms of non-liquid waste generated by the EIS Proposal would include:

- **Building Wastes** (timber, scrap metal, packaging materials). It is expected that waste from this source would be minimal and would be in the order of less than 50 tonnes;
- **Demolition Wastes** (concrete, asphalt and waste from demolition of Farrell Road and Mitchell Road houses). Concrete and asphalt from pavements would be reused in fill material or sent to the recyclers wherever possible. In the sections of the EIS Proposal where the proposed NDE would be constructed over an existing road, this would simply be left in-situ. Much of the waste from the demolition of houses would be recyclable.

The disposal of this waste would be at the discretion of the relevant contractor, however the contractor would be required to follow the Waste Resource Management Hierarchy principles of the WARR Act and any contractual requirements stipulated in the tender documents. It is estimated that the quantity of demolition waste would be less than 500 tonnes.

Typical waste generated from construction compounds would include:

- **Sewage** — where a sewer is unavailable, septic tanks and portable self-contained toilets of suitable capacity may be used, subject to suitable arrangements for disposal of the effluent. Pit toilets would not be permitted;
- **Rubbish** — Appropriate recepticles would be provided for depositing of litter and other waste materials, and their contents disposed off site at a suitable waste disposal station on a regular basis; and
- **Contaminated soil** — Contaminated soil resulting from oil or fuel spills would be excavated and transported to an approved disposal centre. Excavations would be filled with suitable clean soil.

Management of Excavated Material

Management of excavated material would be based on a balanced earthworks ratio. The following reuse and recycle opportunities would be considered in the development of the Waste Management Plan (WMP):

- Utilise excavated material as fill for road works, including embankments and noise mounds;
- Reuse spoil in landscaping works; and
- Excess spoil could be stockpiled and reused on other projects in the area.

15.3.5 Waste Management Strategies

The *Waste Avoidance and Resource Recovery Act* 2001, incorporates Resource Management Hierarchy principles. The Resource Management Hierarchy principles would be applied to the EIS Proposal.

Avoidance: Where possible, resource use would be avoided through the ordering of materials in sufficient but not excessive quantities.

Reuse: Where it is not possible to avoid an excess of materials, or if existing material from the EIS Proposal could be reused, reuse on site would have priority over recycling.

Recycling: Where reuse is not possible, waste would be minimised through recycling progressively from the site.

The following goods can be recycled free of charge at the Wollongong City Council recycling depot:

- Scrap metal, whitegoods, copper, brass, aluminium, domestic car bodies;
- Motor, gear, transmission, and heater oil;
- Kerosene (no petrol or fuel);
- Bulk clean glass; and
- Bulk paper & cardboard.

The RTA would recycle the green waste by transporting it to Whytes Gully or Helensburgh Waste Disposal depots for the appropriate fee. These depots mulch the green waste and provide this mulch to residents free of charge.

Disposal: As a last resort, materials would be disposed of to a local landfill. Other waste materials which would be used or produced on site include:

- Water — Water would be used for dampening exposed surfaces during the construction. Retrieval of this water would not be possible as the water would soak into the soil;
- Putrescent Waste;
- Sewage;
- Contaminated Waste — Contaminated or chemical waste is not anticipated. Soils that are potentially contaminated would be tested in accordance with the *Contaminated Sites: Sampling Design Guidelines* (EPA 1995);
- Although Acid Sulfate Soils (ASS) are not anticipated, there is a slight risk of encountering ASS at the northern end of the works in the vicinity of Woonona High School;
- Asbestos — It is likely that the houses along Farrell Road, proposed for demolition, would contain Asbestos materials, such as fibro. Asbestos is classified as an industrial waste in accordance with the *Environmental Guidelines: Assessment, Classification and management of Non-Liquid Wastes* (EPA 1997).

Suitable disposal sites for waste could include industrial waste centres at Port Kembla and Bellambi. Any disposal of waste would be in accordance with the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (EPA 1997).

Waste Management Plan

The Contractor would be required to prepare a Waste Management Plan (WMP). The following factors would be considered during the preparation of the WMP:

- Quantity and classification of excavated material generated as a result of the EIS Proposal;
- Disposal strategies for each type of material;
- Details of how waste would be stored and treated on site;
- Identification of all non-recyclable wastes;
- Identification of strategies to "reduce, reuse and recycle";
- Identification of available recycling facilities on and off site;
- Identification of suitable methods and routes to transport waste;
- Disposal arrangements for unsuitable excavated material; and
- Strategies to transport and dispose of contaminated material, including acid sulfate soils, if encountered.

15.3.6 Mitigation Measures

The following measures are proposed to mitigate the impacts of the EIS Proposal with regard to waste:

- The contractor would be required to follow the Waste Resource Management Hierarchy principles of the WARR Act;
- The Resource Management Hierarchy principles would be applied to the EIS Proposal as follows:

  Avoidance: Where possible, resource use would be avoided through the ordering of materials in sufficient but not excessive quantities and retaining potential waste materials in-situ.

  Reuse: Where it is not possible to avoid an excess of materials, or if existing material from the alignment could be reused, reuse on site would have priority over recycling. Materials which could be reused on site include:

  - Spoil and excess construction materials;
  - Excavated material from the site would be used as fill for road works, including the embankments at Campbell Street and Farrell Road;
  - RAP (Recycled Asphalt Pavement) removed pavement would be stockpiled and reused where possible;
  - Concrete and asphalt from pavements would be economically reused in fill material wherever possible;
  - Road furniture (guardfence, posts and road signs) from the existing alignment would be reused where the existing material is in a condition which warrants economical reuse and where the road furniture conforms with current standards;
  - Fuel and oils required during the construction period would be stored within secure areas and properly bunded. At the end of the construction period unused fuel and oils would be removed from the site for reuse;
  - Cleared non-weedy vegetation would be mulched and used in landscaping works;
  - Topsoil would be stockpiled and reused in landscaping works; and
  - Excess spoil would be reused in landscaping works or noise mounds, or otherwise incorporated within the EIS Proposal where feasible.

  Recycling: Where reuse is not possible, waste would be minimised through recycling. Wastes would be source-separated and sent to recycling outlets and recycling facilities would be made available to site staff operating from the site compound.

  Disposal: Would be undertaken as a last resort.

  - Where a sewer is unavailable, septic tanks and portable self-contained toilets of suitable capacity may be used for disposal of the effluent. Pit toilets would not be permitted.
  - Skips would be provided at each compound and would be emptied regularly.
  - Effluent from the amenities would be discharged into the local sewerage system, where available. Where connection to the local sewerage system is not possible, portable self contained toilets of suitable capacity would be provided and appropriately discharged.

- Contaminated soil resulting from oil or fuel spills would be excavated and transported to an approved disposal centre. Excavations would be filled with suitable clean fill;
- If fill or soil were identified as contaminated, these materials would be kept separate from clean material. It would be stored or removed under the appropriate EPA licences, approvals and procedures; and, it would be sent to an appropriate waste handling facility;
- Procedures for excavation, storage, transport and disposal of ASS would be required prior to the commencement of construction. Storage, transport and disposal methods for contaminated materials, including ASS would be detailed in the WMP;
- Asbestos waste would be transported and disposed of according to *Environmental Guidelines: Assessment, Classification and management of Non-Liquid Wastes* (EPA 1997).

16. Visual Assessment

This Section makes an assessment of the visual impact of the EIS Proposal and is based on **Working Paper 11** prepared for the EIS by Infranet and Kiah Environmental Design.

The assessment recognises that, whilst the proposed NDE would represent a new structure in the existing landscape, it would sit alongside an existing street network and that the proposed NDE has extensive urban design and landscape treatments to moderate its visual impact.

The assessment also considers the visual impacts in terms of road users as well as local residents and community perceptions in the wider study area.

16.1 Existing Visual Environment

16.1.1 Topography, Drainage and Vegetation

The site topography is varied with the majority of the land being relatively flat to gently undulating, between 10 and 20 metres above sea level. The northern part of the site is undulating, and the road traverses three ridges. **Figure 16.1** refers.

The varied topography offers potential to exploit views from the road. There are also two main permanent creeks that cross the alignment as well as other minor creeks. These also create an opportunity for visual interest along the proposed NDE route.

The main categories of **vegetation** on site include:

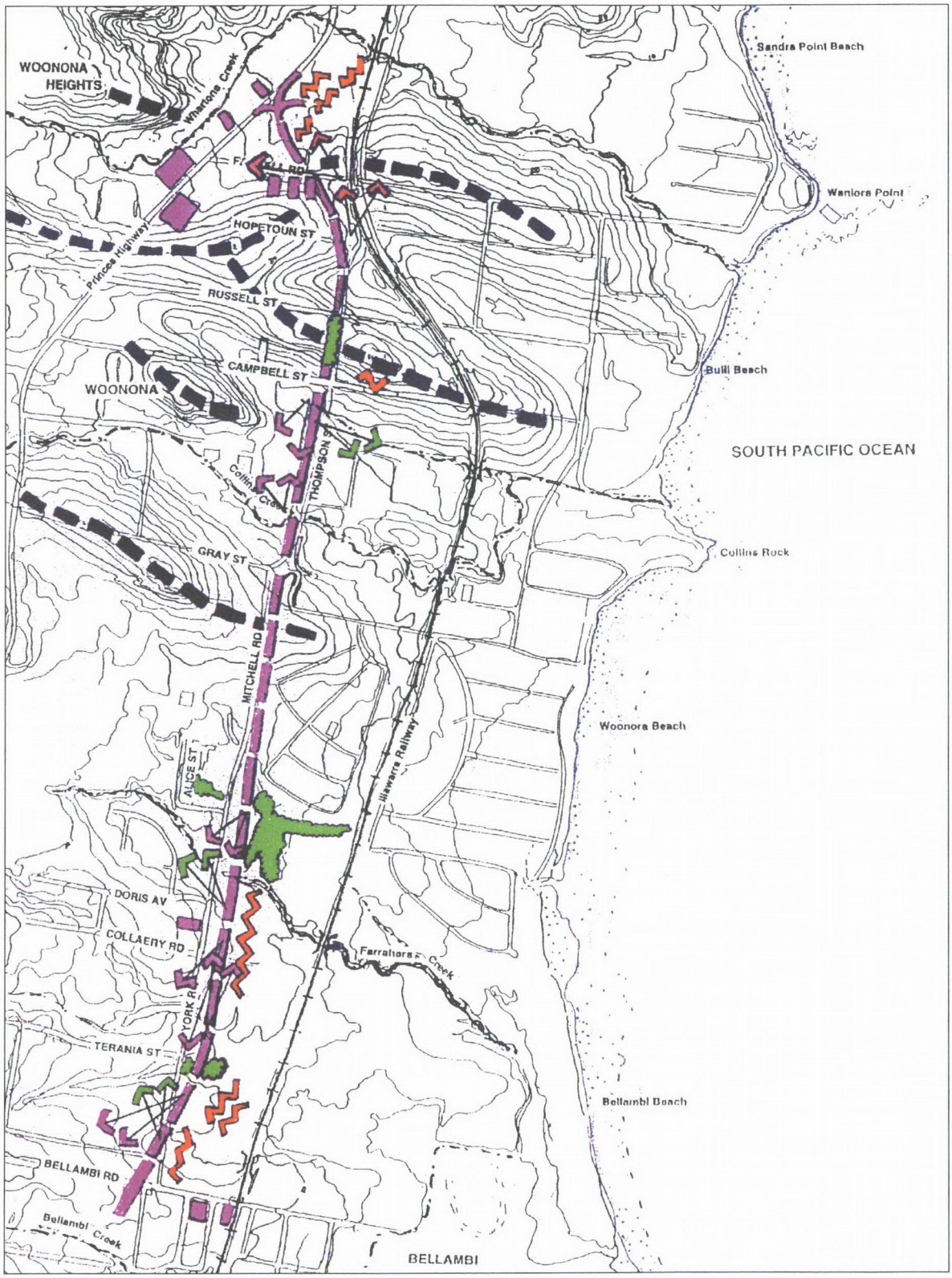
- Remnant indigenous eucalyptus;
- Exotic copses at the creek crossings;
- Two Norfolk Island pines near the intersection of Gray Street and Park Road; and
- Existing road-side plantings.

16.1.2 Landscape Zones

Six distinct landscape zones have been identified along the proposed NDE Corridor as outlined below (refer **Figure 16.2**):

- **Zone 1:** Light industrial/residential with heritage significance (from Princes Highway to Farrell Road)
- **Zone 2:** Undulating with significant vegetation/residential (from Farrell Road to Campbell Street)
- **Zone 3:** Floodplain with open views/residential (from Campbell Street to Collins Creek)
- **Zone 4:** Enclosed junction environment (vicinity of Gray Street)
- **Zone 5:** Residential character with back fencing to the east (from the ridge south of Gray Street adjacent Park Road to Farrahars Creek in the south)
- **Zone 6:** Residential/light industrial with partial open views (from Farrahars Creek to Bellambi Road)

Figure 16.1: Visual Analysis

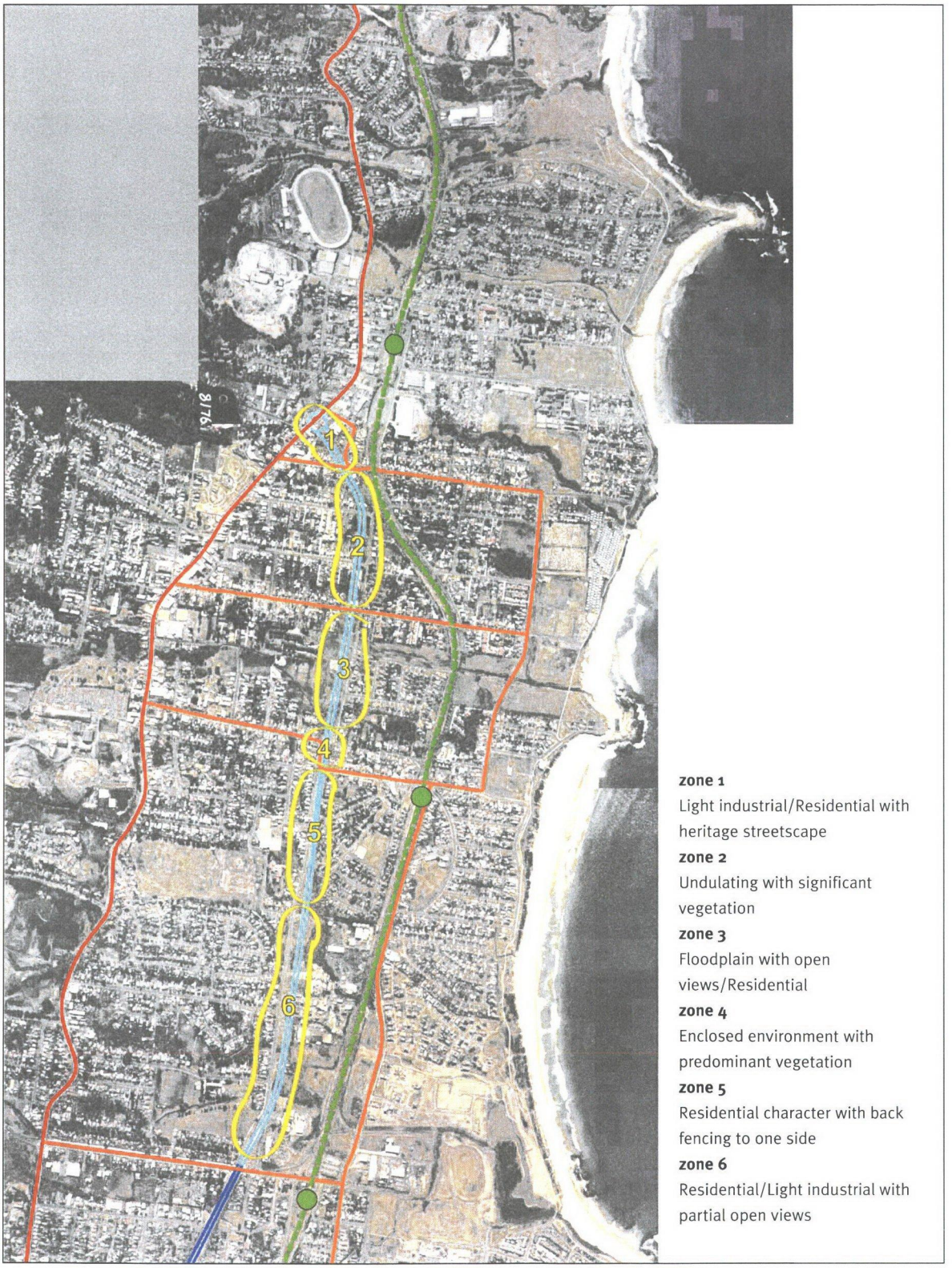


Legend

- Major skyline ridges
- Escarpment views
- Open space views
- Detracting elements
- Significant Heritage elements
- Significant vegetation

Source: Infranet/Kiah

Figure 16.2: Landscape Zones



Source: Infranet/Kiah

16.1.3 Landscape Elements

Key visual elements along the proposed NDE corridor and the wider regional context include:

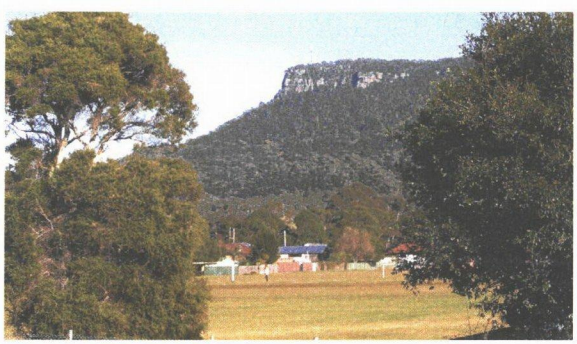
- **Major skyline ridges:** There are three prominent ridges that form visual catchments to the road user. Care needs to be taken to ensure that their prominence in the landscape is not reduced and that the earthworks are sympathetically handled. The highest ridge, between Russell and Campbell Streets, is dramatic in the landscape and the mature trees on the ridge would be retained as they are visually prominent.
- **Enclosing valleys/open spaces:** Wherever possible, the views from the road to these spaces would be left open to exploit the spatial feeling. This helps the driver orientate himself/herself within the landscape.
- **Detracting elements:** These include large industrial sheds, discordant built form elements and overhead power lines. The future NDE design needs to address these elements and improve the views of them from the road.
- **Escarpment views:** Along the alignment, in both directions, there are many instances where the escarpment is seen. These views need to be framed wherever possible and exploited as they provide key contextual reference for the users of the Distributor, as well as for the residents. Enhancement of views to the escarpment would require site analysis and careful design integration between the acoustic walls, mounding and planting design.
- **Open space views:** Views to adjacent open spaces would also be exploited and framed wherever possible. A variety of enclosures and openings along a roadway creates a more interesting visual experience.
- **Streetscape heritage:** The existing heritage houses along Farrell Road, in addition to the views to heritage buildings in the general area around Princes Highway/Farrell Road, add visual interest and a sense of place to the environs.

16.2 Visual Assessment

The visual impact of a new road is very subjective, and can vary significantly between the viewer as motorist, local resident and distant viewer.

This section reviews the EIS Proposal according to different visual parameters. These include: visual sensitivity; visual effect; and visual impact.

16.2.1 Views from NDE

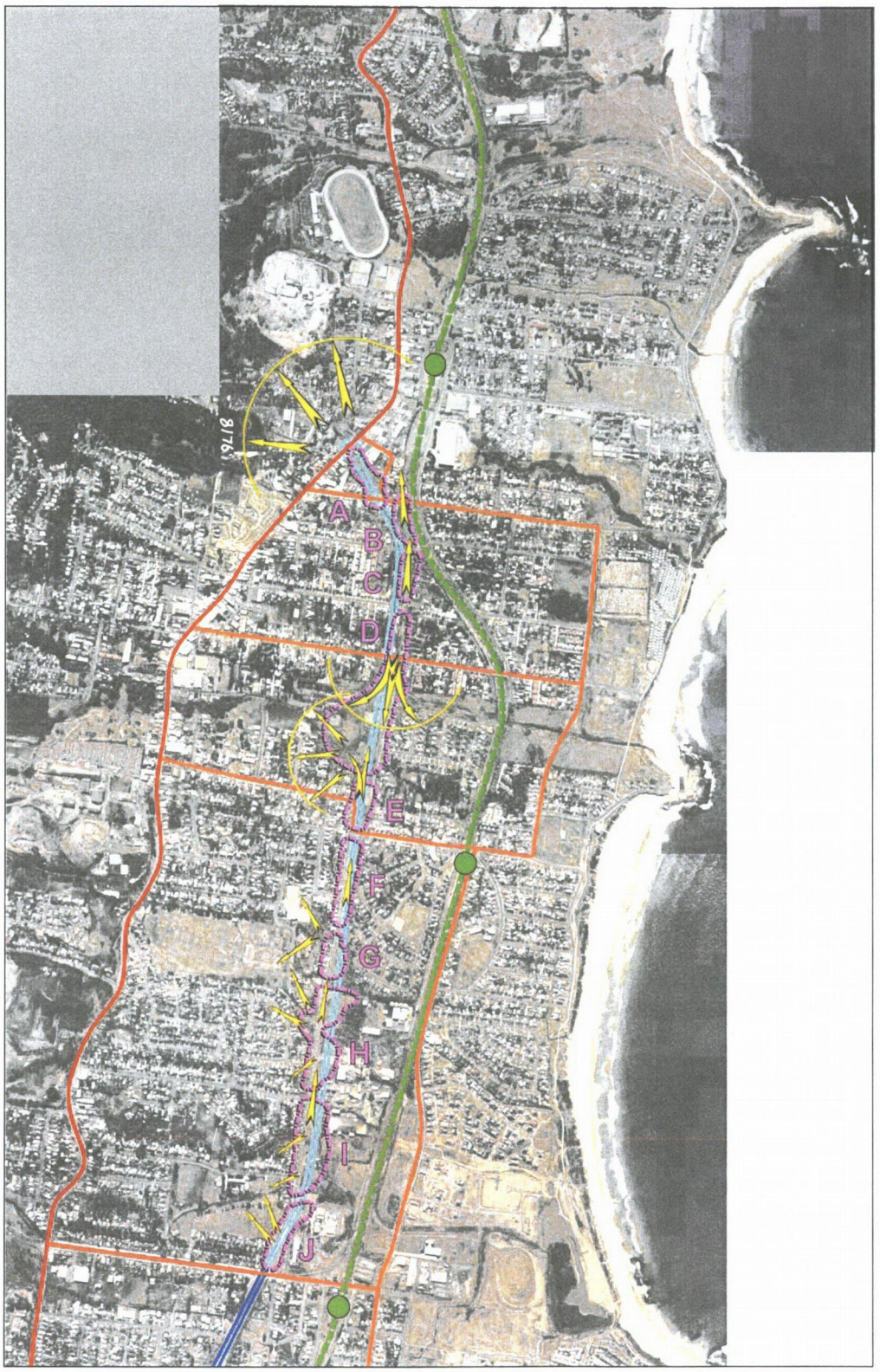


Escarpment view from the NDE.

For the motorist travelling north to south along the proposed NDE from the Princes Highway, a number of visual impacts would be perceived as shown in **Figure 16.3** and summarised below:

- Landscaped sound walls between Molloy Street and Russell Street, with views to distant escarpment on the right, and views of pedestrian over-bridge at Farrell Road;

Figure 16.3: Visual Catchments for NDE Motorists



Legend

- Princes Highway
- Existing Northern Distributor
- Propsed Distributor Extension
- Local Distributor Roads
- Railway Line
- Railway Station
- Visual catchments
- View sheds
- Panoramic views

Source: Infranet/Kiah

- Views of a steep cutting between Russell street and near Campbell street, with distant views of central Wollongong ahead;
- From the Campbell street bridge, there would be extensive views of the escarpment on the right and views of the local area and central Wollongong ahead;
- South of Campbell Street the motorist would have views along a landscaped road corridor to the Park Road bridge in the middle ground and views of the escarpment to the right;
- South of Park Road, the motorist would have views along a landscaped road corridor and right hand views of the escarpment.

Travelling north, the proposed NDE motorist would experience the following views commencing Bellambi Lane:

- Glimpses of the escarpment to the left;
- Views of the new Park Road bridge through a landscaped road corridor;
- Views of the escarpment to the left from near Woonona High School;
- View of the cutting north of Campbell Street;
- Views of landscaped road corridor and pedestrian over-bridge at Farrell Road north of Russell Street.

In summary, the motorist would generally have a view along a landscaped road corridor with partial views of the escarpment tops on the western skyline.

16.2.2 Views towards NDE

Existing residential dwellings occupy about 55% of the total length (both sides) of the proposed NDE corridor. Of these houses, about three quarters would front the proposed NDE across a new or existing service road whilst 25% would back onto the road reserve.

All dwellings fronting the proposed NDE would be screened by new landscaping along the perimeter of the proposed NDE. Properties backing onto the proposed NDE corridor would face a concrete noise barrier of varying height.

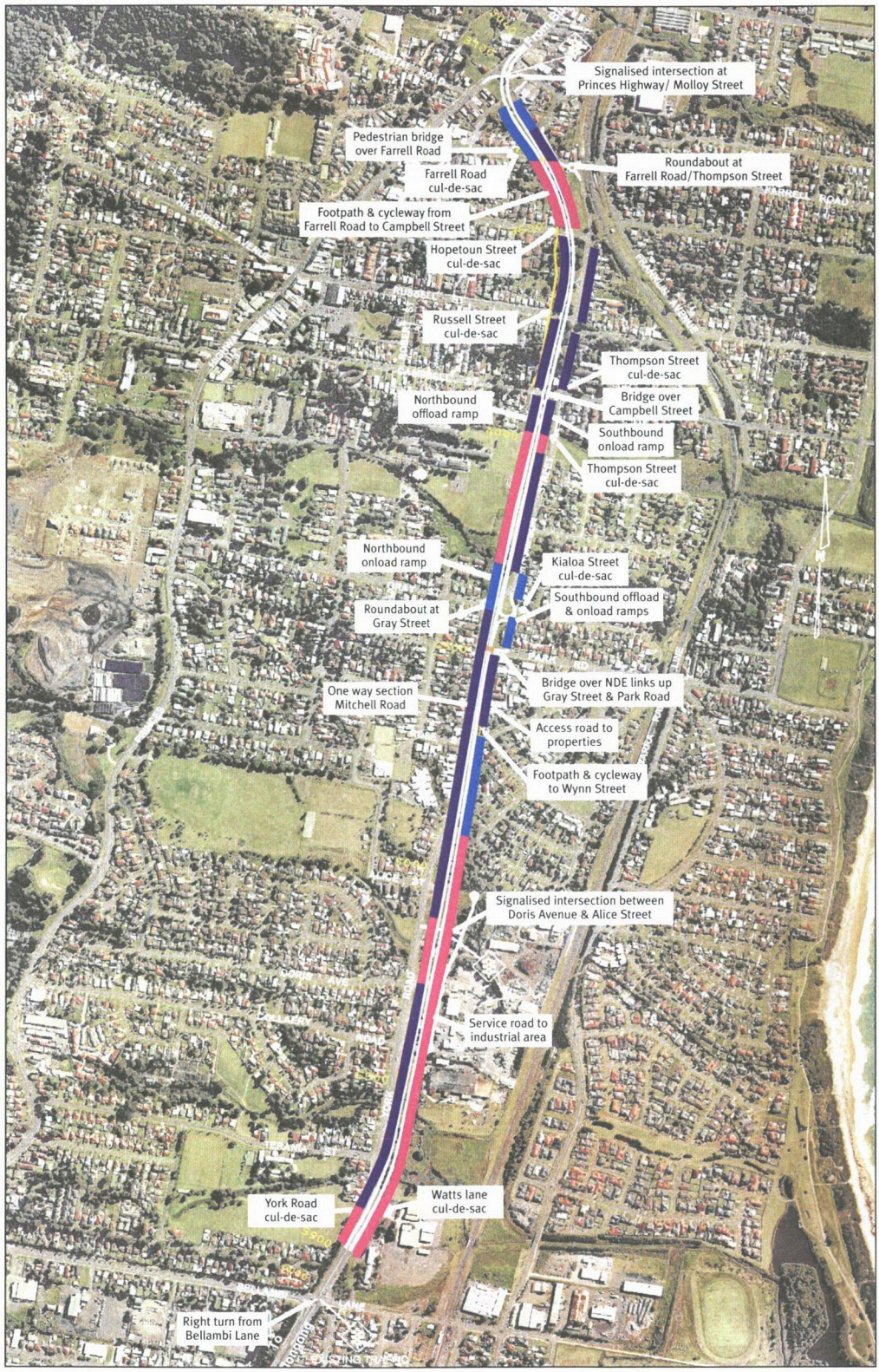
Figure 16.4 and **Table 16.1** indicates the basis for the assessed visual impact. This analysis assumes that rear property views to sound walls constitute an adverse visual impact, and that front facing properties would have a neutral adverse impact in response to proposed landscaping and the fact that they already face busy visually cluttered streets.

Table 16.1: Visual Assessment for Properties along NDE Corridor

	Approx Distance		Assessed Impact					
			Positive		Neutral		Negative	
Land Use	**m**	**%**	**m**	**%**	**m**	**%**	**m**	**%**
Housing fronting NDE	2100	42%			2100	42%		
Housing with back to NDE	600	12%					600	12%
Industry, roads & open space	2300	46%	2300	46%				
Total	5000	100%	2300	46%	2100	42%	600	12%

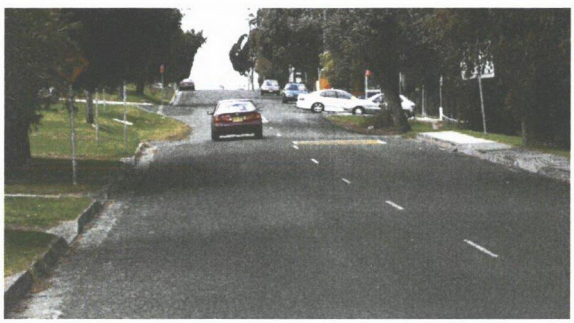
Source: Purdon Associates

Figure 16.4: Land Uses Adjacent to EIS Proposal



The analysis shows that about 12% of the total length of the route would have views into new sound walls for which RTA landscaping would not be provided. About 88% of the total route is assessed as having either a neutral or positive visual impact for adjacent land uses.

On this basis, it is concluded that there is no adverse visual impact on adjacent properties for a large part of the corridor. The provision of planting material to properties with new noise barriers in their backyards would further mitigate this visual impact.



Campbell Street looking east.

More distant views of the proposed NDE are confined to a few east-west streets and public lookouts along the escarpment edge. The bridge at Campbell Street would be visible from local houses and people using this street. The NDE sound walls would also be dominant from housing in Farrell Road west.

The distance of the escarpment from the study area would minimise any views of the proposed NDE from these vantage points. The new road would only be seen from the existing Princes Highway for a very short section near Molloy Street.

16.2.3 Visual Sensitivity

Visual sensitivity is a measure of how critically a change to the existing landscape would be viewed by the community surrounding the proposed corridor. Visual sensitivity is based on many factors including viewer perception, distance of views, and duration of viewing. All these parameters are considered through an assessment of the land uses. **Table 16.2** shows the relationship between land uses in the study area and viewing distance from the proposed NDE.

Table 16.2: Land Uses and Viewing Distances from NDE

Land Use	Distance		
	Foreground	Middle	Background
Industrial	L	L	L
Residential	H	H	M
Open Space	M	M	L

Source: infranet/Kiah (Working Paper 11)

L=low sensitivity M=medium H=high

People using a recreation area, for example, would use the surrounding landscape as a part of their leisure experience and would experience change to the landscape more critically than, for example, people viewing the proposed NDE from an industrial situation. All other things being equal, the shorter the viewing time (for example, views whilst travelling along a road) the lower the sensitivity, and similarly, the greater the distance from the project the lower the sensitivity.

Views from the yards of housing either facing or backing onto the proposed NDE can be regarded as having moderate to high visual sensitivity for residents depending on the height of sound walls and the amount of landscaping between the viewing platform (house/yard) and the new structure. In general, this category of visual sensitivity can be regarded as low given the high level of landscape treatment provided along the proposed NDE, and proposed mitigation for backyard landscaping.

Views from prominent public lookouts are also relevant. However, given that the proposed NDE largely follows existing roads, and is viewed from escarpment lookouts that are distant from the site, the visual sensitivity can be regarded as low.

16.2.4 Visual Effect

The visual effect is the expression of the visual interaction between a proposed project and the existing visual environment. It can also be expressed as the level of visual contrast (ie. form, shape, pattern, line, texture and colour) of the project with the setting and background within which it would be viewed.

A **high** (H) visual effect would result if the road creates a high visual contrast with the surrounding land use area. This would occur where no road currently exists and where the form of the proposed road contrasts with the adjoining open space areas, but would be offset by the extent of landscaping and the time this landscaping reached maturity.

A **moderate** (M) level of visual effect occurs if the road contrasts with the landscape but is integrated with it to some degree. This would occur where the road uses some existing infrastructure corridor or roadway, and would be further offset by the extent of landscaping and the time this landscaping reached maturity.

A **low** (L) visual effect occurs if there is minimal contrast or visual change in the landscape. This would occur where the road is essentially within an existing road formation, and would be further offset by the extent of landscaping and the time this landscaping reached maturity.

16.2.5 Visual Impact

The visual impact is determined by consideration of both the visual effect and the visual sensitivity. Various combinations of visual effect and visual sensitivity would result in high, moderate and low overall visual impacts.

Table 16.3 provides a Visual Impact Matrix indicating visual impact based upon the relationship between visual effect and visual sensitivity.

A low visual impact for any new major road is regarded as desirable, although in some cases this is not possible and may not be the design intent. There may be instances associated with the road where a moderate or high rating is preferential in order to provide the level of visual cues for users in certain areas, such as in feature elements for gateways.

A high visual impact does not have to be associated with a negative impact. For example, whilst cuttings are very visible, they also provide visual interest to passing motorists.

Table 16.3: Visual Assessment Matrix

	Visual Sensitivity		
Visual Effect	**High**	**Moderate**	**Low**
High	High Impact	High Impact	Moderate Impact
Moderate	High Impact	Moderate Impact	Low Impact
Low	Moderate Impact	Low Impact	Low Impact

Source: Infranet/Kiah (Working Paper 11)

The following assessment refers to the landscape character zones identified on **Figure 16.2**:

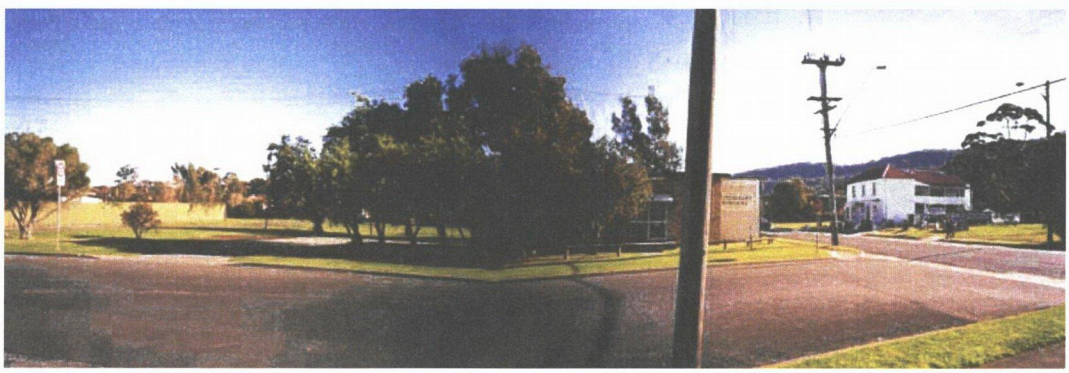
Zone 1 — Princes Highway to Farrell Road (Figure 16.5 refers)

Summary: Light industrial / residential with heritage streetscape.

Design Features: Gateway at intersection of NDE and Princes Highway, high noise walls, pedestrian overpass at Farrell Road.

Visual sensitivity: High, because this area is highly exposed including impacts to established residential area, pedestrian networks and heritage streetscapes.

Figure 16.5: Princes Highway & Molloy Street Intersection



Existing view of the intersection of Molloy Street and the Princes Highway.

Artistic impression of the view at the intersection of the NDE and the Princes Highway.

Visual effect: High, considering that this portion of the proposed NDE is categorised as a new road. In addition the changes to local streetscapes are high particularly along Farrell Road west, including the introduction of a cul-de-sac and the provision of a pedestrian overpass as well as the introduction of large noise walls.

Visual Impact: High; strong changes are proposed to the existing landscape, however certain design features such as a gateway at Princes Highway are high due to necessary design elements, in particular the high sound walls. Landscaping on both sides of the noise walls would help ameliorate the visual impact.

Zone 2 — Farrell Road to Campbell Street (Figure 16.6 refers)

Summary: Undulating with significant vegetation / residential.

Design Features: Accent feature at intersection of Farrell Road and Thompson Street, major cut in the vicinity of Russell/Muir Street. Introduction of a cul-de-sac at Thompson Street, north of Campbell Street.

Visual sensitivity: High, because of the highly exposed cut, as well as the proximity to the adjacent residences. However, extent of cut has been minimised with the introduction of a grade separated interchange at Campbell Street.

Figure 16.6: Farrell Road west

Existing view looking east along Farrell Road west.

After view looking east along Farrell Road west.

Visual effect: High, due to the scale of the cut and impacts to the adjacent vegetation. In addition moderate effects to changes to local streetscapes with the introduction of cul-de-sac configurations.

Visual Impact: High; significant visual changes are proposed to the existing landscape but noise impacts are minimised.

Zone 3 — Campbell Street to Collins Creek (Figure 16.7 refers)

Summary: Floodplain with open views / residential, school grounds.

Design Features: Grade separated interchange at Campbell Street provides good cross-linkages for the local community. Introduction of a cul-de-sac at Thompson Street, south of Campbell Street. Partial local access to the proposed NDE.

Visual sensitivity: Moderate to high, visually exposed area with fairly high pedestrian activity due to school grounds.

Figure 16.7: Thompson Street

Existing view looking north along Thompson Street towards Campbell Street

View looking north along Thompson Street towards Campbell Street.

Visual effect: Moderate to high, due to the location of the vertical alignment of the proposed NDE, introduction of ramps and sound attenuation measures in combination with the new road. Road is mostly on fill. Views from Thompson Street towards the escarpment would be partially restricted due to sound mounding/barriers. Moderate effect would be experienced from school grounds and road corridor.

Visual impact: High, particularly to residences along Thompson Street, but this would be moderated by substantial landscape planting in the zone between the existing street and the proposed NDE. Views looking north from Collins Creek to the cutting would be noticeable but the proposed NDE would have low visual impact from views in the east-west direction, other than directly along Campbell Street where the proposed NDE bridge would be visible.

Zone 4 — Park Road/Gray Street (Figure 16.8 refers)

Summary: Enclosed environment with predominant vegetation / residential.

Design Features: Road partially on fill and partially in cut. Local access to the proposed NDE.

Visual sensitivity: Moderate, greater distance between road corridor and adjacent residences.

Figure 16.8: View North to Park Road Bridge

Existing view along Mitchell Road looking north towards Park Road.

View along the NDE looking north towards the Park Road.

Visual effect: Moderate, road integrates somewhat with the surroundings due to the minor scale of the cut and fill at this location. Residual spaces offer opportunity to introduce landscaping to mitigate visual impacts and accent local landscape features.

Visual impact: Moderate, because the visual exposure is limited from adjacent areas. Pedestrian activities are limited mostly to school children. Motorists would view the cutting and bridge from both directions along the proposed NDE but this is not regarded as an unattractive view.

Zone 5 — Park Road to Farrahars Creek

Summary: Residential character with back fencing to one side.

Design features: Overpass at Park Road, long cut along the corridor, reduced width of corridor. Important cross connectivity for local community.

Visual sensitivity: Moderate to low, eastern side of corridor less susceptible due to back fences. However, residences to the west side of corridor front the new road development. In addition significant pedestrian activity at overpass and partially along Mitchell Road make this section highly exposed.

Visual effect: Moderate. Road is in cut in order to minimise sound attenuation impacts which would otherwise provide a stronger visual impact. Overpass provides a safe and interesting crossing point for the community with a minimum visual impact due to its "at grade" location.

Visual impact: High by design to provide better urban permeability and safety while minimising visual dissection of the community through the introduction of sound attenuation walls.

Zone 6 — Farrahars Creek to Bellambi Lane (Figure 16.9 refers)

Summary: Residential / light industrial with partial open views.

Design features: Road partially on fill and partially in cut. Local access to the proposed NDE.

Visual sensitivity: Moderate to low, greater distance between road corridor and adjacent residences to the west. Low sensitivity at the east side due to the industrial land usage and distance to the road corridor.

Visual effect: Moderate to low. Road integrates well with the landscape, residual spaces offer the opportunity to introduce landscaping, sound attenuation is achieved through sound mounding on the western verge. The mounding has been extended beyond the immediate road corridor to achieve better integration with the surrounding landscape and to reduce overall visual impact. Low impact to the eastern side of corridor. Views to the escarpment are mostly retained, from outside and from within the road alignment to the escarpment.

Visual impact: Moderate to low, because the visual sensitivity is low along this sector and the visual effect integrates well with the existing landscape.

Figure 16.9: View North from Farrahars Creek

Existing view along the proposed corridor looking north.

View along the NDE looking north towards the intersection at Farrahars Creek.

16.2.6 Summary of Visual Impacts

For the wider community the visual exposure of the proposed NDE would be regarded as low. This is because long sections of the road would be either visually confined by locating the alignment in cut or visually screened through the introduction of mounding and planting.

The areas of most visual impact would be the area to the north where high acoustic walls are required, the large cut north of Campbell Street, and the area immediately south of Park Road.

In areas where sound walls would be introduced such as at Farrell Road, urban design concepts of integrating the walls with terracing would assist in reducing the visual impact. In addition, landscape strategies are proposed to improve streetscape facilities such as cycle/pedestrian networks, and provision of passive recreation facilities with formalised seating areas.

In other areas such as north of Farrell Road and south of Park Road, sound walls would be integrated with back fences so to assimilate with the general urban fabric. There, where sound walls face a local street, landscaping measures would be introduced to improve the visual quality of the streetscape.

Towards the southern end of the project, the local streetscape would be improved through the introduction of open spaces in the form of a linear park, that also contains acoustic mounding with planting, hence screening some of the industrial buildings on the eastern side of the corridor.

For drivers along the proposed NDE, the visual impact would be considered to be positive from both the overall travelling experience, including views towards the escarpment, as well as views to newly landscaped areas directly adjacent the corridor. The proposed landscape character for the proposed NDE would add visual interest and context by also reflecting the local ecology. The few areas where sound walls and retaining structures are proposed are limited in length and provide a visual threshold between different character zones that adds interest to the travel experience.

Existing vegetation would be removed from sections along the route. The most notable areas are in the vicinity of Collins Creek (coral trees and Norfolk Island pine), and in the cutting between Campbell Street and Farrell Road. Whilst the loss of this vegetation would have a short term visual impact, there would be substantial replacement vegetation along the entire length of the route as part of the landscape planting program, and this would offset some of this visual impact over time.

The site is regarded as having a low visual impact from public vantage points on the escarpment.

16.2.7 Open Space

The EIS Proposal does not cut through any formal open space areas or recreation zones along the route, although it would occupy vacant land currently located within the corridor and a small section of land adjacent to playing fields at the high school.

16.3 Conclusion

Overall, whilst the EIS Proposal would result in a new section of road, for the most part its visual impact would be low. This reflects the fact that for most of its length it would be replacing existing roads and would have a substantial landscape component along its entire length.

In other locations (eg southern section of the proposed NDE), the use of landscaped sound mounds would make a positive improvement to the outlook of housing opposite industrial land uses.

The route does not impact on open spaces apart from the Woonona High School area and would not be visually significant from public viewing places along the escarpment.

The EIS Proposal includes benefits from ESD initiatives such as improving the biological quality and ecological value through revegetation strategies, introducing sensitive water management and waste minimisation both during and after construction.

Throughout the community consultation process to date, comment on all aspects of the proposed landscaping for the EIS Proposal has been positive, and there has been no substantial comment on any negative visual impacts of the project.

Mitigation measures include the introduction of artistic panels along sound wall structures and the use of transparent materials in strategic locations.

16.4 Mitigation

The following mitigating measures are proposed in order to further integrate the project in its setting and reduce the impacts resulting from the EIS Proposal. These mitigating measures would be reviewed and if appropriate they would be integrated into the EIS Proposal at a later stage.

Key mitigating measures include:

- Transparent sound attenuation walls in the area directly north and south of Campbell Street. It is suggested that transparent sound attenuation panels be introduced along the proposed NDE to maintain the open feeling of the overall setting while providing better views towards the escarpment for local residents along Thompson Street as well as NDE road users travelling in a southbound direction.
- Textured panels to complement concrete sound walls. In order to articulate the height of sound walls. In critical locations along the proposed NDE, such as between Princes Highway and Farrell Road, south of Park Road and south of Terania Street, it is suggested that textured panels be introduced with themes that provide context to the general setting.
- RTA to provide at no cost to owners, a selection of trees and shrubs to landscape the rear side of noise walls adjacent to the EIS Proposal.

17. Socio-Economic Impact

The purpose of this Section is to assess the potential impacts of the EIS Proposal on the existing social and economic environments as well as the current land uses within the study area.

The objectives of the study are to:

- identify the expected social and economic effects of the project and possible mitigating measures for the project;
- assess the effect of the EIS Proposal on current and proposed land use; and
- provide a summation of the likely inter-relationship between the EIS Proposal and other factors in terms of the combined impacts of socio-economic and land use factors.

Working Paper 9 has been prepared by EGIS for this EIS.

The social impact assessment overlaps with issues that have been discussed above including traffic, noise, visuals and air quality. This Section should be read in conjunction with this material.

17.1 Existing Conditions

17.1.1 Land Use

Wollongong is a major metropolitan area with a wide range of industrial, commercial, educational and tourist activities.

The study area is located in the northern part of the urban area and contains a mixture of land use and economic activities. (**Figure 17.1** refers).

The predominant land use is low density residential development, but there are a number of commercial outlets (retail and services) located along the Princes Highway, with a concentration in Woonona and Bulli shopping centres. Light industry is located in the south east corner of the study area. In addition, there are several schools, other community facilities recreation centres and open spaces scattered throughout the area.

The major transport routes include the Princes Highway and Illawarra railway line, together with a closely developed local street network.

Many of the businesses are owned or managed by local residents and also provide employment for residents within the study area as well as the wider Wollongong region. There are some vacant business premises along the highway at present.

A detailed description of land uses along the proposed NDE route is provided in **Working Paper 9**.

The proposed NDE is located for the most part within an area zoned as "9b Main Roads" (Wollongong LEP 1990). Land was initially set aside for a future road corridor and subsequently has mostly been retained as open space as a result of this reservation (owned by the RTA).

17.1.2 Population Profile

The study area is situated entirely within the local government area (LGA) of Wollongong. At the 1996 Census, the population of the Wollongong LGA totalled 177,009 persons (ABS 1996). The estimated resident population (ERP) of the Wollongong LGA as at 30 June 2002 was 188,276 persons. Between 30 June 2000 and 30 June 2001, the ERP of the Wollongong LGA grew by 1,301 persons, or 0.7%.

The study area (comprising postal codes 2516 and 2517) had a total population of 15,103 persons as at the 1996 Census. The age distribution of the study area generally correlates to that of the Wollongong LGA. 35.8% of the study area population were aged below 25, while 21.5% were aged over 55.

17.1.3 Dwelling Types and Ownership

There were a total of 5,973 private dwellings within the study area in 1996. 75.2% (4,492) of these were separate dwelling houses, 11.5% (689) were semi-detached or town/villa houses and 10.9% (651) were flats, units or apartments.

Of the 5,973 private dwellings in the study area in 1996, 3,896 (65.2%) were owned or being purchased, while 1,470 (24.6%) were being rented. 344 private dwellings (5.8%) were unoccupied at the time of the Census.

17.1.4 Household Size and Structure

The average household size of the study area was 2.7 persons in 1996. The predominant household type comprised a couple with children (37.6% of all households), followed by couples without children (25.7%) and lone person households (20.9%). Single parent households comprised 11.7% of all households in the study area.

17.1.5 Vehicle Ownership and Journey to Work

The majority of employed people living in the study area choose to travel to work by private vehicle with over 60.1% driving to work and a further 7.7% travelling as passengers. A total of 4,158 travel to their place of employment by car or as a passenger compared to travel by public transport for example bus (78), train (345) or by walking (163) and cycling (70).

17.1.6 Employment Profile

The ABS Census results for 1996 show that the study area had a very similar profile to the whole of the Wollongong urban area in terms of occupation and industry groups in the population.

There is a substantial component of the local workforce employed in the construction industry. The accessibility between the study area and Wollongong also means that there is a substantial supply of labour in the wider urban area potentially available within a short distance of the construction site and this in turn reduces the possibility of an influx of "outside workers" requiring accommodation etc for the duration of the construction period of the proposed NDE.

17.2 Future Urban Development and Land Use

Figure 17.1 shows the current general zoning pattern under *Wollongong Local Environmental Plan (LEP) 1990*. The majority of the study area is zoned for residential purposes. Other significant zonings include commercial, industrial and open space, along with the main roads and railway reservations. In the northern part of the study area a small proportion of land is zoned "environmental protection".

Approximately 50% of the residential zoned land is zoned 2(a) Low Density Residential, while the remaining 50% is zoned 2(b) Medium Density Residential.

In zone 2(a), single dwelling houses are permissible with Council's consent, as are dual occupancy developments and residential flats. The zone objectives, combined with floor space ratio controls contained within the LEP would effectively restrict multi-unit development in this zone to small scale dual occupancy and villa and townhouse developments.

Permissible uses in zone 2(b) include single dwelling houses, dual occupancies and residential flats. As indicated by the zone objectives and the floor space ratio control, a higher density of development is envisaged in this zone than in the 2(a) Low Density Residential zone. Again, multi-unit development would effectively be restricted to dual occupancies, villas and townhouses, although a greater scale of development could be expected.

It is understood that Wollongong City Council intends to undertake a review of city planning strategies and a review of the LEP within the next 2 years. At this stage, Council intends to focus on local centres and adopt a "place-based" planning approach, which would place less reliance on traditional zoning and focus on achieving the "desired future character" for each particular locality.

In conjunction with this review there is the potential for some parts of the study area to be rezoned. Council has indicated that this is likely to be in terms of allowing greater densities within the residential areas to provide additional housing within the City of Wollongong.

As such, the land use of the study area is not expected to change significantly in the short to medium term. There is likely to be some increase in residential densities, even under the current zoning, as older housing stock in the study area is redeveloped and replaced with low to medium density multi-unit housing. This would result in a greater population in the study area, and may also result in a slightly different demographic profile. Depending on the number of bedrooms within new multi-unit development, it could be expected that household size would decrease as the amount of multi-unit housing increases, and there may be a different age profile of residents.

The traffic modelling undertaken by Gabites for the EIS Proposal includes assumptions about future land use and residential development in the study area. **Section 7 refers.**

It is considered unlikely that completion of the proposed NDE would have a significant impact on urban redevelopment in the wider study area, although it would contribute to improved urban accessibility and improved local amenity.

17.3 Social Impact

Social impacts can be described as the direct impacts on people, their amenity, health and the way they use their community. Potential social impacts have been assessed by means of consultation with individuals in the community, a review of previous consultations and surveys for the Preferred Option and EIS Proposal, and a review of the results of other investigations conducted for the EIS Proposal. Many impacts, which may be considered from a strictly environmental point of view also have social implications. These include noise effects, impacts on access and visual impacts.

17.3.1 Community Severance

Community severance can be said to relate to possible impacts from linear infrastructure proposals such as the proposed NDE in terms of impacts on community identity and cohesion, possible divides within the community, and changes in community demographics and social equity. Disruption to the community, including loss of easy access to community facilities and links to other communities or recreational and leisure opportunities, is also an important element in considering potential severance impacts. This section, however, focuses on the more general issue of community severance, while **Section 17.3.2** specifically addresses impacts on access.

The NDE is not likely to result in significant severance impacts in terms of community identity and cohesion. The study area and surrounding areas generally are heavily oriented towards north-south movement patterns in their physical layout. Several barriers to east-west movement presently exist in the study area, namely the Princes Highway in the west and the railway line in the east. Community cohesion is currently adversely affected by the large volumes of through traffic on the existing Princes Highway. Increasing volumes of traffic would result in further deterioration of conditions in terms of local accessibility to schools, shops and other destinations, amenity and safety for pedestrians and cyclists, and noise and visual amenity.

The NDE, which would remove a proportion of this through traffic from the Princes Highway, is therefore likely to have positive impacts on community cohesion on and around the Princes Highway, and would improve physical and social connectivity within the study area in this regard. Local destinations within the Woonona business area may be made more attractive as a result, therefore enhancing community identity and cohesion in this location.

The proposed NDE would result in an additional east-west barrier being placed within the community, which could be said to further highlight the focus on north-south movement patterns. However, the proposed NDE corridor, which has been identified and reserved for some time, already forms a limited barrier by virtue of the considerable volumes of traffic that utilise York Road, Mitchell Road and Thompson Street as an alternative north-south transport route.

The EIS Proposal has attempted to incorporate east-west crossings at appropriate locations along the entire length of the route in order to minimise the potential severance effects of the proposed NDE. It is anticipated that the EIS Proposal would result in improved east-west accessibility due to the improved functioning of the east-west intersections at Gray Street/Park Road and Campbell Street.

Figure 17.1: Land Use in the Study Area

Source: Egis

The NDE may also result in loss of community cohesion and neighbourhood networks for those residents who would be displaced by the proposed NDE through total acquisition of their homes. However, the numbers affected by this would be minimal and adequate notice has been given to these residents of the likely impacts.

The NDE is also not likely to result in significant changes to community demographics in the study area. While the proposed NDE would facilitate greater north-south movement, and may result in improved access to Sydney, the demographic profile of the study area is not expected to alter dramatically as a result of its construction.

17.3.2 Access

Construction Impacts

The disruption of local access routes would be an issue during the construction phase of the proposed NDE. Disruption would occur as a result of some local roads being blocked during the construction of the proposed NDE.

These changes to access during construction would require some alterations to a portion of the local residents' typical trip making routes on a temporary basis. For example destinations such as Waniora Primary School, Bulli High School, Bulli shops and the beaches to the east of the study area would all require a different route for access from streets running east west across the location of the proposed NDE. In most cases, these impacts would be temporary only, and appropriate traffic management measures would be implemented to ensure impacts are minimised.

Vehicular Access

The design of the proposed NDE has been refined throughout the development process, and some design changes have been in direct response to the community concerns expressed during the course of the consultation process.

Although the proposed NDE would represent an additional barrier to east-west movement in the study area, adequate provision has been made in the design of the proposed NDE to cater for east-west movements. The existing railway line represents an existing restriction on east-west movements in the area, with only limited opportunities for crossing. Where possible, provision for east-west movement across the proposed NDE has been located so as to be consistent with the existing access across the railway line. This is the case at Molloy Street/Rixon Avenue/Farrell Road east, Campbell Street and Gray Street/Park Road.

New arrangements for local traffic include the creation of cul-de-sac on Farrell Road west, Hopetoun Street and Russell Street. These residential streets would no longer provide any form of east-west vehicular access. For Farrell Road west and Hopetoun Street west residents, vehicular access to the east would be possible by turning right or left onto the Princes Highway and using Campbell Street to the south, or Molloy Street/Rixon Avenue/Farrell Road east to the north, or Park Road (Bulli) further to the north. Right turn movements onto the Princes Highway should be more easily facilitated following construction of the proposed NDE due to the decrease in traffic volumes on the Highway.

For Russell Street west residents, vehicular access to the east would be available via Robert Street and Campbell Street, which would be grade separated from the proposed NDE. Residences to the east of the proposed NDE on these streets would be able to travel toward the west using Thompson Street and the proposed Farrell Road east/Rixon Avenue/Molloy Street route to access the Princes Highway.

Further south, properties on Thompson Street would be affected by the creation of a cul-de-sac at the northern end. Vehicular access to the north, south and west for these residents would be available via the proposed Thompson Street southern connection to Park Road and the south-bound and north-bound on-load ramps on to the proposed NDE.

Properties in the vicinity of Nicholson Road, Gray Street, Alfred Street, Hale Street and Stanhope Street would be able to use the proposed grade separated intersection at Gray Street/Park Road for both easterly movements, and access to the proposed NDE in northerly and southerly directions.

Properties fronting Mitchell Road between Rose Street and Gray Street would be restricted to one-way access in a northerly direction on that part of Mitchell Road that is to be retained. Access to these properties would therefore be via Gray Street and John Street. Although this access arrangement would be considerably different to the existing situation, it is considered to be adequate.

On the western side of the proposed NDE, south of Rose Street through to Terania Street, vehicular access to the proposed NDE would be available via the proposed signalised intersection between Alice Street and Doris Avenue. This would facilitate movement in a northerly and southerly direction via the proposed NDE, and would also allow easterly movement via the proposed NDE and Bellambi Lane. Access to the east would also be available via York Road, Mitchell Road (including the one-way section) and the Gray Street/Park Road overbridge. Access to the north, east, south and west would be similarly available for industrial properties on the eastern side of the proposed NDE in this location.

Pedestrian and Bicycle Access

The construction of the proposed NDE would result in a barrier to east-west pedestrian and bicycle access in much the same way as it would for vehicular access. However, the provision of pedestrian and bicycle crossings has been catered for at all vehicular crossings of the proposed NDE.

Furthermore, pedestrian and bicycle access has been provided through specific design elements of the proposed NDE. In particular, a pedestrian overpass would be provided over the proposed NDE at Farrell Road, which would link with a new footpath and cycleway from Farrell Road to Cambpell Street. This would cater for pedestrian and bicycle access to Woonona High School in particular, as well as other general pedestrian and bicycle movements in the locality.

Pedestrian access would be provided across the new Park Road bridge, and there would be a signalised crossing near Doris Avenue. Existing streets parallel to the proposed NDE would also become safer pedestrian environments than at present.

17.3.3 Emergency Services

Existing Northern Distributor

The consultation undertaken with emergency services providers as part of this study has provided valuable insight into the changes that their services have undergone as a result of the existing Northern Distributor (south of Bellambi Lane). The existing Northern Distributor south of Bellambi Lane was regarded as having had a positive effect on the area in relation to reduced traffic congestion to local streets and the Princes Highway. According to the Ambulance Service of NSW, its construction aided in reducing road trauma by effectively decreasing the amount of traffic congestion in the secondary streets in the surrounding area.

The severity of road trauma and traffic incidents was also further minimised on the existing Northern Distributor through the provision of separation barriers. This significantly reduced the occurrence of head on collisions. However, in contrast, the NSW Fire Brigades felt that there had been a slight increase in traffic accidents since the opening of the Northern Distributor due to increased speed and traffic.

EIS Proposal

The proposed NDE is expected to remove a large quantity of the existing traffic from the Princes Highway (particularly heavy vehicles and trucks) and, as a direct consequence, would reduce the accident rate on this road.

Emergency service vehicle response times are expected to be both positively and negatively affected by the proposed NDE. Response times for the emergency service vehicles between Wollongong and Bulli and Bulli and Wollongong would be improved as the proposed NDE provides a route with fewer traffic signals and a higher speed limit, which would serve to decrease the travel time of trips between the two centres. The secondary streets which have direct access off or on to the proposed NDE would also benefit from the opportunity of faster trips to destinations via the proposed NDE.

Access changes for some of the local streets may, however, negatively impact on the response times of emergency vehicles, due to a reduced selection of routes that their vehicles would be able to use to access secondary residential streets. For example, the proposed culs-de-sac may require new route information to be assessed as the accessibility of the road would be reduced and access points to the road would be limited. To counteract any confusion that may occur as a result of the changes of access, public awareness would need to be raised specifically regarding the issue of emergency services access, to assist in a smooth transition period after the proposed NDE is constructed. In this regard, affected residents would be made aware of their relationship to the proposed NDE and the altered access routes, and what their nearest cross street would be following completion of the proposed NDE.

17.3.4 Safety

As discussed in relation to emergency services above, there is likely to be both positive and negative impacts in relation to vehicular accidents as a result of the proposed NDE. Vehicular accidents would be expected to decrease on those streets where there would be a decrease in traffic volumes. In contrast, those streets where there is an increase in traffic volume may experience an increase in vehicular accidents.

In a similar way, the proposed NDE would increase pedestrian safety in some residential streets. In particular, the roads that would become cul-de-sacs would experience a decrease in traffic volumes, and therefore an increase in pedestrian safety.

Increased safety for pedestrians on the Princes Highway would also occur due to a reduction in the numbers of vehicles in general, but in particular heavy vehicles, travelling along the Princes Highway (using the proposed NDE as an alternative).

However, increases in traffic volumes in some of the quieter existing residential streets would reduce safety for pedestrians and motorists due to the increased volumes of local traffic.

Accidents would also be expected to occur on the proposed NDE itself, particularly at intersections, as a result of increased speed. However, these accidents would generally not involve pedestrians, as pedestrian access to the proposed NDE would be restricted.

The design of the proposed NDE incorporates a separated carriageway. This feature of the design would serve to reduce the severity of impacts as the ability of the vehicles to meet head on would be limited by design.

17.3.5 Amenity

Specific amenity issues relating to noise and air quality are discussed in other sections of this EIS, however, in general, the amenity of the study area is expected to improve as a result of the construction of the proposed NDE.

On some residential streets within the study area, traffic volumes would decrease following construction of the proposed NDE. This is particularly likely to be the case on Farrell Road west, Hopetoun Street, Russell Street and Thompson Street, where these streets would become cul-de-sacs. That part of York Road to be retained would also experience a decrease in traffic volumes, although this decrease may be less than other streets, due to the presence of north and south-bound access to the proposed NDE from Russell Vale. In these streets, it is anticipated that there would be an improvement in amenity.

Similarly, there would be a reduction in traffic volumes along the Princes Highway between Bellambi Lane and Molloy Street. This would contribute to an improved amenity within the retail and commercial strip at Woonona in particular, but also for residences located on the Princes Highway in Woonona and Russell Vale.

However, some streets within the study area would experience an increase in traffic volumes. This would particularly be the case with Molloy Street, Rixon Avenue, Campbell Street, Gray Street and Park Road, as these streets would provide the only east-west crossings of the proposed NDE. This increase in traffic is unavoidable, however appropriate traffic calming measures, would be implemented to manage the increased traffic on these streets.

As the proposed NDE is proposed to terminate at the Princes Highway near Molloy Street, it would effectively funnel traffic onto the Highway at Bulli. Whilst traffic levels on the Highway at Bulli are not predicted to be significantly greater than existing traffic levels immediately after opening, as traffic volumes increase over time, there would be greater levels of traffic being funnelled into Bulli between Molloy Street and Lawrence Hargrave Drive. This may result in a reduction in amenity along this section of the Princes Highway.

17.3.6 Land Acquisition and Compensation

The general corridor for the Northern Distributor Extension has been established for over 60 years and has been generally well known in the public arena since the 1940s through DMR (now RTA) proposals. The corridor has been shown on planning instruments since 1968. The current arterial road reservation was first shown on Wollongong City Council's LEP38 in 1984.

Properties along the corridor have been acquired from about 1938 under various legislative and/or RTA/DMR policy provisions usually relating to hardship. Currently a land owner that has property subject to arterial road zoning or an RTA preferred option and has demonstrated hardship can initiate acquisition under the provisions contained in the LEP, Land Acquisition (Just Terms Compensation) Act 1991 or the RTA Preferred Option Policy.

The extent of the area required for the project is largely limited to the existing road reservation. Some property acquisition would be required, however, to enable construction of the EIS Proposal.

Numerous discussions have been held between the RTA and affected property owners during the refinement of the EIS Proposal and preparation of the EIS studies. The RTA has worked with property owners to identify potential impacts and the way the construction and operation would affect them and their amenity. The EIS Proposal is a result of considerable consultation and reflects the many suggestions for alignment refinements to minimise individual property impacts. Indeed, 5 properties that previously needed to be acquired, either under earlier designs or as part of the road reservation, are now no longer required for the EIS Proposal.

The RTA would continue to negotiate with individual property owners regarding property acquisition. All property negotiations would be undertaken in accordance with the RTA Policy on Land Acquisitions.

Details of properties already acquired and yet to be acquired are provided in **Working Paper 1**. The current proposal requires whole or partial acquisition of another 28 properties. Ten of these properties are not zoned for arterial road. Included within the properties proposed to be acquired are 9 residences and one combined commercial/residential building.

The current proposal does not require acquisition from 5 properties (excluding those in RTA ownership) that are zoned for arterial road due to changes in the design concept for the proposed NDE.

Land to be acquired for the EIS Proposal would be acquired in accordance with the Land Acquisition (Just Terms Compensation) Act, 1991. The RTA's Land Acquisitions Policy Statement reflects the procedures stipulated by the Act. The policy sets out the procedures for partial acquisition and the special conditions, which apply to acquisition, compulsory acquisition and hardship acquisition.

The RTA would seek to purchase the land required for the EIS Proposal in much the same way as private land sales are undertaken, whereby compensation is assessed by having regard to the market value of the property as if it were unaffected by the EIS Proposal. The purchase price would be negotiated with the property owner to establish an agreement satisfactory to both parties, and the RTA would allow for compensation as a result of the impact of the road on the property. There is no appeal against acquisition, but provisions exist for appeal to the Land and Environment Court regarding compensation.

The RTA is not required to acquire more land than needed for the road. However, whole properties may be acquired (rather than just that part required for road) dependent primarily upon the impact on the property residue and the owners' desires. Where partial acquisition of property is proposed, the RTA would purchase only the part required for the EIS Proposal. The RTA would be responsible for adjustment of improvements to the new road boundary. Adjustments may include the reconstruction of fences, driveways, landscaping and the relocation of utilities. However, each acquisition would be subject to negotiations with the property owner. The negotiated agreement would supersede anything that may be indicated in this EIS regarding that acquisition.

After construction has been completed, any surplus properties would be identified and assessed for disposal in accordance with government policy. The RTA would assess each property on its merits to determine a suitable end use.

The existing tennis courts, cricket nets and soccer fields affected by the proposed NDE will be relocated within the Woonoona High School grounds.

The effect of the EIS Proposal on property values in the immediate vicinity of the route cannot be easily determined because of the interplay of many factors. In many cases, however, reduced noise levels, reduced traffic congestion, improved local property access and increased local traffic safety could be expected to offset any negative market perceptions about proximity to a major urban arterial road.

View of Woonona High School from Thompson Street.

The existing tennis courts, cricket nets and soccer field within Woonona High School will be relocated within the school grounds.

17.3.7 Health and Psychological Effects

Noise

There is an established relationship between noise and public health. Public health effects cover a wide spectrum, ranging from annoyance or nuisance, to sleep disturbance, the most common reason for distress by noise. As indicated in **Section 13**, relatively high noise levels would be expected at residences near the proposed NDE during construction. Such noise levels would only be temporary and are therefore not likely to have any significant long term health effects. After the opening of the proposed NDE, noise levels at residences near the route would generally reduce. This results from the extensive noise mitigation measures proposed as part of the development.

The proposed NDE is not likely to result in significant health impacts resulting from noise.

Air Quality

The EIS Proposal would not have any noticeable adverse impact on health of local residents arising from deterioration in air quality during the operational life of the project.

The EIS Proposal would have a minor impact on Woonona High School playing fields. Tennis courts and cricket practice nets would be affected but would be relocated within school grounds at cost to the project.

Dust suppression and other measures are included as mitigation measures during construction to minimise potential adverse impact on health.

Road Safety

The project would result in a forecast reduction in traffic accidents and improvements to pedestrians and cyclist safety.

Psychological Stress

The general issue of psychological stress is related to people's uncertainty about when the proposed road would be built, how and when acquisition might occur, and how they might be compensated, whether the EIS Proposal and related activities may affect their lifestyle, and so on.

Given other factors which cause stress in people's lives, it is not possible to separate out those factors relating to the EIS Proposal which may cause stress and other events, or to separate out the effects of various concerns relating to the EIS Proposal. It is also noted that the number of local residents directly impacted by the EIS Proposal is relatively few, and that existing road users suffer some levels of stress (unquantified) as a result of current traffic congestion and safety problems in the area.

During construction there would be disruption to people's travelling patterns when traffic is temporarily or permanently diverted, and there may be periods of relatively high noise. These impacts are unavoidable during construction of a major project and, although mitigation measures would be implemented, could result in increased stress to the community. Mitigation measures include keeping the community fully informed about upcoming road construction activities and temporary and permanent road closures, through advertisements in the local media and by prominently placed advisory notices. The contractor or the RTA would be required to establish a project phone number and prepare and implement a community consultation plan.

On balance, the EIS Proposal is considered to have no significant adverse impact on the health of the local community.

17.3.8 Construction Workforce

A substantial workforce would be employed directly and indirectly during construction of the proposed NDE. This workforce would include a range of activities including earthworks, bridge construction, pavement construction, landscaping and project administration.

The occupation groups likely to benefit from the construction of the proposed NDE, such as labourers, tradespersons and related workers, make up 22% of the local employment.

There are adequate numbers in the local labour force with experience in the building and construction industry to meet construction requirements for the project. There is likely to be a short term benefit derived from providing construction employment in the Region.

17.4 Potential Economic Impacts

17.4.1 Construction Phase

The construction phase of the proposed NDE is not expected to generate any substantial positive or negative economic effects although there would be a temporary boost to local retail trade as a result of the new project workforce. There may be some increase in heavy vehicle traffic along the Princes Highway, which may detract from the amenity of the Woonona commercial strip, but these impacts would only be temporary.

Some access restrictions may occur to properties in the vicinity of the Princes Highway at its intersection with the proposed NDE during construction. This would be minimised by ensuring that adequate access is maintained to all properties during the construction period.

17.4.2 Impacts on Local Businesses

As part of the EIS Proposal, two properties containing businesses would be wholly acquired. These properties are located in the vicinity of the proposed intersection of the NDE and the Princes Highway and contain a veterinary surgeon and a two storey commercial and residential building.

The acquisition of these properties means that the businesses located on them would need to relocate prior to construction. This may result in temporary closures, whilst alternative premises are found, and increased short term costs for relocation and advertising. Prior notice of acquisition and construction works would be given to affected businesses, which would enable the above activities to occur before the businesses would need to relocate.

The main potential business impacts of the proposed NDE are likely to be on the local shopping centres of Woonona and Bulli located on the Princes Highway. It is difficult to predict actual impacts as they depend on the characteristics of the individual businesses involved. They also depend on what actions are undertaken eg. traffic management schemes, car parking facilities, development of street side cafes, to mitigate negative effects and take advantage of the opportunities presented to improve the attractiveness of the centres for shopping.

The potential impacts on each centre are discussed below.

Northern Wollongong Suburbs

The proposal would marginally increase accessibility of the study area to both Wollongong and Sydney. This could create a growth potential enabling the local business economy to increase profits as a result.

Woonona

One of the most significant impacts of the proposed NDE to the community is the positive effect on the shopping centre at Woonona. The reduction of traffic along this section of the Princes Highway (refer **Section 7**) would provide great opportunities to improve the amenity and service of this centre to the community and revitalise commercial and retail activities.

After completion of the proposed NDE, the need for clearway, no standing and no stopping restrictions between Gray Street and Bellambi Lane would be eliminated for the short to medium term. This would present a range of urban design opportunities for revitalisation of the Centre, but these actions are beyond the scope of the present EIS and would require further assessment by local business and community groups, WCC and other relevant government agencies.

The new road could lead to an improvement in business due to increased safety and amenity with the reduction in through traffic, particularly truck traffic, thereby enhancing the commercial attractiveness of the shopping centre. Less through traffic minimises the conflict between vehicles accessing the centre for shopping. Fewer heavy vehicles in particular leads to a quieter environment that is safer for pedestrians and that encourages shopping.

Less traffic on the Princes Highway at Woonona after completion of the EIS Proposal at Woonona would enable clearway restrictions to be removed. This is likely to result in significant improvement in trade. Increased use of highway parking could also improve the trading of some businesses.

There may be some loss of "passing trade" business, as distinct from destination traffic, depending on the present attractiveness of the centre as a stopping place for through traffic (eg. availability of parking). Businesses that are currently benefiting from their location on the Highway through being both visible and accessible may also be affected but this could be addressed by greater use of Woonona shopping centre by local trade.

Discussions with local business outlets in Corrimal confirmed that the existing Northern Distributor had resulted in an improved shopping environment, with a reduction in noise and air pollution and reduction in heavy vehicle traffic.

Bulli

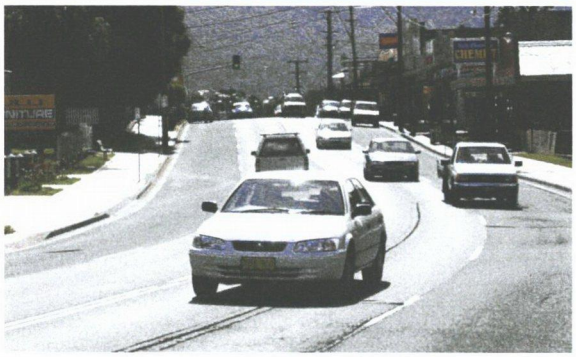
Bulli shopping centre would be affected by the EIS Proposal from the commencement of operational traffic flow due to the increase in traffic volume as a consequence of the improved infrastructure and the reduction of "rat runs" in the immediate area. This issue was of some concern in the local community as expressed by businesses and residents. **Section 7** refers.

However, even without the proposed extension of the Northern Distributor there is already a conflict between pedestrian amenity and vehicular traffic in this locality, and this situation would deteriorate over time based on the general increase in traffic flow along the highway.

The traffic analysis found that extending the proposed NDE would result in some additional traffic using Bulli Pass compared to Mount Ousley, but the level was minor.

On the other hand, there would be a significant increase in traffic on the Princes Highway through Bulli shopping centre with the termination of the proposed NDE at Molloy Street due to diversion of traffic from Park Road and Franklin Avenue. This increase would be around 5,000 vehicles per day on the current 20,000 vehicles per day. This traffic volume would be similar to the current volume north of Park Road and would require similar parking restrictions as soon as the Northern Distributor was extended to Molloy Street. The increased traffic including trucks would exacerbate road safety and pedestrian amenity in Bulli.

Accordingly, it is likely that the existing clearways would need to be replaced with extended parking restrictions. This would mean the eventual removal of on-street parking through the shopping centre.



Princes Highway north of Molloy Street.

Any ultimate further extension of the Northern Distributor to the foot of Bulli Pass would substantially reduce the traffic volumes through Bulli shopping centre. The projected volume is approximately 5,000 vehicles per day for 2016 in the event that the Northern Distributor was further extended. At this level of traffic, no parking restrictions would be required and the "No Stopping" restrictions and clearways could be removed.

There is community support for extension of the proposed NDE (north of Molloy Street) to the west of the centre along the current gazetted alignment, with a connection to an upgraded intersection at the foot of Bulli Pass. This is seen as reducing congestion in Bulli and allowing the local centre to benefit from increased "destination trade".

The community raised concerns that the clearways operating in Bulli on the Princes Highway and the lack of off-street parking would impact the local shopping centre and an assessment of strategies for revitalisation of Bulli shopping centre would be required.

Access to Industrial Properties

Access for heavy vehicles are also issues for a small number of the industrial businesses located within the study area. The delivery of materials and transport of finished goods create a requirement for the businesses to have turning space for such vehicles to access their premises.

The design of the EIS Proposal has taken these access requirements into consideration, and would provide better access/egress to the proposed NDE than in the current situation.

17.4.3 Land Uses

The proposal would create localised impacts for some individual properties as well as effects on the wider study area. The potential for longer term impacts mainly relate to changes in access for both residential properties as well as business in the local area. Disruptions to properties and businesses in the short term include impacts such as access, noise, visual amenity and dust to be addressed during the construction works.

A new service road will be provided for industrial areas east of the EIS Proposal.

Long term local access arrangements to individual properties and general local movement patterns would not be adversely affected by the EIS Proposal because of the extended concept design process and community consultation. There would also be a reduction in traffic volumes on the Princes Highway, increased safety for pedestrians and motorists on the Princes Highway, reduction of noise to a majority of properties along both the existing Princes Highway as well as the proposed NDE.

The potential increase in accessibility, reductions in traffic volumes, safety and amenity may encourage an increase in the property values in some of the residential areas within the study area. Business also may benefit from the reductions in traffic volumes and heavy truck movement along the Princes Highway as well as the subsequent increase in safety for pedestrians and potential for additional parking along the Highway.

The overall impact of the proposed NDE on the existing land uses within the study area would not alter the use of the majority of the existing land uses except for the land to be wholly or partially acquired for the purpose of the EIS Proposal.

17.5 Mitigation Measures

The EIS Proposal incorporates a number of design features that would mitigate against potential environmental, social and economic impacts. These include the provision of landscaped noise barriers along the length of the route, provision of a number of east-west vehicular and pedestrian crossings of the proposed NDE, provision of a pedestrian overpass at Farrell Road and provision of pedestrian and cycle path between Farrell Road and Campbell Street. The design of the EIS Proposal has also taken into account access requirements for properties directly affected by the proposed NDE, such that adequate access would be maintained to all properties following construction.

However, in addition to these design elements, there are a number of additional mitigation measures which would be implemented to minimise the potential social, economic and land use impacts of the proposed NDE. Note that this section does not include mitigation measures to minimise environmental impacts such as noise or air quality.

The following measures would be implemented during the construction phase to minimise impacts on the study area:

- A Construction & Traffic Management Plan would be prepared to identify how east-west vehicular and pedestrian access would be maintained during the construction period. This would address issues such as temporary road closures and provision of alternative access, and staging of permanent road closures;
- A community consultation plan would be prepared and implemented during the design and construction of the proposed NDE;

- The community would be kept fully informed about upcoming road construction activities and temporary and permanent road closures, through advertisements in the local media and by prominently placed advisory notices;
- The contractor or the RTA would establish a project phone number that residents could utilise to register concerns, complaints or other comments about the construction of the proposed NDE;
- Negotiations with owners of properties required for acquisition would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the RTA Land Acquisition Policy Statement; and
- Access to all properties not wholly acquired would be maintained during the construction period.

The following measures would be implemented to minimise potential social impacts of the operation of the proposed NDE:

- A Public Awareness Program would be developed for streets affected by access changes, to ensure residents are aware of new access arrangements to properties, particularly in relation to emergency services access;
- Traffic calming measures would be implemented on Campbell Street, Gray Street and Park Road, as recommended by the Traffic Report, to minimise the effects of increased traffic volumes on these streets;
- The RTA would be actively involved in the preparation of the Bulli Development Control Plan.
- Signage would be provided within the study area and/or along the proposed NDE to encourage shoppers to visit Woonona and Bulli business districts; and
- Clearway restrictions along the Princes Highway through Woonona shopping centre would be removed.

18. Hazard and Risk Assessment

A hazard and risk assessment has been conducted for the EIS Proposal by Connell Wagner and is listed as **Working Paper 13**.

This report identifies the likely risks of the project and considers mitigation strategies where appropriate. A **Risk Management Pla**n has been prepared based on the risk assessment process, which brought together a wide range of stakeholders in a workshop discussion. This Plan would need to be reviewed at appropriate intervals during the project to ensure that actions are taken as required and that any new risk issues are added into the Plan.

The risks were identified under four headings: environmental, safety, social and flooding. The risks were first assessed against level of impact and then against the likelihood of the risk. This allowed the risks to be categorised into critical, major, medium and low impacts.

Many of the issues raised were found to be already resolved by the EIS Proposal design or normal emergency response procedures. Several items would require the review of the design and some items would require re-visits to the geotechnical studies and the drainage studies, as described in the mitigation measures. However many issues would be resolved by compliance to normal design standards such as the RTA and Austroads design guides.

18.1 Risk Assessment

The following risk assessment has been made based on a review of the EIS Proposal and a workshop involving a wide range of relevant stakeholders.

18.1.1 Crash Analysis

The accident rates and the crash severity indices for the existing Northern Distributor are lower than the roads situated in the vicinity of the proposed Northern Distributor. Crash rates are higher for the road section on the Northern Distributor with traffic signals (between Bellambi Lane and Towradgi Road) compared to the road section with limited access control (between Towradgi Road and North Wollongong). The EIS Proposal has only one signalised intersection between Bellambi lane and Molloy Street, compared to three on the Princes Highway for the same section and four signalised intersections between Bellambi Lane and Towradgi Road on the Northern Distributor. This is a significant reduction.

The crash severity index in the Northern Distributor between Bellambi Lane and Towradgi Road and the average for divided urban roads in the Southern Region is about the same at 1.18 and 1.16.

The current severity index in the EIS Proposal area is above 1.21. On the existing Northern Distributor the severity index is 0.43 without signals and 1.18 with signals. A reduction of the severity index would also be expected as there is only one signalised intersection on the EIS Proposal.

Based on data presented above for crash rates for number of signalised intersections, divided and undivided roads in urban areas in Southern Region and the data on the existing Northern Distributor a substantial reduction in accident rates would be expected from the EIS Proposal.

A reduction in traffic on the Princes Highway should also reduce the crash rate on this road. The crash severity risks would also be expected to come down in the area. **Section 7** refers.

18.1.2 Transport

Buses

It was identified that the Northern Distributor Extension would have an impact on bus operation. The bus operators would have to introduce new bus routes after implementation of the EIS Proposal. However, this is not considered a critical or major issue. Public safety of pedestrians and children in relation to bus stops on the EIS Proposal was discussed. Due to the proposed 80km/hr speed zoning it was decided that bus stops along the proposed NDE are not appropriate on grounds of safety.

Transport to/from Local Schools

Most of the popular routes to Woonona High School, Woonona Primary School and Russell Vale Primary have not been affected with the EIS Proposal. Eastern access to Woonona High School and playing fields would be affected although alternative routes can be used.

Pedestrian and Cyclists

The EIS Proposal would provide improved safety for pedestrians and cyclists for east-west and north-south movements in the area. Cyclists would be able to travel north-south in kerb-side lanes along the EIS Proposal. Cyclists would also be able to use a shared cycle path between Farrell Road and Campbell Street. Safe crossings by overpass and signals are provided for east-west pedestrian movements.

18.2 Risk Management Plan

18.2.1 Introduction

A comprehensive Risk Management Plan has been prepared by Connell Wagner for this project (refer **Working Paper 13**).

The Risk Management Plan categorises potential risk under four main headings: Critical; major; medium; and low.

Some of the issues raised were not considered to be project specific, but a general risk. For instance fog or heavy rain would cause a safety issue on any road. Oil spills on roads are also expected events. Failure of traffic signals is an issue that can occur on any road. Road maintenance is another area where the risk is common and councils and the RTA follow safety procedures to deal with the issue. The Hazmat units advise they would be able to manage dangerous goods incidents as they currently do. The flood studies undertaken for this project have calculated designs for culverts and bridges which would not worsen the effect of flooding on the residents. Residents' concerns about separation of the community are being addressed by overpasses and signalised intersections to allow crossing of the EIS Proposal in an east-west direction.

18.2.2 Critical Risk Items

A few items were identified in the risk assessment process as being potentially critical. The majority of issues in this category relate to safety, in particular: pedestrians (particularly children and school children), drivers in terms of oil spills and loss of control and slow moving vehicles. Mitigation measures have been recommended in the EIS (refer summary in **Section 21.4**) to address all of these items.

Fencing was seen as one of the best forms of protection measures for pedestrians and vehicles affected by pedestrian actions (eg throwing items onto the road).

In terms of crossing safety for pedestrians, **overpasses and signalised junctions** are recommended and these form part of the current EIS Proposal design. Restriction of crossings at unauthorised locations is managed by the noise walls and fencing of the road corridor.

In order to ensure adequate response times are maintained for **emergency services** in the locality, it was recommended that adequate communication be maintained with the emergency services in relation to road closures. During construction there is a need for good communication between the contractor and emergency services to ensure satisfactory emergency access is always available and road closures are communicated.

The EIS Proposal has adequate median breaks in the road design for emergency vehicles to use.

Management of **oil spills** on the road affecting driver control is considered a normal issue that can occur on any road. Pavement design and drainage assist in reducing the amount of oil on the road and maintain grip of the vehicle tyres.

The safety of the tight radius curve where the proposed NDE joins the Princes Highway has been checked against the RTA Design Guidelines and the Austroads Guidelines and comply to the appropriate design speed.

18.2.3 Risks involving Hazardous Substances

Hazardous substances incidents were classified as major risks in the Management Plan. However, Emergency Services advise that the Hazmat units are geared up to deal with hazardous substances incidents and the EIS Proposal incidents would be dealt with as per other dangerous goods incidents on other roads.

The EIS Proposal has spill containment basins and emergency services require suitable vehicle access to these basins. Suitable access to spill containment basins would be provided as part of the design of the EIS Proposal.

Design of the bridges in the EIS Proposal would assist in directing hazardous spills away from environmentally sensitive areas such as creeks.

18.3 Conclusions

This report has detailed the work undertaken to make a fair assessment of the risks associated with the EIS Proposal. The process followed was generally in accordance with the Australian Standard for risk assessment AS/NZS 4360. Almost 180 different risks have been identified and assessed and mitigation has been recommended where appropriate. Some issues raised would require a revisit of the design or the associated studies (eg flooding, geotechnical), for instance the risk of drowning in stormwater detention basins. This risk would be mitigated by providing fencing or restricting public access around the detention basins.

Through the risk review process many issues have become non-issues, for instance where concern for safety in the pedestrian underpass has been eliminated by the removal of the underpass. Other items refer to issues which are subject to compliance with normal design standards.

The **Risk Management Plan** would need to be reviewed at appropriate intervals to ensure that actions are taken as required and that any new risk issues are added into the Plan.

The risk assessments indicate no adverse environmental findings from the EIS Proposal.

19. Energy Statement

The RTA is committed to the reduction in the use of energy derived from fossil fuels, and the promotion and development of sources of alternative energy. These commitments are outlined in the RTA documents "Environment Strategic Plan, Environment And Community Policy Summary Strategic Plan 1999-2004", and "Road Network Infrastructure Strategic Plan 1999–2004".

The objective of this section is to develop a project energy statement to determine energy requirements for the project and develop options for possible energy savings and conservation measures.

In undertaking this commitment the RTA is following the principles of Ecologically Sustainable Development (ESD) as outlined in Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

19.1 Energy Assessment

19.1.1 Construction Energy Requirements

The energy consumed during construction of the road has been estimated based on construction equipment and materials to be used on the project. Construction of the EIS Proposal would require the consumption of:

- Energy in the form of electricity, fuel (diesel and petrol) and water; and
- Construction materials including non-renewable material such as steel, concrete and petroleum.

The main sources of construction fuel energy consumption would be:

- Operation of excavation machinery;
- Road transport of materials;
- Operation of concrete pumps and agitators;
- Operation of drilling rigs and cranes;
- Operation of water carts, graders, compactors, asphalt paver and rollers; and
- Use of the construction equipment.

The main sources of construction electricity energy consumption would be:

- Lighting for occasional night work; and
- Power supply for construction compound(s) comprising lighting, office equipment operation, air conditioning and exterior flood lights.

Minimal excavation waste can be expected to be generated by the EIS Proposal. The EIS Proposal is aiming to achieve a balanced cut and fill ratio. Off-site disposal of excavation material is therefore not expected to be required. Energy consumption for off-site disposal of excavated material is expected to be zero.

The electricity supply would be obtained from the existing power grid nearby the works area. Water would be required during construction for dust control, washing equipment, sewerage and drinking water. Water use would be minimised and regulated, and where possible, water conservation practices would be implemented. This would include aerate taps, waste efficient appliances, trigger action hoses, low/dual flushing or composting toilets, and prompt repair of water leakage. Water would be sourced from local town-water supplies and reticulated to the work sites and compounds. It is not anticipated that water would need to be sourced from local watercourses, but may be sourced from sedimentation ponds required for the works.

Materials to be used during construction would include slag, concrete, asphalt, recycled asphalt pavement, and fill material. Other materials would include electrical cables and pipework. Indicative quantities of key construction materials include:

- Slag (23,954 m^3);
- Asphaltic concrete (7,680 tonnes);
- Fill material (106,500 m^3);
- Pipework (a maximum of 5 in various sizes); and
- Noise walls (5,200m^2).

Supply of these materials (except fill material) is expected to originate from offsite locations within 42km of the works site. The total quantity of concrete required by the works, and the close proximity of batching plants in North Wollongong and Bellambi would not warrant the establishment of an on-site concrete batching plant.

Beer (2000) states that in-process greenhouse gases associated with RTA asphalt road comprise 650 tonnes of CO_2 per km of road. These are indirect greenhouse gas emissions arising from in-process activities. The total energy consumption to construct the 2.8km EIS Proposal subsequently equates to 1820 tonnes of CO_2 of in-process greenhouse gas emissions.

Reduction in energy requirements

Reduction in fuel consumption and energy requirements could be achieved by using alternative fuels for heavy vehicles. Alternative fuel sources for heavy vehicles include:

- Low sulphur diesel;
- Ultra low sulphur diesel;
- Compressed natural gas;
- Liquefied natural gas;
- Ethanol and Diesohol; and
- Biodiesel.

Recent CSIRO research into the potential benefits of alternative fuels for heavy vehicles and equipment indicated that biodiesel has the lowest greenhouse gas emissions on a life cycle basis.

A variety of plant and equipment would be used in construction of various components of the EIS Proposal. Actual numbers of plant times to be used would be dependent on the Contractor's decision on utilisation rates.

Operational impacts of associated infrastructure such as lighting and signage relate to the use of non-renewable resources on and off site. It is not anticipated that the EIS Proposal would deplete any resources that are currently or likely to be in short supply. Street lighting and VMS systems would be assessed for energy conservation and life cycle, and alternative energy

sources would be investigated. Operational lighting for the EIS Proposal would be designed to minimise impacts on nearby residents.

19.1.2 Operational Energy Requirements

Following project construction, energy requirements would be limited to that required by vehicles travelling along the carriageway and for periodic maintenance and occasional pavement repair. Provision of energy efficient lighting and VMS and/or use of renewable energy would be considered where technically and economically viable.

Interchange lighting, street lighting, and Variable Message Signs (VMS) would be connected to the existing electricity network and would be subject to negotiation between the RTA and Local Government Authorities. Provision of solar power would be implemented where possible. Equipment to be used during the operation of the EIS Proposal, such as street lighting, would be chosen on the basis of efficiency. The type of lighting would be chosen to minimise light pollution.

The estimation for fuel consumption during operation has been determined based on traffic volumes and assumptions presented in the traffic and transport section of the EIS. Passenger vehicles travelling along the upgraded road are assumed to be travelling under free flow conditions, with an average fuel consumption of 11.5 litres/100km. Heavy vehicles, which comprise approximately 8 % of the estimated traffic flow, are assumed to have an average fuel consumption of 50.6 litres/100km.

The following data applies to land uses for the whole Wollongong network for 2016:

- The EIS Proposal would save 8,260 vehicle kilometres average weekday compared with 2016 network without EIS Proposal at an annual saving of $6 million dollars at 2016 values. Carbon monoxide emissions are projected to be **0.527 tonnes less per day with the EIS Proposal, than without**
- carbon dioxide emissions are projected to be 7.273 tonnes less per day with the EIS Proposal, than without
- Fuel use is projected to be 3179 litres less per day with the implementation of the EIS Proposal

The proposed NDE in its first year of operation will save 2,626 tonnes of CO_2 which would more than offset the construction amount of 1,820 tonnes.

19.2 Sterilisation of Resources

Existing and potential extractive resources in the Illawarra are identified in *Illawarra Regional Environmental Plan (REP) No 1.* (Department of Urban Affairs and Planning 1998), Part 3 (Provisions Relating to Extractive Industries) and Part 4 (Provisions Relating to Coal). Clause 33 and 37 of the REP state that the determining authority would not approve development on land containing extractive materials and coal.

There are no coal seams present under the road corridor. Under *Wollongong Local Environment Plan (LEP)* 1990, Clause 33 and 37 of the Illawarra REP do not apply to land covered by the LEP. The EIS Proposal is located within an urban area. It is therefore unlikely that any future extractive operations would occur in the vicinity of the road corridor.

19.3 Mitigation Measures

The following mitigation measures are recommended for energy savings:

- The EIS Proposal would be designed to ensure that optimum traffic flow is achieved, and vehicle emissions from stops and starts are reduced (RTA Environment Strategic Plan 1999–2004).
- All materials required during construction and operation would be selected to minimise energy use where feasible.
- Alternative fuel sources would be used wherever economically and technically feasible (eg. Biodiesel)
- The consumption of natural resources would be reduced by implementing measures contained in the RTA Environment Strategic Plan 1999-2004.
- Materials for road construction and maintenance would be reused and recycled where possible.
- Energy efficiency requirements would be incorporated into the contract for road construction and maintenance (RNI Strategic Plan 1999–2004).
- The project would include provision for public transport and cycling (RNI Strategic Plan 1999–2004).

20. Cumulative Effects

This Section identifies and discusses the anticipated cumulative impacts of the EIS Proposal to construct a four lane dual carriageway controlled access road from Bellambi Lane to the Princes Highway near Molloy Street in Bulli.

These cumulative impacts relate to the combined effect of the EIS Proposal as well as other development activity in the northern suburbs of Wollongong

Clause 228 (2) of the Environmental Planning and Assessment Regulations 2000 requires that an environmental assessment under Part 5 of the Act must take into account any cumulative environmental impact with other exisiting or likely future activities.

The assessment of cumulative impacts associated with the EIS Proposal is set against the "no change" option that envisages a gradual build up of through traffic in local streets as well as more congestion on the Princes Highway between Molloy street and Bellambi Lane. In general terms, the cumulative impact of the EIS Proposal on the study area in terms of environmental, social, economic and land use effects would be positive.

20.1 Transport Network

The EIS Proposal is consistent with State Government policies for social and economic development of the Illawarra and is consistent with *Action for Transport 2010* (Illawarra). Construction of the road would add another link to the exisiting network of major transport infrastructure in the Illawarra region, and will lead to quantifiable improvements to traffic efficiency, improved accessibility, reduced air pollution levels, and reduced energy consumption.

20.2 Road Safety and Local Amenity

The NDE would result in a reduction in traffic volumes on the Princes Highway and a number of local streets.

The EIS Proposal would substantially improve amenity along most local streets adjacent to the proposed NDE route, as well as that section of the existing Princes Highway supplemented by the new road. Projected road safety over the network would also be improved as a result of the EIS Proposal.

20.3 Flooding and Drainage

Proposed hydraulic structures (bridges and culverts) included in the concept design for the EIS Proposal would meet Wollongong City Council draft guidelines for flood structures and will not have any adverse impact on the 1 in 100 year flood event. Peak maximum flood events will over-top the road surface.

20.4 Air and Water Quality

The NDE would provide an alternate route for existing traffic and would therefore not by itself generate additional water pollutants (as the increase in traffic along the proposed NDE would be offset by a reduction in traffic along the Princes Highway). Nevertheless, it would in the longer term facilitate traffic growth and hence a potential increase in polluted runoff.

There is likely to be a small increase in overall pollutant loads generated by the proposed NDE. However, the majority of the pollutant load generated would be captured and treated within appropriately designed water control facilities. These controls are currently absent from the Princes Highway. Overall, long-term water quality should therefore improve.

It is considered unlikely the proposed NDE would result in any significant cumulative impacts on water quality, provided the proposed controls are appropriately maintained and an adequate Emergency Response Plan put in place for dealing with spills. The extent of existing development upstream and the limited scope for significant further development reinforce this conclusion.

The EIS Proposal is not expected to have any long term adverse impact on local air quality levels, although some short term localised adverse impact may be experienced by local residents during construction phase. The need for dust suppression measures has been identified as a mitigation measure to be adopted by the RTA.

20.5 Biodiversity

There would be no adverse cumulative impact on biodiversity as a result of the EIS Proposal. New landscaping along the corridor would improve to the biodiversity of the local area.

20.6 Noise and Residential Amenity

Noise levels on the highway and at residences adjacent to the proposed NDE would also be reduced as a result of the proposed noise barriers, and other noise attentuation design features of the EIS Proposal.

Adequate provision for east-west vehicular and pedestrian movements has been catered for in the design of the EIS Proposal. Local opportuntites for east-west movement have generally been maintained or replaced to ensure continued community connectivity after completion of the proposed NDE.

20.7 Visual Impact

The EIS Proposal would superimpose a new road structure onto an existing road network. Whilst the visual impact for motorists and local residents would change as a result of the new road, the concept design and landscaping would create minimal adverse cumulative impact. Views from public lookouts on the escarpment would not be adversely affected, and the driving experience would be one of a landscaped corridor with continued views of the escarpment skyline. Most local residential properties along the route currently face onto existing streets.

This outlook would generally be maintained, but the actual views of the EIS Proposal would be blocked by a landscaped corridor between the service road and the Distributor.

20.8 Construction Materials

Most of the construction fill required for the project would be obtained from on-site sources, thus reducing demand for use of off-site material. Where possible, the RTA would also recycle materials on site (eg vegetation for mulch), minimise waste and use recycled materials from other sources to help minimise any cumulative impact on other resources.

20.9 Property Acquisition

There would be some adverse cumulative effects for some properties, particularly those located adjacent to the proposed NDE route and/or on a major east-west access route. Increased traffic volumes on the east west access routes and a corresponding reduction in property values may cumulatively impact these properties. Any adverse impacts would be mitigated where possible.

There would be some adverse cumulative effects on owners and occupiers of land to be acquired, due to increased psychological stress and general disruption to their daily activities. The relatively few residents forced to relocate may also be affected in terms of loss of community and neighbourhood networks. Again, these adverse effects would be mitigated through implementation of acquisition procedures in accordance with RTA policy.

20.10 Local Economic Structure

On balance there would be a positive net long-term impact on the local economy, although some positive elements (eg improvements to the Woonona shopping centre) would be offset by negative impacts on Bulli shopping centre.

A prolonged presence by a large construction workforce in the local area would benefit local retail traders.

A number of local business establishments would experience improved accessibility once the proposed NDE was constructed and this would benefit the local business environment. One establishment on the Princes Highway would be forced to relocate as a result of its location in the route of the EIS Proposal, but this would be addressed by RTA acquisition policy.

20.11 Future Urban Development

The local area has been undergoing urban change over recent years and this trend is expected to continue in response to the high local amenity of the area, its access to employment centres, and proximity to the Sydney metropolitan area.

Construction of the EIS Proposal is likely to have a minor net positive impact due to improved accessibility and improved local amenity.

20.12 Other Activities in the Surrounding Area

The EIS Proposal includes traffic and flood modelling based on assumptions about continued urban redevelopment in the study area. This includes completion of several major residential estates either under construction (eg Edgewood) or mooted (eg Sandon Point).

The RTA is separately undertaking preliminary feasibility studies for the intersection of the Princes Highway at Bulli Pass and Lawrence Hargrave Drive and the Northern Distributor link between Molloy Street and Bulli Pass. Neither of these projects is scheduled for construction in the immediate future but represent two more steps in the overall transport network associated with *Action for Transport 2010*.

The EIS Proposal would be consistent with possible future extensions of the Northern Distributor along the lines envisaged by both of the above studies.

Over recent years, there have been various studies undertaken by the NSW Government and private companies into the provision of fast train services between Wollongong and Sydney. Such proposals would represent a major investment in infrastructure, and at this stage there is no commitment to any substantial upgrade. Extension of the Northern Distributor as envisaged in the EIS Proposal would complement possible plans for the railway upgrade, providing choice and increased movement capacity within the overall transport network.

20.13 Summary

The EIS Proposal is expected to have a potential positive cumulative impact within the study area without any significant negative cumulative effects.

21. Environmental Management

This section provides an outline of the environmental management processes and legislative requirements required to effectively mitigate and manage environmental impacts associated with construction and operation of the EIS Proposal.

The responsibilities of the RTA and its contractors to implement environmental management processes are outlined, including specific monitoring, auditing and reporting requirements.

A summary of the mitigation measures detailed in this EIS is provided at **Section 21.4**.

This section would also form the basis for the Project Environmental Management Plan (PEMP) to be developed by the RTA once a decision to construct the EIS Proposal is made by the Government. The PEMP would allow the RTA to maintain, monitor and evaluate environmental controls throughout the project.

21.1 Environmental Management Processes

21.1.1 RTA Responsibilities

The RTA has established an Environmental Management System (EMS) that was developed to meet the requirements of AS/NZS ISO 14001:1996. The EMS enables the RTA to assess its environmental performance and to identify and manage environmental risks as they relate to the organisation as a whole including individual infrastructure projects. The EMS also allows the RTA to assess the environmental performance of its contractors against guidelines specific to roadwork and bridgework contracts. The RTA has developed a series of specifications and guides that form components of its EMS.

The major relevant specifications of environmental management of the EIS Proposal would include: ***G36 Environmental Protection — (Management System)***.

The assessment of environmental risks began as part of the EIS process, whereby a risk assessment was Undertaken (refer **Working Paper 13**). The outcome of the risk assessment assisted in focusing on managing impacts associated with the project and devising mitigation measures to safeguard the environment from risks.

In order to detail all environmental mitigation measures, legislative requirements, monitoring, auditing and reporting requirements relating to major contract works, the RTA is responsible for preparing a Project Environmental Management Plan (PEMP). The PEMP details how environmental requirements are to be met, assigns environmental management responsibilities between the RTA and contractors and establishes mechanisms for evaluating the environmental performance of the project. The PEMP would detail any licensing requirements or permits obtained post EIS and the Minister for Planning's Conditions of Approval to the EIS. The RTA's Project Manager is responsible for preparing the PEMP.

21.1.2 Responsibilities of Contractors

In accordance with the RTA's EMS, contractors for the EIS Proposal would be required to have in place their own environmental management system. The contractor's EMS allows for continual improvement and assessment of environmental performance.

Contractors for construction of the EIS Proposal would be required to prepare a Contractor's Environmental Management Plan (CEMP), in accordance with the RTA QA Specification *G36 — Environmental Protection (Management System)* aimed at addressing the specific environmental issues raised by the project. The CEMP would include as a minimum:

- Details of environmental controls to be implemented by the contractor and subcontractors in accordance with the requirements of the Contract which in turn reflects the Project EMP;
- Copies of Statutory requirements including approvals and licences;
- Location of environmental control works;
- Timing of environmental control activities;
- Procedures for undertaking and recording environmental inspections and audits;
- Procedures and instructions for implementing, maintaining, assessing and monitoring each environmental control;
- Reporting procedures (incident, complaint, non-conformance);
- Details of training for personnel working on the project;
- Procedures for undertaking environmental auditing;
- Emergency procedures;
- Corrective action requirements and verification;
- Assignment of authorised personnel and procedure for changing and issuing the CEMP;
- Details of how the changes to the environmental management documentation and data are to be identified and communicated to relevant project personnel; and
- Mechanism for regular evaluation of environmental performance.

In addition, the CEMP would include supplementary environmental management plans, specifically:

- Soil and Water Management Plan and/or Erosion and Sediment Control Plan (SWMP/ESCP) prepared in accordance with Section 8 of the *RTA Road Design Guide*, 1989, (Erosion and Sedimentation), and the *Department of Housing's Managing Urban Stormwater, Soils and Construction, 3rd Edition*, 1998. The ESCP would detail all site specific measures the Contractor would implement during construction to prevent an increase in pollution loads being exported from the site;
- Water quality monitoring plan to assess the effectiveness of erosion, sediment and water quality controls;
- Dust monitoring plan, to assist in the reduction of dust nuisance to nearby neighbours;
- Noise and Vibration Management Plan to assist in reduction of noise and vibration impacts;
- Traffic and Access Management Plan;
- Waste Management Plan;
- Emergency procedures for chemical spills and other potential incidents; and
- Community Consultation Plan.

The supplementary EMPs would include identification of potential impacts and an outline of the mitigation measures to be implemented. The EMPs would detail measures to comply with specific licence and approval conditions. Individual EMPs would also be structured to fit within the overall framework of the CEMP.

21.2 Environmental Legislation, Regulations and Guidelines

There are a number of relevant controls, in the form of legislation (Acts, Regulations), policies, standards and guidelines which must be complied with throughout the project. Approvals and licences which may be required for the EIS Proposal are listed in **Table 21.1. Table 21.2** details non-regulatory requirements that relate to the environmental management of the EIS Proposal.

Table 21.1: Regulatory Approvals

Regulatory Authority	Legislation	Activity requiring approval
WorkCover Authority	*Dangerous Goods Act, 1975*	A permit would be required for storage of dangerous goods and chemicals
National Parks and Wildlife Service	*National Parks and Wildlife Act, 1974*	A consent to destroy, disturb or salvage archaeological items or sites may be required
Department of Land and Water Conservation	*Water Act, 1912*	Permit to extract water from the waterways for dust control, compaction or during bridge construction works may be required. A permit would also be required for any diversion of Collins Creek
NSW Department of Fisheries	*Fisheries Management Act, 1994*	Permit may be required with regard to blocking potential fish passage, dredging and reclamation

Source: RTA

Table 21.2: Non-regulatory Requirements

Authority	Document	
Australian Standard	AS 1055.1 and AS 1055.2	Acoustics — Description and Measurement of Environmental Noise
	AS 2659.1 and AS 2659	Guide to the Use of Sound Measuring Equipment Sound Level Meters
	AS 2072	Acoustics — Methods for Measurement of Road Traffic Noise
	AS 3580	Methods of Sampling and Analysis of Ambient Air
	As 2031	Selection of Containers and Preservation of Water Samples for Chemical and Microbial Analysis
	AWWA	Standard Methods for the Examination of Water and Wastewater
	AS 5667	Water Sampling
	AS 1216	Classification, Hazard Identification and Information Systems for Dangerous Goods
	AS1940	Storage, Transport and Use
	AS 2508	Safe Storage and Handling. Information Cards for Hazardous Materials
	AS/NZS ISO 14001	Environmental Management Systems, Specifications & guidance for use
	AS/NZS ISO 8402	Quality Assurance and Quality Management Vocabulary

Table 21.2: Non-regulatory Requirements (continued)

Authority	Document	
RTA Specifications	RTA G2	General Requirements
	RTA G10	Control of Traffic
	RTA G22	Occupational Health and Safety (Major Works)
	RTA G36	Environmental Protection (Management System)
	RTA Q	Quality System
	RTA G38	Erosion and Sedimentation Control
	RTA R41	Clearing and Grubbing
	RTA R162	Vegetation
	RTA B30	Clearing, Excavation and Backfill for Bridgeworks
RTA Guidelines		Environmental Impact Assessment Policy Guidelines and Procedures, Version 4
		Environmental Noise Management Manual
		RTA's Schedule of Environmental Legislation
		Acid Sulfate Soil Guidelines
		Waste Reduction and Purchasing Plan
		Code of Practice for Water Management, Road Development and Management
		Quality, OHS and Environmental Auditing Package
		Contractor's Environmental Management Plan Proformas & Guidance Notes
		RTA Water Policy
		Heritage Guidelines
		Aboriginal Heritage Guidelines
		Community Involvement — Practice Notes and Resource Manual
		Road Design Guidelines
		Roadscape Guidelines
		Roadside Environment Strategic Plan
		Policy on Vehicle Emissions
		Urban and Regional Design Practice Notes
Environment Protection Authority		Environmental Noise Control Manual
		Environmental Criteria for Road Traffic Noise, May 1999
		Green Waste Action Plan
		Construction and Demolition Waste Action Plan
NSW Department of Housing		Managing Urban Stormwater Soils and Construction, 1998

Source: RTA

21.3 Training, Monitoring, Auditing and Reporting

21.3.1 Environmental Training

Both the RTA and its contractors are responsible for ensuring that all employees working on the project have received environmental training in relation to the PEMP and CEMP respectively.

Training would be structured to ensure all workers understand their obligation to exercise due diligence in relation to environmental matters. Issues to be covered include:

- Relevant environmental legislation;
- Reporting procedures;
- Complaint management;
- General site issues;
- Traffic and access;
- Noise and vibration;
- Water quality, erosion and sedimentation;
- Air quality and dust;
- Flora and fauna;
- Heritage and archaeology;
- Hazards, risks and safety;
- Waste disposal and recycling; and
- Emergency response procedures

The contractors are responsible for training all their employees in relation to their CEMP, supplementary EMPs and all relevant environmental issues prior to the commencement of construction. Records of contractor employees' training must be provided to the RTA prior to those employees commencing work on the project.

21.3.2 Environmental Monitoring

Monitoring during construction and operation of the project would be undertaken in accordance with PEMP and CEMP. The PEMP would outline the monitoring required to assess the environmental performance of the RTA and contractors. Monitoring would also be undertaken to assess the effectiveness of the contractors EMP and all supplementary EMPs.

Environmental aspects to be monitored throughout construction of the EIS Proposal include:

- Noise and vibration;
- Air quality;
- Water quality.

Pre-construction monitoring would be undertaken to establish background levels for comparison with levels monitored throughout construction. Monitoring undertaken throughout construction allows for assessment of the adequacy of environmental protection measures and enables further mitigation measures to be developed, should they be required. Post-construction monitoring results would be used to assess actual impacts against predicted impact levels outlined in this EIS.

The monitoring programme would be designed to specifically address any PlanningNSW Conditions of Approval and licensing requirements.

21.3.3 Environmental Auditing

Auditing to ensure compliance with the PEMP, CEMP and supplementary EMPs would be undertaken at regular intervals during construction.

Audits of the RTA

Independent audits of the RTA would be undertaken every 6 months to determine compliance with the PEMP. All environmental documents, records and monitoring results would be reviewed to ensure compliance with the requirements of the PEMP. The need for auditing would be reviewed throughout the project.

An annual audit would be undertaken to assess key environmental impact predictions made in this EIS and detail the extent to which impacts reflect predictions. This audit would also specifically assess the suitability of environmental mitigation measures.

Audits of the Contractor

The contractor's performance would be reviewed by the RTA at regular intervals throughout construction in accordance with the RTA Quality, OHS and Environmental Audit Package. Contractor's activities would be assessed against their CEMP and the contract specifications. The frequency of audits would be determined by the RTA and the need for these audits would be reviewed throughout the duration of the project. Audits would involve reviewing all environmental documents, records and monitoring results to ensure the Contractor is complying with the requirements of legislation, licences, permits, approvals and their CEMP.

Completion Audit

The contractor would undertake an audit following completion of construction works. The audit would involve a site inspection, review of all environmental records and assessment of existing environmental protection controls.

21.3.4 Schedules and Reporting

As part of the PEMP, the following registers or schedules would be developed to provide a record of site conditions and activities:

- Site surveillance, inspection and audit schedule;
- Non-conformance/Corrective Action Report Register;
- Incident Report Register;
- Complaints Register; and
- Training Register.

The Contractor would formulate relevant schedules for their own operations. These are likely to include, but not be limited to a Waste Register, Water Quality Monitoring Report, Water Quality Sample Submission Form, Purchase Register, Purchase Materials with Recycled Content Report, Incident Report Register, Equipment Noise Monitoring Report, Training Register, Environmental Performance Evaluation Reports and Complaints Register.

Six monthly environmental performance reports would be prepared to assess the environmental performance of the contractors. The reports would include a summary of environmental monitoring results, comparison against guidelines and licence conditions, discussion of issues identified during site audits and recommendations to improve environmental management.

21.4 Summary of Proposed Mitigation Measures

The EIS Proposal contains design elements including noise walls, onsite detention ponds, and landscaping which have been incorporated to minimise environmental impacts listed throughout the EIS.

Table 21.3 provides a summary of all mitigation measures identified in the EIS for the proposed Northern Distributor Extension. In this table, each measure has been divided into pre-construction, construction and operational phases.

The categories of mitigation covered address a wide range of issues and activities as listed below:

- Statutory approvals
- Local area traffic management
- Construction traffic access and management
- Bus routes
- Signage
- Bulli shopping centre
- Air quality
- Community consultation
- Cycleways and pedestrian paths
- Economic impacts
- Land acquisition and compensation
- Construction environment management plans (CEMP)
- Energy Conservation
- Erosion and sediment control
- Cut and fill batters
- Acid sulfate soils
- Contaminated land
- Flooding and hydrology
- Flora and fauna
- Indigenous and non-indigenous heritage
- Noise and vibration
- Residential amenity
- Site compounds
- Equipment operating hours
- Urban design and visual impacts
- Utility services
- Waste minimisation and management
- Construction materials
- Input procurement
- Water quality
- Additional Soil testing during construction

The RTA would be required to address these matters if the project is given approval to proceed. Mitigation measures identified would be incorporated into the PEMP, contract documents and CEMP depending on the responsibility for undertaking and monitoring the measure.

Table 21.3: Summary of Mitigation Measures

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
Statutory Approvals	Pre -construction	All necessary environmental approvals would be obtained prior to the EIS Proposal proceeding. These would be included in the Project Environmental Management Plan.	4.3
		The RTA and contractor(s) would comply with the requirements of the Waste Avoidance and Resource Recovery Act, 2001 in relation to waste management during construction.	15.3
		Should any supplementary work additional to that described in the EIS be required, a supplementary environmental assessment would be undertaken in accordance with the requirements of the EP&A Act, 1979 and Regulation 2000.	4.3
	Construction	If any archaeological sites or remains are found during construction, all works would cease in the vicinity of the site and a s90 'Consent to Destroy' would be obtained from the National Parks & Wildlife Service.	4.3; 14.3
	Operation	The RTA and contractor(s) would comply with the relevant aims & principles of the Illawarra Regional Environmental Plan No.1.	4.1
Access and Traffic Management	Pre-construction	A Traffic Management Plan would be prepared in accordance with RTA QA Specification G 36 (Clause 6.4) and RTA QA Specification G10	7.6
	Construction	Maintain access to all residential and business properties during the construction period.	7.6
	Operation	**Clearway restrictions** along the Princes Highway through Woonona would be removed.	7.6
Local area Traffic Management	Operation	LATMs are proposed for Campbell Street, Gray Street, Park Road, Hillcrest Avenue and Farrell Road east.	7.6
		Implement a review of traffic signals along the existing section of the Princes Highway after opening of the proposed NDE.	
Bus routes	All stages	The RTA would advise affected bus companies of proposed disruptions so they can review local routes and stops.	7.6

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
Cut and Fill batters	Construction	Structural support would be provided for steep batters.	8.4
Acid Sulfate Soils	Pre-construction	Further testing for acid sulfate soils would be undertaken in vicinity of Collins Creek	8.4
Erosion and Sediment Control	Construction	Erosion and sediment would be managed in accordance with RTA QA Specification G 36 (Clause 6.5).	10.6
Contaminated Land	Pre-construction	Further testing for contaminated soils would be undertaken in vicinity of RTA works depot.	8.4
Flooding and Hydrology	Pre-construction	The alignment of Collins Creek immediately upstream of the bridge would be investigated. There may be some value in straightening the main channel in this area. Investigate inclusion of a workable trash rack upstream of the culvert for creek 8. In accordance with WCC draft blockage policy this culvert has been assumed to be fully blocked. Due to the realistic small size of the catchment, a well designed trash rack may assist in maintaining at least some flow through this culvert.	9.8
Water Quality	All stages	Undertake water quality monitoring: Pre-construction water quality monitoring program comprising sampling campaigns during 3 wet weather events at or immediately downstream of the highway crossings of the four main waterways. Construction phase water monitoring program comprising sampling at Sedimentation Basin outlets, upstream and downstream of nominated creek crossings. The construction phase water monitoring program would incorporate a defined Emergency Response Plan mechanism involving rapid feedback/response from project management to large storm events, fuel or oil spills so that in the event the monitoring indicated serious downstream pollution impact from any specific water quality controls an appropriate corrective action can be quickly taken.	10.5

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		Operational (post construction) phase water monitoring program comprising performance assessment of the two basins in Farrahars and Bellambi Creek catchments. These locations were selected on the basis of the highest environmental sensitivity of the receiving water (Bellambi Creek Lagoon) and the poor on-stream assimilative capacity of the two creeks, that feed to the Lagoon. Testing should be conducted once every 3 months (dry weather) and for at least 6 rainfall events with a 24 hour antecedent rainfall depth greater than 10 mm (wet weather), during the following 12 month period.	
	Construction Phase		10.5
		Implement effective water management practices and procedures in accordance with the Contractors Environmental Management Plan and Soil & Water Management Plan, as an integral part of on-site construction management to ensure that water quality and quantity impacts to the environment are minimised. Identifying those areas required to be disturbed by construction activity and ensuring that disturbance is limited to only those areas. Staging of construction activity as necessary to ensure good environmentally sensitive construction practices are followed and minimising the area disturbed at any one time. Maintain controls after completion of the construction until the land is fully stabilised and vegetation re-established. Utilising a suite of sediment control measures to suit each specific site. Appropriate measures would typically include a combination of: — Diversion drains to channel clean runoff away from construction areas. — Silt fences to filter runoff from disturbed areas and from around stockpiles. — Hay bale sediment traps in areas of concentrated flow to trap sediment and reduce scour.	

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		— Geotextile filter rolls upstream of kerb inlets — Designing drainage through and from disturbed areas to minimise surface flow velocities. — Diverting surface and road runoff away from fill batters and into drainage lines. — Using temporary sediment basins to treat sediment-laden runoff. Where possible these basins would be constructed in the location of proposed long term water quality ponds. — Stabilising bare areas within 14 days of the completion of construction activities. Temporary stabilisation techniques such as erosion matting, mulching and grass species establishment would be implemented on disturbed areas. — Undertaking regular inspection and maintenance of all works and rehabilitated areas. — Installing all sediment control measures as detailed on the approved management plans before the commencement of construction. Water for the purpose of dust suppression and moisture conditioning of fill materials during construction would be drawn from the existing town water supply to avoid impact on the natural stream flow regime. Air cooled slag products would not be used in the lower layers of embankment fill to protect ground water.	
	Operation		10.5
		Many of the primary pollutants in road runoff are those associated with finer sediment particles. These would be removed through: ■ Source control (Street Sweeping, litter control) ■ Landscaped buffer strips (to provide coarse filtration of runoff prior to entering the drainage system)	

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		■ Water Quality Ponds (also referred to as a sediment pond) ■ Water Quality Wetlands (similar to a water quality pond but provides enhanced filtration of finer particles)	
Utilities	Pre- Construction	Liaise with service providers to determine the need for any disruption to services resulting from the construction process. Any parties affected by service disruptions would also be notified.	6.8
Site Compounds	Pre-construction	Compounds would be located ■ More than 50m from waterways; ■ In areas of low conservation significance for flora, fauna and indigenous and non-indigenous heritage; ■ Where no substantial clearing of native vegetation would be required.	6.8
Air Quality	Pre-construction	Air Quality would be managed in accordance with RTA QA Specification G 36 (Clause 6.6) by the following actions: ■ Daily watering of unsealed roads to ensure that they are damp when significant dust generating activities are taking place ■ Reducing vehicle speeds on unsealed roads ■ Stabilising stockpiles that are not required to be used frequently ■ Exposed areas be stabilised as quickly as possible ■ Appropriate dust suppression methods be used to keep dust impacts to a minimum. ■ Monitoring would be carried out during the construction phase of the project to assess compliance with EPA goals. A minimum of three deposition monitors would be installed at the closest residences or other sensitive receptors.	11.6

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
Biodiversity	Construction	Flora and Fauna would be managed in accordance with RTA QA Specification G 36 (Clause 6.9 and 6.10) **Landscaping would:** ■ be undertaken in such a manner that it meets the life cycle needs of those fauna species recorded and would include the provision of locally occurring native trees, shrubs and ground cover plants, as well as mulch, debris and leaf litter from the site. ■ endeavour to provide linkages between the planted road reserves and adjacent habitats to meet the dispersal and foraging needs of a number of native fauna species. ■ be maintained for a period of no less than twelve months. During this time any dead or dying plants would be removed and replaced. A Bushland Plan of Management would be prepared by a suitably qualified person/ organisation to control the future management of the landscaped areas and include the treatment of weed species. A pre- and post-construction weeding program would be undertaken across the whole of the study area. Bridging of creeks would avoid locating piers within any of the creek channels. Bridges would also be as wide and high as practical to permit the penetration of light into the creek channels. Subject to other constraints of the road design the **waterway structures** would: ■ not have an adverse impact on the flows currently exhibited by those creeks traversed by the study area; ■ be box culverts as opposed to rounded pipes; ■ ensure that the water levels above and below the creek crossing remain the same; ■ ensure that there is no drop or waterfall at the end of any established structures;	12.6

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		■ not include the removal of any large woody debris outside of the construction area; ■ not result in the erosion of any creek banks; ■ not result in the significant increase of sediment loads beyond those currently exhibited by the creeks which traverse the study area; ■ not result in the restriction of any fish dispersal or movement patterns. The potential for the movement of fish species along the major creeks would not be prevented during, or after the roads construction; ■ minimise the disturbance of any aquatic habitat features; and ■ not reduce the extent of light penetration in to the main creek lines traversed by the proposed Northern Distributor Extension. The bridges and large box culverts would be designed in such away that the movement of ground and lower shrub traversing species are able to utilise these as fauna underpasses. The bridge abutments would be set back from the existing creek channels, thereby assisting the movement of native fauna. The inclusion of habitat features such as logs and boulders would also provide some species with shelter and protection as they pass under these structures. The following measures would be undertaken to preserve the flora and fauna habitat values of drainage lines that occur within and adjacent to the study area: ■ erosion and sediment barriers be erected on the downslope boundaries of all construction zones; and ■ regular inspection of erosion and sediment structures would be undertaken to ensure their adequacy and effectiveness. Where these are identified as being inadequate or in need or repair, this would be undertaken immediately.	

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		■ An Erosion and Sedimentation Control Plan would be prepared: ■ During construction activities, construction vehicles would be restricted in their movements to the delineated construction zone. ■ No polluted or sediment laden stormwater runoff from any work areas would be allowed to flow straight into any creek lines without first being filtered. ■ Cleared native vegetation would be mulched and used in the project's rehabilitation works undertaken during and after construction. ■ Weeds and seed bearing exotic plants that are removed would not be mulched but taken to an approved Council waste facility. ■ Newly exposed surfaces would be stabilised as soon as possible in order to reduce the potential for soil erosion. ■ All contaminants would be collected and removed from the construction areas.	
Noise and Vibration	Pre-Construction	Prepare a **Construction Noise and Vibration Management Plan** to control noise and vibration associated with construction to address the following:	13.5
	Construction	Alteration of construction methods, where practicable, to reduce noise and vibration levels. Selection of quiet equipment for the construction process to limit construction noise at nearby residences and monitoring of noise emission levels from the equipment on a regular basis to ensure that the equipment is well maintained. Shielding of construction noise from nearby residences by practical means which are available. Monitoring of construction noise and vibration to provide information for decision making regarding construction equipment and methods.	

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		Implementation of a community liaison program, involving advice as to construction progress and methods of registering a noise compliant. Procedures to be adopted in the event of a noise complaint being received. Limiting high noise and vibration generating activities during examination periods at Woonona High School. Where required, noise generated from the compound would be mitigated. Noise from the compound site would be monitored due to the proximity of nearby residences. Restrict hours of machinery operation during construction to meet with EPA guidelines. Restrict vehicle movements to EPA approved construction hours.	
Indigenous Heritage	Construction	The Illawarra Local Aboriginal Land Council members would be given assistance to explore every opportunity available to assist with construction of the Distributor Extension. Monitoring of excavation of topsoil on creek banks would be undertaken. Should any archaeological site be located all work would cease and ILALC and the National Parks and Wildlife Service would be contacted to assess the situation.	14.3
Non Indigenous Heritage	Construction	The possibility of relocating the heritage houses will be investigated before NDE construction. Any houses that are unable to be relocated would be recorded prior to demolition. In the event of an unexpected find of a heritage item work would cease in the immediate vicinity and the NSW Heritage Office would be notified and advice on management sought.	
Purchasing Strategies/ Construction	Construction	The contract documents (RTA Specification G36) would incorporate the requirements, where cost effective, to use recycled products which meet quality specifications.	15.1

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		The contractor must include in their CEMP a commitment to use recycled and recyclable products where effective, and reflect this in their Waste Management Plan. Contractors must be able to demonstrate that materials they intend to use are recycled, are from a non-virgin source, unless it is more cost effective to use alternative materials.	
Construction Materials	Construction	All water would be extracted from legally operating sources and would comply with standard operating procedures as outlined within the Contractor's Environmental Management Plan; No water would be sourced from natural watercourses in the area; Construction and vegetation materials to be used in the EIS Proposal would be purchased in accordance with the RTA's Waste Reduction and Purchasing Plan; The contractor would be required to source materials from appropriately licensed quarries that would have prior planning approval from the relevant local government authority; and should any heavy vehicles used by the contractor not conform with the dimensions outlined in *Division 2 of Part 3 of the Road Transport (Mass, Loading and Access) Regulation, 1996*, the contractor would be required to obtain a permit for over-dimensional vehicles.	15.2
Minimisation and Waste Management	Pre-Construction	The contract documents (RTA QA Specification G 36) would include the requirement, where possible, to use recycled products which meet quality specifications.	15.3
	Construction	Excavated material from the site would be used as fill for road works, including the embankments at Campbell Street and Farrell Road. Where reuse is not possible, waste would be minimised through recycling. Materials would be source-separated and sent to recycling outlets and recycling facilities would be made available to site staff operating from the site compound.	15.3

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		Putrescent waste from food scraps and rubbish would be removed from the site at regular intervals. Effluent from the site compound would be discharged into the local sewerage system, where available. Where connection to the local sewerage system is not possible, portable self contained toilets of suitable capacity would be provided and appropriately discharged via pumpout. If fill or soil were identified as contaminated, these materials would be kept separate from clean material. It would be stored or removed under the appropriate EPA licences, approvals and procedures; and it would be sent to an appropriate waste handling facility.	
Urban Design and Visual Impacts	Construction	Install transparent sound attenuation walls in the area directly north and south of Campbell Street to maintain views of escarpment Install textured panels to complement concrete sound walls along sections of the proposed NDE between Princes Highway and Farrell Road, south of Park Road and south of Terania Street. Use themes that provide context to the general setting. RTA to supply trees/shrubs to properties backing onto new noise barriers at no cost to owners to reduce visual impact of new noise barriers.	16.4
Consultation and Social Impact	Pre-construction and Construction	A Construction & Traffic Management Plan would be prepared to identify how east-west vehicular and pedestrian access would be maintained during the construction period. This would address issues such as temporary road closures and provision of alternative access, and staging of permanent road closures. A community consultation plan would be prepared and implemented during the design and construction of the proposed NDE. The community would be kept fully informed about upcoming road construction activities and temporary and permanent road closures, through advertisements in the local media and by prominently placed advisory notices.	17.5; 17.4

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		The contractor or the RTA would establish a project phone number that residents could utilise to register concerns, complaints or other comments about the construction of the proposed NDE. Negotiations with owners of properties required for acquisition would be undertaken in accordance with the Land Acquisition (Just Terms Compensation) Act 1991 and the RTA Land Acquisition Policy Statement. Access to all properties not wholly acquired would be maintained during the construction period. A Public Awareness Program would be developed for streets affected by access changes, to ensure residents are aware of new access arrangements to properties, particularly in relation to emergency services access. Traffic calming measures would be implemented on Campbell Street, Gray Street and Park Road, as recommended by the Traffic Report, to minimise the effects of increased traffic volumes on these streets. Signage would be provided within the study area and/or along the proposed NDE to encourage shoppers to visit Woonona and Bulli business districts.	
Bulli Shopping Centre	Pre-construction	WCC would prepare a planning study to identify scope for changes to Bulli local centre, including a possible Development Control Plan	17.5
Energy	All Stages	The EIS Proposal would be designed to ensure that optimum traffic flow is achieved, and vehicle emissions from stops and starts are reduced (RTA Environment Strategic Plan 1999–2004). All materials required during construction and operation would be selected to minimise energy use where feasible. Alternative fuel sources would be used wherever economically and technically feasible (eg. Biodiesel) The consumption of natural resources would be reduced by implementing measures contained in the RTA Environment Strategic Plan 1999–2004. Materials for road construction and maintenance would be reused and recycled where possible.	19.3

Table 21.3: Summary of Mitigation Measures (continued)

Potential Impact	Timing	Mitigation Measure/Safeguard	Cross Reference in EIS Text
		Energy efficiency requirements would be incorporated into the contract for road construction and maintenance (RNI Strategic Plan 1999–2004).	
		The project would include provision for public transport and cycling (RNI Strategic Plan 1999–2004).	
EMPs and Contract Documents	Pre-construction	The CEMP would be consistent with RTA QA Specification G 36 (Clause 4)	21.1
		RTA QA Specification G 36 would include, as a minimum, a requirement that the Contractor and any sub-contractors make a commitment to purchase and use products with recycled content where they are cost- and performance-competitive with the non-recycled product which would be followed by the Contractor and any sub-contractors.	
		The RTA and contractor would prepare an input register which would identify all raw materials used in the project for later analysis as to possible alternative sources.	15.1
		Contractors must be able to demonstrate that materials they have used are recycled or are from a non-virgin source, where these present a feasible and cost-effective option.	
Risk Management	All Stages	Review the Risk Management Plan during the design and construction of the proposal.	18.3

22. Ecologically Sustainable Development

This Section provides an assessment of the EIS Proposal and its potential environmental, social, economic and land use effects in terms of the principles of Ecologically Sustainable Development (ESD) as specified in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

These ESD principles identified have been an integral part of the development of the concept design and the environmental mitigation measures for the EIS Proposal. As the land subject to the EIS Proposal has been reserved over a number of years, this has ensured that inappropriate developments have not established along the proposed route as well as minimised property acquisition. This has also ensured that environmental impacts would be minimised.

It should also be noted that the "do nothing" option would have significant longer term adverse environmental impacts on the local community.

Each of the four key ESD principles are discussed below.

22.1 The Precautionary Principle

- *The precautionary principle*: if there are threats of serious or irreversible harm to the environment, then a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

The precautionary principle has been applied throughout the project planning phase and environmental assessment process. The RTA intends to adhere to all of the statutory planning and environmental approval processes which have been designed with this key principle in mind. Adherence to these processes would ensure that this principle is met.

Potential threats to the environment that could arise from the proposed NDE's construction include temporary soil erosion and sedimentation, increased runoff and increase in paved surfaces. However, the EIS Proposal envisages a number of initiatives that would alleviate any threat to the environment. Examples include: soil and water mitigation measures to be introduced during construction; use of OSD basins; new landscaping incorporating increased vegetation cover; sensitive earthworks with no slopes steeper than 2 horizontal:1 vertical; adequate sound attenuation; and sound principles of water quality management that minimise adverse water quality effects on existing creek systems.

The big cut near Campbell/Russell streets would minimise environmental damage by having higher retaining walls against the road pavement to reduce the overall cut through the ridge. This would minimise tree removal required on the ridge, thereby reducing visual impact in this area.

In locations where urban stormwater from the roadworks re-enters the creek systems, water would be cleaned and filtered through on site detention ponds and wetland filters prior to release back into existing systems.

Earthworks required for the EIS Proposal would be largely sourced from material excavated on-site. The selection of other **construction materials** needed for the project would take into account proximity to the EIS Proposal site and potential environmental risk during material haulage. Extensive recycling of materials and minimising the haulage distance between materials sources and the works is expected to minimise the risk to, and impact on the environment.

An assessment of the potential socio-economic and land use impacts of the EIS Proposal has been undertaken. Mitigation measures would be implemented to minimise any potential adverse effects on residents and businesses.

Flooding studies have concluded that the hydraulic structures included in the EIS Proposals would not have any adverse impact on 1 in 100 year flood events.

Traffic studies undertaken indicate a positive environmental impact of the EIS Proposal by better traffic flows.

There are no threats of serious or irreversible environmental damage through climate change.

The evaluation of route options and the assessment of the preferred route option have concentrated on avoiding serious or irreversible damage to the environment. The use of energy in relation to this EIS Proposal also does not pose a threat of serious or irreversible damage.

The generation of waste in relation to this EIS Proposal does not pose a threat of serious or irreversible damage, as there would be very little waste generated. Waste that would be generated would be managed in accordance with the Resource Management Hierarchy and as identified in the sections above there are many opportunities to reuse and recycle anticipated wastes.

The purchase of raw materials for the EIS Proposal does not pose a threat of serious or irreversible damage. Purchasing recycled products and making it a contractual arrangement that products purchased have recycled content would assist in reducing the impact of the EIS Proposal in relation to this ESD principle. Waste that would be generated would be managed in accordance with the resource management hierarchy of the WARR Act.

22.2 Intergenerational Equity

- *Intergenerational equity:* the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

In terms of inter-generational equity the EIS Proposal would benefit the community by ensuring that all environmental and planning requirements are met. Due to the EIS Proposal being situated in an existing reservation, the direct impact on residents and therefore social impacts have been minimised with the result that housing and industry would be retained for future generations.

In terms of **landscape design** the EIS Proposal would improve the quality of life by providing increased areas of indigenous vegetation that would provide improved environmental and ecological qualities for the community.

In relation to **traffic noise**, the mitigation by mounding and sound walls would provide more noise attenuation for future generations than the existing population has now.

Quantitative assessment indicates that there may be a net long term improvement to **water quality** downstream of the proposed NDE due to the relocation of traffic from the Princes Highway to the NDE. The former has no installed water quality controls, whilst the proposed NDE would have installed water quality controls. Therefore there should be no increased threat from the proposed NDE to the long-term viability of the existing environment and the species diversity it currently supports.

Intergenerational equity in terms of air quality would be preserved.

The EIS Proposal would benefit the community through selective use of environmentally friendly **construction materials**. Use of the RTA's purchasing power can effect changes in industry practice regarding implementation of policies to improve safety, contractual relationships, innovation and especially environmental performance.

The EIS Proposal is also consistent with long term planning strategies including the 'Construct NSW' strategy (www.epsc.nsw.gov.au/constructNSW), and the RTA's Waste Reduction and Purchasing Plan.

No long term environmental impacts are anticipated through the construction of the EIS Proposal due to the choice of construction materials and the implementation of ameliorative and mitigatory measures. Maximising the volume of fill obtained from on-site cuttings required for the EIS Proposal would reduce the need for imported fill, and minimisation of haulage distances through close proximity to works would reduce the energy requirements of the EIS Proposal.

Careful purchasing of materials for this project would help ensure that less waste is generated, and that any surplus materials could be reused and recycled.

Use of **recycled products** in the EIS Proposal would limit the waste that would otherwise have been disposed to landfill.

The EIS Proposal would address the intergenerational principle through improved amenity on local roads and the Princes Highway, as well as providing improved travel times, improved vehicle efficiency and improved safety on the proposed NDE itself. There may be some minor adverse social, economic and land use effects on individual properties for a range of factors, however these would be mitigated against wherever possible.

The EIS Proposal would provide long term improvements in the **operation and efficiency of the road network** and would provide a quicker more efficient route to and from Wollongong. In addition it would assist in maintaining and enhancing the strategic, economic, and tourism role of Wollongong. However, the short term impacts on Bulli shopping centre could lead to longer term restrictions of availability of local services.

The EIS Proposal incorporates the principles of avoid, reuse and recycle, with disposal as a last resort. This would ensure that the EIS Proposal minimises the amount of waste disposed of to landfill, this combined with the previously listed benefits would ensure that the principles of inter-generational equity are maintained.

Projected savings in kilometres travelled and improved vehicle movement efficiency associated with the EIS Proposal would lead to significant energy savings over the project life.

It is unlikely that there would be any climatic changes induced by the proposed NDE. Therefore, there would be no threat to local biodiversity due to induced climatic changes.

22.3 Conservation of Biological Diversity and Ecological Integrity

- *Conservation of biological diversity and ecological integrity:* conservation of biological diversity and ecological integrity should be a fundamental consideration.

The EIS Proposal is located in an area where no threatened or endangered species are known to occur. The proposal would improve the existing situation and create a far richer biological/ecological resource for future generations.

There is little existing ecological integrity on the site. The only area of "indigenous" vegetation is on the Russell/Campbell Street hill. While the vegetation may not be of high ecological value, it has a high local environmental/visual value. Care would be taken to retain the maximum vegetation cover on this skyline ridge.

It is unlikely that there would be any threat to local biodiviersity resulting from climatic changes induced by the EIS Proposal.

The proposed landscape design would add value to biological and ecological diversity of the area, especially with its revegetation strategies relating to riverine, wetland and escarpment and coastal themes. The area at present is devoid of indigenous vegetation and has a high amount of exotic vegetation and noxious weeds, particularly in the vicinity of the creek and drainage systems.

The proposed landscape concept for the proposed NDE encompasses the principles of sensitive water planning, design and management. Such principles increase infiltration of stormwater back into the soil and water table, slow down velocities and purify the water before it re-enters the creek system, thereby creating a more sustainable design solution.

The scheme demonstrates leading water conservation principles and sustainable water management incorporating the following key elements:

- Incorporation of on-site detention basins and wetland ponds to intercept water, slow it down, and purify it with water detention and aquatic plants before it is discharged into the adjacent creek systems or existing urban stormwater systems;
- Low water demand landscape design. Minimal impervious surfaces and use of permeable pavements where possible to reduce stormwater runoff and promote infiltration. e.g. for small scale streets, pedestrian/cycle paths and other pedestrian paved spaces;
- Provide opportunities for sensitive water management community interpretation;
- Use of vegetated swales, (instead of pipes or concrete drains) using hardy native grass species where space permits; and
- Use of infiltration gravel trenches and distribution drains with planting to absorb excess drainage.

The scheme demonstrates integrated waste management through:

- Cleaning and filtering of stormwater before releasing it back into adjacent creek stormwater systems;
- Construction practices would adopt the practice of chipping existing trees (required for removal due to roadworks) into mulch for reuse as mulch on new planting beds; and
- Reuse and treatment (if required) of site soils and limiting importing of top soils.

It is not anticipated that there would be any adverse impact on the existing water environment due to the use of water quality controls. In particular emergency response measures and accidental spill containment devices would be installed to minimise the risk of fuel or oil entering the waterways and threatening the biological diversity of existing aquatic habitat.

The EIS Proposal is consistent with the conservation of biological diversity and ecological integrity, and potential impacts on ecology were carefully considered during the development of route selection options and the EIS Proposal's concept design. Mitigation measures incorporated into the project design, such as keeping the removal of natural vegetation to an absolute minimum, would ensure that the local biodiversity and ecological systems are maintained.

No impacts are expected in terms of social, economic or land use that would affect biological diversity or ecological integrity.

This project is an extension of an existing road and the areas of the extension are urban and include roads. Planting and landscape plans to be considered and hence are more likely to enhance the current environment.

Resource Management Hierarchy principles in the *Waste Avoidance and Resource Recovery Act 2001*, of Avoidance, Reuse, Recycling and Disposal Options would be applied to the EIS Proposal. This would reduce the pressures on biological diversity and ecological integrity.

Minimisation of waste production and focusing on the use of recycled goods reduces the amount of raw products used on the project and also the amount of waste going to landfill. This indirectly reduces the pressures on biological diversity and ecological integrity via minimisation of land consumed in landfill and land degradation as a result of natural resource depletion.

22.4 Improved Valuation and Pricing of Environmental Resources

- I*mproved valuation and pricing of environmental resources:* environmental factors should be included in the valuation of assets and services.

The cost of environmental factors have been included in financial evaluations of the EIS Proposal, but are also recognised in the overall assessment of the net benefits.

The landscape and urban design would not have any significant environmental costs. The proposed water quality measures and revegetation costs would create solutions that reduce maintenance costs, improve water and air quality.

The EIS Proposal is considered to have no significant environmental costs. The small increase in pollutant generation and associated aquatic impacts can be adequately addressed through incorporation of proposed water quality controls.

The impact on valuation of environmental resources from climatic changes induced by the EIS Proposal is considered unlikely.

Requirements imposed in terms of design and construction would be incorporated in the cost of the EIS Proposal. This includes the cost of providing appropriate measures to minimise potential adverse environmental, social, economic and land use effects.

Improved safety would be achieved by the reduction of through traffic on the Princes Highway and removing unnecessary traffic from residential streets. Improved travel times would be achieved in the northern suburbs of Wollongong. Reduced pollution is possible by traffic moving at 80 or 90 km/h instead of stop/start travel.

Purchasing alternative types of fuel and energy efficient products creates viable, long-term markets for these products. Without consumer support, markets for alternative fuels, and energy efficient products made from them, would not reach their full potential. The EIS Proposal supports the use of these products where possible. Therefore the EIS Proposal supports the principles of Improved Valuation, Pricing and Incentive Mechanisms.

Buying recycled content products creates viable, long-term markets for these products. Without consumer support, markets for recycled waste materials, and products made from them, would not reach their full potential. The EIS Proposal supports the use of recycled goods in addition to reuse of materials where possible. Therefore the EIS Proposal supports the principles of Improved Valuation, Pricing and Incentive Mechanisms.

22.5 Conclusion

It is considered that the EIS Proposal is justified on the basis of social, biophysical and economic considerations, and is broadly in accordance with the principles of ecologically sustainable development.

The EIS Proposal is considered to be more compatible with ESD principles than a "do nothing" option, and the Rixons Pass option that would involve major impacts on the escarpment.

23. Economic Analysis

This section provides an economic justification for the EIS Proposal and is based on **Working Paper 14** prepared for this EIS by Sinclair Knight Mertz.

The assessment is based on a road user cost benefit analysis (RUCBA) methodology adopted by the RTA for all major road projects. It uses a number of quantifiable costs (see below) to generate a Benefit Cost Ratio (BCR) for the project as well as other economic indicators. Information has also been drawn from **Section 7** of the EIS and **Working Paper 3** on Transport.

Non-quantifiable aspects of the EIS Proposal resulting from noise, flooding, cultural heritage and social impacts have been discussed in earlier sections of this EIS.

The economic analysis is based on a 30 year time frame, and assumes that construction would commence in 2007–08 and that the EIS Proposal would be opened for traffic use by 2010–2011.

23.1 Background

The first RUCBA for this project was undertaken for the RTA as part of the May 2000 Project Justification Report prepared by SKM. The *Project Justification Report* proposed that two options (2 and 4 lane road) be considered for the NDE.

Project development work since the *Project Justification Report* (SKM, May 2000) has determined that the four-lane option for the proposed NDE is the preferred option for planning, investigation and EIS preparation. The level of service (LoS) in 2016 at the southern end of the proposed NDE is predicted to be LoS D for the two-lane road and LoS B for the four-lane road. This means that after a few years of opening the two-lane road, it would be necessary to widen to four lanes. This is not efficient from a construction perspective, or a cost perspective as the cost difference between a two-lane and four-lane road is generally due to pavement and road furniture. It would also prolong disruption to the local community through an extended construction period.

The RUCBA of the preferred option was updated in October 2001 and again in August 2002 to incorporate the latest project costings based on revised concept design for the EIS Proposal, and latest traffic data and projections.

23.2 Travel Demand Projections

Annual Travel demand projections based on the TRACKS transport model are summarised in **Table 23.1**. The projections of annual vehicle kilometres of travel (VKT) and annual vehicle hours of travel (VHT) are less with the proposed NDE built than without the proposed NDE.

There is a slight increase in the number of vehicles delayed with the proposed NDE built than without the proposed NDE. This is because the proposed NDE requires more traffic signals in the system — the total number of stops would tend to increase with more signals despite the shift in traffic from routes with more signals to fewer signals. However, this slight increase is more than offset by the reduction in overall travel time and other network efficiencies.

Average weekday travel demand projections is shown in **Table 23.2**.

Table 23.1: Annual Travel Demand Projections

Item	Year	Without NDE	With EIS Proposal	Net Change with NDE
Total Vehicle Kilometres (VKT)	2001	2,121,503,000	2,122,692,000	+1,189,000
	2016	3,476,200,000	3,473,432,000	-2,768,000
Total Vehicle Hours of Travel (VHT)	2001	40,435,700	40,409,100	-26,600
	2016	77,679,800	77,341,100	-338,700
Total Vehicles Delayed (Number)	2001	1,480,960,000	1,484,224,000	+3,264,000
	2016	2,327,2011,000	2,328,745,000	+1,734,000

Source: SKM (Working Paper 14)

Table 23.2: Average Weekday Travel Demand Projections

Item	Year	Without NDE	With EIS Proposal	Net Change with NDE
Total Vehicle Kilometres of Travel from *Project Justification Report* (a)	2001	6,527,422	6,527,422	0
	2016	10,741,628	10,732,914	+8,714
Revised Total Vehicle Kilometres of Travel (b)	2001	6,332,844	6,336,395	+3,551
	2016	10,376,715		+8,260
Percentage Change from *Project Justification Report* (a)	2001	-3.0%	-2.9%	-0.1%
	2016	-3.4%	-3.4%	0
Total Vehicle Minutes of Travel from *Project Justification Report* (a)	2001	7,409,542	7,409,542	0
	2016	13,021,362	12,984,774	-36,588
Revised Total Vehicle Minutes of Travel (c.)	2001	7,242,221	7,237,447	-4,774
	2016	13,912,808	13,852,135	-60,673
Percentage Change from *Project Justification Report*	2001	-2.3%	-2.3%	0
	2016	6.8%	6.7%	-0.1%

Source: SKM (Working Paper 14)

Notes:

From *Project Justification Report* Table 5.6

Calculated from Table 1.1 using an annualisation factor of 335.

Calculated from Table 1.1 using an annualisation factor of 335 and converted to minutes.

23.3 RUCBA Parameters

Introduction

The RUCBA and the benefit-cost ratio (BCR) which results from it, take into account the following effects of the different options compared to the base case. All costings are expressed in 2002 dollar values. The base case is defined as the **'do nothing'** scenario — essentially the existing situation unchanged.

Project capital costs

Land acquisition is based on a net cost of approximately $19m (including additional purchase and disposal costs) and values past land acquisition at current values. Construction costs are estimated at approximately $39m including project design.

Annual road maintenance costs

These were calculated at approx $633,500pa for the base case and $707,200pa with the EIS Proposal.

Vehicle operating costs

These were calculated for cars, light trucks and heavy vehicles. Total vehicle operating costs were obtained by multiplying projected vehicle kilometres of travel for selected years by the unit vehicle operating costs derived above.

Road user travel time costs

The average cost of road user travel time per vehicle hour ($16.90 — *RTA Economic Analysis Manual*) was applied to the projected vehicle hours of travel to calculate overall travel time costs for both options.

Accident costs

Accident costs have been determined for roads in the vicinity of the EIS Proposal by use of data on the number and type of crashes on these roads over the 5 Year Crash Summary from 1/10/95 to 30/9/00.

Emission costs

The environmental impacts of changes in noise, air pollution and greenhouse emissions (GHG) are valued, to an extent, in monetary terms in this evaluation. Unit costs for these pollutants are available from a number of studies. These costs essentially represent the health costs associated with emissions. **Table 23.3** shows the unit values per kilometre of pollution avoidance.

Table 23.3: Environmental Parameters Values (cents per km)

Parameter	Car	Heavy Vehicle
Air Pollution	1.10	19.20
Greenhouse Emissions	2.20	5.90
Noise	0.50	3.30
Total	**3.80**	**28.40**

Source: SKM (Working Paper 14)

The above unit values are then applied to the vehicle kilometres of travel under each of the options, using a heavy vehicle proportion of 8%. The resultant pollution costs for each of the options is shown in **Table 23.4**.

Table 23.4: Pollution Costs ($m)

Year	Without NDE ($m)	With EIS Proposal ($m)
2010/11	$174.5	$174.4
2015/16	$200.5	$200.3
2025/26	$231.5	$231.3
2039/40	$283.1	$282.9

Source: SKM (Working Paper 14)

23.4 RUCBA Findings

Introduction

The EIS Proposal was compared to the **'do nothing'** base case, using a discounted cash flow technique on the basis of a real discount rate of 7% and alternative discount rates of 4% and 10% in accordance with NSW Treasury guidelines. The evaluation period allowed for 30 years from the assumed first year of opening (2010–11). All values are expressed in 2002 prices. The discount year was taken as the present financial year 2002–03.

The detailed cost and benefit schedules on which the results in the following sections are based are given in **Appendix A** of **Working Paper 14**.

Results

Table **23.5** summarises the results at the 7% discount rate and the alternative discount rates of 4% and 10% for the EIS Proposal incremental to the **'do nothing'** base case.

In interpreting the results, the following criteria indicate economic justification of the NDE EIS Proposal:

- a positive NPV, ie. the present value of the project benefits exceeds the present value of the project costs;
- a BCR exceeding 1.0, ie. the ratio of the present value of the project benefits to the present value of project costs exceeds 1.0;
- an internal rate of return (IRR) exceeding the discount rate (the IRR is the discount rate that produces a NPV of zero);
- a first year rate of return (FYRR) exceeding the discount rate (the FYRR is the present value of project benefits in the first full year of operation divided by the present value of capital costs, expressed as a percentage).

The NPV/Capital Cost measure (the ratio of the NPV to the present value of capital costs) is used more for ranking different projects within a budget constraint and indicates the return per dollar invested.

Table 23.5: Results of RUCBA

	Discount Rates		
	7%	4%	10%
Present Value of Costs ($m)	$43.2	$48.9	$38.5
Present Value of Benefits ($m)	$76.7	$135.6	$46.4
Net Present Value ($m)	$33.5	$86.7	$7.9
NPV/Capital Cost	0.8	1.8	0.2
Benefit-cost Ratio	1.8	2.8	1.2
Internal Rate of Return	12%	12%	12%
First Year Rate of Return	9%	10%	8%

Source: SKM (Working Paper 14)

Table 23.5 shows that the EIS Proposal is economically justified when compared to the **'do nothing'** base case at the 7% discount rate. It generates a substantial positive NPV of $33.5 million and acceptable economic return ratios:

- BCR of 1.8;
- IRR of 12%; and
- FYRR of 9%.

Other quantifiable benefits include: saving in network operating costs; and network emission effects.

The table also shows that the benefits stream associated with the EIS Proposal is sensitive to the level of the discount rate. This is because the project does not start to produce benefits until eight years from the discount year. At the higher discount rate of 10%, the EIS Proposal is only marginally economically worthwhile.

Sensitivity testing was undertaken in order to test the economic robustness of the EIS Proposal. This showed that the EIS Proposal is economically robust. The economic results are relatively insensitive to the tests undertaken — for instance, the BCR never falls below 1.6.

Unquantifiable benefits in the areas of noise, cultural heritage and drainage and flooding are listed below.

Noise

The *Operation and Construction Noise Assessment and Vibration Report* assessed the noise impact associated with use of the poposed NDE, on the basis that appropriate noise mitigation measures were included in the project. It concluded that:

- At all but a few residences adjacent to the road, noise levels from the proposed NDE are expected to comply with the base nose criteria recommended by the NSW Government *Environmental Criteria for Road Traffic Noise* (ECRTN);

- At the two affected schools, noise levels from the proposed NDE are expected to comply with the base noise criteria in the ECRTN for classrooms, playgrounds and sporting fields;
- Noise levels near the route of the proposed NDE would generally reduce after the opening of the NDE; and
- Some other roads will experience noise level changes due to a future traffic growth as well as to the introduction of the proposed NDE:
- A noticeable decrease in noise level will result on the Princes Highway between Bellambi Lane and the proposed intersection with the NDE near Molloy street;
- North of the proposed intersection with the NDE near Molloy Street, there will be an increase in noise level;
- A possible noticeable increase in noise level in Campbell Street and Gray Street (on the western side of the proposed NDE), as a result of traffic entering the proposed NDE along these streets.

Cultural Heritage

The report on Cultural Heritage Study assessed the potential impact of the proposed NDE on the indigenous and non-indigenous cultural heritage values and items. It concluded that the proposed NDE would:

- Not affect any known indigenous archaeological remains and is unlikely to affect any potential archaeological deposits;
- Be unlikely to affect non-indigenous archaeological remains;
- Directly affect the Farrell Street housing groups which is judged to be of high local significance, particularly in regard to community value;
- Indirectly impact on houses of historical date located on the western side of York, Mitchell and Thompson Streets; and
- Have no significant natural heritage impacts.

Drainage and Flooding

The report on *Drainage & Flooding Study* assessed the impact of the proposed NDE on flooding conditions in the vicinity. In determining design flood flows and flood levels, it considered upstream catchments extending to the escarpment and downstream controls to the ocean, the impacts of future catchment conditions and Council's On-Site Detention (OSD) policy.

The report concluded that, with mitigation measures in place, existing flooding conditions and downstream catchment water quality will not be worsened. These measures will include:

- Appropriately sized OSD facilities;
- Appropriately located sags and crests along the alignment, in conjunction with appropriately sized hydraulic structures; and
- Trash racks/gross pollutant traps and fuel, oil and grease separators.

23.5 Conclusions

The main RUCBA shows that the EIS Proposal is economically justified when compared to the **'do nothing'** base case at the 7% discount rate. It generates a substantial positive NPV of $33.5 million and acceptable economic return ratios — a BCR of 1.8, an IRR of 12% and a FYRR of 9%.

The investment of $58 million in the EIS Proposal is economically justified when compared to the base case at the 7% discount rate over an evaluation period of 30 years from the assumed first year of opening (2010/11).

In summary, the results of both the main RUCBA and the sensitivity testing indicate that the EIS Proposal is an economically worthwhile investment. The results are robust and the absolute levels of economic return can be accepted with confidence at this stage of project development.

24. Project Justification and Conclusions

The EIS Proposal for the Northern Distributor Extension would result in construction of a new four lane divided carriageway controlled access road for about 3kms connecting the Northern Distributor at Bellambi Lane in the south to the Princes Highway at Molloy Street in Bulli at the northern end.

The road would contain four new intersections (including two grade separated intersections) and would generally follow the alignment of the road reservation that has been in place since the mid 1940's.

The project has reached its current status of concept design as a result of substantial studies and community consultation undertaken by the RTA over recent years. A number of changes in the design concept ultimately adopted for the EIS Proposal have occurred as a direct consequence of this community involvement in the planning stage of the project.

There is strong support from the local community for construction of the EIS Proposal, although a small percentage of residents have expressed concern about the need for the road and about specific design elements.

There is widespread community support for future extension of the Northern Distributor beyond Molloy Street to connect with Bulli Pass, but this is outside the scope of the current EIS.

24.1 Justification

The environmental assessment carried out for this EIS has concluded that the EIS Proposal is justified for the following reasons:

- The EIS Proposal is consistent with the Government's strategic planning and environmental management policies relevant to the area. It is also consistent with the Local Environmental Plan administered by Wollongong Council;
- The new road would divert through traffic from the Princes Highway and local street network, and would improve the efficiency of the main transport network in this part of the Wollongong metropolitan area;
- The financial evaluation shows that the EIS Proposal has a positive benefit to cost ratio;
- Hydraulic structures in the EIS Proposal are consistent with WCC guidelines and would not have any adverse impact on flood regimes up to the 1 in 100 year storm event;
- Sound attenuation measures incorporated into the EIS Proposal would significantly reduce existing noise levels experienced by residents along the current de facto alignment of the proposed NDE;
- All existing east-west movement by vehicle, bicycle and foot in the local community would be maintained and/or replaced, and would generally be enhanced in safety terms on completion of the proposed NDE;
- The EIS Proposal would require minor adjustments to local bus routes but would not have any significant or lasting impact. Commuter bus services would be able to use the proposed NDE for faster access to and from the study area;

- The EIS Proposal contains provisions for on-road bicycle lanes consistent with the existing Northern Distributor;
- There is no endangered or threatened flora or fauna along the route of the proposed NDE that would be adversely affected by construction or operation of the new road;
- Three heritage properties located in Farrell Road (west) and listed in the LEP 1990 would require demolition to accommodate the route adopted by the EIS Proposal.
- There is no adverse impact on Indigenous Heritage values in the study area;
- Most of the land required for construction of the proposed NDE has been progressively acquired by the RTA over many years. Purchase of the relatively few remaining properties would commence after approval of the EIS;
- The visual impact of the project on completion would be noticeable but is not regarded as having an adverse impact. Landscaping along the route is part of the concept design included in the EIS Proposal. The road alignment would be visible from public vantage points along the escarpment but would not be prominent;
- The amenity of Woonona shopping centre would be substantially improved as a result of the diversion of through traffic from the Princes Highway onto the new NDE. Projected traffic increases on the Princes Highway north of Molloy Street post opening of the proposed NDE would have adverse impact on the amenity of Bulli shopping centre, and would require increased restrictions on kerbside parking in this area;
- Construction of the proposed NDE would generate short term employment opportunities that could be readily sourced from the local area;
- The EIS Proposal responds to the majority of community needs expressed through the consultation process.

24.2 Sustainable Development

The EIS Proposal for the proposed NDE is based on **ecologically sustainable design principles** as listed below:

- use of sensitive water planning and design through use of vegetated swales, infiltration trenches, distribution drains directed to planted areas, retention ponds, detention ponds and permeable pavements.
- use of recycled materials such as mulch created from site materials, topsoil from the site, recycled materials in the pavement, and possible recycled materials in gateway designs and wall detailing;
- use of renewable and sustainable materials and resources;
- re-use road cuttings for the fill along the route;
- retention of existing vegetation wherever possible;
- promotion of biodiversity through use of native plant materials in the landscape plan for the EIS Proposal;
- provision of on-road cycle ways, and provision for express commuter bus services;
- minimal use of traffic lights;
- extensive noise attenuation; and
- an improved road network that will result in improved vehicle operation and fuel efficiency.

24.3 Environmental Assessment

The EIS Proposal is assessed as providing a substantial net social, economic and environmental benefit to the general locality and is in accordance with the basic needs and objectives of the project:

- The NDE would provide a safer and more efficient level of service for commuting traffic between the northern suburbs of Wollongong and southern areas;
- For the local community, the proposed NDE would provide the opportunity to improve the Woonona shopping centre as an important part of the local community;
- The NDE would substantially reduce overall traffic volume and noise pollution on the existing Princes Highway between Molloy Street and Bellambi Lane;
- There would be a distinct improvement in safety and reduced traffic levels on many local roads currently affected by through traffic;
- The NDE would maintain and improve safer pedestrian and vehicle connections between the eastern and the western side of the corridor, as well as providing improved access to local schools and bus services;
- Noise abatement measures along the proposed NDE corridor would lead to a reduction in current noise levels on most local roads in the vicinity of this corridor;
- Access to the Northern Distributor would be improved for local residents;
- Traffic signals at the northern end of the proposed NDE would facilitate use of the Distributor by through traffic, thus reducing traffic on local roads;
- The EIS Proposal would also allow cyclists to travel along the proposed NDE in kerbside cycle lanes for the full length of the route, as well as along a safer local road network; and
- Creation of employment opportunities in the local area during the construction period.

View of the project area from escarpment.

Appendix A: Department of PlanningNSW Requirements for EIS

Department of
Urban Affairs and Planning

Development and Infrastructure
Assessment
Level 22, 1 Farrer Place
GPO Box 3927
Sydney NSW 2000

Telephone: 02 9391 2095
Facsimile: 02 9391 2151
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christopher.munro@duap.nsw.gov.au

Mr Kali Gupta
Project Development Manager
Southern Regional Office
Roads and Traffic Authority
PO Box 477
Wollongong NSW 2500

Dear Mr.Gupta,

Environmental Impact Statement – Proposed Northern Distributor Extension From Bellambi Lane to Princes Highway, Bulli - Our reference: W98/00127 Pt1

Thank you for your letter dated 21 August 2001 seeking consultation with the Director-General for the preparation of an Environmental Impact Statement (EIS) for the above activity. The Department notes that Director General Requirements were sent to the RTA for the above proposal on 25 March 1999.

You have indicated that the proposal would be permissible without consent. This would make the proposal subject to Division 4 Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Statutory requirements for the form and content of the EIS applies together with requirements for public exhibition and seeking approval are outlined in Attachment No. 1.

Attachment No. 1 outlines the statutory matters that must be included in any EIS under clauses, 229 and 230 of *Environmental Planning and Assessment Regulation 2000* (the *Regulation*), assuming that Division 4 of Part 5 applies. Under clause 231 of the *Regulation*, the Director-General requires the EIS to address the issues listed below. You should note however, that clause 231(e) of the *Regulation* requires you to re-consult the Director-General in relation to the preparation of the EIS if the EIS is not exhibited within two years of the date of this letter.

Specific Issues

- Justification of the proposal in terms of its compliance with broad planning principles and goals in *DUAP's Shaping Our Cities* (in particular efficiency, equity, environmental quality and liveability), the EPA's *Action For Air* and the DoT's *Action For Transport 2010.*
- Implications of relevant state and local environmental planning instruments, planning policies and guidelines including the Wollongong Local Environment Plan 2000, Illawarra Regional Environmental Plan No.1, 1986
- Address issues raised in critical environment studies prepared for the DUAPs *Draft Illawarra Escarpment Study,* including key issues raised in the Commission of Inquiry into the Illawarra Escarpment.

- A detailed assessment of all viable alternatives to the preferred proposal including the 'do nothing' alternatives.
- An assessment of interchange options, including on/off ramp alternatives.
- Flooding issues and mitigation measures.
- An assessment of the heritage significance of the site and any impacts the development may have upon this significance. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.
- Non-Indigenous heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), trees or places of non-Indigenous heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies to conserve their heritage significant should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment must be undertaken by a qualified archaeologist with historic sites experience. The NSW Heritage Office can provide a list of suitable consultants.
- A soil survey for acid sulfate soils and consideration of the impact of the proposal on these soils.
- An assessment of any impacts on open space, parks, or nature reserves and proposed safeguards.
- An assessment of the visual impacts of the proposal, improved landscaping and other mitigation measures.
- A detailed assessment of noise and vibration impacts both during construction and operation with reference to the NSW EPA's 'Environmental Criteria for Road Traffic Noise' and Environmental Noise Control Manual', including any proposed mitigative measures such as mounding, glazing, insulation, noise walls etc.
- Operational noise, vibration and regenerated noise issues including particularly sensitive locations such as schools,
- Assessment of air quality impacts both during construction and operation.
- Traffic and Transport impacts during construction and operation including:
  i. truck movements during construction and impacts on local roads;
  ii. traffic capacity of the proposal and the ability to cater for predicted growth.
- Erosion and sedimentation control including the design and location of sedimentation basins.
- A detailed analysis of the impacts on any watercourses and protection of water quality in the surrounding area. Particularly mitigation measures for potential pollution/degradation of waterways and tributaries. Also assessment of potential impacts on aquatic ecology in surrounding waterways.
- Spoil management/reuse during construction. Spoil disposal including feasible disposal locations, potential for encountering contaminated spoil, truck volumes (day and night and peak) and routes to be used.
- A description of the energy to be used during construction and the greenhouse gas implications.
- Cumulative impacts of the proposal with any existing or proposed Princes Highway upgrades.
- Impact on net energy consumption. Relationship to greenhouse gas emissions with or without the proposal.
- Impacts on existing utilities and services and requirements for any major disruptions.
- Impacts on pedestrian and bicycle traffic and means of providing safe movements
- Impacts on existing and potential future development

The Department's EIS Guideline 'Roads and Related Facilities' should also be consulted in the preparation of the EIS. The Guideline is available for purchase from the Department's Information Centre, 1 Farrer Place, Sydney or by calling (02) 9391 2222.

Your attention is drawn to the possible need to prepare a Species Impact Statement (SIS) in accordance with the Threatened Species Conservation Act 1995. To determine whether an SIS is required you will need to take into account the eight factors described in section 5A of the EP&A Act (the "8 part test") This

"test" assesses whether there is likely to be a significant effect on threatened species, populations, or ecological communities or their habitats. A specific study area (land defined as the area likely to be directly and indirectly affected by the proposal) should be defined for the flora and fauna assessment. The flora and fauna assessment should therefore involve the following steps:

1. Carrying out baseline surveys to ascertain the presence or likely presence of flora and fauna species including threatened species;
2. Consulting relevant data bases to identify threatened species likely to occur in the study area and checking new listings by the Scientific Committee;
3. Targeting species that may occur on site as identified from the databases and known habitat requirements;
4. Carrying out an "8 part test" (Section 5A of the EP&A Act) for any threatened species, or their habitat, found by surveys (or known from the site which, due to survey limitations, were not detected); and
5. Providing a brief explanation (one to two paragraphs) of why the threatened species known or recorded in the area, and not addressed in the "8 part test", were excluded from the "8 part test". (This should give consideration to the habitat requirements of the species concerned and the ability of adjacent sites to provide these features.).

The Department notes the advice and recommendations offered by various agencies in reference to the original Director General Requirements dated 25 March 1999. This information should be reviewed and updated. If any licences and/or approvals are identified you must conduct your own consultation with the relevant agencies to identify their requirements for the preparation of the EIS.

The EIS should also address other issues that emerge from consultations with relevant local, State and Commonwealth government authorities, service providers and community groups including, but not limited to the following:

- NSW Environment Protection Authority;
- NSW Department of Land and Water Conservation;
- NSW National Parks and Wildlife Service;
- NSW Fisheries;
- Rail Infrastructure Corporation;
- Department of Transport;
- Wollongong Shire Council; and
- Southern Catchment Management Board.

Under the Commonwealth *Environment Protection Biodiversity Conservation Act (EPBC Act) 1999*, approval of the Commonwealth Minister for the Environment is required for actions that may have a significant impact on matters of National Environmental Significance, except in circumstances which are set out in the *EPBC Act*. Approval from the Commonwealth is in addition to any approvals under NSW legislation. If you need approval under the Commonwealth Act, your EIS will be expected to assess the impacts on these matters.

Please contact Chris Munro on (02) 9391 2190 if you require any further information regarding the Director-General's requirements for the EIS.

Yours sincerely

19/10/01

Mark Hather
Team Leader Transport and Telecommunications
Development and Infrastructure Assessment
As Delegate for the Director-General

Note: Matters of National Environmental Significance under the EPBC Act are:

i) World Heritage properties
ii) RAMSAR wetlands
iii) threatened species or ecological communities listed in the EPBC Act
iv) migratory species listed in the EPBC Act
v) the environment in a Commonwealth marine area
vi) nuclear actions

DEPARTMENT OF URBAN AFFAIRS AND PLANNING

Attachment No. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION AND EXHIBITION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 5 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

In accordance with the *Environmental Planning and Assessment Act 1979* (the Act), an environmental impact statement (EIS) must meet the following requirements.

Content of EIS

Pursuant to Schedule 2 and clause 230 of the *Environmental Planning and Assessment Regulation 2000* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including the consequences of not carrying out the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity, and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and
   (c) the likely impact on the environment of the development or activity, and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment and
   (e) a list of any approvals that must be obtained under any other Act or law before the development or activity may lawfully be carried out.
5. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
6. (1)The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:

   (a) the **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

   In the application of the precautionary principle, public and private decisions should be guided by:

   (i) careful evaluation to avoid, wherever possible, serious or irreversible damage to the environment, and
   (ii) an assessment of the risk-weighted consequences of various options,

   (b) **inter-generational** equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations,

   (c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

   (d) **improved valuation pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as:

   (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
   (ii) the users of goods and services should pay prices based on the

full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Note

The matters to be included in item (4)(c) might include such of the following as are relevant to the development or activity:

(a) the likelihood of soil contamination arising from the development or activity;
(b) the impact of the development or activity on flora and fauna;
(c) the likelihood of air, noise or water pollution arising from the development or activity;
(d) the impact of the development or activity on the health of people in the neighbourhood of the development or activity;
(e) any hazards arising from the development or activity;
(f) the impact of the development or activity on traffic in the neighbourhood of the development or activity;
(g) the effect of the development or activity on local climate;
(h) the social and economic impact of the development or activity;
(i) the visual impact of the development or activity on the scenic quality of land in the neighbourhood of the development or activity;
(j) the effect of the development or activity on soil erosion and the silting up of rivers or lakes;
(k) the effect of the development or activity on the cultural and heritage significance of the land.

An environmental impact statement referred to in Section 112(1) of the Act shall be accompanied by the information specified in clause 229 of the Regulation.

The EIS must also take into account any matters required by the Director-General of Urban Affairs and Planning pursuant to clause 231 of the Regulation, which may be included in the attached letter. A copy of the Director-General's requirements should be included as an appendix to the EIS.

Attention is also drawn to clause 283 of the Regulation regarding false or misleading statements in EISs.

Nominated Determining Authority

Where there are a number of determining authorities (as defined under Part 5 of the Act), Section 110A of the Act provides for the Minister to make one of them the nominated determining authority. This avoids duplication of certain procedures and simplifies the exhibition of the EIS.

It is recommended that you discuss with the other determining authorities which one should become the nominated determining authority and advise the Department accordingly. Normally it is the proponent agency that becomes the nominated determining authority. The written agreements of all other determining authorities must be forwarded with the request to be made the nominated determining authority.

It should be noted that the onus is on the proponent agency to identify all other potential determining authorities.

Public Exhibition

When the EIS has been completed, four (4) copies should be forwarded to the Secretary (Attention: Director, Development and Infrastructure Assessment) pursuant to Section 112(2) of the Act, together with details of the exhibition period and public display locations.

This should occur prior to public exhibition of the EIS in order that simultaneous exhibition of the EIS occurs in the offices of the Department and determining authority as required by Section 113 of the Act and clause 235 of the Regulation.

It is requested that a copy of the text of the EIS also be supplied on a 1.44 MB floppy disk. This should be in a format readable by Microsoft Word 97® or as plain text (ASCII). Inclusion of files of supporting maps and diagrams is optional.

Procedures for public exhibition of the EIS are set down in clauses 234 and 235 of the Regulation.

Note
Should the EIS not be exhibited within 2 years from the date of issue of the Director-General's requirements, under clause 231 (e) of the Regulation the proponent is required to re-consult with the Director-General.

Representations
Any representations made in response to public exhibition of the EIS should, as soon as practicable and not less than 21 days before determining the activity, be forwarded to the Secretary in accordance with Section 113(3) of the Act.

Seeking the Minister's Approval
If Division 4 of Part 5 of the Act applies to the proposal, the proponent, pursuant to Section 115B, should seek the Minister's approval once it has obtained and exhibited an EIS, examined and considered any representations, and forwarded copies of all representations to the Department.

If a Species Impact Statement (SIS) has been prepared, the Proponent must have complied with Sections 112B and/or 112C of the Act (i.e. concurrence and/or consultation requirements) before seeking the Minister's approval.

The Department's *Best Practice Guidelines* encourage proponents when seeking approval to provide:

- a comprehensive report which addresses in detail its consideration of issues raised in representations;
- any proposed changes to the activity, and any further measures to mitigate impacts; and,
- all relevant technical information relating to the proposed activity.

New South Wales Government
Department of Urban Affairs and Planning

Ms Kali Gupta
Project Development Manager
Southern Regional Office
Roads and Traffic Authority
PO Box 477
WOLLONGONG EAST NSW 2520

Contact: Gavin Alford
Our Reference: W98/00127 Pt1
Your Reference:

Proposed Extension of Northern Distributor
From Bellambi Lane to Molloy Street, Bulli, Wollongong:

Dear Ms Gupta,

Thank you for your facsimile dated 10 February 1999 seeking consultation with Director-Generals Requirements for the preparation of an Environmental Impact Statement (EIS) for the above development.

Under clause 85 of the *Environmental Planning and Assessment Regulation 1994* (the Regulation), the EIS should specifically address the key issues outlined below.

Key Issues

- Consideration of the proposal within the context of strategic planning for the area as addressed in the Illawarra Regional Environmental Plan No.1, 1986, in particular Clause 80-89, Shaping Our Cities: The Planning Strategy for the Greater Metropolitan Region of Sydney, Newcastle, Wollongong and the Central Coast, and in Action for Air.
- Flooding issues, mitigation measures and the findings of and considerations raised in the local government investigations into the 17 August 1998 floods.
- Impacts on heritage items/ character, including visual impacts, improved landscaping and other mitigation measures.
- Interchange options.
- A soil survey for acid sulfate soils and consideration of the impact of the proposal on these soils.
- A report on threatened species, populations or ecological communities, or their habitats. Attachment 1 outlines the issues to be addressed.

Attachment No. 2 outlines the statutory matters that must be included in any EIS under clauses 83 and 84 of the Regulation.

Governor Macquarie Tower
1 Farrer Place, Sydney 2000
GPO Box 3927, Sydney 2001

Telephone: (02) 9391 2000
Facsimile: (02) 9391 2111

Attachment No. 3 contains a guide to the issues that may be relevant to the preparation of the EIS for your proposal. The Department's EIS Guideline Roads and Related Facilities' should also be consulted in the preparation of the EIS. The Guideline is available for purchase from the Department's Wollongong Office at Level 2, Block G, 84 Crown Street, Wollongong, NSW 2500 or by telephoning (02) 4226 8120.

You should consult with Wollongong City Council and take into account any comments Council may have in the preparation of the EIS. The EIS should also address other issues that emerge from consultations with relevant local, State and Commonwealth government authorities, service providers and community groups.

The EPA has requested that a number of issues be addressed in the EIS. These issues are outlined at Attachment 4. The EPA has noted that the proponent would be required to submitted an application for a Pollution Control Approval (PCA) for this project as required by Section 17(K) of the *Pollution Control Act* (1970), Section 19 of the *Clean Waters Act* (1970), and Section 27 of the *Noise Control Act* (1975). In addition, the EPA highlight, for your information, the requirements of the forthcoming Environment Operations Act, where highway constructions consisting of (1) physically separated carriageways for traffic moving in different directions; (2) at least four lanes (other than lanes used for entry or exit); and (3) no access for traffic between interchanges, for at least one kilometre of their length in the Metropolitan area, will require licensing.

Please contact Gavin Alford on (02) 9391 2293 if you require any further information regarding the Director-General's requirements for the EIS.

Yours sincerely,

25/3/99

Geoff Noonan
Director
Development and Infrastructure Assessment
As Delegate for the Director-General

Appendix B: Study Team for Northern Distributor Extension EIS

Team Member	Subject
RTA Southern Client Services Office	Project Management
RTA Operations Southern Technical Services	Road Design
RTA Property Section	Land Acquisition
RTA Operation and Environmental Technology	Miscellaneous Studies
Purdon Associates	EIS Preparation and Community Consultation
Forbes Rigby and Gabites Porter	Traffic, Transport & Water Quality
Connell Wagner	Drainage & Flooding, Hazards & Risk Assessment
Infranet Pty Ltd and Kiah Environmental Designers	Urban & Landscape Design
Wilkinson Murray	Noise Assessment
Holmes Air Services	Air Quality
Lesryk	Flora & Fauna
Egis	Socio-economic and Land Use studies
Rod Howard and DIG International	Heritage
Coffey Geosciences	Topography, Geology and Soils
Sinclair Knight Mertz	Road User Cost Benefit Analysis

Wollongong: Northern Extension Environmental Impact Statement
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