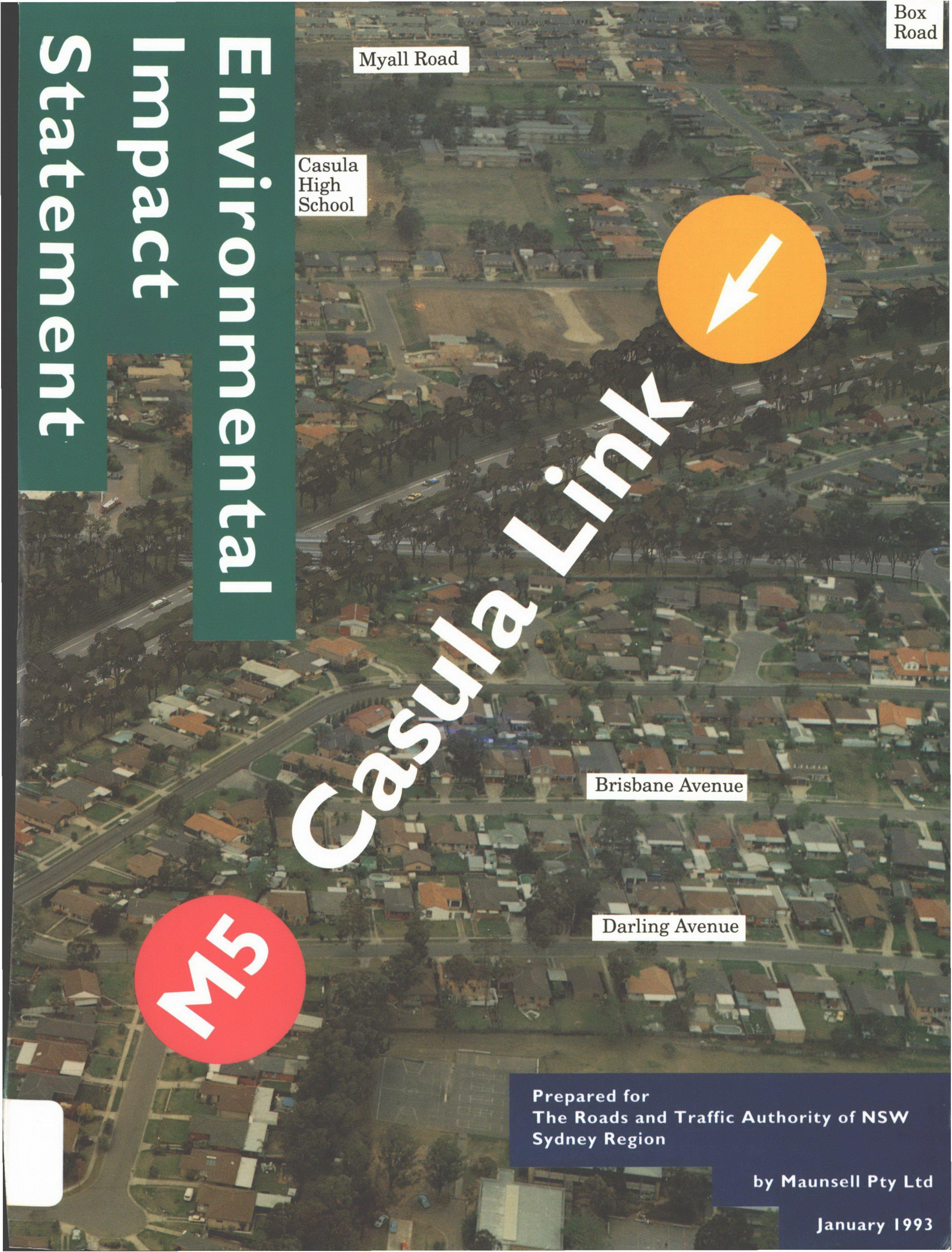

Environmental Impact Statement

Casula Link

Prepared for
The Roads and Traffic Authority of NSW
Sydney Region

by Maunsell Pty Ltd

January 1993

KEVIN BURKE
633-0819

M5 CASULA LINK

ENVIRONMENTAL IMPACT STATEMENT

CLAUSE 59 CERTIFICATE

This is to certify that the Environmental Impact Statement set out herein has been prepared in accordance with Clauses 57 and 58 of the Environmental Planning and Assessment Regulations 1980.

Georgina Legoe

GEORGINA LEGOE
Project Manager
Maunsell Pty Ltd

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    ‡ *Vol A Existing Traffic Conditions*
    ‡ *Vol B Transport and Traffic Analysis and Economic Analysis*

Within this document the following terms are used with the meanings indicated:

Alignment

A geometric layout, in plan and profile, following a general route option.

Arterial Road

A roadway with the primary purpose of carrying medium to long-distance traffic, usually with at-grade intersections and access to adjoining property may be allowed.

Assignment

The process whereby estimated travel demand is allocated to definite routes (existing or planned) based on factors known to influence route selection, the primary factors being travel time and cost.

Base-Year

1992, the year for which the study traffic model was calibrated.

Batter

The excavated or constructed face of an embankment, cutting or a dam wall, produced as a result of earthmoving operations involving cutting and filling. In describing batter grade, 1:3 or 1 in 3 means a fall (or rise) of 1 vertical metre in a horizontal distance of 3 metres.

Batter Toe Drain

A drain used at the base of a fill to direct run-off from a drop-down drain into a drainage line or sediment basin. It can be the extension of a catch drain which is carrying run-off into a drainage line or sediment trap.

Black Spot Intersection

An intersection ranked on total accident numbers in 1990 and 1991 in the worst 100 in New South Wales.

BOD (biochemical oxygen demand)

The quantity of oxygen utilised in the biochemical oxidation of organic matter in a sample of waters or of wastes.

Calibration

The adjustment of the traffic model to ensure that it adequately reflects the existing pattern of travel. Similarly for hydrologic models to ensure that they reflect the existing catchment behaviour.

Capacity

The maximum number of vehicles which can travel along a road in a given time.

Catch Drain

A diversion channel constructed above a road or batter to intercept surface water and divert it to a stable water disposal area or channel.

Chainage

The length of a road (in metres) from the designated start to a particular point, used to identify locations. For this proposal, chainages start from Sydney CBD.

Corridor

The area to be investigated in the Environmental Impact Statement as defined in Section 1.3.

Culvert

One or more adjacent pipe or box conduits for conveying run-off under a roadway or other structure.

Cut Batter

An exposed sloping surface left by excavation during earthmoving operations.

Demand Management

Measures to influence behaviour associated with travel demand so as to optimise the use of transport facilities.

Design Year

2011, the year for which planning data and travel patterns are forecast, so that alternative transportation strategies for the future can be consistently compared for a common demand set.

Discount Rate

The parameter used to transform costs and benefits arising in different years to their present values to acknowledge the time value of money.

Effects

The potential results, both positive and negative, of a particular option.

Endangered Fauna

"Endangered fauna" are those listed in Schedule 12 to the National Parks and Wildlife Act 1974 (NPW Act, 1974). See also "Protected Fauna".

Expressway

A high-speed, high-capacity roadway with access limited to interchanges and with no at-grade intersections.

F5

Naming Convention:

The Roads and Traffic Authority has recently introduced its Metroad system designations for the metropolitan motorway system. The Casula Link proposal examined in the EIS would form part of the M5 route. Earlier documents and public discussions have referred to the route as "F5".

To allow easy distinction in this document between the two existing sections of this route they are designated by different names when either is discussed:

South Western Motorway
The east-west route from Beverly Hills to the Hume Highway, Casula.

South Western Freeway
The route south from Camden Valley Way, Prestons (the southbound carriageway of which commences at Campbelltown Road).

Fill Batter

An exposed sloping surface created during earthmoving operations by deposition of fill.

Gabion

A rectangular basket made from steel wire mesh which is filled with quarried stone or river shingle. Gabions may be assembled into may types of structures such as revetments, retaining walls, channel liners and drop structures.

Grade Separation

Separation of intersecting roadways by provision of a bridge or underpass.

Home-Based Trips

Any trip which begins or ends at the trip-maker's own home.

Hydrocarbons

Compounds containing hydrogen and carbon which are principally derived from petroleum products.

Impacts

See "Effects".

Journey Time

The total time (including stopped time) taken for a journey between two specified points.

LA_{eq}, L_{10}, L_{90} (See "Traffic Noise Terms")

Limited Access Roadway

A roadway for which entry and exit is restricted to selected locations.

M5

Naming Convention:

The Roads and Traffic Authority has recently introduced its Metroad system designations for the metropolitan motorway system. The Casula Link proposal examined in the EIS would form part of the M5 route. Earlier documents and public discussions have referred to the route as "F5".

To allow easy distinction in this document between the two existing sections of this route they are designated by different names when either is discussed:

South Western Motorway
The east-west route from Beverly Hills to the Hume Highway, Casula.

South Western Freeway
The route south from Camden Valley Way, Prestons (the southbound carriageway of which commences at Campbelltown Road).

Modal Split

The proportions of the total number of trips using different modes of travel eg. 60% public transport, 30% private car, 5% cycle, 5% walk.

Morning Peak Period

The period in the morning during which a maximum traffic flow occurs. In this report it is usually the 2 hour period between 7.00am and 9.00am. It is normally the case that a reciprocal flow of similar magnitude occurs in a comparable evening peak period.

Motorway

A high speed, high capacity roadway with access limited to interchanges

and with no at-grade intersections. The roadway may be operated with or without a toll applied.

Net Present Value

The difference between the present value of benefits for an assumed period and the present value of costs over the same period calculated using an appropriate discount rate.

New Jersey Barrier

A concrete structure, usually 0.8 m high, designed to deflect vehicles back onto the road without their overturning.

NFR - Non Filtrable Residues

Fine particulate matter or dissolved solids which cannot be removed by filtration or sedimentation alone.

Opening Year

The year adopted for analysis purposes when the project is assumed to come into operation.

Participation Rate

The proportion of the labour force (population 15 years and older) that is employed, or is actively seeking employment.

Present Value

The equivalent present-day value of a time stream of costs or benefits.

Protected Fauna

"Protected fauna" as defined by the NPW Act are "fauna of a species not named in Schedule 11" to the National Parks and Wildlife Act. Schedule 11 names the following non-protected fauna:

- *Carnivora*: Bears, lions, dogs, other than Pinnipedia etc
- *Insectivora*: Moles, hedgehogs.
- *Artiodactyla*: Cloven hoofed animals.
- *Perissodactyla*: Horses, donkeys, etc.
- *Primates*: Apes, monkeys.
- *Subungulates*: Elephants.
- *Lepus europaeus*: Hare.
- *Oryctolagus cuniculus*: Rabbit.
- . *Scirius palmarum:* Indian Palm Squirrel.

All other "fauna" is "protected fauna". "Fauna" is defined to mean "any mammal, bird, reptile or protected amphibian". The term does not include the dingo nor insects.

Rat Run

Local street excessively used by through traffic avoiding congested through routes.

Road User Benefits

The aggregate saving, in time or monetary terms, to vehicle operators and occupants which results from a network alteration.

Road User Costs

The cost to operators of vehicle use; considered to comprise operating costs (fuel, oil, tyres, maintenance and depreciation) and attributed road accident costs.

Reduced Level

Surveying and engineering term for the height of a point relative to a datum, usually sea level.

Reservation

Area of land reserved under the Planning Scheme for development as a transportation facility.

Run-off

That portion of precipitation not immediately absorbed into the soil and which thus becomes surface flow. Run-off is the major agent of water erosion particularly on tilled soils. The amount of run-off depends on rainfall intensity and duration, land slope, surface roughness, vegetative cover and surface soil conditions including moisture content.

Sensitive receptors

Locations of a built, public or biophysical nature which would be most affected by accidents involving dangerous goods carriers.

Sediment

Material of varying particle size, both mineral and organic, that is being, or has been, moved from its site of origin by the action of wind, water or gravity, and comes to rest on the earth's surface either above or below sea level.

Sedimentation

Deposition of sediment. The typical use of the term would infer deposition by water. In a soil conservation context, sedimentation is an end point in the erosion process, with transported soil material being deposited in locations such as in a channel, along a fence line, on an area of low slope, or in a gully, creek, river, sediment trap or dam.

Sediment Trap

A structure or a vegetative barrier designed to trap sediment in run-off before it enters stormwater pipes, channels or streams. It is usually designed to control run-off from only small catchments.

Solatium

Compensation to a person for non-financial disadvantage resulting from the necessity of the person to relocate his or her principal place of residence as a result of the acquisition.

Strategic Alternative

A generic scheme which may provide a response to the transport needs of the corridor.

(The) Study

The set of activities undertaken by the consultants towards the preparation of this EIS.

Study Area

The area of data collection, within which the proposal was evaluated for effects on the "corridor". Further described in Section 1.3 and illustrated in Figure 1.

Traffic Calming

The means by which local streets are kept relatively free of through traffic, by the implementation of traffic management devices and/or by private vehicle demand management.

Traffic Management

The use of traffic regulations and traffic devices to control road users in order to regulate use of the existing road system.

Traffic Model

A mathematical procedure which expresses the relationship between the distribution of land use and other planning variables and the amount of travel produced, in such a way that travel patterns can be estimated.

Traffic Noise Terms

Due to its nature, traffic noise varies from instant to instant. Statistical terms have evolved to describe its level using a single number value:

dB

This is the abbreviation used for decibel which is the measure of the sound pressure level.

dB(A)

The (A) denotes that the sound pressure level has been weighted so that the scale approximates the response of the human ear. The ear is less sensitive to high and low frequency sounds than it is to sound in the mid-range. Most community noise is measured in "A" weighted decibels.

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$)

The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval (T), has the same mean-square sound pressure as a sound under consideration whose level varies with time.

L_{10} Sound pressure level exceeded 10% of the time.

L_{90} Sound pressure level exceeded 90% of the time.

Environmental Goals

These are levels set for traffic noise such that the road authority should be reasonably able to achieve them with current technology at a cost which is affordable. The term Design Goal may ultimately be used in this context whereas an "environmental goal" will be a future desired state.

Trip, Journey

A one-way movement from one place to another for a particular purpose.

Trip Matrix

A tabulation of movements where elements are the number of vehicles

per unit time wishing to travel between each origin and end-destination pair.

Turbidity

The cloudy condition caused by suspended solids in a liquid. In a soil conservation context, the term refers to the cloudy condition of run-off and ponded water in which sediment is suspended.

Unemployment Rate

The percentage of the labour force (population 15 years and older) that is not employed.

Viaduct

Roadway elevated above the ground on a bridge.

AADT
Average Annual Daily Traffic

AAQS
Ambient Air Quality Standard

ABS
Australian Bureau of Statistics

ACVEN
Advisory Committee on Vehicle Emissions and Noise

AHD
Australian Height Datum

AUSTROADS
Association of Australian State, Territory and Federal Road and Traffic Authorities

AS
Australian Standard

BTCE
Bureau of Transport and Communications Economics

CALM
Conservation and Land Management Department, NSW

CBD
Central Business District

CCPS
County of Cumberland Planning Scheme

CSIRO
Commonwealth Scientific and Industrial Research Organisation

DMR
Department of Main Roads (NSW)

DoP
Department of Planning (NSW)

DoT
Department of Transport (NSW)

DORT
Double opposed Right Turn

EIS
Environmental Impact Statement

EPA
Environment Protection Authority (NSW) (formerly SPCC)

EPAC
Economic Planning Advisory Council

EP & A Act, 1979
Environmental Planning and Assessment (Regulations Act) (1980)

ESD
Ecologically Sustainable Development

FIS
Fauna Impact Statement

GDP
Gross Domestic Product

GLALC
Gandangara Local Aboriginal Land Council

IDO
Interim Development Order

KSA
Kingsford Smith Airport

LATM
Local Area Traffic Management

LEP
Local Environment Plan

LGA
Local Government Area

MAQS
Metropolitan Air Quality Study

MoT
Ministry of Transport (NSW)

NAASRA
National Association of Australian State Road Authority

NERDDC
National Energy Research, Development and Demonstration Council

NH & MRC
National Health and Medical Research Council

NPWS
National Parks and Wildlife Service (NSW)

NRMA
National Roads and Motorists' Association

PM_{10}
Suspended particulate matter of diameter less than 10μm

PPG
Populations Projections Group (NSW)

REP
Regional Environmental Plan

RL
Reduced Level

RTA
Roads and Traffic Authority (NSW)

SATS
Sydney Area Transportation Study

SPA
State Planning Authority (NSW)

SPCC
State Pollution Control Commission (NSW) (now the EPA)

SRA
State Rail Authority (NSW)

STA
State Transit Authority (NSW)

STSG
State Transport Study Group (NSW)

TLALC
Tharawal Local Aboriginal Land Council

TSI
Torres Strait Islander

UDP
Urban Development Program

USEPA
United States Environmental Protection Agency

VFT
Very Fast Train

WHO
World Health Organisation

HOW TO MAKE A PUBLIC SUBMISSION

The Environmental Impact Statement (EIS) has been prepared by a study team led by Maunsell Pty Ltd for the NSW Roads and Traffic Authority in relation to a proposal, of which the RTA is the proponent to develop a motorway link between the M5 Motorway at Heathcote Road and the M5 Motorway south of Campbelltown Road.

The EIS will be placed on public exhibition for a six week period to enable comment on the proposed motorway.

Submissions from members of the public, government agencies and interest groups are invited in response to the exhibition of the EIS. The submissions will be reviewed by the Roads and Traffic Authority which will then prepare an assessment report with recommendations on whether the project should proceed as proposed, with modifications, or not proceed. The Chief Executive of the Roads and Traffic Authority then makes his Determination after examination and consideration of the EIS, public submissions received in respect of the EIS, the assessment report and any other relevant matters.

WHY WRITE A SUBMISSION?

A submission is a way to provide input to the environmental impact assessment process for the proposal. The EIS is part of this process. The EIS is a public statement of what a proponent intends to do and the likely environmental implications of that proposal.

Submissions on an EIS can therefore provide information, comment or suggestions relevant to the consideration of these environmental issues by the determining authority.

WHAT SHOULD YOU INCLUDE IN A SUBMISSION?

A submission can provide information, comment and suggestions. It is particularly useful if you can indicate:

- Your interest in the proposal;
- Your opinion of the proposal (or particular aspects of it);
- What measures you consider would be appropriate to improve the proposal;
- When you think there are any errors or omissions in the information presented in the EIS; and
- Any further factual information you have (and its source).

Your comments may also cover related facts or topics that you believe should be considered.

All submissions will be treated as public documents unless otherwise stated. Please indicate if you wish your submission to remain confidential.

WHAT SHOULD YOU KEEP IN MIND?

You will make it easier for your submission to be analysed if you:

- List points, so that the issues raised are clear;
- Refer each point to the appropriate sections in the EIS;

· Include your name, address and the date; and
· Ensure that your Submission is as legible as possible.

Submissions should be addressed to:

Project Manager
M5 Casula Link EIS
NSW Roads and Traffic Authority
83 Flushcombe Road
BLACKTOWN NSW 2148

ACKNOWLEDGMENTS

Maunsell and the study team wishes to express its thanks to the individuals, organisations and government bodies who have generously provided their assistance, and to the members of the public who greatly contributed to the debate.

All base mapping material was supplied by the NSW Department of Lands and Central Mapping Authority; UBD base maps by Universal Press.

INTRODUCTION

Background

The proposal recommended for acceptance in this EIS, with stated mitigative measures, is the construction of a motorway - between Moorebank Road, Moorebank and Campbelltown Road at Prestons linking the existing M5 Motorway to the east with the M5 South Western Motorway running south to Campbelltown. The motorway would use the existing road reservation through Casula, Lurnea and Prestons and, with the most minor exceptions, would be contained wholly within the reservation. The proposed motorway Link is shown on Figure (i).

The proposed motorway has four lanes with a breakdown lane in each direction which is also intended for cyclists' use. Buses would travel in the general traffic stream as an appropriate response to the characteristics of the public transport demand in the corridor. The existing bridge over the Georges River would be widened to allow for five lanes of traffic.

No tolls are envisaged for the motorway Link, and accordingly no toll plaza would be needed.

Ramps at Moorebank Road, Hume Highway (Casula), Camden Valley Way and Campbelltown Road would provide intermediate access points to the extended motorway system created by the Link. A new off-ramp for eastbound traffic is proposed at Heathcote Road to complete the existing interchange there.

Local access would be preserved by overpasses for vehicles and pedestrians at Kurrajong Road and, when its location can be resolved, in the vicinity of Cedar Road; these would be supplemented by a pedestrian bridge at Box Road and an underpass for pedestrians at De Meyrick Avenue.

Extensive landscape planting and general provision of noise barriers are proposed as other mitigative steps to protect the community in the vicinity of the proposal.

The proposal is described and illustrated in detail in Section 9 of the EIS. Other Sections explain the background to the proposal, possible alternatives, expected effects and ways in which these will be contained and monitored. The following paragraphs briefly outline how these matters are covered within the main body of the EIS.

A motorway running south west from inner Sydney towards Campbelltown has featured in urban planning proposals for more than 40 years. The recent opening of the M5 Motorway between Moorebank and Beverly Hills added to earlier South Western Motorway sections east and south of Casula and Campbelltown Road, leaving the section between Moorebank and Casula as the "missing link" in the planned regional route.

This EIS has been prepared to examine the issues associated with construction of a motorway to provide the absent link in accordance with relevant legislative and regulatory requirements. It describes the processes of investigation, consultation and evaluation which have been undertaken in pursuit of this aim.

The proponent is the NSW Roads and Traffic Authority (RTA).

EIS Approach

The approach taken in the studies leading to this EIS involved first testing the perceived need for transport improvements in the corridor. This was followed by an investigation of the projected improvement and other possible responses to the transport need in the light of the characteristics of the corridor determined from both physical surveys and broadly-based consultation with the community.

Evaluation of the alternatives against criterion encompassing performance, the natural and human environments and economic measures allowed the identification of the preferred alternative, which was then assessed in detail against the same range of criteria. Measures for mitigation of unwanted effects and for on-going monitoring of the successful achievement of environmental and other targets have been identified.

CONSULTATION

Community involvement in the planning of urban infrastructure projects is now an accepted social expectation.

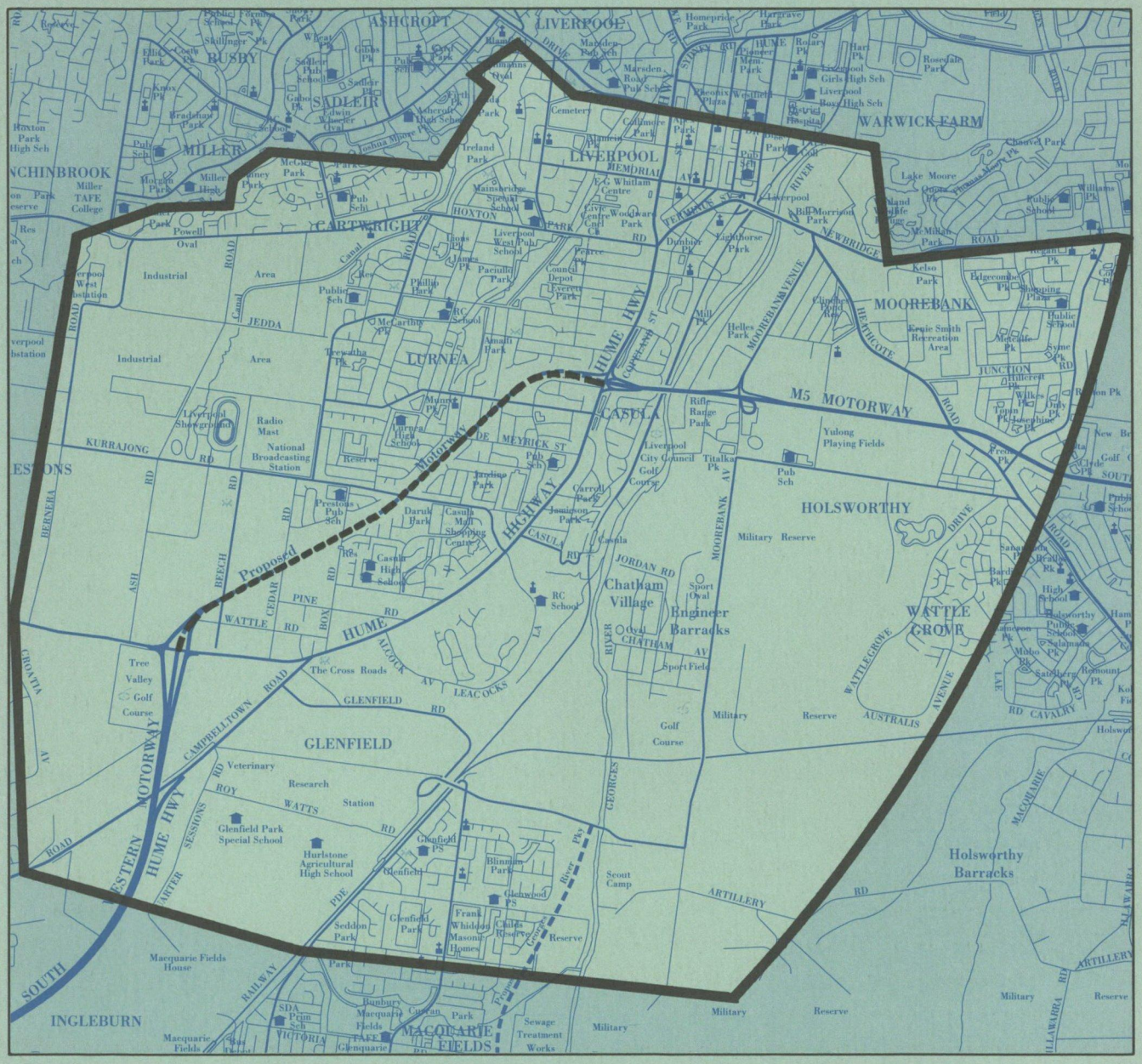

FIGURE (i)

PROPOSED M5 CASULA LINK

For the M5 Casula Link EIS, community consultation used three broad streams of involvement. They were:

- Contact with government bodies with formal responsibilities toward transport proposals.

- Invitations to organisations with a wide strategic interest in transport issues (including unions, environmental groups and service clubs) to be kept informed of EIS issues.

- Seeking out representatives from the local community, both individuals and organisations, and the formation of a study Consultative Committee.

These involvements produced formal written responses from government authorities, a wide distribution (5000 copies) of the three study newsletters and a series of Consultative Committee meetings (open to the general public). These meetings debated key issues of concern to the Committee such as traffic assessment and engineering design, social impacts, urban design and landscaping, air quality and noise and property effects.

The Committee proved to be an excellent vehicle for ensuring that local concerns and views were heard and addressed.

A feedback questionnaire in the newsletters also sought community responses to a list of traffic alternatives, the provision of on and off ramps, the matter of road closures, questions of air pollution, noise, hazard and risk and the retention of open space.

Section 4 provides more detail on the consultative process and the matters raised.

EMERGING TRENDS AND ISSUES IN METROPOLITAN SYDNEY

The potential urban development of Sydney is guided by broad land use and transport plans in the Metropolitan Strategy and the Roads 2000 documents. Sydney's rate of growth is sometimes difficult to predict because of the level of migration (and the proportion settling in Sydney), private sector developments and changing lifestyle and priorities which influence planning guidelines and introduce an element of uncertainty.

The EIS has taken a critical look at the likely development scenarios and their influence on the utility of the Casula Link. A number of the EIS evaluations were based on the year 2011, assumed to be 15 years post opening.

Issues of interest in the metropolitan context are:

- Changing work and lifestyle patterns which affect the use of private and public transport modes.

- Developments in vehicle technology with improvements to reduce fuel consumption and pollutant emissions.

- Initiatives to reduce the use of the car for work trips.

- Government initiatives to introduce alternative means of funding high-cost infrastructure projects.

- The impact of transport proposals on the urban environment and how the solutions proposed will provide a trade-off between sustainable development and economic growth.

See Section 5 for more detail.

THE STUDY AREA AND TRANSPORT LINK IN THE REGION

The six kilometre Casula Link reservation is strategically located near to major developments such as Badgerys Creek airport, South Creek urban release areas, Liverpool, Hoxton Park and Camden. It also provides opportunities for links to the M5 to the east and south; and the Prospect Arterial or Cumberland Highway for the north-south network.

Public transport in the region is a combination of bus and rail. Further integration of these two modes, improvement to services and complementary benefits accruing from a new road link are likely to become regional issues rather than corridor concerns.

Environmental issues are dominant at present in the region with continuing focus by community groups on air quality in the Western Sydney basin and traffic as a result of continued urban development and roadway construction.

THE NEED FOR A TRANSPORT LINK IN THE STUDY REGION

Section 6 addresses two questions in relation to the need for major transport improvements in the study region:

- Is the transport system satisfactorily coping with current demand for travel?

- Will the system cope with expected short to medium term demand as it exists or with minor improvements?

Section 6.2 discusses the existing transport infrastructure conditions in detail. It indicates that the size of the Sydney road system is small in relation to population and vehicle numbers when compared with other capital cities. The road system within the study area is currently carrying a high proportion of trucks, particularly between 12pm and 6am. In the section of the study area between the ends of the existing motorways few alternative routes for through traffic exist without using local streets. Travel speed within the study area is already below 35km/h in peak conditions. These speeds need to be improved considering the requirements to service the expected growth in Sydney's south west region.

The study area contains eight of the top 100 listing of accident blackspots in New South Wales.

Most intersections within the region are performing at about the upper limit of desirable operation, with three intersections on the Hume Highway at Leacocks Lane, De Meyrick Avenue and Elizabeth Drive operating in the undesirable range. The impact of projected population and traffic growth would be to force these intersections to operate well above the limits of desirable operation. If no major improvements were made to the road network then very high levels of congestion, traffic delays and queuing would be experienced well before the year 2011.

The future of the region would appear to be characterised by high rates of population growth in Campbelltown and Camden Local Government Areas, high employment growth in the corridor especially Liverpool, continuing reliance on the motor vehicle as the main means of travel including the journey to work, and reductions in the level of performance based on implied traffic growth.

Doing nothing to improve the road capacity is likely to result in peak period traffic congestion for extended periods of the day. This would lead to increased traffic on local roads as they are used to bypass the bottlenecks.

In a regional sense doing nothing would quickly offset the gains in mobility offered by the recently opened sections of the M5 motorway since this road can feed much higher volumes onto the Hume Highway than this road can handle.

These current and forecast deficiencies provide a strong case for transport improvement which can jointly address regional travel needs and the protection of local area quality.

Sections 5 and 6 provide a more detailed analysis of the need for transport improvements.

TRANSPORT ALTERNATIVES FOR THE STUDY AREA

Having established the need for improved transport arrangements, the possible alternatives to the proposed motorway were investigated. The alternatives described and evaluated in Section 8 are:

- Meeting the demand by other transport modes.

- Upgrading and improvements for existing arterial roads.

- Other motorway routes.

The alternatives were evaluated in terms of their ability to meet the broad transport needs identified. The effects of each alternative were considered on social, physical and economic criteria.

This analysis allowed the less effective, or feasible, alternatives to

be put aside. A detailed evaluation of the preferred alternative, the M5 Casula Link proposal, could then proceed with the EIS team concentrating on developing a design that responded to the mitigative and management measures. These requirements were identified by specialists in the team, and by the community presenting their interests and concerns and RTA policies in respect to major new roads (e.g. Environmental Vision policies).

Base Case

Alternative transport improvements were evaluated relative to a common "base case", to provide a fully documented baseline against which all the effects (positive and negative) of project options could be tested.

The assumed base case road network improvements in the region of the project are listed in Section 8.3.

Alternative Transport Modes

Travel demands can hypothetically be met by transport modes other than conventional road transport. The ability of alternative modes of transport to meet the needs for travel within the corridor have been examined as part of the EIS.

Although those travel needs include commuting and other forms of personal travel which can be served to varying degrees by public transport, the wide dispersal of jobs and homes in Sydney and the complex organisation of industry and commerce severely limit the capacity for substitution. Traffic using the corridor is a mixture of local, regional and interstate and no public transport system can cater adequately for all these trip-types.

The EIS has hence determined that, by itself, an increase in public transport capacity in the corridor is insufficient to cater for future travel demands.

See Section 8.2 for more detail.

Hume Highway Upgrading

An alternative examined for the EIS was the upgrading of the Hume Highway to provide for the traffic demand within the corridor. The assessment of the alternative is described in Section 8.4.

Traffic modelling of the future network shows that to provide for the demand by the end of the study period (2011) by the upgrading of the existing Hume Highway would require unacceptable social and physical disbenefits within the corridor. The Highway would need to be upgraded to provide 6 lanes in each direction. The present highway is 3 lanes in each direction so that the upgrading would require doubling the width of the existing highway. It is likely that this would involve acquiring all the properties fronting the highway on both sides. Acquisitions on this scale are a clearly unacceptable outcome so a lesser alternative was examined.

An upgrade of the Hume Highway which would provide increased capacity but minimize the impact on the community was examined. By increasing the number of lanes on the Highway to eight, and grade separating both the M5 interchange and the Crossroads intersection an improvement in operating conditions could be provided. Improvements to intersection arrangements and signal phasing would also improve the capacity of the Highway.

The intrusions of such a scheme on the human environment of the corridor would however be severe, and the transport performance would be inadequate, particularly in the medium term.

By 2011 the traffic demand will far exceed the capacity of the Hume Highway upgrade. Additional capacity would therefore be needed within the network. In effect upgrading the Hume Highway would simply delay the requirement for the Casula Link and produce additional short term social and environmental disbenefits. The alternative was therefore not pursued for adoption.

See Section 8.6 for more detail.

M5 Casula Link

The M5 Casula Link is the preferred option for transport improvement within the corridor. The M5 Casula Link provides a direct connection between the existing section of the M5 at Camden Valley Way and Hume Highway. A continuous route providing motorway conditions would thus run northwards from Campbelltown to Beverly Hills.

Section 9 describes the proposal in detail.

Figure (i) illustrates the proposal in outline.

The corridor available allows a design speed of 110 km/h which has been adopted for the design proposal.

Predicted traffic volumes indicate the need for a minimum of two traffic lanes in each direction. Allowance would be made for widening to three lanes in each direction at some time beyond the 20 year forecast horizon. The widening would occur on the inside of each carriageway by reducing the median width, and would proceed only after further assessment of its merits.

The configuration of access by ramps and overpasses has received considerable attention during the study. The arrangement proposed is shown on Figure (i) and in detail in Figures 9.1.1 to 9.1.15 in Section 9.

The ultimate configuration includes a full diamond interchange at Camden Valley Way which includes all possible on and off traffic movements. Construction of some of these ramps may be delayed until traffic volumes reach levels which warrant their construction. For example, the southbound on ramp is one such ramp which may be delayed as the existing ramp at Campbelltown Road allows a similar movement. The bridge over the expressway at Camden Valley Way would also need to be widened but this may not occur until required by traffic volumes.

East facing ramps would be provided at the Hume Highway as well as a temporary northbound off ramp on the western side of the highway. The western off ramp is dependent on the Liverpool Street/Park Road interchange which is currently under consideration by the RTA. If the Park Road interchange proceeds the off ramp at the Hume Highway would not proceed.

The intersection with Moorebank Avenue would be reconstructed as an overpass with both west facing ramps and one east facing ramp. The west bound on ramp would be constructed as a loop to provide additional acceleration length for traffic joining the motorway.

No toll plaza would be incorporated into the Link.

Local traffic would be catered for by providing an overpass at Kurrajong Road and an overpass between Cedar Road and Beech Road. The second overpass would be provided in the future as part of subdivision work adjacent to the motorway.

Pedestrian crossings would be provided at Box Road (an overpass) and De Meyrick Avenue (underpass).

Cyclists would be provided for by a "bike safe" lane on the left shoulder of both carriageways.

OVERVIEW OF ENVIRONMENTAL EFFECTS

Key issues for the EIS corridor are transport, social, environmental, economic and construction effects and funding.

Transport issues

Establishment of a Functional Road Hierarchy: The Casula corridor is a primary road corridor for traffic classes from national through to local. The proposal allows the separation of high speed long-distance traffic from slower moving local traffic, and protection of the amenity of precincts from intrusive through traffic.

Travel Demand and Forecasting: Long term population and employment distribution will determine private vehicle travel demand, but commercial vehicle demands will be determined by broader factors not related to the study area such as road/rail market shares, level of economic activity.

Social Issues

The new link would have direct effects on immediate proximity to the corridor and indirect effects along the Hume Highway. Social issues arising from the construction of the new link depend upon the nature of the improvements and characteristics of the population, but they could include:

- Community severance.

- Potential reductions and increases in housing values.

- Loss of commercial exposure on the Hume Highway.

- Potential for reduction of traffic intrusion in local streets in and near the corridor.

Regionally and sub-regionally, improvements in the corridor would produce social benefits through enhanced access to employment and services, and reduced travel time.

See Section 11.1 to 11.3 for further details.

Environmental Issues

Noise: This is an emotive and controversial issue, particularly for local residents presumably living adjacent to an "open space" road reservation. A thorough and stringent assessment process of measurement and analysis of the likely noise was followed. It has demonstrated how environmental design goals will be achieved. The mitigative measures concentrate on sound barriers and they were considered as an integrated urban design and engineering solution.

See Section 11.5 for further details.

Air Quality: Smog summits and community attention on the quality of Sydney's air-shed has focused environmental assessment on regional as well as local air impact.

See Section 11.6 for further details.

Accidents: It is expected that a reduction in accidents of 1.5% would result following the construction of the Casula Link. This represents a reduction of 1 fatality and 45 injuries per year in the south west region.

Visual Landscape: An unused road reservation is perceived as open space, an oasis of green in an urban environment. A roadway dramatically changes the reservation's status, and local residents react negatively to the perceived loss even if they acknowledge the transport benefits so gained. A landscape master plan is proposed as an integral part of the proposed motorway design concept.

See Section 11.4 for further details.

Urban Design and the Roadway: An important issue in corridor developments is to use the new transport infrastructure to achieve environmental goals. Corridor improvements can include better definition and linkage of the arterial road network and screening of the new road to better define local precincts.

See Section 11.4 for further details.

Construction Effects

Disruption caused to adjacent communities during construction of a new road is always an issue of great concern. Temporary bypass measures and control of construction activities to alleviate potential air quality, noise, dust, vibration and traffic disruption effects will be part of the proponent's contract requirements.

See Section 14 for further details.

Funding Issues

While the new road is put forward as an RTA project, other funding options (such as Federal Government funds or private funds) would be investigated.

NSW in common with most communities is experiencing dramatic shifts away from sole reliance on public funds to initiate large infrastructure projects. For the Casula Link the eastern end adjoins the M5 toll road and the opportunity exists to build the link as part of the toll road extension.

MONITORING AND AUDITING

In the preparation of the EIS, the specialist consultants have collated baseline data, evaluated the proposal and, where relevant, recommended ongoing monitoring which would be required should the Casula Link be built.

Monitoring requires an ongoing commitment and maintenance of key records, both during construction and operation. A key indicator can be described as one that serves as both an indicator of impact, and which may be indicative of the effectiveness of mitigative measures.

In setting up auditing procedures the following points should be followed:

- Identify predicted impacts and key indicators.

- Collect baseline data on present

conditions before the project is implemented.

• Through monitoring, obtain data on actual conditions as they change during the implementation of the project and once it is operational.

• Compare the actual impacts with predicted impacts to identify any difference.

• Determine the cause of the difference and especially whether the difference can be used to improve future predictions and mitigative measures.

Monitoring and auditing has been proposed in the areas of transport and safety effects, community effects, human environment effects including air quality, traffic noise, landscape/ visual quality, archaeology, biophysical environment effects, economic effects and construction effects.

The key indicators to be assessed during monitoring include traffic accidents, traffic noise including heavy vehicle noise especially with regard to change to Australian Design Rules, concentration of carbon monoxide and nitrogen oxides to the air quality, plant die off or damage to the landscape, site disturbance during construction for archaeological sites, total phosphorous, total nitrogen, turbidity and efficiency of sediment control for water quality, fauna surveys to determine numbers of animals present before and after construction, comparison of construction costs with pre-construction estimates to determine economic evaluation as well as monitoring of travel times within the network.

Construction effects to be monitored include most of the above key indicators. Particular attention would be paid to noise, dust generation and dissemination caused by construction equipment and processes.

Chapter 16 provides further detail of Monitoring and Auditing.

introduction

BACKGROUND

Section 1 provides a brief description of the proposal. A short history of transport planning in metropolitan Sydney as it affects the corridor, and a description of the events leading up to this EIS are given.

THE ROLE OF AN ENVIRONMENTAL IMPACT STATEMENT IN THE DECISION-MAKING PROCESS

Section 2 is a description of the EIS process and the requirements of it are presented. The function or role of an EIS is also discussed.

RATIONALE OF THIS ENVIRONMENTAL IMPACT STATEMENT

Section 3 describes the study methodology and objectives are outlined. This section includes this guide to the document.

CONSULTATION

Section 4 outlines a presentation of the community consultation processes and feedback.

1 BACKGROUND

1.1 TRANSPORT PLANNING FOR SYDNEY

Planning that is specifically directed towards achieving a particular form and organisation of metropolitan development is a relatively new process world wide and has existed in NSW only since 1945. Post war developments had the effect of enlarging the economy, increasing the demand for urban land in the largest metropolitan centres and creating the need for land planning.

The County of Cumberland Planning Scheme (CCPS) was produced in 1951 to manage urban growth in an era of rapid change, and remained in force until the late 1960's. Conceived under the influence of post-war British planning theory, the Scheme proposed a metropolis of fixed size, confined by a Green Belt. Land beyond this was to remain predominantly rural. The Scheme showed a road and rail network for Sydney and included a road reserve between the Sydney CBD and Campbelltown which is now part of the road reservation in the study area of this EIS.

Acquisition of land within the Casula section of the reservation commenced in May 1962. The reservation was established by the then Department of Main Roads in August 1964.

Due to a lack of flexibility, in time, the County of Cumberland regime proved unable to respond adequately to societal pressures. These included continued rapid population growth, the demand for new residential areas and factors affecting land use such as increasing rates of car ownership, declining household sizes and higher workforce participation.

The Sydney Region Outline Plan (SROP) was conceived from the outset as a more flexible structure plan with a long term horizon *(NSW State Planning Authority 1967)*. The Plan constituted a strategy for managing the city's growth from about 2.7 million to 5 million over a period of 20-30 years. The Plan was conceived to act as a broad framework for subsequent, more detailed planning and land management programs. It formed the basis for setting up the ongoing Urban Development Program controlling the release of new land for urban development around Sydney and to coordinate servicing programs, particularly those for water and sewerage, roads and housing.

The Plan recognised the critical transport problems associated with metropolitan growth generally, and with the concentration of office development in the Sydney CBD. To quote from the study which laid the groundwork for the Plan:

The problem of peak traffic movements provides one of the greatest and most intractable planning problems to be solved in city development. On the one hand, public transport finds difficulty in operating without losses. People increasingly use private transport for leisure activities, and it is uneconomic to provide and maintain a large fleet of vehicles and ferries which are fully utilised only for very short periods during the day. On the other hand, the cost of providing new urban highways up to and around the city centre is extremely high because of the great land and property costs involved (NSW State Planning Authority, 1967).

Maintaining public transport use, particularly for city-bound workers, was accepted as a major planning objective and a constraining influence on urban form.

The development of a highway grid formed an integral part of the Plan. The grid of primary roads complementing the existing network was seen as offering the greatest potential for satisfying the future transport needs of the Sydney region.

In this context, the 1974 Sydney Area Transportation Study (SATS) was conducted to determine the transport needs of the Sydney region to the year 2000 and to propose a series of alternatives to meet those needs. Some of the study findings are still familiar in 1991 when discussing transport planning in the Sydney region. To illustrate, SATS found that:

- There was insufficient capacity in the existing road system to cater for any significant growth in motor vehicle traffic.

- Dispersion of employment throughout the region had created a situation where it was not possible for all persons to obtain public transport from their homes to a sufficient number of job opportunities.

- Even if extensive public transport systems were developed, they would not serve all persons and there would be a significant number of the workforce who must use private motor transport in the course of their employment.

- Movement of through traffic into residential streets was a disruptive and unnecessary interference that should be eliminated *(NSW Department of Main Roads, 1974)*.

The study's conclusions and recommendations, relevant to Sydney's south west region, may be summarised thus:

- Effective transportation planning was essential.

- A highway system was recommended for the Sydney region within identified corridors, including the M5 Casula Link.

- The stated aim of the recommended highway system, in support of SROP, was to convert the essentially radial freeway system previously planned for Sydney into a grid pattern, with freeways or motorways planned generally east-west and north-south. The major orientation of the highway system would be no longer towards the central business district but across the total region.

- Inadequate highway access was affecting the Sydney region in key areas such as the lack of east-west links in the network to serve the continued strong growth of the middle and outer western suburbs were highlighted.

Pressures of continuing growth and changes in the metropolitan economy put new strains on the process of managing and controlling physical growth of Sydney into the 1980's and gave rise to changes in the planning system.

Statutory planning processes associated with the CCPS and SROP proved to be cumbersome, and led to a high level of intervention by the State Planning Authority (SPA) in local planning. The environmental effects of physical expansion were also becoming evident, and the need to address these explicitly in the land use planning process was recognised by Government. In order to provide a more adequate framework for planning at various levels and for controlling environmentally sensitive uses, the Government of the day enacted the Environmental Planning and Assessment Act in 1979 (commonly referred to as the EP and A Act, 1979) and upgraded the SPA to a department: the Department of Environment and Planning (DEP).

The new statutory framework facilitated policy related intervention in physical planning at local and regional levels, but the plan that was being administered (SROP) remained very broad. Critical policy directions remained unresolved, leaving the potential of the statutory framework largely unrealised. The current Metropolitan Strategy for the Sydney region was produced with the intention of overcoming these problems.

In 1988 the Sydney Region Outline Plan was succeeded by the Metropolitan Strategy published as "Sydney into its Third Century". This plan, which was designed to guide development in the Sydney region to a population of 4.5 million, remains in force today and provides the basis of transportation system planning, including the major road network. The Strategy identified the developable residue of land in the Sydney basin that will remain for further growth under different scenarios, and highlights the differential effects which uncontrolled or laissez-faire planning are likely to have on the erosion of long-term resources.

The Strategy plan promotes a distributed form of development with employment, services and facilities concentrated into major activity centres throughout the region. Overall, the objective is to increase accessibility to activities, thus reducing urban sprawl. An integrated transportation system is identified as a vital part of this plan.

The Metropolitan Strategy was based upon intensive land use - transportation modelling - carried

out on behalf of the Department of Planning and The Department of Main Roads (DMR), (now RTA).

In 1985, Sydney Urban Expansion Studies (SUES) were conducted and looked into transport and land use issues arising from Sydney's urban development over the next three decades. *(NSW State Transport Study Group, 1985)*. Originally the aim of the studies was to identify transport corridors to cater for travel demands arising from future urban expansion. The scope broadened to include assessment of the adequacy of population and employment forecasts. Refinement of the data led to the development of the "concentrated" and "dispersed" population scenarios, subsequently adopted by the Metropolitan Strategy. Broadly speaking the "concentrated" scenario encouraged the consolidation of Sydney's population and the planning for commercial and retail development at identified regional centres. The "dispersed" scenario enabled development to follow a more laissez faire or market driven form of growth.

SUES found that no new freeways or corridors for fixed track transit systems would be needed over and above those already planned. However it was found that a significant number of road developments and widenings would be needed to service Sydney's future urban development.

In 1987-88 the Department of Main Road (now RTA) published "Roads 2000" which included a concept plan for Sydney's road needs to the year 2000, as its contribution to an overall urban transportation strategy and compatible with the Metropolitan Strategy (discussed below and in Section 5.2). The "Roads 2000" network remains the long term target for the RTA today and hence for the purposes of this EIS.

"Roads 2000" proposed an expanded road network to cater for the needs of a growing population numbering 4.1 million people by about 2000 *(NSW DMR, 1988)*. Three zones were identified as the basis for the recommendations of the plan, as follows:

- An established area in the east of the Sydney region with a stable population, a largely developed road network and where the high cost of new works restrained project development.

- A growing area to the west requiring infrastructure improvements.

- The future growth areas to the south-west and north-west.

"Roads 2000" projected that the bulk of traffic growth would be in the current and future growth areas and that there would be an increasing need to provide for "east-west" traffic between the growing and established areas of Sydney. "Roads 2000" aimed to achieve an expanded road network to growth centres such as the south west region, and major new freeways linking the new areas to the industry, employment and recreation facilities of established Sydney.

A key component of "Roads 2000" is an "Orbital Route" linking all major incoming highways in a bypass route around the city (see Figure 1.1). "Roads 2000" describes the M5 as especially important in linking the south west growth areas to employment and commercial centres to the north and east.

The process of continual review and refinement of land use - transport planning strategies that is evident in this overview of development since the CCPS was formulated continues today.

The RTA is currently seeking public response to its Road Transport Future Directions Study which explores the consequences of varying development scenarios and transport management strategies for metropolitan Sydney and NSW as a whole.

The Road Transport Future Directions Study is exploring the transport, environmental and cost implications of widely differing population, employment and land use scenarios for Sydney in which the city's ultimate population is constrained to 4.5 million or allowed to grow to 5.5 million. The scenarios have been selected to maximise differences rather than to define a most likely outcome, since the objective is to initiate serious public and governmental debate about planning and management directions.

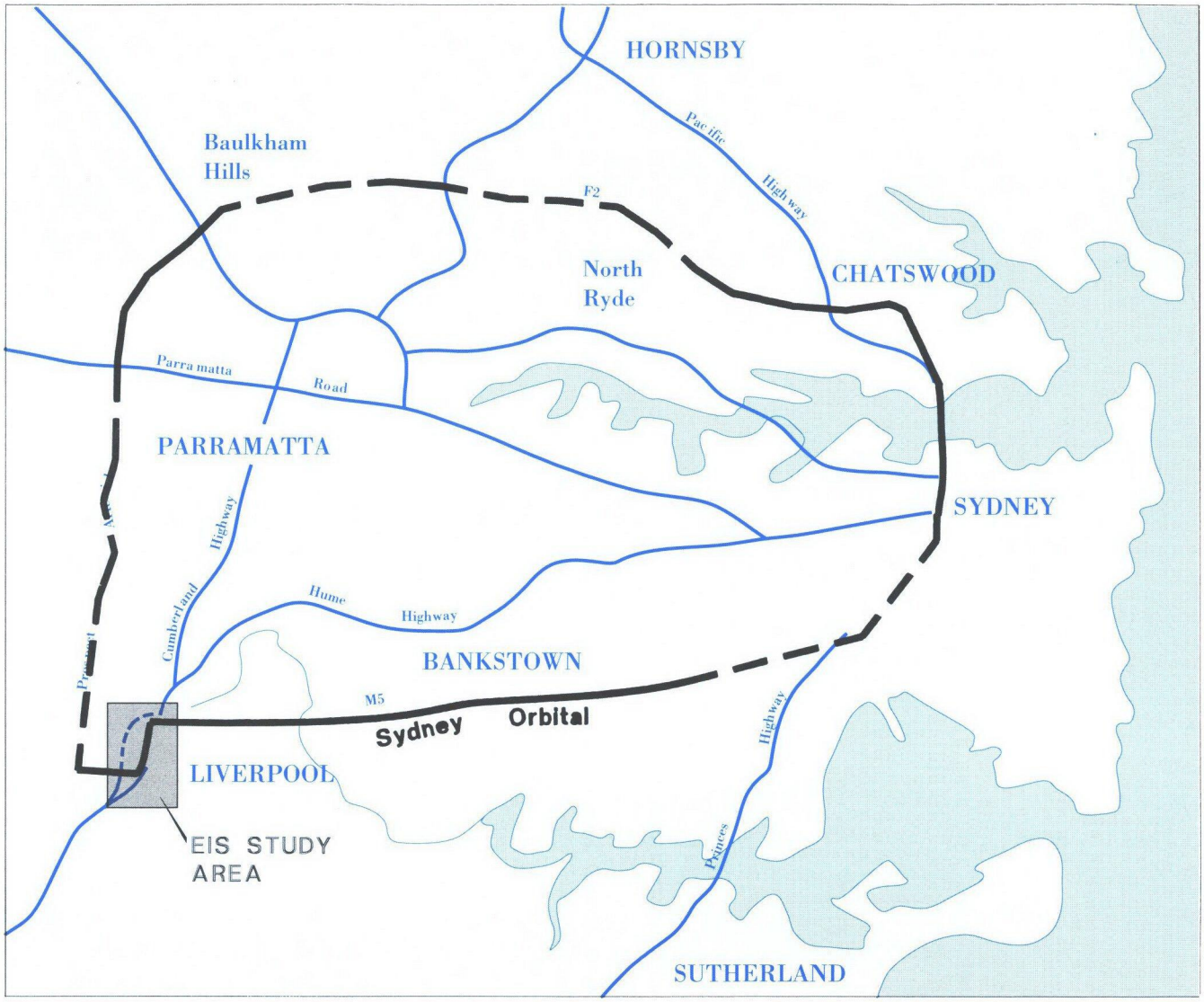

FIGURE 1.1

PROPOSED SYDNEY ORBITAL ROUTE

Source: RTA

On the land use front, the Department of Planning is currently seeking public comment on the Metropolitan Strategy as input to a regular review of the Strategy aimed at keeping it in tune with emerging trends and influences.

These reviews are necessary and will contribute to more efficient metropolitan management over time, but the ability to alter the structure of this city is limited by its complexity and the influence of private and public investment and ownership.

1.2 BACKGROUND TO THIS ENVIRONMENTAL IMPACT STATEMENT

The road reservation for the M5 Casula Link was established in August 1964 by the NSW Department of Main Roads. This reservation has been shown on the Liverpool Council Planning Scheme Ordinance since 1972.

The then F5, South-Western Freeway, now terminating at Camden Valley Way, was opened for service from Raby Road in October 1983. Subsequent to this, the South-Western Freeway link between the Hume Highway and Heathcote Road was commissioned in February 1985.

Procedures for implementing the next stage of this motorway route began in October 1985 when the DMR (now RTA) exhibited the EIS for the "F5 Freeway" (now M5 motorway) from King Georges Road to Heathcote Road.

In 1986 a determination was made to proceed with the western segment of the then F5 between Heathcote Road and Fairford Road as a dual carriageway. However, work did not proceed due to lack of funding.

In April 1989 the RTA advertised for expressions of interest to finance, construct and operate the western F5 from King Georges Road to Moorebank Avenue as a tollroad. The successful bid for this project was received from Interlink Roads Pty Ltd and construction commenced in February 1991. The project was subsequently challenged by Liverpool Council. The matter was heard in the Land and Environment Court. Justice Cripps found in favour of the RTA in December 1991.

The project approval was subject to various conditions, as described in sections 36, 37 and 38 of the Environmental Impact Assessment Report, February 1991.

Conditions of project approval were applied to the construction company, the RTA and as general matters. They included:

- *Compliance with all necessary approvals and licences particularly with regard to air, noise, water and hazardous chemicals.*

- *Erosion protection during and after construction.*

- *Planting from collected seeds of native trees and grasses in accordance with a landscape plan.*

- *Traffic volumes and delays be monitored at the intersection of the Western F5 with King Georges Road.*

- *Traffic flows on alternate routes to be monitored once the new tollway opens.*

- *Street light glare to adjoining residents be minimised and pedestrian crossings be provided at ramps and interchanges.*

- *Pavement is surfaced with open graded asphalt to reduce noise.*

- *Noise barriers are constructed to ensure that the traffic noise level of 63dB (A) will not be exceeded at adjoining residences even when considering the noise produced by the level of traffic expected in the year 2000.*

The first section of the privately funded tollway was opened in August 1992 with the complete motorway being opened in October 1992.

Traffic travelling north from Campbelltown must currently leave the freeway at Camden Valley Way and join the Hume Highway at The Crossroads. After travelling through five sets of traffic lights, traffic may then rejoin the M5 Motorway opposite Grove Street and continue to King Georges Road.

Thus the 5km of the M5-Casula Link represents a "missing link" in the

freeway/motorway network from Campbelltown to Beverly Hills.

Support for the proposed M5 Casula Link has been expressed by the M5 Taskforce. This is a group of the local Councils in the region, viz Liverpool, Campbelltown, Camden and Wollondilly.

The study brief for this EIS is given in Appendix B.

1.3 THE STUDY AREA

Figure 1.2 shows the location of the south west sector in the Sydney region, and the area nominated for this study.

The study area (Figure 1.3) was chosen to analyse in more detail the transport/traffic, social, environmental and economic issues relevant to the EIS investigations of the proposed motorway and alternatives.

The study area is bounded by the intersection of Campbelltown Road and the M5 Motorway in the south, Bernera Road, Prestons in the west, Hoxton Park Road in the north and Heathcote Road, Anzac Road and Moorebank Avenue in the east.

After consideration of the alternatives, the motorway link was retained as the proposal to be subject to detailed assessment in the EIS. The road reserve identifies the area for such assessment to be accurately undertaken by, for example, the air quality and traffic noise team members.

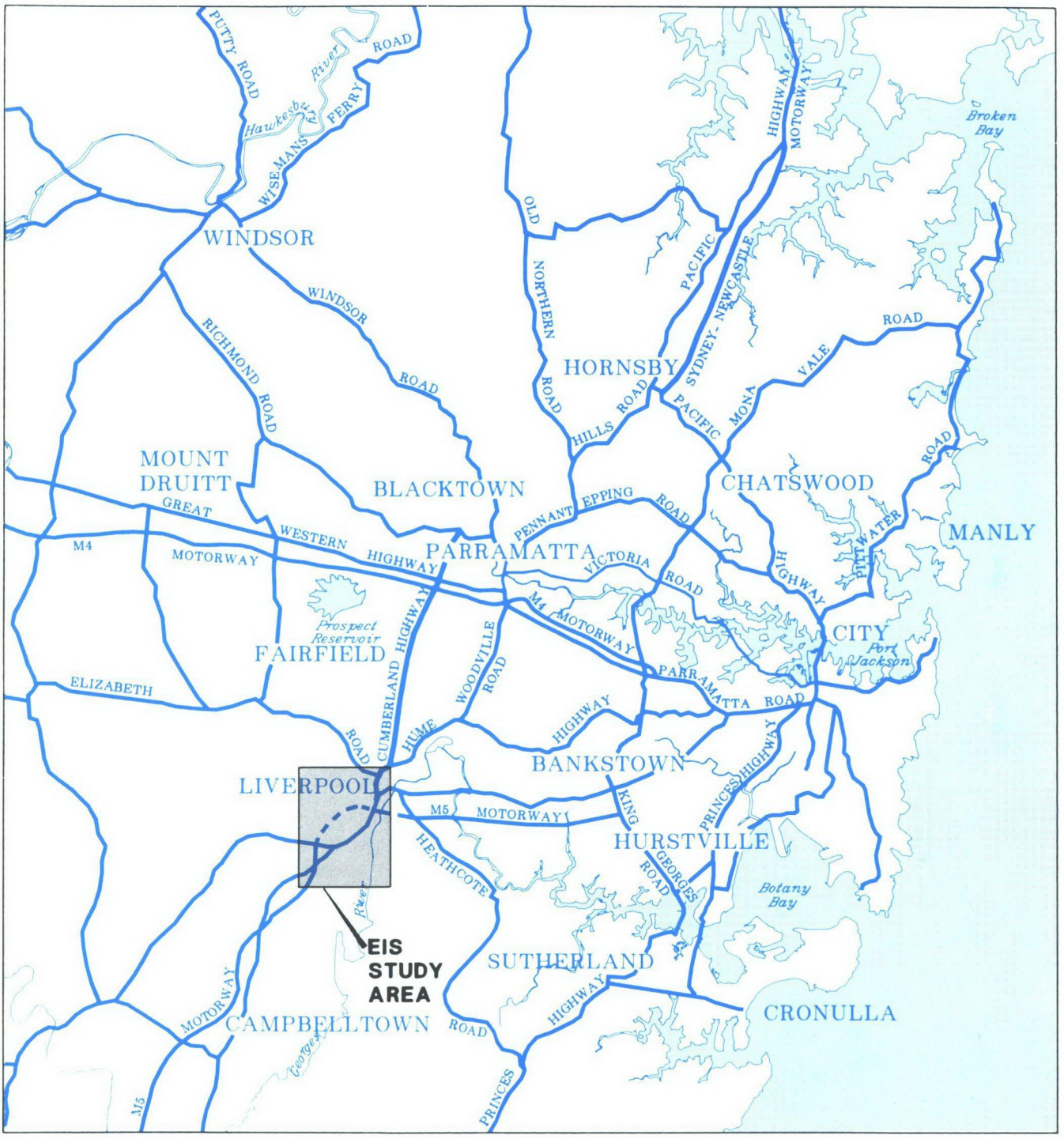

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FIGURE 1.2

THE SOUTH WEST SECTOR STUDY AREA WITHIN THE SYDNEY REGION

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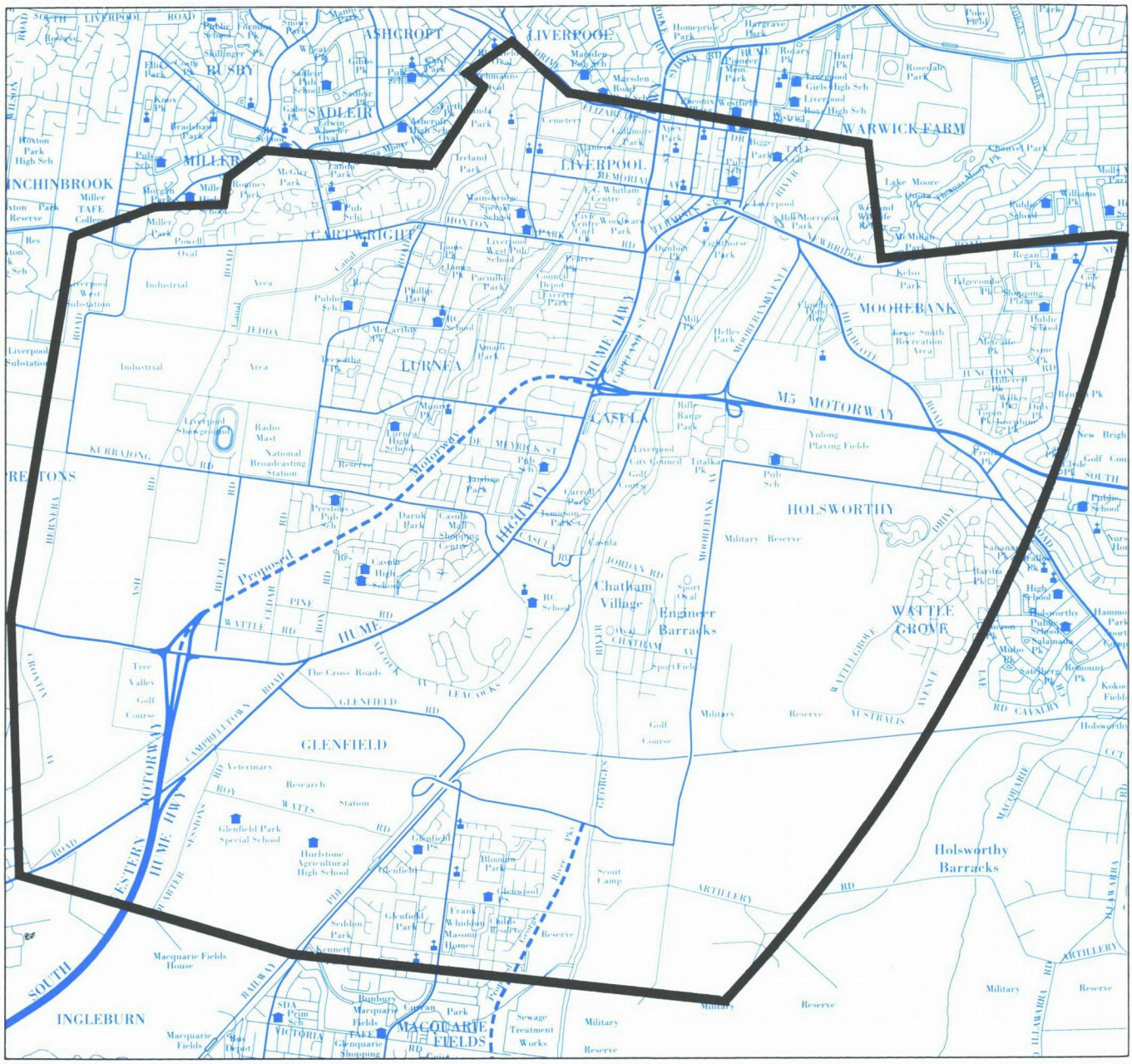


FIGURE 1.3
STUDY AREA

2

THE ROLE OF AN ENVIRONMENTAL IMPACT STATEMENT IN THE DECISION-MAKING PROCESS

2.1 STATUTORY REQUIREMENTS

This EIS has been prepared under Part V of the Environmental Planning and Assessment Act, 1979 (EP&A Act 1979).

The EIS addresses the issues raised through the community consultation programme (Section 4 and Appendix E), previous studies, and the specialist investigations undertaken by the study team (separately published as EIS Working Papers). The matters required by Part V of the EP&A Act, 1979 for inclusion in this EIS, and the relevant sections where they are addressed, are indicated in Table 2.1. The requirements of the Director of the Department of Planning are summarised in Table 2.2 and reproduced in full in Appendix A.

Amendments to the EP & A Act in March 1992 now require consideration of whether a Fauna Impact Statement (FIS) need be prepared.

The advice from the study team's fauna specialist was that a FIS was not warranted as the proposal is unlikely to significantly affect the environment of protected or endangered fauna. The background to this advice can be found in Section 12.3. On November 2, 1992, the RTA determined, in accordance with the study team's advice, that no FIS need be prepared.

Regard has also been had to the May 1992 recommendations by the National Better Health program for health impact assessments to be prepared as a separate part of the environmental impact assessment and process. Of the twenty five "issues to be addressed" recommended in the document, some ten of the key issues including particularly air quality, noise, greenhouse, water quality and infrastructure needs are covered by this EIS.

TABLE 2.1 MATTERS TO BE ADDRESSED IN THE EIS

	Matter	Section
a.	A full description of the proposed activity.	9.2
b.	A statement of the objectives of the proposed activity.	3.1
c.	A full description of the existing environment likely to be affected by the proposed activity if carried out.	11,12,13
d.	Identification and analysis of the likely environmental interactions between the proposed activity and the environment.	10,11,12,13, 14,15
e.	Analysis of the likely environmental impacts or consequences of carrying out the proposed activity (including implications for use and conservation of energy).	10,11,12,13, 14,15
f.	Justification of the proposed activity in terms of environmental, economic and social considerations.	17
g.	Measures to be taken in conjunction with the proposed activity to protect the environment and an assessment of the likely effectiveness of those measures.	11,12,13,14, 16
h.	Details of energy requirements of the proposed development and measures to be taken to conserve energy.	10.3
i.	Any feasible alternatives to the carrying out of the proposed activity and the reasons for choosing the latter.	8
j.	Consequences of not carrying out the proposed activity.	6.4

Source: Clause 57(2) of the EP & A Regulation 1980

The EIS has also been prepared in the light of the principles of ecologically sustainable development which were the subject of recent reports by the Commonwealth Ecologically Sustainable Working Groups and which are included in the objectives of the newly enacted Protection of the Environment Administration Act of NSW, 1991.

The RTA's decision as to the transport proposals to be adopted will be based on this EIS and the RTA's examination and consideration of comments on the EIS and a submission by the Department of Planning. This process of environmental impact assessment is illustrated in Figure 2.1.

TABLE 2.2 SUMMARY OF DIRECTOR OF DEPARTMENT OF PLANNING'S REQUIREMENTS

	Section
- Justification for the proposal;	17
- Identification of proposed route of motorway, including clear identification of all properties to be affected, and (if necessary) proposals for acquisition of properties;	9.2
- Impact on existing local road system, including impact on local traffic movements;	11.2
- Impact on existing residential areas, including noise, air pollution and access impacts during the construction and operational stages. Proposed mitigation measures;	11, 12, 14
- Impact on access to the Prestons industrial area;	10.1
- Impact on lands proposed for future urban release;	11.2
- Visual impact, and proposed mitigation measures;	11.4
- Construction impact, including noise, traffic movements, and measures to control erosion and runoff;	14
- Flood related issues;	12.2
- Impact on vegetation, including impacts on any Cumberland Plain remnant vegetation;	12.3
- Discussion of the community consultation process, and review of its findings;	4
- Results of consultation with: - Liverpool Council - Campbelltown Council - Environment Protection Authority - Department of Conservation and Land Management - National Parks and Wildlife Service	Appendix E2
- General compliance with clauses 57, 58 and 59 of the EP&A Act	

2.2 FUNCTIONS OF AN ENVIRONMENTAL IMPACT STATEMENT

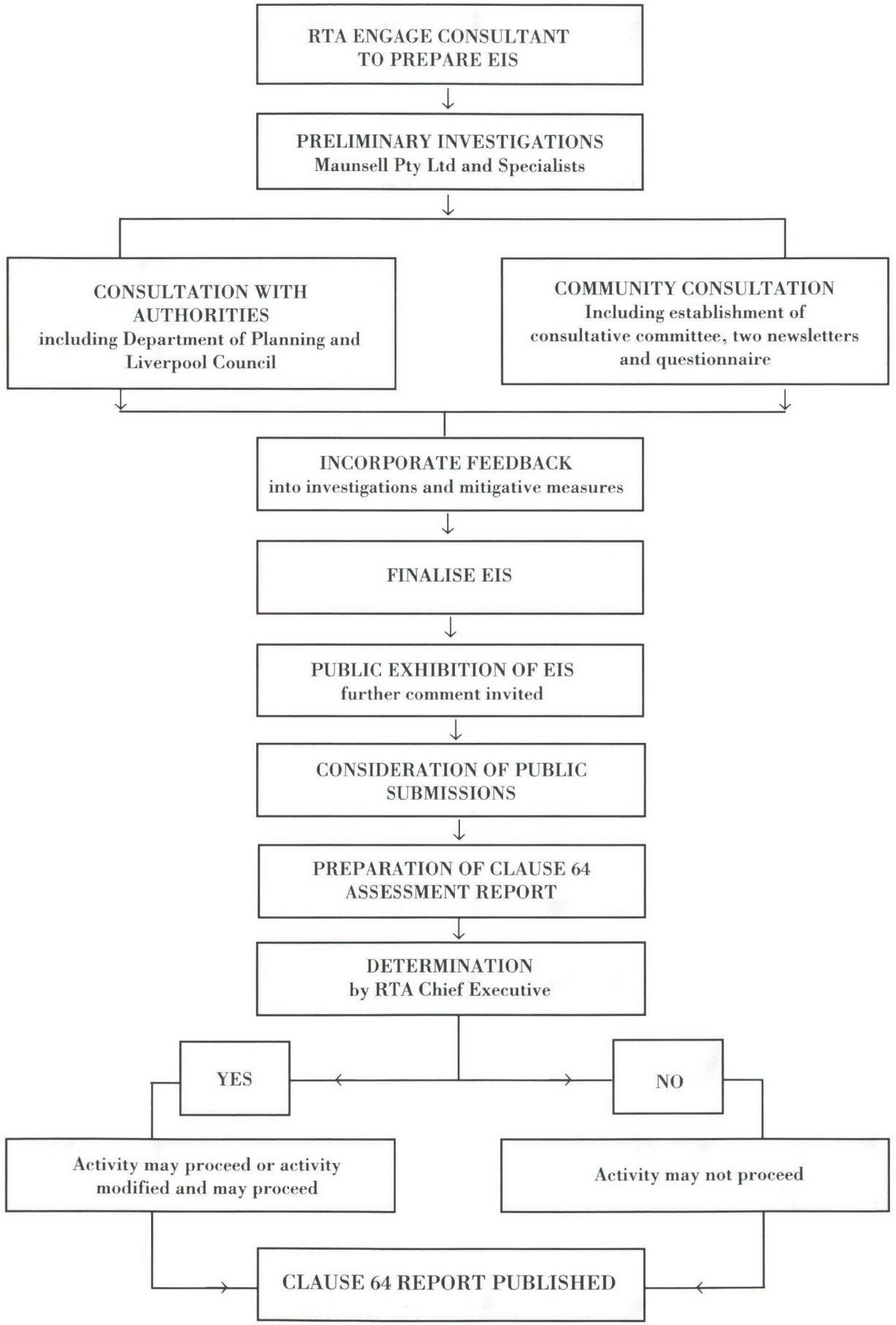
The process of exhibiting and receiving comments on an EIS is a means whereby a public authority, interest groups and the general public can communicate on the environmental consequences of a proposed activity.

This EIS has been prepared to be readable, and to be sufficiently specific to inform the lay and specialist reader of the consequences of carrying out (or not carrying out) the proposal developed and discussed in the EIS.

As well, in preparing this EIS, a broad approach has been taken with public consultation. The EP&A Act, 1979 requires public consultation only after the EIS has been completed. As described in Section 4, consultation has occurred throughout the period of EIS preparation.

Ongoing monitoring and auditing is increasingly an issue in environmental impact assessment. An aim of this EIS is to present, in Section 16, impacts or mitigative measures that could be reviewed by these processes at a later date.

FIGURE 2.1 EIS PLANNING PROCESS



THE ROLE OF AN ENVIRONMENTAL IMPACT STATEMENT IN THE DECISION MAKING PROCESS

This EIS has been prepared after a wide ranging investigation including:

- A review of contemporary transport and environmental studies, to elicit issues of importance to the south west region's transport efficiency, the social and environmental context, economic and financial constraints.

- A review of a range of Australian and overseas Environmental Impact Statements prepared for proposed transport developments. These documents were referred to in considering the process and approach to be adopted in this EIS.

- Consultation with the public.

- An investigation and evaluation of the transport proposal and testing its feasibility against broad criteria for transport, safety, the social and natural environment.

- Development of the best form of the proposal for detailed evaluation.

- Specialist studies to develop and justify the proposal, to assess its likely effects and to propose mitigative measures and outline a monitoring process on matters of:

  - Aboriginal heritage
  - Air quality
  - Community consultation
  - Economic performance
  - Engineering design
  - European heritage
  - Flora and fauna evaluation
  - Hazards and risk
  - Landscape and visual impact
  - Metropolitan strategy and planning
  - Noise assessment
  - Social impact assessment
  - Transport and traffic analysis
  - Urban design
  - Water catchment and soil management.

The EIS aims to report in a thorough and independent manner on the likely environmental effects of the proposal. In this regard, the reader should be aware of the following points:

- The EIS is constructed from the supporting Working Papers.

- Each Working Paper has been prepared by an expert in their field who was commissioned to prepare an independent report.

- The Working Papers have been prepared as stand-alone documents, for detailed reference by readers interested in the subjects dealt with in the Working Papers. Copies of the Working Papers are held by Liverpool, Campbelltown and Camden libraries for perusal by interested parties.

- Furthermore, the detailed evaluation in the EIS results from the relative assessment of all the environmental effects of the proposal.

3
RATIONALE OF THIS ENVIRONMENTAL IMPACT STATEMENT

3.1 OBJECTIVES

There is a widely held view in the community living in and near the study area that it is necessary to improve the transport network and to improve access to the south western region.

The first objective is therefore to determine whether these views are supported by objective evidence; that is, to establish the need for transport improvements.

Once the need is established, it then becomes fruitful to investigate alternative ways of responding to the need.

Options for providing better transport arrangements include:

- Improvements to the public transport system.
- Upgrading of the existing arterial road system to increase its capacity.
- A significant increase in the amount of road space through the construction of a proposed Motorway.
- Combinations of the above.

The second objective is therefore to canvass if there are feasible alternatives, to respond to the need for transport improvements.

The third objective is to evaluate the alternatives to progressively reject the less satisfactory ones and refine those remaining, culminating in the detailed evaluation of the proposal for the detailed assessment.

This evaluation is a process that considers the alternatives against a range of criteria encompassing human environment, natural environment and economic and engineering feasibility issues.

The fourth objective is to report on the outcome of these processes and to recommend an option for implementation.

Reporting also encompasses ancillary matters, including on-going community inputs and monitoring and auditing implementation, to ensure achievement of environmental, economic and other community objectives.

3.2 APPROACH

The approach to these objectives adopted by the study team for this EIS is discussed in more detail below.

Formulating need: Both present and future needs are relevant here. Present needs relate to the effectiveness with which the existing transport arrangements enable the community to achieve its diverse social and economic objectives; whether current levels of congestion are acceptable; whether they can be alleviated by transfer of demand to alternative transport modes (either existing or improved); whether demand is being suppressed and therefore opportunities lost by lack of system capacity; and so on.

Future need is a much more complex issue. One relevant issue is the predictions of where people may choose to live and where their employment opportunities will be provided. The work trip is chosen because it makes the greatest demand on our transport systems.

Understanding the corridor: This strand of the study relates firstly to the social characteristics of the corridor, to establish how people view the current transport provisions and effects, the quality of their residential environments and the ways in which they use the community facilities available in and near the corridor. This information provides a base against which new transport system alternatives may be assessed. Secondly, the study investigates the physical characteristics of the corridor, as they exist now and may be in the future, and the opportunities and constraints they present for improvements in transport provisions. An important aspect here has been the opportunities for further urban development, both residential (especially to higher densities) and job-based, and the transport demands these may generate.

Investigating alternatives: The EIS canvasses a feasible alternative for responding to an increased demand for transport in and through the corridor. The effectiveness with

which this alternative is able to meet the transport objectives for the corridor are tested against a range of social, physical and economic criteria.

Facilitating community inputs: An important strand of the study has been to involve the community's inputs in a timely and managed way so that they may influence the development of ideas and alternatives rather than merely react to a short-list of preferred options. This has created a constructive situation, enabling the study team to work directly, and in detail, with the community.

3.3 STRUCTURE OF THIS ENVIRONMENTAL IMPACT STATEMENT

Part A: Introduction

Section 1

A brief description of the proposal.

A short history of transport planning in metropolitan Sydney as it affects the corridor, and a description of the events leading up to this EIS are given.

Section 2

A description of the EIS process and the requirements of it are presented. The function or role of an EIS is discussed.

Section 3

The study methodology and objectives are outlined. This section includes this guide to the document.

Section 4

A presentation of the community consultation processes and feedback is given.

Part B: Establishing the Need for Roadway Improvements in the Corridor

Section 5

The metropolitan issues and trends pertinent to the economy, community and government (including population and employment growth and traffic demands) are considered in a national, regional and local context.

Section 6

The existing transport infrastructure in the corridor is described. This description leads onto the need for the project and the consequences of doing nothing.

Part C: Alternative Ways of Responding to the need for Transport Improvements in the Corridor

Section 7

The objectives of the M5 Casula Link are described and the study approach and method for this EIS are given.

Section 8

Investigation of the transport alternatives to respond to the transport need. The identified alternative to the proposal, the upgrading of the existing Hume Highway, is developed and evaluated.

The "Do Nothing" scenario is also examined.

Section 9

A detailed description of the proposed M5 Casula Link is given.

Part D: Assessment of Effects and Mitigative Measures

Section 10

The effects of the proposal on transport efficiency, road safety and energy consumption are examined.

Section 11

Detailed effects on the human environment and community effects such as traffic noise are examined and proposed mitigative measures are set out.

Section 12

The detailed effects on the biophysical environment of soil, water, flora and fauna are assessed and proposed mitigative measures are stated.

Section 13

An analysis of the economic effects of the project including costs, benefits and funding issues.

Section 14

Details an environmental management plan to minimise effects during the construction phase of the project.

Section 15

The impact of all factors discussed in the EIS is summarised.

Part E:
Monitoring and Auditing

Section 16

Requirements are given for future monitoring and auditing for compliance with this Environmental Impact Statement if the M5 Casula Link is constructed.

Part F:
Conclusion

Section 17

The findings and conclusions of this EIS are described.

4
CONSULTATION

This section describes both the process of community consultation undertaken in the course of this study and the issues arising from the consultation.

4.1 APPROACH

The community consultation incorporated three broad streams of activity oriented to sectors of the community with differing levels of interest in the possible transport alternatives. These included:

- Government bodies with formal responsibilities or potential responsibilities in regard to the transport proposals.

- Organisations with a wide strategic interest in transport issues.

- The local community (both individuals and organisations) whose basic interest was specific to the proposed M5 Casula Link.

This categorisation of interest groups determined the general approaches used in the consultation which were:

- Formal contact with all government bodies who might be expected to have an interest in the transport proposals. This includes, in particular, ongoing liaison with the M5 Task Force Committee comprised of representatives of the Liverpool, Campbelltown, Wollondilly and Camden Councils as well as additional liaison with officers of Liverpool Council and elected representatives.

- Letters sent to a broad range of organisations and groups (e.g. environmental groups, unions, service clubs, transport groups etc.) briefly describing the transport proposals being assessed and inviting them to be kept informed by their inclusion on a mailing list for the study newsletters. People were invited to contact the study project manager with any queries.

- The formation of a Consultative Committee whose membership includes local residents, business people and community group representatives.

These approaches are discussed in greater detail below.

4.2 IDENTIFICATION OF STAKEHOLDERS

The following stakeholders were identified who had an expressed or potential interest in the transport alternatives being investigated:

- Local residents and businesses or land holders

  - directly abutting the road reserve

  - fronting the Hume Highway

  - residents in the immediate vicinity of the road reserve on the Hume Highway.

- Local Councils.

- Community-based groups and organisations - local, regional and state-wide.

- Transport groups - regional and state-wide.

- Environmental groups - regional and state-wide.

- Unions.

4.3 CONSULTATION WITH AUTHORITIES AND REPRESENTATIVE GROUPS

Letters were sent to over 110 federal, state and local government departments and authorities and to relevant representative groups at the commencement of the EIS consultation. This letter outlined the proposal for an M5 Casula Link and provided a preliminary plan of the proposed route. The organisations were informed of the preparation of the EIS for the corridor and the approach to be taken in the production of the EIS document.

The issues raised by this correspondence are summarised in Appendix E.2.

Meetings have been held between the study team and the following government agencies:

- NSW Department of Planning.

- NSW Environment Protection Authority (EPA).

- National Parks and Wildlife Service (NPWS).

- NSW Department of Conservation and Land Management (CALM).

- Councils of the region: Liverpool, Camden, Campbelltown and Wollondilly.

Special interest groups including:

- Prospect Electricity

- Inghams Enterprises Pty Ltd

- EDAW Consultants (representing Prospect Electricity)

- Interlink Roads

- Nippon Credit Australia (mortagees of the land at the Crossroads intersection)

- M5 Taskforce Committee.

Two meetings with the joint M5 Taskforce Committee engineers and representatives from the EIS study team occurred during the EIS consultation period.

The objectives of the Taskforce are to:

i) Ease existing traffic congestion on the Hume Highway.

ii) Provide better access to the south western region.

iii) Provide an adequate road system to cope with the urban release of Prestons and the proposed South Creek development.

The Taskforce are strong supporters of an improved road network in order to reduce traffic congestion particularly at the Hume Highway.

Surveys of students have been undertaken to determine the proportions of students who walk to school across the Link reservation and the routes taken. A total of 19 schools in the region were contacted. Each school was requested to distribute questionnaires amongst its students and to comment on the issue.

It was clear from the surveys that the majority of pedestrians need to cross the Link reservation at De Meyrick Avenue, Kurrajong Road and Box Road. Between 10 and 20 students from each school regularly walk to school and need to cross the reservation.

4.4 COMMUNITY CONSULTATIVE COMMITTEE

The Community Consultative Committee was established to provide local community input into the environmental assessment process. The membership was drawn from the study area and was intended to include interested individuals as well as representatives of local organisations.

Advertisements were placed with three local newspapers calling for nomination to the Committee; and some 5000 leaflets repeating the advertisement were distributed to households and businesses in the study area. Interested parties were invited to attend an initial meeting, at which the conditions and terms of reference guiding the Committee and the EIS study were discussed. Of those attending this meeting, sixteen community members were self-selected to form the Consultative Committee. The Committee membership included interested individuals, members of local parents and citizen associations, transport, resident and environmental action groups and local business people. Subsequently, three other local business people joined the Committee.

The Committee agreed to meet regularly throughout the study period to examine and consider the developing transport proposals and to inform the EIS study team of the likely local effects of the proposals. The meetings involved presentations by study team members and discussion between the study team members, Council and RTA officers and the Consultative Committee. The following issues were addressed:

- Traffic assessment and engineering design.

- Social effects

- Urban design/landscaping opportunities.

- Air quality and noise.

- Property effects.

The Consultative Committee members were provided with working documents from the study team (e.g. alternative ramping designs) for consideration.

The Committee members were also invited to participate in a tour of the (then, as yet unopened) M5 motorway so that they could see at first hand the type of motorway being proposed as the M5 Casula Link.

As well as meeting with the study team over the four month study period, the Consultative Committee also met separately to further examine and assess various proposals. In addition, Committee members liaised with others in the community to keep them informed on the study's progress and to seek feedback.

From the outset, the Committee requested that the meetings with the study team be open to any interested parties and not be restricted to Committee members alone. As a result the meetings were open to the community in general.

The result was a considerable commitment of time and effort by the Consultative Committee to a serious assessment of interim designs, study findings, possible mitigating measures etc. The Committee provided detailed written responses to the documents and presentations put before them by the study team. The Committee also stated, in a communication to the study team and the RTA that: "The majority of committee present was sympathetic to the need to move traffic through the area more effectively and wish to express the view that it was in the interest of all parties to work closely together as harmoniously as possible to achieve a satisfactory solution whilst minimising the impact on the local area, residents and businesses".

The Consultative Committee was instrumental in influencing the proposed design of the motorway Link so that adverse impacts could be identified and mitigated. The issues that the Consultative Committee identified are discussed below in Section 4.6.

4.5 ISSUES ARISING FROM THE COMMUNITY CONSULTATIVE COMMITTEE

The issues and attitudes discussed here arose from combined meetings of Maunsell, RTA and the Consultative Committee.

Consultation process: The Committee raised a number of issues relating to the consultation process itself. These included the study duration (which was felt by some to be too short); the information distribution network which, it was recommended, should utilise the local schools, the K Mart, and local radio stations; the need for, and availability of, Council staff at the Consultative Committee - study team meetings; the design of a newsletter that would distinguish it from junk mail.

EIS procedure and terms of reference: Issues included a concern that the proponent of the transport proposals (the RTA) also made the final determination as to whether or not to proceed with a proposal; the independence of the consultants on the study team; what quality assurance plan applied to the study consultants; the relationship between the proposed M5 Casula Link and the local area traffic management (LATM) study carried out by Liverpool Council, whether or not the assessment of the motorway was as a "tollway" or freeway; what funding source - State Commonwealth or private - was committed.

Severance effects - pedestrian and car: Severance appeared to be one of the major concerns of the Committee. Major concerns were expressed about the ability of school children to walk and be driven to and from school if local access was disrupted (particularly at De Meyrick Avenue and Kurrajong Road); other concerns included effects on local shopkeepers on De Meyrick Avenue, in Casula Mall, and, along the Hume Highway; the need for a pedestrian overpass at Box or Cedar Roads; the provision of access to Ingham's factory; access to and from Casula Fire Station.

Design of motorway: Questions were raised about the width of the proposed motorway and the number of lanes; the levels along the motorway; the visual impact of ramps and need to minimise ramp lengths; width and treatment of verges;

staging of the motorway (i.e. whether six lanes at outset or staged development from four lanes to six); whether building a toll plaza would be feasible.

Access on and off ramps, over and under passes and interchanges on the proposed motorway: Issues included the need for motorway access to and from the Hume Highway, in particular, on/off ramps at Campbelltown Road and Camden Valley Way; access to and from Liverpool town centre; design of interchanges and the implications for adjacent properties (e.g. the Moorebank Avenue interchange and Army, industrial and residential access); traffic changes on the Hume Highway and crossings of it; need for a north-south access road north of Camden Valley Way (Cedar Road or similar).

Flooding and drainage: Concern was expressed about flooding, particularly at Maxwells Creek; need for a retention basin and the value of associated wetland.

Open space and recreation: Issues included loss of general open space; effect on the park at the end of Jarrah Avenue; consideration of a bicycle track adjacent to the proposed motorway; preservation of bushland in Cedar Road; need for access to open space adjacent to the motorway for recreational purposes; positive responses to the "linear park" proposed by the study team to meet open space needs.

Public transportation: Concerns were raised by users and the operator about changes to bus routes; potential loss of service, particularly at Box and Cedar Roads; operational problems associated with a bus-only lane on the Hume Highway.

Noise and sound barrier design: Concerns were raised about the noise standards applied; truck noise, particularly at night; the design, scale and treatment of sound barriers (painting of barriers as carried out on existing M5 was considered effective); need for painting, landscaping and mature planting to improve visual impact of barriers; sound amelioration measures that could be utilised by individual home owners; any impacts on local schools.

Air quality: Questions were raised about the air quality standards used; how and when air measurements were carried out; regional effects on air quality; and the cumulative effects of the Casula Link and the existing M5, particularly at the toll plaza site.

Property acquisition and compensation: Concern about possible property acquisitions was raised, particularly in relation to Graham Avenue, the rear of properties on Grove Street and on the Hume Highway between Leacocks Lane and Alcock Street (if the Hume Highway were to be widened); compensation for shop-owners affected by local streets being closed; and the inability of property owners to maintain or upgrade their property while awaiting decision.

Traffic congestion and access: The Committee proved an effective source of local information about current congestion points, danger spots, preferred routes etc. and contributed to the development of the preferred design of the proposed motorway.

Conservation: Status of flora species, for example, *Acacia pubescens*, suggested to be of restricted status.

Early Construction of Landscape

Community suggestion: Areas of high visual exposure, and areas which have adequate easement space ought to be considered for early landscaping, even prior to the commencement of the main construction activities. This could ameliorate the visual impact of the construction process, and lead to a more substantive landscape development at the time the motorway is commissioned.

Monitoring and Auditing

Community concern: Community representatives are sceptical of the landscape proposals, based on their observations of the existing landscape on the recently commissioned M5. The concerns include small size of plant specimens, the apparent absence of 'bushland' growth from the hydroseeding, and the presence of plants which have failed to survive. The community requires a 'guarantee' that the landscape will be managed and maintained, to achieve their expectations, and the images presented in the design proposals.

Response: The construction of the landscape must be carried out in accordance with the detailed plans and specifications which are to be prepared by a qualified and experienced landscape architect to accord with the requirements of this EIS. A plan of management is recommended for the guidance of the longer term protection and stewardship of the landscape corridor.

The landscape for the M5 tollway has just been installed. The majority of the landscape works were installed after April, 1992. Current progress in the landscape development is in line with previous projects, and as expected in the initial phase of such works it is characterised by small plantings. The intended result is to develop a mature long lasting landscaped environment as opposed to an instant landscape which would be likely to deteriorate, rather than improve, over time. Inspection of the early plantings reveals substantial progress, and many of the hydroseeded areas show evidence of the germination of seedlings.

All landscape works on the M5 are subject to a management and maintenance plan, as described in Section 14.4, for the duration of the tollway agreement (22 years).

During the planning and design of the M5 landscape, the community was thoroughly briefed on the methods and time required to achieve the intended 'endemic woodland' effect. Illustrative information panels, photographs, drawings, formal and informal meetings were all utilised to keep the community fully informed of the proposals, and progress. It is recommended that this process be continued during the management and operation phases of the M5 Casula Link.

The issues identified above were addressed by the study team and, where feasible, were reflected in the design of the motorway proposal which is the subject of this EIS. Some issues raised (e.g. the length of time available to carry out the EIS) were constraints that were not amenable to change by the study team. All of the matters raised by the Consultative Committee, as well as those identified by members of the wider public (see Section 4.8) received serious consideration by the study team. An iterative process resulted, as refined designs or new data were fed back to the Committee for further review and assessment. Thus the transport proposals that were developed in the course of this EIS represented the efforts of the study team and the Consultative Committee.

4.6 NEWSLETTERS

A series of three newsletters was produced to keep both the local and the wider communities informed about the progress of the study. Between 5000 - 6000 copies of each of three newsletters were distributed to: all households and businesses in the study area, local schools and all government bodies and interested organisations and individuals on the mailing list.

The first newsletter described the transport alternatives to be evaluated, broadly described the planning and transport context of the M5 Casula Link, explained what an EIS was and its likely timing, and identified broadly the type of issues likely to arise. It also included a feedback form which permitted people to express their attitudes toward the major proposals being studied and sought their views on detailed ramping options and possible closure of roads. The results of the analysis of the feedback forms received are included in Section 4.8.

The second newsletter contained much more detailed findings of the study team, including information on current traffic conditions in the study area, the local impacts arising in regard to the proposed motorway link and the mitigating measures being investigated, as well as the design opportunities opened up for the Hume Highway if the M5 Casula Link were built.

The third newsletter summarising the EIS will be issued when the EIS is exhibited.

4.7 RESULTS FROM THE FEEDBACK FORM

Some 5000 - 6000 of Issue No. 1 newsletters containing the feedback form were distributed and 117 completed forms were returned. Therefore the results cannot be considered representative. However the results are reported here as they at least reflect the attitudes of those who felt strongly enough to complete a form. Of those who responded and

provided an address (some 100 people), 55 resided in Casula/Lurnea/ Prestons, 15 in Liverpool, 14 in Glenfield and 16 resided elsewhere. Thus the great majority of those completing forms resided in the area immediately affected by the transport proposals. These responses therefore reflect the concerns of people living close to the proposed motorway.

The first question asked people's views on alternatives being assessed in the EIS which included:

- Proceeding with the M5 Casula Link.
- Upgrading and widening the Hume Highway.
- Shared use of the motorway by public and private transport.
- Doing nothing.

The responses in relation to each of the alternatives are shown in Table 4.1 below.

Included in responses in the feedback form were three suggestions showing alternative routes to the M5 Casula Link. Each can be broadly described as following a north-east/south-west

TABLE 4.1 RESPONSES TO FEEDBACK FORM: TRANSPORT ALTERNATIVES

Proceeding with the M5 Casula Link motorway as proposed	**No.**
Positive response - "yes proceed"	90
Negative response - "do not proceed"	12
Other	5
No response	10
Total	**117**
Upgrading and widening the Hume Highway as an alternative	
Postive response - "yes, as an alternative"	21
Negative response - "no, not as an alternative"	72
As well as Casula Link "not only as an alternative"	5
Other	4
No response	15
Total	**117**
The shared use of the motorway by public and private transport	
Positive response - "yes, shared use"	64
Negative response - "no, not shared use"	15
Other	9
No response	29
Total	**117**
Doing nothing	
Positive response -"yes, do nothing"	2
Negative response - "no, something should be done"	58
Other	4
No response	53
Total	**117**

Source: MSJ Keys Young, 1992

axis to connect The Crossroads to the South Western Freeway at Moorebank Avenue, crossing the Georges River at Chatham Village.

These alternative routes were given serious consideration during the course of the preparation of the EIS. However, although they may have involved slightly reduced air and noise pollution effects, it was decided not to proceed with any of these options for the following reasons. Firstly, it would take considerable time to establish a new road reserve, even if the Army agreed to sell some of its land. Secondly, it would be costly to establish this new reservation. Thirdly, it would penalise those who bought land away from the existing motorway reservation.

Fourthly, the alternative routes involved higher construction costs due to more complex interchanges at The Crossroads and the Hume Highway as well as a skewed crossing of the Georges River.

Another suggestion showed access to Heathcote Road and then to Sutherland for vehicles eastbound on the existing M5. This is proposed to be included in the preferred option by providing a west facing off ramp at Heathcote Road with both left and right turn movements.

The second question in the feedback form asked people's responses to a number of more detailed alternatives, including:

- On and off ramps at the Hume Highway.
- The closure of roads crossing the motorway .
- The provision of pedestrian crossings of the motorway.

Of those who replied responses showed strong support for the provision of on-and-off ramps at the Hume Highway.

In regard to road closures, 41 people said that cross roads should be closed. It is entirely possible that some of these people assumed that keeping roads open would require increase traffic on their local roads or that the severance would reduce traffic.

A number of people went on to nominate specific roads which they felt must be left open, and these included Kurrajong Road (16 people), Graham Avenue (8), Cedar Road (3), De Meyrick Avenue (2) and Camden Valley Way, Hillview Parade and Beech Road (1 each).

Responses to the query on attitudes showed strong support for pedestrian crossings. Eighty-eight people supported the need, while eight people stated they should not be provided.

As can be seen from Table 4.2, traffic issues (e.g. congestion) and access issues were of particular concern. As well, environmental issues such as air pollution, noise, hazard and risk and retention of open space were also of concern.

The feedback form also invited people to identify any other questions or issues that they would like the study team to address, or matters on which they would like more information. The comments raised covered a very broad array of topics ranging from issues that had already been addressed in the feedback form (e.g. the issue of noise) to questions that had been raised by the Consultative Committee (e.g. whether the road would be a tollway; specific design considerations relating to over and under-passes of cross streets etc.). Other comments were very general (e.g. build other or better roads; why taking so long?) or in some cases, outside the terms of reference (e.g. reduce medium density housing). On the whole, most of the issues identified were ones raised by, and discussed with, the Consultative Committee.

4.8 MEDIA MONITORING AND PRESS RELEASES

Three news releases have been issued. The first at the beginning of the project, the recent one reporting progress and a third covering the last Consultative Committee meeting. A final release would certainly cover the exhibition and overview of the project. Newspaper monitoring during preparation of the EIS showed that nothing emerged regarding the M5 Casula Link.

TABLE 4.2 RESPONSES TO FEEDBACK FORM: DETAILED DESIGN ALTERNATIVES

Provision of off-ramps at the Hume Highway	**No.**
Positive response - "yes, provide off-ramps"	89
Negative response - "no, don't provide off-ramps"	11
Other	3
No response	14
Total	**117**
Provision of on-ramps at the Hume Highway	
Positive response - "yes, provide on-ramps"	94
Negative response - "no, don't provide on-ramps"	9
Other	1
No response	13
Total	**117**
Closure of roads that cross the motorway	
Positive response - "yes, close roads"	41
Negative response - "no, don't close roads"	19
Some should be left open	29
Other	9
No response	19
Total	**117**
Provision of pedestrian crossings of the motorway	
Positive response - "yes, provide pedestrian crossings"	88
Negative response - "no, don't provide pedestrian crossings"	8
Other	5
No response	16
Total	**117**

Source: MSJ Keys Young, 1992

establishing the need for roadway improvements in the corridor

METROPOLITAN ISSUES AND TRENDS

Section 5 outlines metropolitan issues and trends pertinent to the economy, community and government (including population and employment growth and traffic demands) in a national, regional and local context.

SUMMARY OF NEED: PROJECT JUSTIFICATION

Section 6 describes the transport infrastructure in the corridor. This description leads onto the need for the project and the consequences of doing nothing.

5
METROPOLITAN ISSUES AND TRENDS

5.1
GOVERNMENT INITIATIVES AND OBJECTIVES

5.1.1
Commonwealth Initiatives

For the first time since the 1970's, urban development is coming back onto the national political agenda *(Australian EPAC, 1990)* and the media are again taking an interest in urban environmental, lifestyle and housing issues. Constructive media debate will be crucial to changing public attitudes to housing, transport and the structure of our cities. Changes in public awareness and attitude modify the tendency to behave incrementally and to make personal or corporate decisions without any real understanding of their effects or of the potentially better alternatives that might be available.

The Commonwealth government's Better Cities initiatives come from a recognition that the on-going provision of new urban areas on the fringes of Australia's major cities is probably not the most socially just, environmentally sound or economically sensible way of responding to population growth. In an announcement in September 1992, the Deputy Prime Minister advised that four regions have been targeted for Better Cities funding in NSW. These regions are Ultimo/Pyrmont, Honeysuckle (Newcastle), Transit West and Eveleigh (near Redfern), and together will be provided with $520M of Federal and State funding over the next five years.

Of particular interest to this study is the Transit West region which involves a strategy to promote a more effective transport system for western Sydney including construction of the Merrylands rail link, upgrading of Parramatta station, bus priority measures to Parramatta and Blacktown stations, construction of a Blacktown bus/rail interchange and residential consolidation around rail and bus nodes.

The Commonwealth remains a major source of funds for road works and will account for $582M or 32% of total funds for the RTA in 1992/93 *(NSW State Budget, 1992)*. The majority of these funds will be spent on specific projects related to new construction or improvements for national highways and national arterial roads. However, from 1993 onwards the national arterial funds are not to be related to specific projects.

The remaining funds are state sourced and come from taxes on motor vehicles and registration fees (32%), fuel levies including the 3 x 3 levy (26%) and other sources of revenue (10%). Most of these funds are used in the Capital Works Programme for major road construction or minor roadworks.

5.1.2
State Initiatives

In 1988 the Sydney Region Outline Plan was succeeded by the Metropolitan Strategy published in "Sydney into its Third Century". This plan, (Figure 5.1) which was designed to guide development in the Sydney region to a population of 4.5 million, remains in force today. The network of major roads proposed under the Metropolitan Strategy was developed jointly with the DMR (now the RTA). The "Roads 2000" plan was developed as part of this Metropolitan Strategy. The M5 Casula Link constitutes a short infill section of one of the major traffic arteries incorporated in the "Roads 2000" plan.

The Strategy promotes the development of a more balanced and concentrated form of development with employment, services and facilities concentrated into major activity centres throughout the region. Overall, the objectives are to increase density and accessibility to activities, thus reducing urban sprawl. An integrated transportation system is an important part of this policy, and joint responsibility for achieving this rests with the RTA and the Department of Transport.

Public transport in Sydney is the responsibility of the Department of Transport at a policy level and the State Rail Authority (SRA) and State Transit Authority (STA) at an operational level. The management of the private bus and taxi industry rests with the Department of Transport. The system is based on rail for longer distance trips

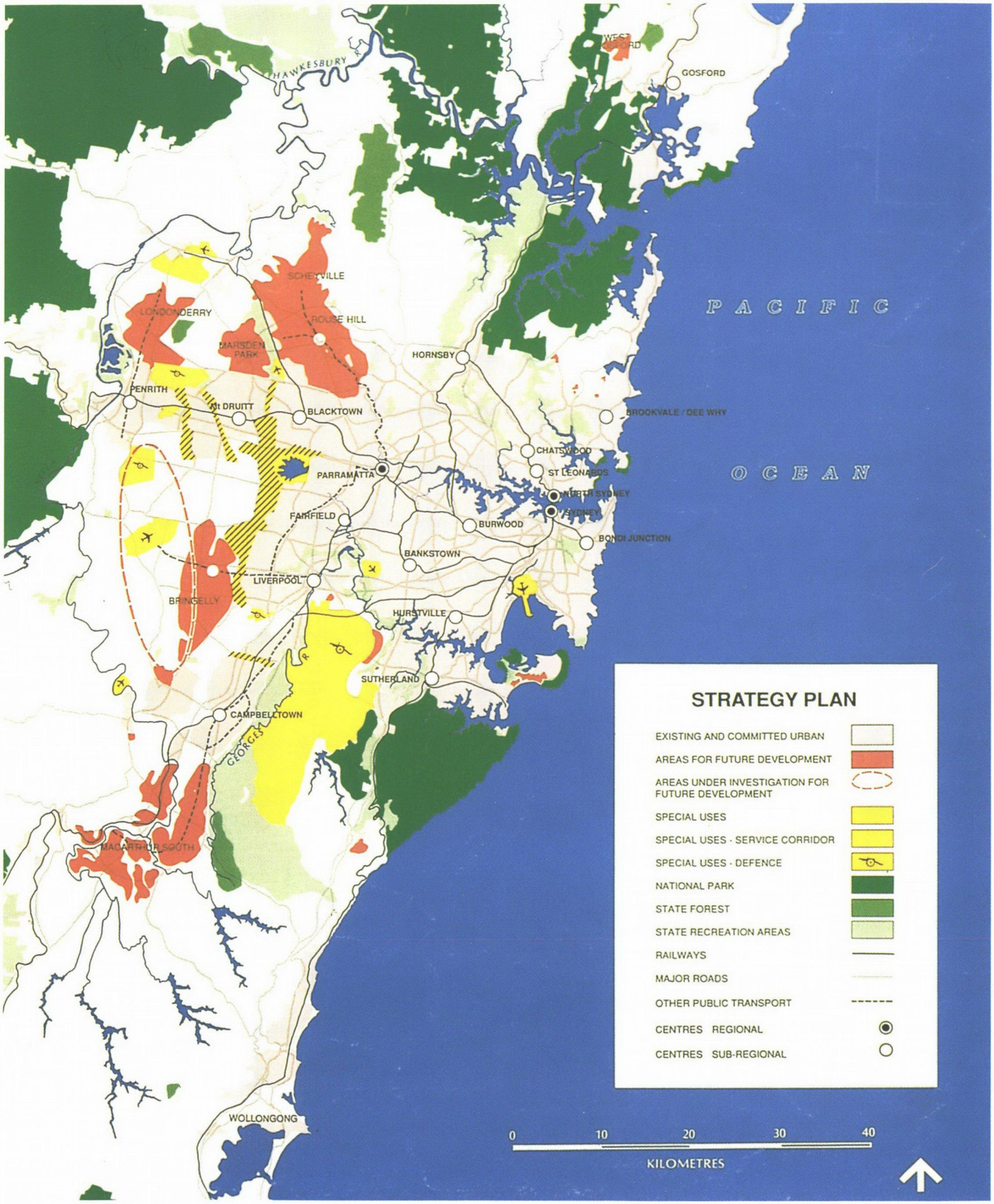


Figure 5.1 Metropolitan Strategy Plan ***(Source: NSW DoP 1989)***

supported by an extensive network of feeder bus services and transport interchanges. At the present time public transport handles 15 per cent of commuter travel and has only a small role in urban freight distribution. However this is not a realistic indicator of relative importance in serving the social needs of the city, particularly in developing areas. In particular, commuter trips to the CBD are predominantly made by public transport.

In general, Sydney remains dependent on its road network to achieve its urban mobility and this situation is not expected to change significantly in the foreseeable future. Whilst most vehicles on roads are private vehicles (cars), roads are also important for public transport (buses), commercial and industrial traffic (trucks) and emergency services.

Traditionally roads have been 100 per cent publicly funded, although toll charges have been used on particularly expensive works where debt charges have been incurred e.g. Harbour Bridge, Southern Tollway, Sydney/Newcastle Tollway. However, this is changing with government policy in NSW now supportive of private funding for motorways where financially achieveable. They have the advantage of reducing the demands on stretched public funds, usually allowing construction at a much earlier date than would otherwise be the case. Recent examples are the Harbour Tunnel and the M4 and the new M5 Motorway.

Privately funded roads are constructed and operated under strict agreements which ensure that the public interest is preserved. Provision is made for the facility to revert to State ownership after an agreed period.

5.1.3 Local Initiatives

Local planning is constrained by requirements to conform to regional land use and transport strategies, by the management of land releases under the Urban Development Program, and by the planning policy framework established under the EP and A Act, 1979.

Local Councils in key areas such as Liverpool therefore become participants in the execution of regional planning strategies and policies, with responsibility for detailed land use and infrastructure planning.

In recent years, Liverpool Council has prepared the Local Environmental Plans for urban land releases south of Kurrajong Road and around Adcocks Lane in Casula, and subsequently amended these plans to remove minimum lot size restrictions in an attempt to increase the density of housing and population.

The Council recently commissioned a traffic study for the stage 2 release areas west of the corridor to provide a framework for managing traffic and progressively upgrading the local road network as the city expands westwards *(Eugene Smith and Beca, 1992)*.

The strategic land use planning upon which the traffic study is based will ensure that Casula and Lurnea are part of a well ordered district with an appropriate array and distribution of retailing, open space and community facilities, and a core of industrial land to provide additional employment opportunities close to home.

Council has also reviewed the long standing provision for the development of a route from the proposed Motorway (along Park Road, connecting to the M5 in the vicinity of Graham Avenue) to bypass Liverpool to the west, and indicated a preference for the development of this route in feeding northbound traffic from the freeway back onto the Hume Highway south of Liverpool (see Section 9.3).

5.2 METROPOLITAN PATTERNS OF GROWTH

5.2.1 Emerging Trends and Issues

Land use and transport planning

The purpose of this section of the report is to discuss some of the more complex and long term land use/ transportation issues affecting Australia's major cities and to consider some emerging trends in Sydney's patterns of urban development and social attitudes which need to be recognised when making recommendations to the RTA.

A key issue relates to the use of the private motor car. The majority of people in our society now have extensive opportunities to use a car, either as drivers or as passengers. Cars provide a large portion of the population with a cheap, relatively safe and very convenient mode of door-to-door transport. Spearitt and de Marco (1989) neatly encapsulated the extent to which this phenomenon has changed our travel habits in just forty years. In 1947, only 13% of trips in Sydney were made by car, the other 87% being made by public transport, on foot, or by other means. By 1987 that proportion had been reversed, with 87% of trips being made by car and just 13% being made by all other means (Figure 5.2).

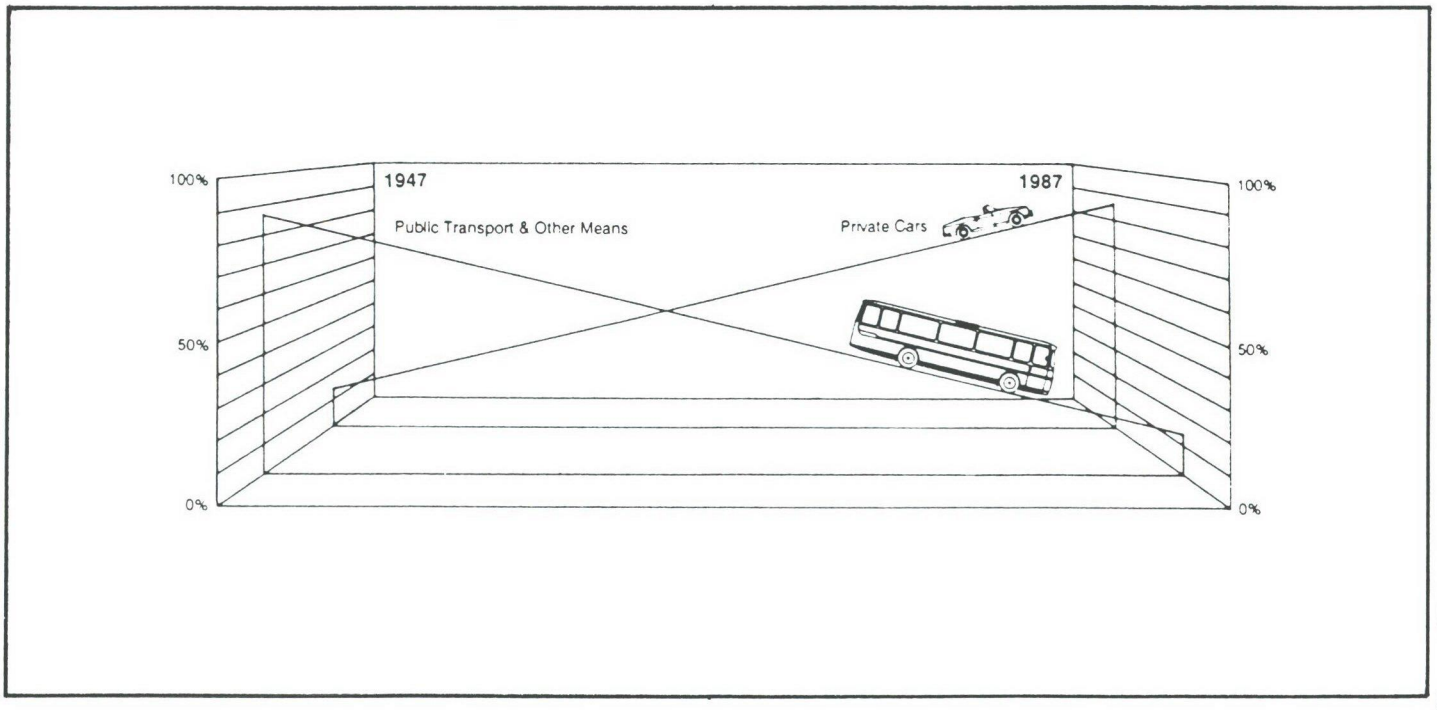
Moreover, people are making more trips and the trips are lengthening as Sydney enjoys an increased standard of living and expands in size and population (the population roughly doubled between 1947 and 1987). However, cars are not universally available, and many people are constrained in their everyday living by having to cope without a car, whether through age, disability, choice, problems with affordability, or priority usage of the family car for getting to work.

Increased mobility and accessibility have had a profound effect on our cities allowing for and accentuating the dispersed development pattern initiated by the construction of suburban rail and tram services early this century. It is not simply housing which has become more dispersed: offices, factories, schools, tertiary education campuses, shopping centres, entertainment facilities and hospitals are now much more evenly distributed across metropolitan Sydney than they were in the 1950's and these trends are continuing.

Complex changes are continuing to take place in our society, some affecting where we choose to live and work or how and when we choose to travel, and others accentuating the difficulties of those without their own car or the ability to drive. These include:

- Changes in the nature and composition of households are affecting housing and travel needs and location choice, but choice is constrained by supply and cost factors. For instance the traditional family of two parents and dependent children have a high need for travel but may be located in less well serviced

FIGURE 5.2 CAR USE 1947 - 1987



Source: Spearitt & de Marco, 1989

locations because of economic constraints.

- An ageing population with a large proportion of retirees has different transport needs and specific personal mobility requirements.

- Car availability continues to increase: although new car registrations have remained at a relatively stable rate, the total number of cars on the road has steadily grown and the proportion of the population holding licences has continued to increase.

- Greater female participation in the workforce and more complex trip patterns are emerging as shopping, child care, educational and recreational functions have to be juggled with the demands of employment and lifestyles.

- Decline in full time employment as a proportion of total jobs: part time employment is expanding, contributing to an overall trend increase in the participation rate and generating journeys to work by those who did little formal work in the past, for example school children who now staff supermarkets after hours.

These examples typify some of the changes taking place in our society which foster or are derived from the creation of land use patterns which have entrenched the primacy of road vehicles over the other modes of transport by separating origins from dispersed, but sometimes linked, destinations.

Demand management approaches

Views now being widely expressed in the community suggest that a mandate may emerge for the State government actively to contain urban growth and manage transport demand, although these have recently been muted by economic pre-occupations as the current recession has deepened.

The notion of arbitrarily constraining the number of people living in Sydney in order to limit urban sprawl and increasing pollution is simplistic. Big cities offer opportunities that cannot be matched in smaller communities for economic diversification and the growth of service industries that will be vital to rejuvenating employment in post industrial societies. City growth stems from a myriad of individual but interactive decisions that are extremely difficult to manage without disrupting the economic and social fabric of the city through such things as the distortion of land and property prices, and restricting choice.

Demand management is a far more complex issue than, say, simply directing more travel to public transport. Travel is a derived demand. Ogden (1991) has noted:

People do not move for the sake of moving. They move only in order to participate in activities of some sort - economic, social, recreational, business etc.

The very definition of a city has to do with presenting people with the opportunity to participate. Hence, artificially and arbitrarily restricting travel ... may lead to a reduction in participation and a reduction in activity - a negation of the very function of a city!

The RTA is presently studying very broadly defined options for demand management. In the Road Transport Future Directions Study *(Roads and Traffic Authority, 1991e)*, eight possible scenarios for transport supply, pricing and demographic distributions in the metropolitan area are explored, all of which would influence travel demand to some extent.

These scenarios are currently being discussed with the community as a precursor to the development of new policy directions for the RTA, and they can be expected to influence the current periodic review of the Metropolitan Strategy which is likely to be finalised in 1993.

To be an effective and useful tool for producing better urban lifestyles and more efficient cities, demand management would need to be applied to the full spectrum of the urban development process and would include:

- Reducing the proportion of conventional suburban housing by stimulating demand for a wide range of higher density alternatives.

- Ensuring that the specific transport needs of people who choose to live in higher density accommodation are fully understood and properly provided for, especially in facilitating high density redevelopment around existing transport nodes or interchanges.

- Intervening in the complex set of processes which lead to employer location decisions to give better integration with residential development, so as to reduce the lengths of work trips and make them more able to be efficiently served by public transport.

- Focusing on the work trip as the most fruitful area for reducing motor car use, provided economically viable and environmentally sustainable alternatives are available.

- Developing a good understanding in the community of the full costs of travel of each mode so as to create the environment for an equitable approach to "user pays" systems of transport pricing.

The consequences that are likely to flow from upgraded landuse and transport demand management towards the end of the time span of this study (2010) include:

- The enhancement of neighbourhood quality by the application of local area traffic management techniques to arterial roads, maintaining their traffic carrying capacity but reducing traffic speeds so as to create a safer, more amenable environment for pedestrian and cyclists. This would have particular application to arterial roads running through shopping centres.

- A reduction in the proportion of work trips made by car, by the provision of better quality multiple-user services. Specific examples include facilitation of car pooling, employer-provided bus services, bus-only roads and transit lanes (as a pre-cursor to light rail when the demand is sufficient), park-and-ride, multi-nodal and multi-modal ticketing, appropriate road pricing and car parking regimes.

- Increased use of the car for trips other than work trips, especially as vehicle technology improves to reduce fuel consumption and pollutant emissions.

- The removal of hidden travel subsidies and a greater emphasis on user-pays mechanisms (tollways, area pricing, etc.) combined with consideration for those unable to pay (i.e. equity issues).

These potential trends were considered as part of the study team's approach for this EIS.

Quality of urban life

The quality of life provided by large cities like Sydney has been a growing issue over the past two decades as suburban sprawl and the associated rise in car dependency have combined to produce increased concerns over air and water pollution and longer journeys to work or recreation for people living on the developing fringes of these cities.

The desirability and practicability of developing a more convenient city has been argued, and the current Metropolitan Strategy (*NSW DoP, 1988*) is directed towards achieving a more compact city in which housing densities increase in established and new areas alike, and in which jobs are redistributed to reduce the average journey to work. More radical restructuring to create higher densities and more intensive suburban employment have been proposed by commentators like Newman and Kenworthy (1991). However, the extent to which the public would tolerate such impositions of their personal freedoms are never fully explored.

Public attitudes towards new forms of housing, and changes to the form and organisation of our cities needed to realise these aspirations, are lagging behind concerns about the residential environment and access to jobs and services.

The extent to which public attitudes and personal housing choices might change remains uncertain, but Dwyer

et al (1992) caution against high expectations for increases in population density through consolidation strategies, due to the tendency for units to be occupied by fewer people than houses.

Despite long standing governmental policies and the imposition of statutory controls to facilitate more widespread consolidation, the consolidation concept has yet to be totally accepted by the public and local government, particularly in terms of lifestyle benefits. Until this is done, the potential benefits of more rational residential development are likely to be under-realised.

Global warming and the greenhouse effect

The "Greenhouse Effect", or "Global Warming", refers to the theory suggesting the enhanced effect of atmospheric warming by the sun's energy caused by emissions from human-developed sources of atmospheric gases. The effect arises because some of the sun's energy enters the atmosphere as short wave energy, is partially absorbed by the earth's surface and is then reflected as radiant energy which itself is partially absorbed by certain atmospheric gases and partially emitted out of the atmosphere. As the quantity of these heat-absorbing or so-called greenhouse gases increases, so the atmosphere becomes warmer. If this occurs to a marked degree there may be climatic and lifestyle implications for people of all countries.

American studies suggest expansion of the oceans and rises in sea level of up to 100cm per decade are possible.

The primary gases contributing to the greenhouse effect are water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFCs) and tropospheric (lower atmospheric) ozone (O_3) *(ANZEC, 1990)*. These gases, except CFCs, which occur naturally in the atmosphere, are generated by sources such as

TABLE 5.1 GREENHOUSE GASES ATTRIBUTABLE TO ACTIVITIES

Gas*	Principal Sources	Current Rate of Worldwide Annual Increase and Concentration	Contribution to Global Warming (%)+
Carbon dioxide (CO2)	Fossil fuel burning, including transport (c.77%) Deforestation (c.23%)	0.5% (353 ppmv)#	55
Chlorofluorocarbons (CFCs)	Various industrial uses: refrigerants foam blowing solvents	4% (280 pptv CFC-11 484 pptv CFC-12)	24
Methane (CH4)	Rice paddies Enteric fermentation Gas leakage	0.98% (1.72 ppmv)	15
Nitrous Oxide (N2O)	Biomass burning Fertiliser use Fossil-fuel combustion	0.8% (310 ppbv)	6

Source: Leggett J (ed), 1990

*Note: * The contribution from tropospheric ozone is also significant but is very difficult to quantify.*

+ Estimates for the decade of the 1980s

ppmv = parts per million volume

ppbv = parts per billion volume

pptv = parts per trillion volume

volcanoes and marshlands, and render our earth habitable.

The major human-induced sources of greenhouse gases and their contributions to global warming are presented in Table 5.1. Humans are putting carbon dioxide (CO_2), one of the principal greenhouse gases, back into the atmosphere at a million times the rate at which nature removes it *(Coghill, 1990)*.

Motor vehicle emissions include CO_2, CH_4, N_2O, CFCs (from air conditioners) and the precursors to ozone - hydrocarbons (HC) and oxides of nitrogen (NO_x) *(DeLuchi et al, 1988; Pearman, 1989)*. It is estimated that motor vehicles account for 26% of Australia's emission of carbon dioxide *(Australia ESD 1991, Greene 1991)*.

The Senate Standing Committee on Industry, Science and Technology, 1990 reports that Australia's contribution to the increase in global greenhouse gases is between 1% and 2%. Nevertheless, Australia is the fourth or fifth highest per capita producer of carbon emissions in the world, producing the equivalent of 4 tonnes per person per annum. Carbon dioxide (CO_2) emissions account for almost half of the total warming effect of Australia's greenhouse gas emission and are the easiest of greenhouse gases to reduce.

The Australian government through the Australian and New Zealand Environment Council (ANZEC) has set as an objective a reduction of CO_2 emissions by 20% (from 1988 levels) by the year 2005. Given that vehicle emissions are a substantial part of total emissions of CO_2, it may be concluded that this source should be explicitly targeted to help achieve the overall CO_2 reduction objective.

The Greenpeace Report *(Leggett (ed), 1990)* found that if state-of-the art emission controls were introduced to all motor vehicles around the world, emissions (hydrocarbons, carbon monoxides, oxides of nitrogen) could be reduced to approximately half of the 1980 levels for some gases by 2005, even accounting for an increase in vehicle numbers in the period. It is unlikely that all vehicles will be fitted with these devices (due to age and relative cost). However a combination of incorporating these controls in new cars with increased fuel efficiency (already occurring due to consumer demand) and new fuel technology would lead to motor vehicle emissions being effectively controlled *(Pearman, 1989)*.

Recent research by the Australian Bureau of Transport and Communications Economics *(Australian BTCE, 1990)* provides a valuable comparison of the performance of various modes of urban transport with respect to energy and greenhouse gas emission efficiency as summarised in Table 5.2.

TABLE 5.2: ENERGY EFFICIENCIES AND EMISSIONS BY TRANSPORT MODE
(Average values calculated from transport modes in Australian cities for 1985 and 1988)

	Energy Intensiveness (MJ/pass km)		Rate of Co2 Emissions (grams/pass km)	
	1985	1988	1985	1988
Cars	2.44	2.42	173.4	172.0
Buses	1.99	2.05	146.2	150.6
Light Commercial Vehicles	3.12	3.12	222.5	222.5
Trams	1.80	n.a	180.0	n.a
Electric Trains	1.97	1.94	189.9	187.1
Diesel Trains	2.00	1.94	147.2	143.1

Source: Greene D, 1991

BTCE estimates that the reduction in total carbon dioxide emissions arising from a doubling of peak period public transport patronage (through a reduction in private car use) would be roughly equivalent to the effect of improving the average emission efficiency of the Australian car fleet by only 2 percent, an effect which could be relatively easily achieved by improved fuel efficiency, higher car occupancies and shorter trip lengths.

In other words, the difference in the emission efficiency of private and public transport (particularly electrically powered vehicles) is not as significant as the "conventional wisdom" would suggest. Policies to improve the efficiency of the internal combustion engine will therefore be more effective in controlling emissions than policies which shift travellers from car to public transport.

There are of course many other factors which influence the wisdom or otherwise of increasing the role of public transport. Air pollution effects and equity for non-drivers are further examples of the factors discussed in following sections.

The ability of governments to fund some of the more exotic forms of public transport in a time of recession is a limiting factor.

Regional air and water quality

Sydney's growth is placing pressures on the region's environment. Deterioration in the quality of air in the region and of the water of the Hawkesbury-Nepean river system has become a major issue of concern. The debate on these regional environmental issues is considered here in the context of their potential influence on the shape of future development in the south west region. These issues effect residents in Sydney's west, as well as the Sydney Water Board and the EPA who are responsible for maintaining water and air quality. Concern about current environmental management practices has led the government to defer long standing plans to release land for urban development in the South Creek Sector pending major technical investigations.

The major air pollutants that influence the quality of air in the Sydney region are hydrocarbons, sulphur dioxide, oxides of nitrogen, particulate matter, acid gases, carbon monoxide, lead and ozone.

Motor vehicles are the major source of air pollution in Sydney. In the mid 1980's they contributed half of all hydrocarbon emissions and about 90% of all carbon monoxide emissions *(SPCC, 1989c)*. These values are likely to decrease with the increased use of catalyst technology required on all new motor vehicles and stricter regulations covering individual vehicle emissions.

The SPCC (now the EPA) has monitored the concentration of pollutants in the Sydney region since 1979. EPA's data has been supplemented by a study of Sydney's regional air movement *(Hyde and Johnson, 1990)*. The study findings recognised that the extrapolation of EPA's data to outer areas seriously underestimated pollutant levels in some cases, particularly in the south west. Data provided by the EPA has therefore been used in this study to give an indication of general air quality only and can not be applied directly to the corridor.

EPA data indicates that ozone and smog levels appear to have decreased over the past twelve years. However Hyde and Johnson *(1990)* suggest that these figures are misleading as the areas of ozone and smog formation have moved downwind from the industrial and traffic-associated pollutant sources particularly toward the south west, and they predict an increasing trend in photochemical smog in the outer areas.

While these predictions have yet to be validated in the outer suburbs, there is clearly some cause for concern over photochemical smog impacts in the Sydney Basin. These impacts will occur largely as a result of increased motor vehicle emissions.

The regional pattern of air movement modelled in the Hyde and Johnson report is illustrated in Figure 5.3. The report observes that during the early morning (0200-1000 hours), pollution emissions are trapped in the air drainage flow as it moves down the Parramatta River Valley to the coast. This air is returned inland in the seabreeze collecting further pollutants along its trajectory towards the Hawkesbury Basin, where it arrives in the later afternoon (1500-1800 hours).

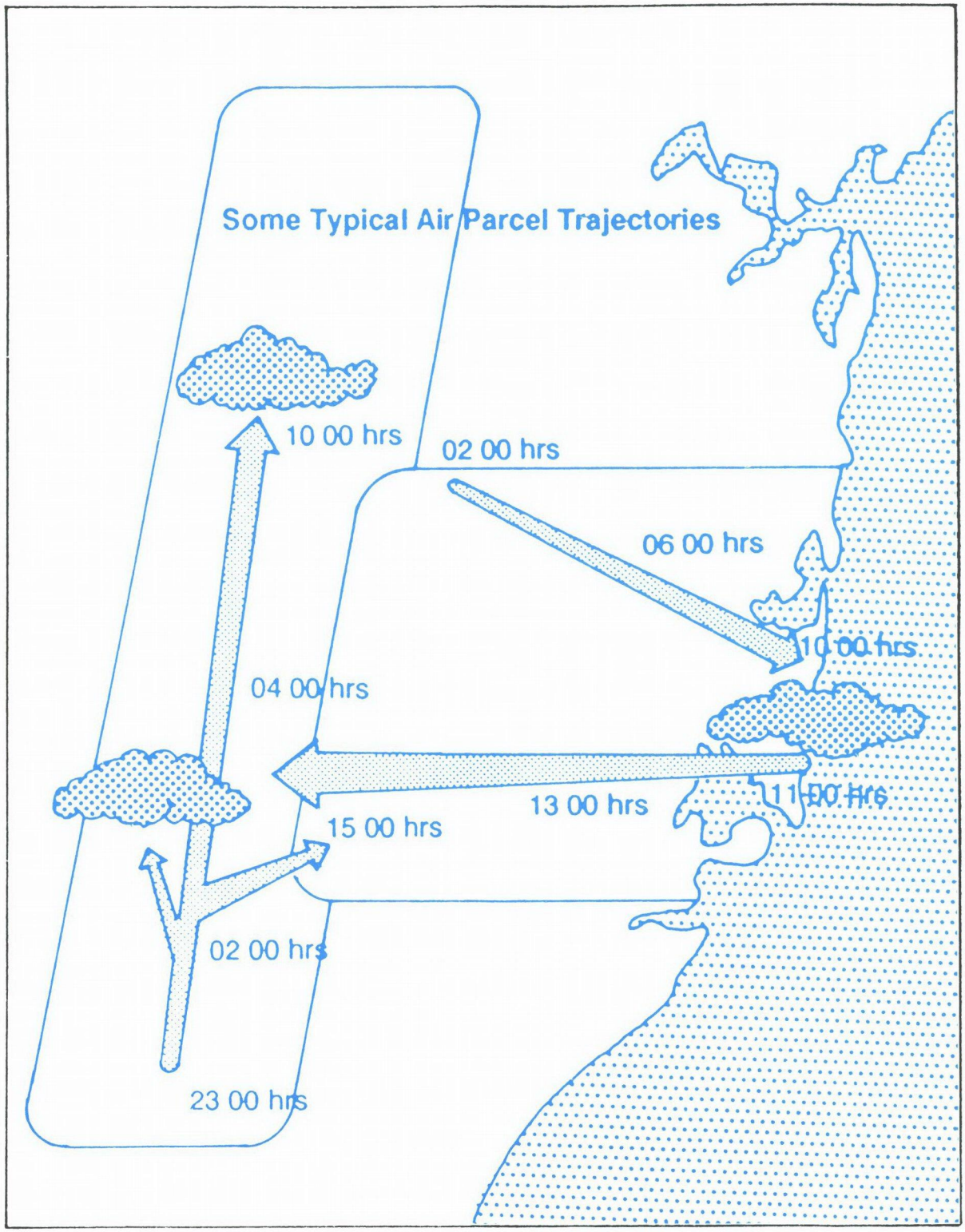


FIGURE 5.3
SYDNEY AIR CATCHMENT
Source: Hyde and Johnston 1990

During the night a second drainage flow event can transport pollutants from the southern end of the Hawkesbury Basin either into the Liverpool Basin via Campbelltown or northwards through South Creek Valley towards Penrith, St Marys, Richmond and Windsor.

However it is important to note that in fact these atmospheric conditions are fairly rare and that, much of the time, the air parcels would travel down the coast and the pollutants would be progressively diluted.

In response to community concern about air quality the state government convened a Smog Summit in June 1991. The Summit identified future policy directions and monitoring activities that could be established. Government policy is directed towards imposing increasingly stricter controls on emissions from motor vehicles and industry. It is also establishing meteorological stations across Sydney to monitor wind conditions and hence to better understand and monitor air movement as it affects pollution.

NSW government policy on urban development has been amended in response to the findings of the Hyde and Johnson study. The pilot study indicated possible trends towards increasing photochemical smog in the proposed Macarthur South and South Creek Valley sector development areas.

These studies will also contribute to the planning for the Macarthur South area. The 1991 Regional Environmental Study proposes an urban development plan based on strategies for urban villages, district centres, employment and transportation developed to minimise the impact of emissions on air quality in Macarthur South, while meeting environmental, economic and social planning objectives *(NSW DoP, 1991a)*.

The areas proposed for development are, generally, on high land. The proposed road network is also on high land. This land is less likely to retain polluted air from eastern Sydney and emissions from activities in the area. Some employment areas in Macarthur South have been assessed as unsuitable for emissive industries, and for activities which generate a large number of vehicle movements. Development of an efficient public transport system is also proposed for further investigation *(NSW DoP, 1991a)*.

The NSW government is acting to treat and control the causes of air and water pollution by policy, planning and regulatory directions; application of new technology; and monitoring and audit activities. In the meantime future release areas in those parts of the south west region that lie within the Nepean catchment are being held back. *(DoP 1992a and subsequent policies further limiting land releases, June 1992)*.

As a first step in the monitoring program, the government has recently commissioned the Metropolitan Air Quality Study (MAQS). Recent activities in MAQS see summaried in Sections 11.6 and 16.4.4.

5.2.2 Regional Growth Patterns

Population growth and distribution trends

Sydney's growth rate fell in 1989 after three years in which growth was much higher than it had been for the previous decade. The preceding spurt in growth had prompted official expectations of a generally higher rate of growth in the coming years and these were reflected in regional projections issued in 1989 *(PPG, 1989)*.

TABLE 5.3 COMPARATIVE METROPOLITAN POPULATION PROJECTIONS

YEAR	LOW		MEDIUM		HIGH	
	1990	1992	1990	1992	1990	1992
1991	3743.3	3694.9	3757.6	3696.1	3768.8	3697.3
1996	3989.4	3886.0	4027.6	3898.9	4062.9	3911.6
2001	4216.9	4067.6	4286.9	4098.9	4352.5	4128.9
2006	4427.4	4290.4	4538.3	4297.4	4639.9	4351.9
2011	4627.0	4400.5	4784.4	4489.9	4923.7	4574.0
2016	4814.7	4547.0	5024.7	4675.3	5203.9	4795.1
2021	-	4676.3	-	4848.6	-	5009.5

Source: MSJ Keys Young, 1992

In view of slowing growth since then, and the prospect of lower net migration from overseas countries which fuels much of Sydney's population gain, the Population Projections Group of the Department of Planning has revised their estimates of future population in Sydney. Table 5.3 compares the current and revised population projections.

The DoP is now reviewing projections for Sydney LGAs around the end of the year. Uncertainty concerning the severity and tractability of environmental constraints in the Nepean River catchment are complicating the process of revising projections at the LGA level.

Locally, ABS Census Counts for 1991 and Estimates of Resident Population (ERP) for recent years confirm slower than expected growth in Liverpool. In the short term, this compounds the sectorial effects of recent deferrals of new land releases in the south western region (see Section 5.2.1).

The latest official population projections *(PPG, 1989; DoP, 1990)* therefore constitute an uncertain basis for planning and evaluation as it stands. However, the urban development process is constantly monitored and is controlled through annual modifications of the Urban Development Program, which nominates new urban land releases within the framework of the Metropolitan Strategy *(DoP, 1989a)*. The population projections prepared by Councils for their LGA's have not yet been adjusted for slower overall growth, although a recent study for Liverpool Council *(Eugene Smith and Beca, 1992)* incorporates projections based on lower overall growth rates.

The current DoP projections at LGA level have therefore been adapted to take account of recent local trends and slower overall growth.

Employment growth and distribution trends

Due to statistical problems that invalidated the journey to work data collected in the 1986 Census, the employment scenarios in the Metropolitan Strategy and its supporting documentation *(DoP, 1989a, b)* were based on uncertain data and have not been realised. The current recession is compounding this problem.

Employment projection presents particular problems since it is inherently more difficult to control development that can attract or generate jobs without distorting the cost structure of commercial, retail and industrial development, the effects of which can impinge on regional competitiveness and overall employment prospects.

In 1990 the Commonwealth Department of Employment, Education and Training (DEET) used ABS Business Register and Labour Force Survey data to construct a 'current' distribution of work as at January 1990, and the DoP have published this in the most recent issue of their Employment Lands Program *(DoP, 1992)*. Publication of this data acknowledges that actual changes in total employment and its distribution are at variance with the Strategy projections, jobs being more concentrated in the CBD, centres on the Lower North Shore and in inner parts of the metropolis than was anticipated under the Metropolitan Strategy. Employment projections in the Strategy will be reviewed by DoP when the 1991 journey to work data becomes available in early 1993, not in time for inclusion in this study.

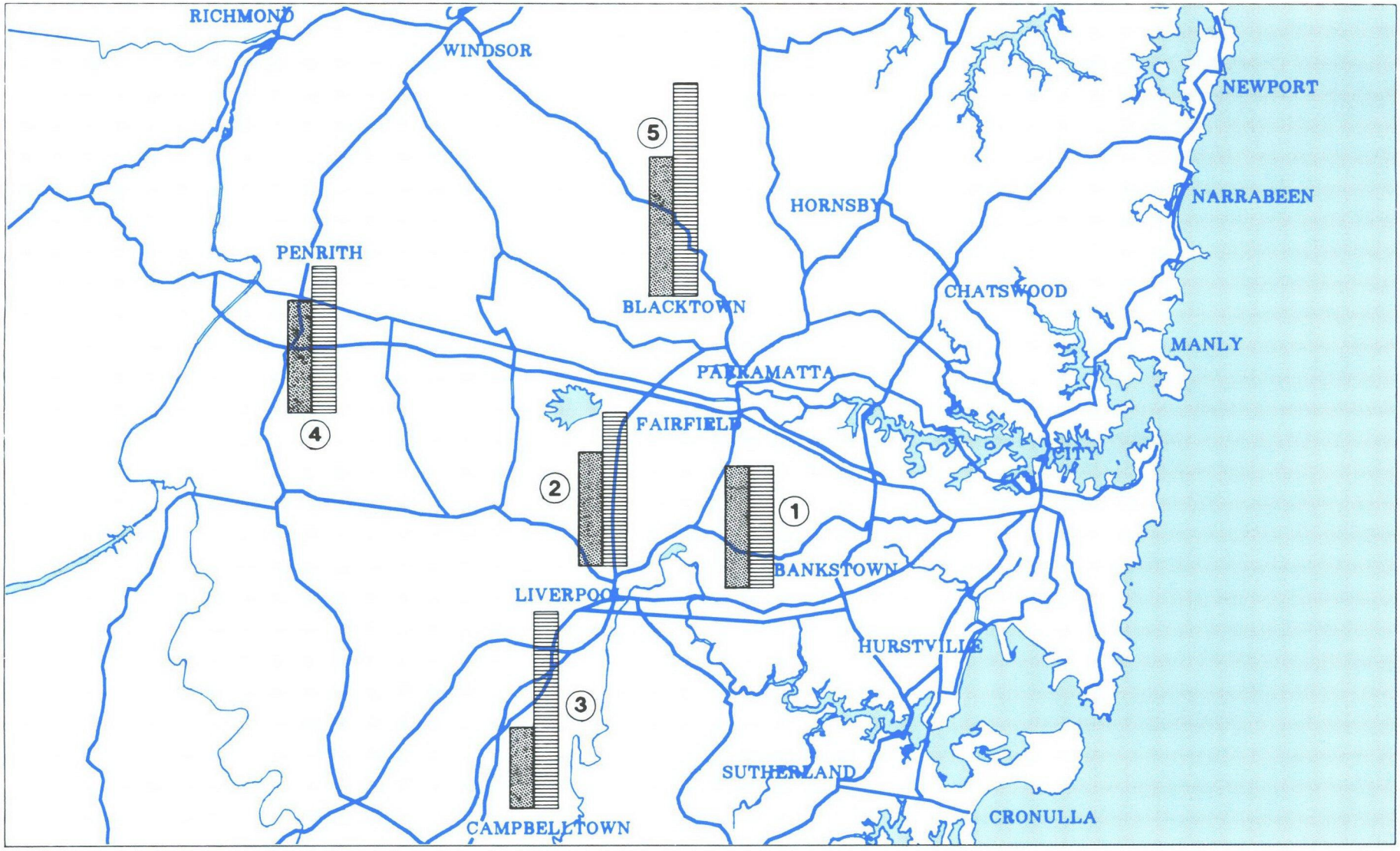
The sharp decline in employment that has occurred since the middle of 1990 will affect short to medium term employment prospects and the distribution of jobs in Sydney, but for planning purposes it would be unreasonable to expect these levels to persist in the longer term.

5.2.3 Population and Employment Estimates for Sydney

Population projections

The preceding discussion of population trends emphasised the uncertainties inherent in projecting regional and local population levels. These uncertainties compound with time, and it is more appropriate to consider a reasonable range of outcomes than to base planning on a single estimate of future growth.

In the short term (i.e. for 1996) recent reducing trend; a higher



1 Canterbury Bankstown
2 Liverpool
3 Outer SW
4 Outer West
5 Blacktown

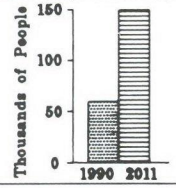




FIGURE 5.4

EXISTING AND PROJECTED POPULATION

Source: MSJ Keys Young 1992

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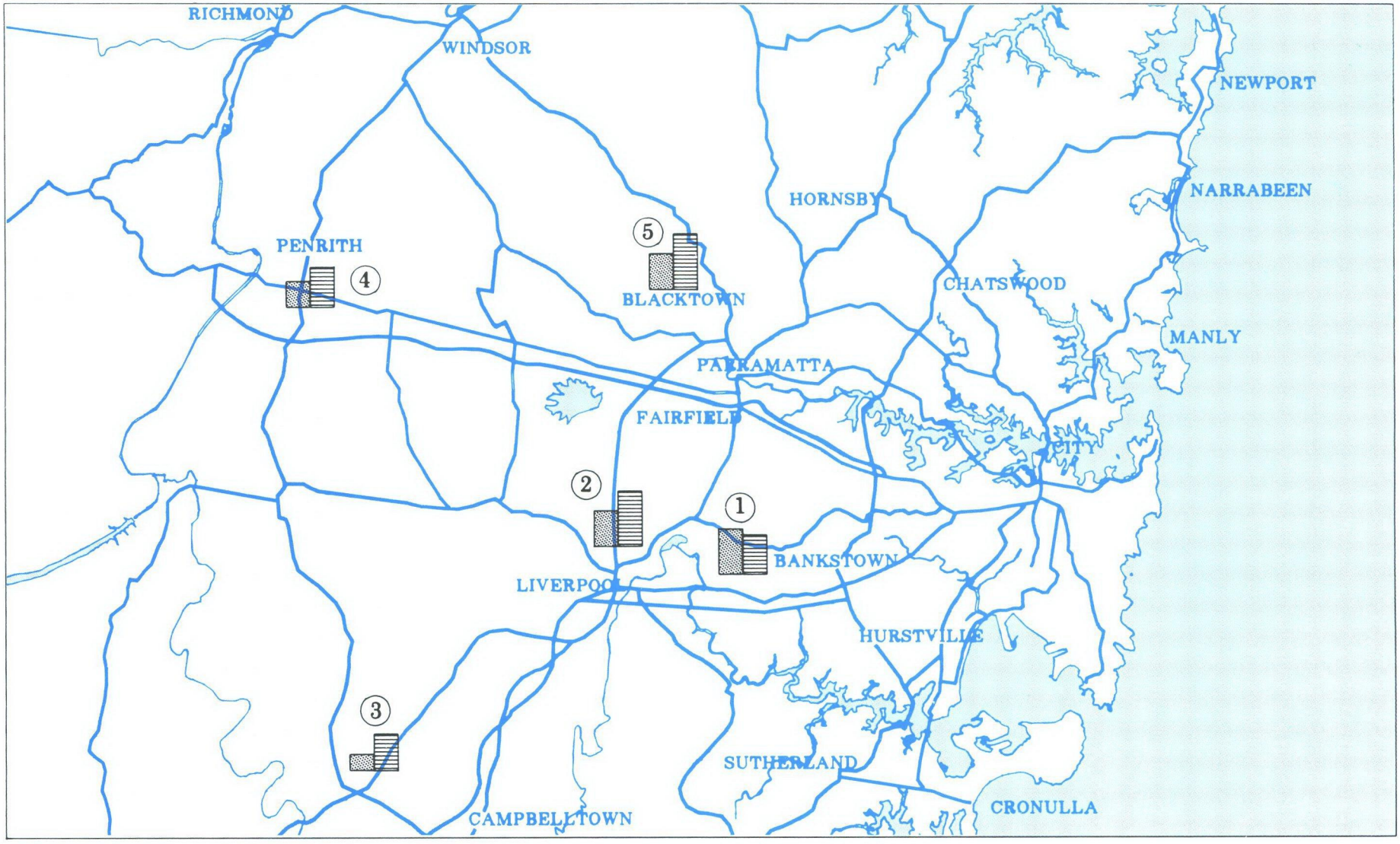


FIGURE 5.5

EXISTING AND PROJECTED EMPLOYMENT

Source: MSJ Keys Young 1992

trends have been used to estimate population growth and its distribution since divergence is not likely to be great in this period.

A slightly conservative estimate of total population growth has been assumed for the medium term (ie. the design year of 2011), lying between the low and medium levels now being projected for the region by the PPG, and two variants have been produced: one assuming that environmental constraints are overcome (2011 Low-Medium), the other that some development is redirected from the fringe through greater consolidation in the established areas of Sydney (2011 Low-Medium Constrained).

Since capacity is more important to test in the longer term, the medium projection has been adopted for 2021, with variants similarly assuming the absence or limited affect of environmental constraint in the Nepean Valley *(MSJ Keys Young, 1992)*.

Employment projections

Various employment scenarios were developed using a simplified version of the employment distribution method adopted for the Metropolitan Strategy. In this method, significant components of employment in each LGA relate directly to the LGA population, while various centre-based and special employment profiles (ie. employment in hospitals, universities and the like) were assumed for different scenarios.

The 1996 projections assume a partial recovery in participation rate and employment, to the extent that the total workforce will roughly equal that of July 1990 (the last peak) although the total population will be nearly a quarter of a million higher at that time. Effectively, the ratio of jobs per head of population in 1996 is projected to reduce to 94% of the levels in July 1990 (ie. lowering by 6%). The preferred projection for 1996 assumes that employment in metropolitan centres is uniformly scaled back to 6% from 1990 levels since there will be little reason to build new office and retail space in this period, and that the 1990 per capita ratios of industrial jobs in each LGA will also be lowered uniformly by 6%.

The total employment levels adopted for the basic medium term projection (2011) assume a return to reasonably buoyant conditions. In order to test the effect of lower levels of employment in the mid term, a projection based on a lower participation rate and a higher unemployment level has been used in analysing employment in conjunction with the 2011 Low-Medium Constrained population projection.

Distribution of the 2011 and 2021 jobs show some decline in the current degree of centralisation, due in part to assumptions of a declining rate of centres growth, and assumptions that industrial jobs will decentralise to the west.

Population/employment scenarios

A set of combined population/ employment projections was selected from a larger number that were generated as best meeting the scenarios likely for Sydney over the next growth cycles *(MSJ Keys Young, 1992)*. These are termed:

1996: Low Western: a population scenario allowing for recent trends; low overall employment distributed on the assumption that industrial jobs per capita will decrease uniformly in the inner areas and outer areas of the city; continuance of the current pattern of centre based employment centred on the CBD/Lower North Shore but at lower levels than at the employment peak in 1990, relfecting the influence of office oversupply for the whole period. This was used for initial demand and impact analysis.

2011: Low-Medium: Population distributed according to the current 2006 DoP projections; continued job growth in the CBD/Lower North Shore central areas but on a

TABLE 5.4 EMPLOYMENT ESTIMATES AND PROJECTIONS

Projection	Jobs
1996 Low Western	1,730,000
2011 Low - Medium	2,023,350

Source: MSJ Keys Young, 1992

TABLE 5.5 POPULATION EMPLOYMENT PROJECTIONS: SYDNEY LGAs 1996-2021

Location	1996		2011 Low-Med		2011 Low Med Constrained		2021 Medium	
	Populatio	Jobs	Populatio	Jobs	Populatio	Jobs	Populatio	Jobs
Botany	35 550	53 161	36 300	50 640	37 200	50 437	36 300	49 716
Leichhardt	59 900	35 688	62 200	31 141	64 100	23 599	62 200	28 756
Marrickville	82 200	35 229	82 600	29 372	84 700	28 195	81 400	27 093
Sydney/South Sydney	85 350	356 429	90 800	404 815	93 700	400 734	93 600	445 558
INNER SYDNEY	263 000	480 506	271 900	515 968	279 700	508 965	273 500	551 123
Randwick	117 650	32 787	120 100	29 855	123 400	28 523	119 800	28 961
Waverley	59 700	17 562	59 700	16 377	61 600	15 632	58 100	18 380
Woollahra	51 150	23 945	51 900	22 439	53 500	21 254	51 700	24 089
EASTERN SUBURBS	228 500	74 294	231 700	68 671	238 500	65 409	229 600	71 431
Hurstville	65 350	20 169	67 400	23 555	69 200	23 240	67 400	27 613
Kogarah	48 200	14 064	51 500	13 634	52 900	12 998	53 500	13 112
Rockdale	85 700	29781	86 900	26 284	89 200	25 320	86 100	24 648
Sutherland	199 400	55 266	208 300	61 840	214 300	59 922	203 300	65 512
ST GEORGE SUTHERLAND	398 650	119 279	414 100	125 313	425 600	121 480	410 300	130 885
Bankstown	157 100	69 981	162 100	70 565	165 900	69 721	161 400	69 565
Canterbury	134 600	33 987	133 100	31 370	136 300	30 249	129 100	28 648
CANTERBURY BANKSTOWN	291 700	103 968	295 200	100 934	302 200	99 970	290 500	98 213
Fairfield	163 600	48 526	185 200	57 243	184 000	54 704	180 500	55 490
Liverpool	125 000	48 663	193 000	90 372	181 500	83 523	263 700	115 733
FAIRFIELD LIVERPOOL	308 600	97 188	378 200	147 615	365 500	138 227	444 200	171 223
Camden	43 850	12 172	111 200	32 374	97 200	26 260	152 700	41 248
Campbelltown	156 900	27 676	184 800	41 197	183 800	39 294	176 400	43 721
Wollondily	40 750	7 775	87 900	16 580	73 100	12 651	147 900	25 592
OUTER S/W SYDNEY	241 500	47 623	383 900	90 151	354 100	78 205	477 000	110 561
Ashfield	39 850	10 816	40 800	10 192	41 900	9 574	40 600	9 276
Burwood	29 650	13 035	31 500	15 227	32 300	14 887	33 700	15 111
Concord	22 700	14 147	24 400	10 956	25 000	10 501	25 800	10 781
Drummoyne	31 850	10 831	33 000	10 017	33 900	9 462	33 200	9 265
Strathfield	26 800	21 687	28 400	20 268	29 100	20 144	29 400	20 313
INNER WEST	150 850	70 515	158 100	66 659	162 200	64 568	162 700	64 746
Auburn	49 800	41 959	53 000	46 698	54 200	46 294	55 500	51 623
Holroyd	83 350	35 607	88 200	35 352	90 400	34 573	89 700	34 302
Parramatta	135 200	82 894	141 300	91 760	145 100	91 051	143 100	105 770
CENTRAL WEST	268 350	160 459	282 500	173 810	289 700	171 918	288 300	191 695
Blue Mountains	78 900	13 505	91 300	15 510	89 300	13 829	101 600	15 802
Hawkesbury	60 700	18 476	69 700	22 322	68 200	20 689	95 500	27 947
Penrith	178 150	42 926	205 100	65 096	199 600	61 181	260 700	78 032
OUTER WEST	317 750	74 908	366 100	102 928	357 100	95 762	457 800	121 781
Baulkham Hills	152 650	40 439	200 400	71 299	190 800	65 342	226 300	83 018
Blacktown	252 300	58 967	334 400	82 495	316 800	75 276	395 400	93 200
BLACTOWN BAULK. HILLS	404 950	99 406	534 800	153 794	507 600	140 618	621 700	176 218
Hunters Hill	12 450	3 758	12 700	3 004	13 000	2 853	12 600	2 798
Lane Cove	30 100	18 006	31 200	17 760	32 000	16 726	31 600	16 585
Mosman	27 450	9 051	28 800	9 414	29 700	8 947	29 400	9 836
North Sydney	53 650	77 548	56 300	92 519	58 300	92 802	57 500	102 307
Ryde	94 100	47 583	96 800	60 765	99 500	59 412	97 200	71 736
Willougby	52 400	45 423	53 800	61 328	55 300	60 832	54 400	63 301
LOWER NORTHERN SYDNEY	270 150	201 369	279 600	244 791	287 800	241 572	282 700	266 562
Hornsby	142 250	38 223	147 200	40 226	150 700	38 992	147 100	44 078
Ku-ring-gai	107 150	28 712	108 300	28 273	110 800	26 946	108 800	26 646
HORNSBY KU-RING-GAI	249 400	66 935	255 500	68 499	261 500	65 938	255 900	70 724
Manly	36 900	12 240	37 300	13 223	38 400	42 629	36 700	13 184
Warringah	181 100	62 226	181 700	76 201	187 700	73 876	174 600	81 298
MANLY-WARRINGAH	218 000	74 466	219 000	89 424	226 100	86 505	211 300	94 483
Gosford	148 550	35 616	186 100	44 081	192 700	12 295	203 400	46 717
Wyong	126 050	23 466	170 600	29 711	177 100	28 566	205 700	33 838
GOSFORD-WYONG	274 600	59 082	356 700	73 792	369 800	70 862	409 100	80 556
TOTAL METROPOLITAN	3886 000	1730 000	4427 300	2023 350	4427 400	1950 000	4814 600	2200 200

Source: MSJ Keys Young, 1992

TABLE 5.6 POPULATION EMPLOYMENT PROJECTIONS: (%) SYDNEY LGAs 1996-2021

Location	1996		2011 Low-Med		2011 Low Med Constrained		2021 Medium	
	Populatio %	Jobs %	Populatio %	Jobs %	Populatio %	Jobs %	Populatio %	Jobs %
Botany	0.91	3.07	0.82	2.50	0.84	2.59	0.75	2.26
Leichhardt	1.54	2.06	1.40	1.54	1.45	1.52	1.29	1.31
Marrickville	2.12	2.04	1.87	1.45	1.91	1.45	1.69	1.23
Sydney/South Sydney	2.20	20.60	2.05	20.01	2.12	20.55	1.94	20.25
INNER SYDNEY	6.77	27.77	6.14	25.50	6.32	26.10	5.68	25.05
Randwick	3.03	1.90	2.71	1.48	2.79	1.46	2.49	1.32
Waverley	1.54	1.02	1.35	0.81	1.39	0.80	1.21	0.84
Woollahra	1.32	1.38	1.17	1.11	1.21	1.09	1.07	1.09
EASTERN SUBURBS	5.88	4.29	5.23	3.39	5.39	3.35	4.77	3.25
Hurstville	1.68	1.17	1.52	1.16	1.56	1.19	1.40	1.26
Kogarah	1.24	0.81	1.16	0.67	1.19	0.67	1.11	0.60
Rockdale	2.21	1.72	1.96	1.30	2.01	1.30	1.79	1.12
Sutherland	5.13	3.19	4.70	3.06	4.84	3.07	4.22	2.98
ST GEORGE SUTHERLAND	10.26	6.89	9.35	6.19	9.61	6.23	8.52	5.95
Bankstown	4.04	4.05	3.66	3.49	3.75	3.58	3.35	3.16
Canterbury	3.46	1.96	3.01	1.55	3.08	1.55	2.68	1.30
CANTERBURY BANKSTOWN	7.51	6.01	6.67	5.04	6.83	5.13	6.03	4.46
Fairfield	4.72	2.80	4.18	2.83	4.16	2.81	3.75	2.52
Liverpool	3.22	2.81	4.36	4.47	4.10	4.28	5.48	5.26
FAIRFIELD LIVERPOOL	7.94	5.62	8.54	7.30	8.26	7.09	9.23	7.78
Camden	1.13	0.70	2.51	1.60	2.20	1.35	3.17	1.87
Campbelltown	4.04	1.60	4.17	2.04	4.15	2.02	3.66	1.99
Wollondily	1.05	0.45	1.99	0.82	1.65	0.65	3.07	1.16
OUTER S/W SYDNEY	6.21	2.75	8.67	4.46	8.00	4.01	9.91	5.03
Ashfield	1.03	0.63	0.92	0.50	0.95	0.49	0.84	0.42
Burwood	0.76	0.75	0.71	0.75	0.73	0.76	0.70	0.69
Concord	0.58	0.82	0.55	0.54	0.56	0.54	0.54	0.49
Drummoyne	0.82	0.63	0.75	0.50	0.77	0.49	0.69	0.42
Strathfield	0.69	1.25	0.64	1.00	0.66	1.03	0.61	0.92
INNER WEST	3.88	4.08	3.57	3.29	3.66	3.31	3.38	2.94
Auburn	1.28	2.43	1.20	2.31	1.22	2.37	1.15	2.35
Holroyd	2.14	2.06	1.99	1.75	2.04	1.77	1.86	1.56
Parramatta	3.48	4.79	3.19	4.54	3.28	4.67	2.97	4.81
CENTRAL WEST	6.91	9.28	6.38	8.59	6.54	8.82	5.99	8.71
Blue Mountains	2.03	0.78	2.06	0.77	2.02	0.71	2.11	0.72
Hawkesbury	1.56	1.07	1.57	1.10	1.54	1.06	1.98	1.27
Penrith	4.58	2.48	4.63	3.22	4.51	3.14	5.41	3.55
OUTER WEST	8.18	4.33	8.27	5.09	8.07	4.91	9.51	5.54
Baulkham Hills	3.93	2.34	4.53	3.52	4.31	3.35	4.70	3.77
Blacktown	6.49	3.41	7.55	4.08	7.16	3.86	8.21	4.24
BLACTOWN BAULK. HILLS	10.42	5.75	12.08	7.60	11.46	7.21	12.91	8.01
Hunters Hill	0.32	0.22	0.29	0.15	0.29	0.15	0.26	0.13
Lane Cove	0.77	1.04	0.70	0.88	0.72	0.86	0.66	0.75
Mosman	0.71	0.52	0.65	0.47	0.67	0.46	0.61	0.45
North Sydney	1.38	4.48	1.27	4.57	1.32	4.76	1.19	4.65
Ryde	2.42	2.75	2.19	3.00	2.25	3.05	2.02	3.26
Willougby	1.35	2.63	1.22	3.03	1.25	3.12	1.13	2.88
LOWER NORTHERN SYDNEY	6.95	11.64	6.32	12.10	6.50	12.39	5.87	12.12
Hornsby	3.66	2.21	3.32	1.99	3.40	2.00	3.06	2.00
Ku-ring-gai	2.76	1.66	2.45	1.40	2.50	1.38	2.26	1.21
HORNSBY KU-RING-GAI	6.42	3.87	5.77	3.39	5.91	3.38	5.32	3.21
Manly	0.95	0.71	0.84	0.65	0.87	0.65	0.76	0.60
Warringah	4.66	3.60	4.10	3.77	4.24	3.79	3.63	3.70
MANLY-WARRINGAH	5.61	4.30	4.95	4.42	5.11	4.44	4.39	4.29
Gosford	3.82	2.06	4.20	2.18	4.35	2.17	4.22	2.12
Wyong	3.24	1.36	3.85	1.47	4.00	1.46	4.27	1.54
GOSFORD-WYONG	7.07	3.42	8.06	3.65	8.35	3.63	8.50	3.66
TOTAL METROPOLITAN	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: MSJ Keys Young, 1992

westward bias in industrial jobs per resident was assumed than that used for the 1996 projections, reflecting trends in a healthier economy towards reduced industrial/ distribution activity in the congested inner areas and the opening up of new industrial land on the fringe. This was used for medium term demand and impact analysis.

2021: Medium: as for 2011 Low-Medium in structure, but assuming higher overall growth This was used for design checks on longer term adequacy of road proposals and impact sensitivity.

Population and employment projections for the four selected scenarios are summarised in Table 5.5, and Table 5.6 compares the percentage distribution of population and jobs for these scenarios.

It should be noted that any inaccuracies in the population projections will cause a similar error in the traffic projections. That is, the growth in traffic is sensitive to the growth in population and traffic growth will increase or reduce in proportion to population growth.

5.2.4 Planned Transport Facility Improvements

Both the infrastructure (i.e. roads, car parks, buses, railways and rolling stock) and the statutory regulations controlling transport operations and the road system influence the operating efficiency of the transport network. There are several major road and public transport projects planned within the time frame of this study which have relevance to the operation of the network in the study corridor.

Road projects

The proposed development of the road network for Sydney is set out in the RTA's "Roads 2000" and "Roads for the 90's" documents and shown on Figure 5.6. The concept of a grid network with a highlighted "orbital" route connecting all incoming arterials including the national highways is central to the plan. Key elements of a possible orbital route which are relevant to the corridor are the M5 Casula Link, connecting between the Hume Highway at Camden Valley Way and the South Western Motorway east of the Hume Highway, and the proposed development of the Prospect Arterial which would eventually form the western arm of the orbital route.

Other significant route upgradings which may influence the operation of the network in the corridor include:

- Campbelltown Road, Campbelltown between Blaxland Road and Rudd Road (possible widening).

- Narellan Road, Appin Road to Blaxland Road (possible overbridge).

- Wallgrove Road between Elizabeth Drive and The Horsley Drive.

- Elizabeth Drive between Brown Road and Cowpasture Road (possible additional lanes).

- The Horsley Drive between Fairfield and Wetherill Park.

- The Horsley Drive between Canley Vale Road and Victoria Street.

Other network modifications are those proposed in the Liverpool and Campbelltown areas:

- Liverpool Council schemes include:

(i) New Local Area Traffic Management (LATM) schemes with roundabouts at the intersections of:

- Graham Avenue and Grove Street

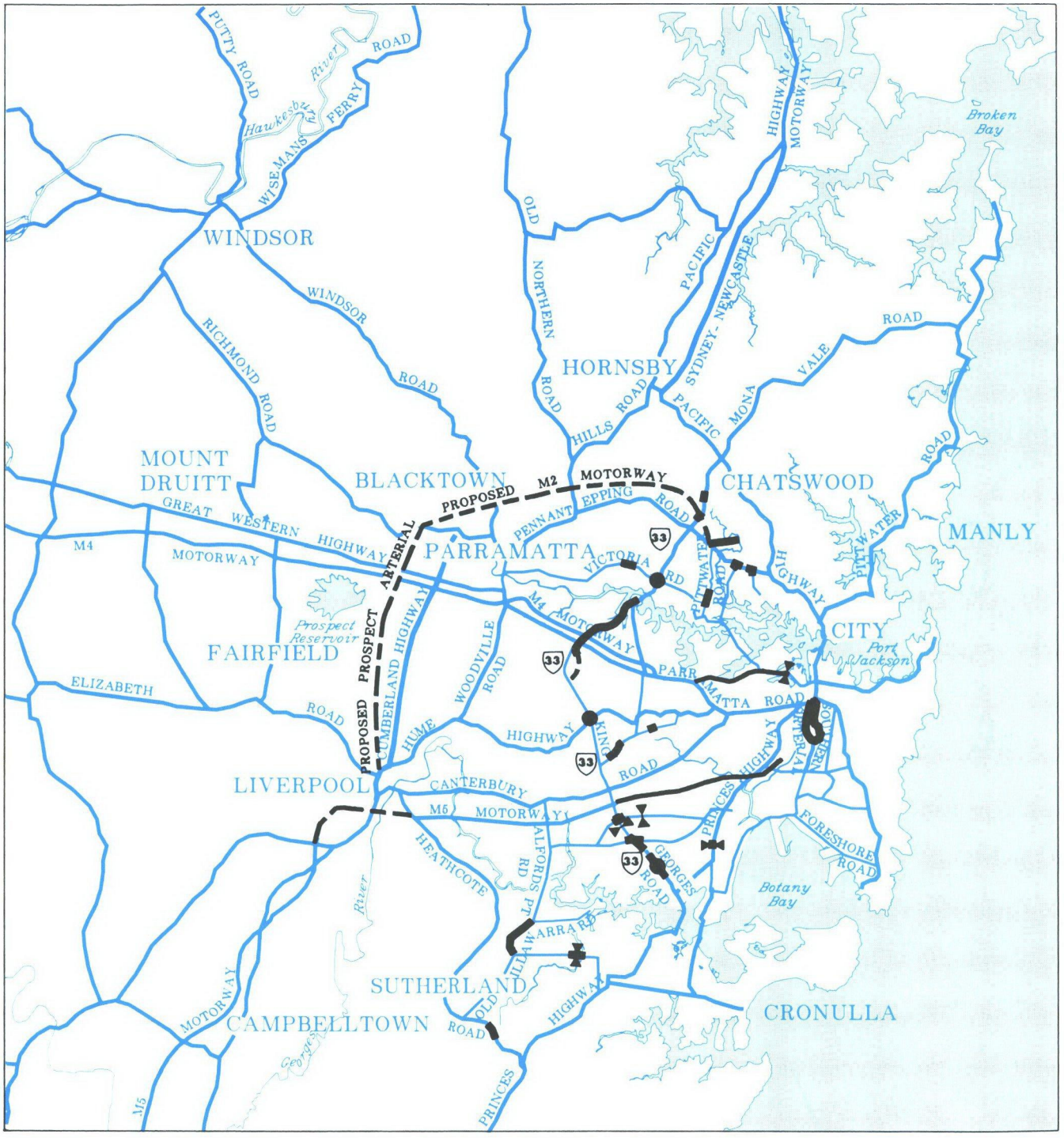
- Kurrajong Road and Napier Avenue (which will only proceed if the Casula Link is not built).

(ii) The extension of Ingham Drive to Alcock Avenue at the Hume Highway and signalisation of the intersection at the Highway.

(iii) Local roads associated with the subdivision of land bounded by Camden Valley Way/ Box Road/Beech Road/ Kurrajong Road.

(iv) Pine Road to be deviated into Ingham Drive extension.

(v) Reconstruction and partial upgrading of Kurrajong Road.



38 State Route
Proposed new Roads & Motorways
Major Reconstruction
New Bridge
Underpass/Flyover

0 5 10 20 30
Kilometres

FIGURE 5.6
PROPOSED ROAD NETWORK

N

Source: RTA 1992

(vi) New local roads associated with further subdivision of east Casula.

(vii) A sub-arterial road connecting the industrial estate area from Lyn Parade to Camden Valley Way, west of and parallel to Cedar Road.

Campbelltown Council LATM schemes and new roadworks include:

(i) North facing on and off ramps to the Hume Highway at Brooks Road by the RTA.

(ii) Major intersection improvement works on Campbelltown Road by the RTA.

(iii) An extension of Henderson Road to Harold Street, Ingleburn.

(iv) The replacement of the railway level crossing with a bridge at Redfern Road, Minto (construction is currently in progress).

Rail projects

CityRail projects that are proceeding at the moment include upgrades of every station in the Sydney network, from minor cosmetic improvements to complete reconstruction. These works are due for completion by 1995.

The following major rail upgrading or construction projects may be built over the next ten years in Sydney:

1. East Hills line quadruplication and greater frequency of high speed trains in the peak hour.

2. Sydenham Junction 6 tracks upgrade.

(Both the above projects are included in CityRail's current capital works program.)

3. Rail link between Merrylands and Harris Park (called "Merrylands Y"or "Harris Park Y" Link). CityRail is committed to this project.

4. High speed tilt trains from Sydney to Canberra/Melbourne. Expressions of interest have been called for this project.

5. Upgrading of the freight line from Enfield to Macarthur by the National Rail Corporation. This should be built within the next 2 years.

6. Possible airport rail link from KSA to CBD. Detailed feasibility studies are in progress and are due for completion in March 1993.

7. Possible extension of a rail link from Glenfield to Badgery's Creek, once the airport is developed. This is a long term project over the next 10 to 20 years.

Many proposals suggesting upgrades of the existing heavy rail network or introduction of light rail facilities have been put forward by CityRail and interested third parties.

The Australian Railways Union *(Jacana, 1990)* proposed extension of Sydney's heavy rail network, designed to generate a second focus for the network at Parramatta with the aim of providing a proper base for future expansion into the north west and south west sector. The proposals suggest a link from Hornsby and Epping to Parramatta and then to Liverpool and Campbelltown.

These links would improve the capacity for cross-suburban movements and would also specifically address the needs of the growing south west region for travel especially toward the north and Parramatta.

Various schemes have been proposed by the Light Rail Association *(1991)* to integrate new light rail technology into the Sydney rail network but none are in the study area.

As yet there is no commitment by CityRail or Department of Transport to undertaking any of these major works within the time frame relevant to this study.

Bus projects

Bus services in the region are provided by four private bus operators. Traditionally, bus operators have exercised exclusive service rights over well defined patronage areas and few standards

have been set concerning the level of service.

The Passenger Transport Act (1990) aims to bring in an element of competition and defines the minimum level of service which a bus operator must provide over a franchised area, related to the population density and car ownership levels within the area. Contracts for bus services are offered at five-yearly intervals and operators must devise routes and timetables to meet the requirements of the Passenger Transport Act.

There are currently no specific new bus projects planned for the study area, but it will be a requirement of the private bus operators to update services to respond to the demands of a developing region.

Transport studies of the south western region

Discussions with statutory planning and transport authorities and Councils show that the following transport related studies have been done for the south west region.

- *Eugene Smith, Beca Consulting, Geoplan and Tech Consulting, 1992*
  'Traffic study for stage 2 Liverpool Release Areas'.

  This study developed a road hierarchy, assessed impact of future release areas, suggested ways to avoid road congestion and prepared a model for Section 94 contributions.

- *Department of Planning, 1992*
  'Revised South West Sydney Strategy'.

  This strategy outlined a revised development plan for south west Sydney considering the delays in development of South Creek.

- *Department of Planning, 1991*
  'South Creek Valley Regional Environmental Plan'.

  This study described the existing environment in South Creek, a strategy option for development, guidelines for planning and implementation and the various facilities that are required.

- *Geoplan, Beca Consulting and Eugene Smith, 1991*
  'Local Area Traffic Management Study of Green Valley'.

  This study examined the local area traffic problems in Green Valley and suggested a management strategy to improve problems.

- *Travers Morgan, 1991*
  'Liverpool CBD Traffic Study'.

  This study examined major traffic issues in the Liverpool CBD and suggested recommendations to improve problems.

- *Department of Planning*
  'Draft South Creek Valley Regional Environmental Plan'.

  The plan outlines the broad aims and objectives for the long term development of the South Creek Valley Sector and guidelines for development of the Oran Park Development Area.

- *Travers Morgan, 1990*
  'South Creek Transport Study'.

  This study prepared a transport planning model for the Region and estimated the scale, timing and costs for road and public transport improvements.

  The major existing travel demands for the south west region are shown in Figure 5.7.

5.3 FUTURE TRAVEL DEMANDS

5.3.1 Preamble and Methodology

The principal objective of the travel demand forecasting process has been to estimate future peak period flows in the corridor by various modes including car, truck, public transport and pedestrian movements. Bicycle travel, whilst acknowledged, still only forms a very small percentage of journey to work trips.

Travel forecasting is a process of simulating the current real world system of population, employment and shopping centres, including the roadway links, intersections and public transport network using a mathematical "model" which, whilst it accounts for the key parameters, is by no means perfect. Some of the main limitations of the process relate to the behavioural aspects of trip generation, distribution, mode choice and route choice which are discussed below.

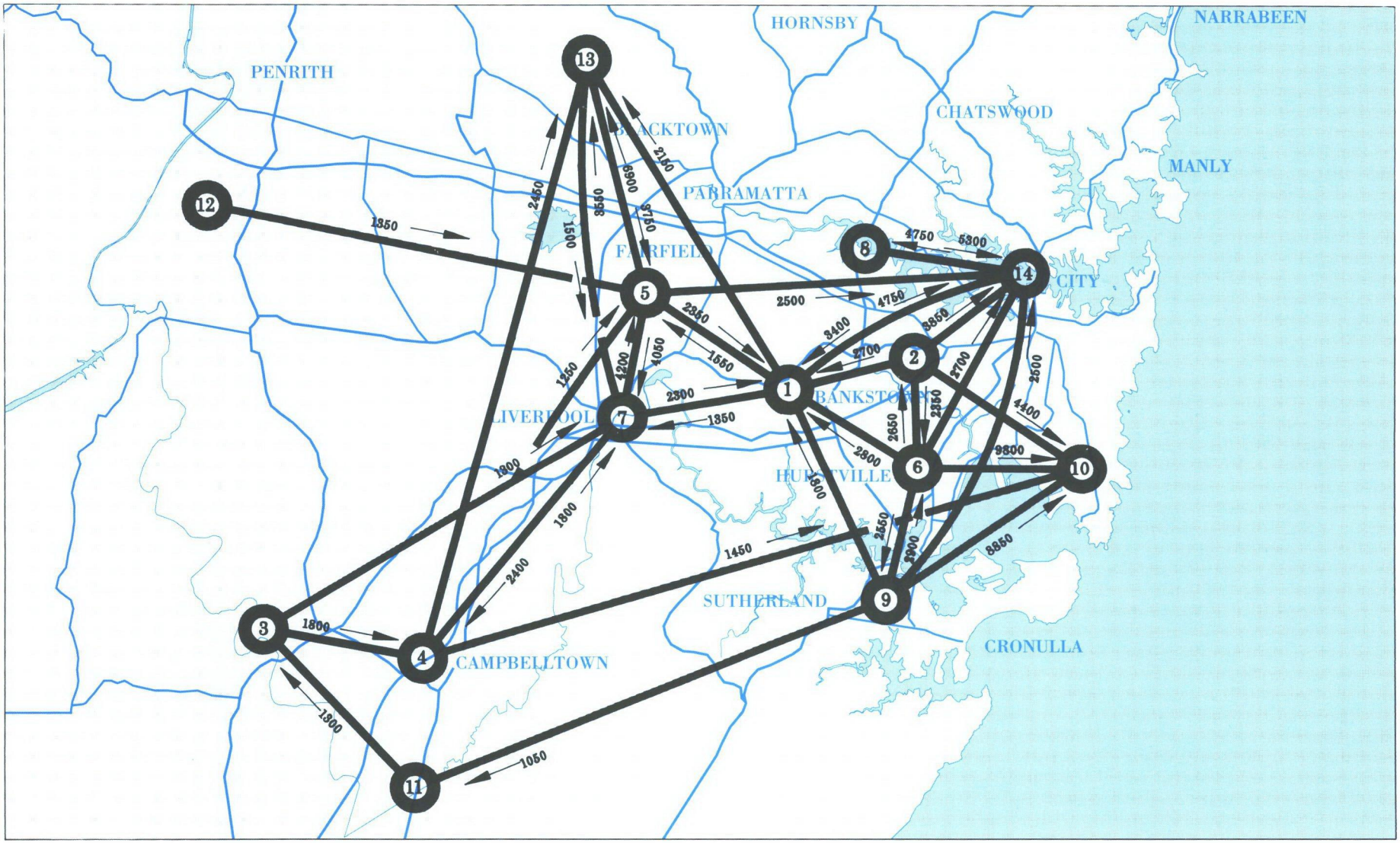


FIGURE 5.7

MAJOR EXISTING TRAVEL DEMANDS 1992

(Vehicle Trips in am 2 hours)

Source: DJA 1992

Trip generation: Trips to work, for example, are *produced* or originate in residential areas and are *attracted* to or have destinations in employment centres such as Campbelltown, Liverpool and the Sydney CBD. Trip generation rates are usually statistically related to household characteristics such as income, car ownership and population density. Thus there are at least three sources of possible uncertainty:

- Forecasts of population and employment derived from strategic planning scenarios (such as those discussed in Section 5.2) could vary significantly from actual outcomes.

- The scatter which is inherent in all predictive statistical relationships and which will tend to underestimate certain zone-to-zone volumes whilst overestimating others.

- Possible instability of the statistical parameters over the 20 year time period considered in this study.

Trip distribution: Once the total trip origins and destinations have been estimated for each of the zones into which metropolitan Sydney has been divided for the purposes of the model, it is then necessary to model the way in which the trips themselves may be distributed between the zones, that is to "fill in the cells" of the trip matrix. The procedure has limitations which add a further source of uncertainty.

Mode choice: Choice of mode decisions, broadly between private car or public transport, are another source of uncertainty. Factors influencing the choice include the relative cost, convenience and travel time of the alternatives and multiple trips. A third set of mathematical and statistical procedures is used to model those complex factors. The resulting division of trips by mode is termed modal spilt and is usually expressed as the percentage of trips made by public transport.

Route choice: Most traffic forecasts assume shortest-time routing with sufficient iterations to ensure that the speeds on congested links are consistent with the predicted volumes. This procedure is a fair approximation to current reality but the limitations will be obvious to any road user given the dynamics of daily traffic flows and personal choice.

These explanations give an indication of the imperfections of the traffic forecasting process and show why it is not possible to model even existing conditions with a high degree of accuracy. Nevertheless, when looking at longer-term time horizons a comprehensive model of this type offers the best available means of testing how alternative transportation networks will serve future population distributions.

As acknowledged, all transportation models have technical deficiencies, so that specialised skill and judgement are required to "tune" parameters and interpret results. Detailed documentation of the methodology adopted by the study team is given in the Working Papers. Whilst the model is considered appropriate to the needs of the project, it is not claimed to be complete. However it does provide the best possible basis for planning and evaluation consistent with world best practice.

The approach has been to produce carefully considered estimates of the key demands, consistent with the accuracy of the planning and modal split data available, and to assess the effects of variations in these parameters by reasoned sensitivity testing. The study team also were aware of the need to legally substantiate their methodology against existing established professional practice.

The travel demand modelling process used for this project was based upon the current State Transport Study Group's (STSG) model. The exercise commenced with an analysis of the accuracy with which 1990 volumes estimated by the STSG corresponded with observed flows on the network in the Casula region. The trip matrix in the model was adjusted to reproduce observed flows within 10 per cent and thus to provide a good starting point for forecasting and for interpolating 1996 volumes.

Longer-term forecasts for 2011 were then estimated by synthesising trip matrices from the planning data described in Section 5.2, and in accordance with usual transportation planning practice.

To address uncertainties in the forecasting process a range of sensitivity tests has been undertaken, relating to population/employment distributions for the forecast years. Thus, whilst figures adopted for analysis purposes usually represent the middle range of assumptions, the extent to which these could vary has also been considered.

A reasonable degree of confidence can be held in the forecast patterns of travel demand at a major facility or corridor level and in the relativities between alternative transportation systems, both public and private. There are limitations though in predictions for travel demand on minor roads and some feeders. In practical traffic modelling it should not be expected that forecasts for all links will be reliable, but the results presented in this report have been thoroughly examined so that they are reasonable in their context.

5.3.2 Travel Demand Patterns

The primary determinants of travel demand in the area are:

- The existing population and employment distribution and the forecast growth.

- The characteristics of the available road links - principally the absence of East-West connections south of Liverpool.

- The regional and interstate role of the Hume Highway particularly for truck traffic.

Growth in population in the municipalities of Campbelltown and Camden is currently "on-hold" pending resolution of environmental investigations. However, even with modest land release programs it is expected that substantial growth in housing development would occur. Indeed, the assumptions about population levels in these municipalities for the year 2011 represent only approximately 75% of the potential capacity of the release areas.

Because of the relatively low growth in employment south of Liverpool there is naturally a very high demand for travel to work set up by the assumed growth pattern. In the vicinity of the new Link the growth would substantially exceed the capacity of the likely roads in the corridor. This would of course lead to substantial spreading of the peak period and is likely to effect the attractiveness of the area and in turn the probability of the predicted population targets being reached in the time periods specified.

Figure 5.7 shows the magnitude of the major sector-to-sector peak period vehicle movements in the region for 1992.

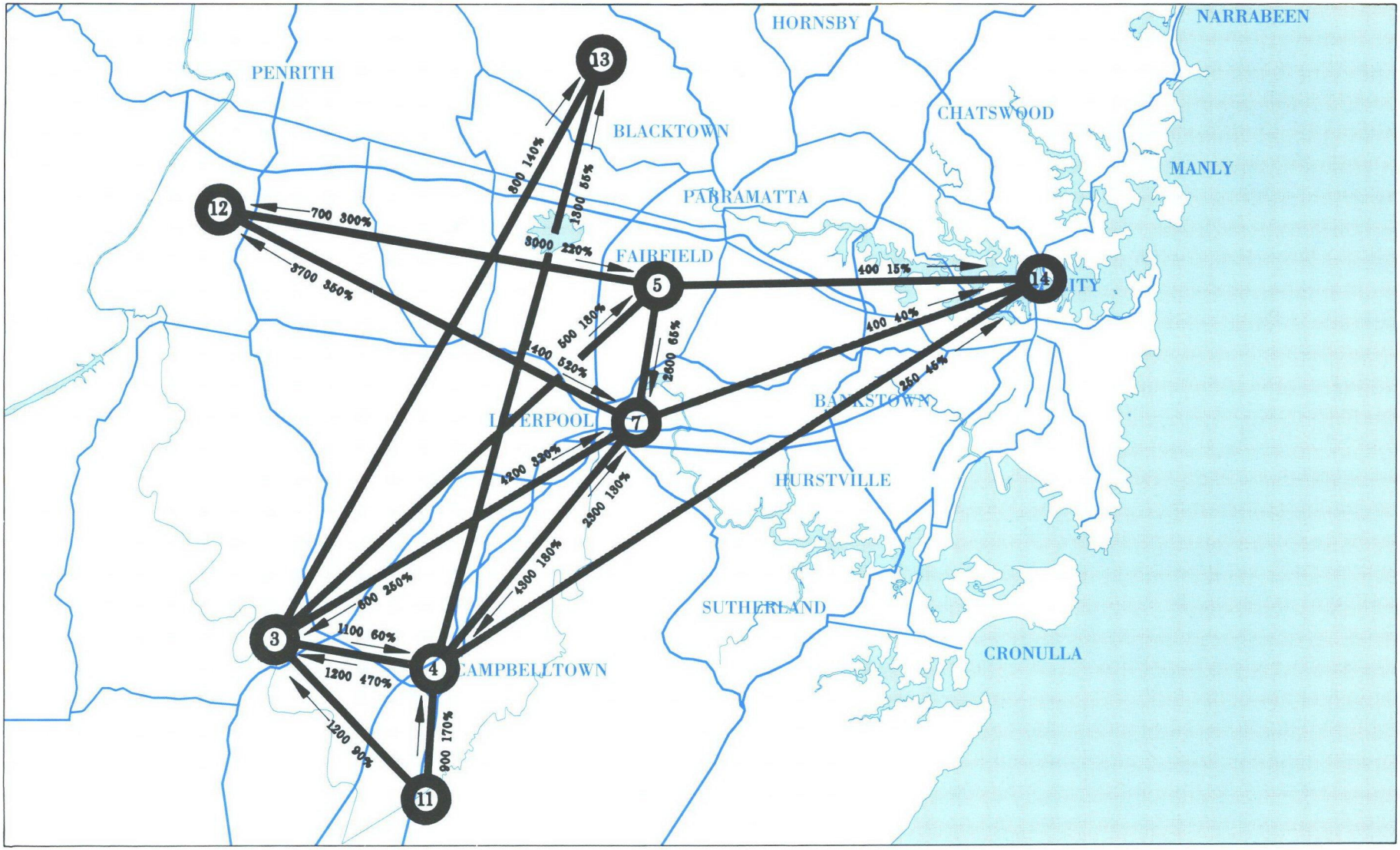
The travel demand pattern shown in Figure 5.7 identifies Liverpool as an employment centre for the south west region. Other major destinations for traffic through the study corridor are Fairfield and Parramatta. Northbound traffic from the Campbelltown sector provides the main contribution to morning peak hour flows through the study corridor.

Figures 5.8 and 5.9 show the anticipated sector to sector growth in car trips based on the population and employment distributions for the year 2011 described in Section 5.2.4. The increase in trips to and from Camden and Campbelltown indicate the projected growth in these areas as Sydney's outer south west is developed. The combination of population growth in Camden and Campbelltown and employment growth to the north of the study area results in a doubling of traffic demand through the study corridor by the year 2011.

Initial estimates of unrestrained travel demand growth to the year 2011 lead to a corridor peak 2 hour flow of 20,000 northbound vehicles and a flow of approximately 11,000 vehicles on the proposed Casula Link (which is likely to have a capacity of only 8,000 vehicles in the two hour period). This forecast assumed that the existing proportions of trips by public transport would be maintained and that household trip generation rates would also remain constant.

Clearly, the forecast demand for unconstrained car travel exceeds the capacity of the planned road system in peak hours and one (or more) of several outcomes can be expected:

- A higher rate of utilization of public transport could result if the system can be upgraded to meet demand.



3	Camden	11	External-South
4	Campbelltown	12	External-West
5	Fairfield	13	External-North
7	Liverpool	14	City/External-North East

0 5 10 20 30
Kilometres

FIGURE 5.8
MAJOR TRAVEL DEMAND INCREASES 1992-2011
(Car Trips in am 2 hours)

Source: DJA 1992

N

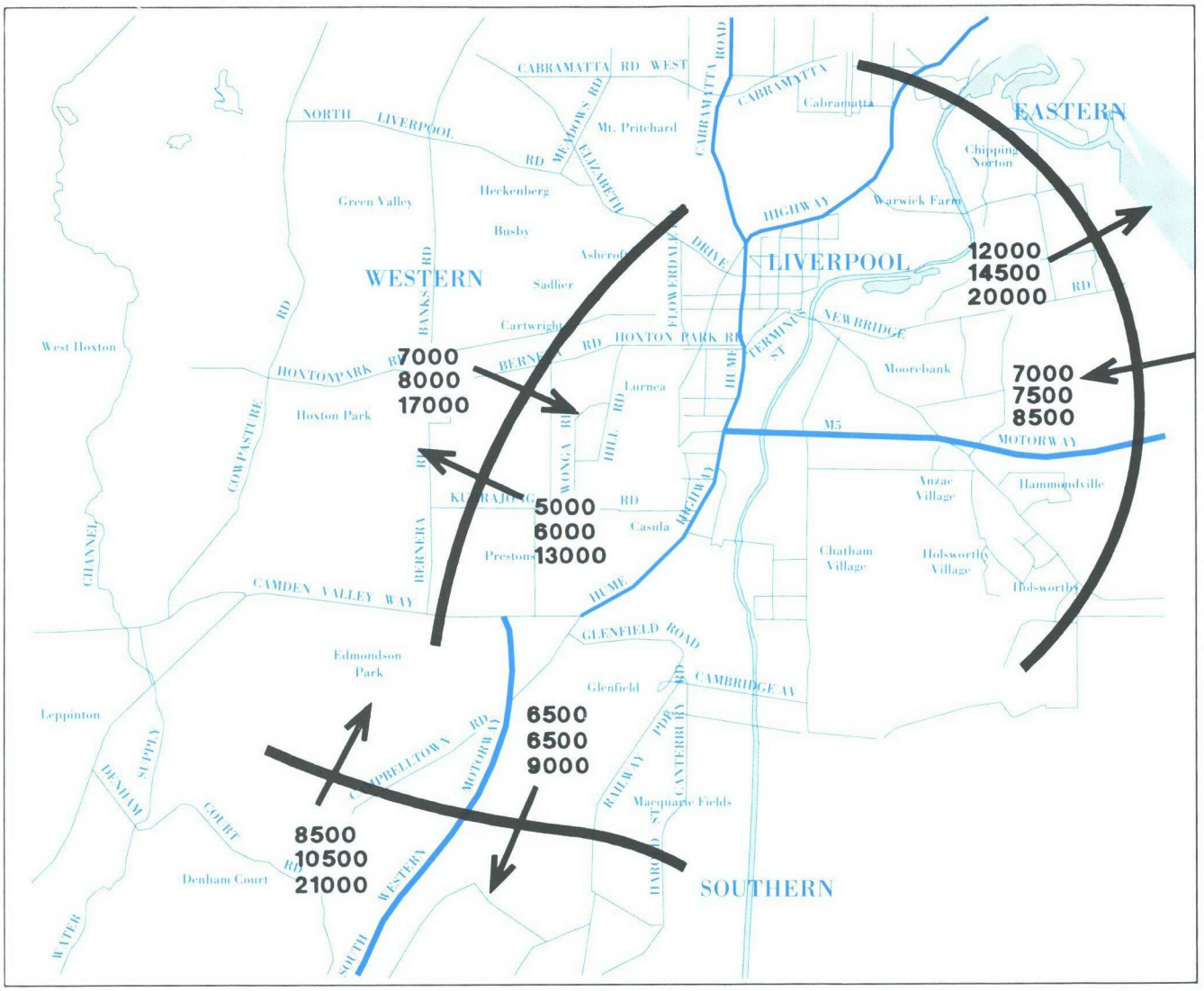


FIGURE 5.9

FORECAST CORRIDOR FLOWS

(Vehicle Trips One Way Across Screenlines in AM Peak 2 Hours)

Source: DJA 1992

- Car pooling may increase.

- The peak period would extend over more than two hours to avoid the congestion.

- The anticipated population/ employment growth and their distribution would be curtailed or modified as a result of perceived congestion.

For the purpose of the assessment of the road options a traffic demand forecast has been developed which is in equilibrium with the available road network capacity. No judgements have been made as to which of the above outcomes (or combinations) would produce this outcome.

Population is expected to grow significantly within the study area with employment opportunities increasing The demand for travel from residential areas to places of employment will increase and the transport system must grow to meet the demand.

6
SUMMARY OF NEED

6.1
PREAMBLE

To estimate the need for major transport improvements in the study area two questions need to be addressed:

- Is the existing transport system satisfactorily coping with current demand for travel?

- Will the system cope with expected short to medium term demand as it exists or with minor improvements?

Section 6.2 discusses in detail the existing transport infrastructure conditions for all users with reference to specific performance related measurements.

The ability of the system to cope with future traffic demand is addressed in Sections 6.3 and 6.4, where the 'baseline' or 'do-nothing' situation is discussed.

6.2
EXISTING INFRASTRUCTURE CONDITIONS

6.2.1
Road Metropolitan context

The condition of Sydney's road network is underlined by the NAASRA Roads Study Report *(1984)* which provides comparisons of arterial road provision in the state capitals. In 1981, urban arterials comprised only 1% of the total road length in Australia, but carried 40% of the total travel. Table 6.1 details the relevant statistics for the group of larger capitals.

It can been seen that Sydney and Melbourne have similar numbers of total cars on register. The daily road travel is also similar at about 31 million vehicle kilometres per day. However, the total urban arterial road space is lower in Sydney than in Melbourne by about 45%. The provision of arterial road space per car and per person is also significantly lower in Sydney.

The NAASRA report states that:

The size of the Sydney network appears small in relation to population even allowing for higher development density. In comparison with other Category A and B cities, the Sydney network would appear to contain relatively few of the less important secondary arterial roads...Sydney has a highly irregular network of relatively narrow roads based mainly on routes which radiate from the central area.

The report notes that the relative narrowness of road lanes in New South Wales may have led to an

TABLE 6.1 ARTERIAL ROAD STATISTICS (1981)

	Sydney	Melbourne	Brisbane	Adelaide	Perth	Total
Population (thousands)	2956	2340	971	910	846	8024
Daily Travel (million vehicle km/day)	31.1	32.5	11.8	11.4	14.8	101.6
Cars on Register (thousands)	1204	1213	463	424	444	3748
Road Space (lane km)	3450	6369	2348	2268	3033	17468
Average Number of Lanes	2.3	3.6	2.3	3.4	2.9	3.1
Average Daily Traffic (veh/day) per Arterial	21500	18200	16500	16900	13900	17800
Lane Km/1000 cars	2.9	5.3	5.1	5.3	6.8	4.7
Lane km/1000 people	1.2	2.7	2.4	2.5	3.5	2.2

Source: NAASRA Roads Study Report, 1984

underestimate of road space, which was calculated using a single standard lane width in all cities; this would only marginally affect the conclusions drawn above.

Although the majority of this research was completed in 1981, the relative difference in population growth and network expansion since then is such that the comparisons are still relevant. It is evident that Sydney is significantly underprovided with urban arterial road space when compared with other State capital cities.

Network description

The road network investigated is shown in Figure 6.1 in which the study area has been shaded. On Figure 6.1, the existing major roads and proposed roads are shown highlighted with the RTA's administrative classifications noted.

The major classifications used are State Roads, which include major arterials, freeways and expressways, and Regional Roads.

The corridor under investigation is located in the south western quadrant of the Sydney metropolitan area. The predominant demand for vehicular movements through the area tends to be along a south west north east axis and is represented by the following major arterial routes:

- The Hume Highway from the south through Liverpool towards Bankstown and the City.
- Cumberland Highway from the Hume Highway connecting to Parramatta and to the north of Sydney.
- The connection from the Hume Highway to Newbridge Road and thus feeding to the east via Milperra Road. This route has recently been duplicated and significantly enhanced by the opening of the section of the South-Western Motorway (M5) between the Hume Highway and King Georges Road at Beverly Hills.

These routes are supported by a secondary route, Cambridge Avenue - Moorebank Avenue, which carries approximately 25,000 vehicles per day (vpd) of traffic which bypasses the Hume Highway.

This route crosses the Georges River Causeway which occasionally becomes impassable due to flooding. When this occurs traffic is forced to use the Hume Highway and traffic delays and queuing become extremely long.

In addition to the major through traffic movements the area contains the Liverpool centre which generates significant traffic in its own right.

Most of the major arterial road intersections in the corridor are traffic signal controlled and linked to the SCATS (Sydney Co-ordinated Adaptive Traffic Systems) signals co-ordination system.

There are some roundabouts on the arterial roads, particularly on Heathcote Road, but most other intersections of arterial roads with lower level roads are controlled by 'Stop' or 'Give Way' signs facing the lesser classified road.

These traffic management measures and co-ordination of traffic signals are used to improve the efficiency of the road network and are reasonably effective to maximise flow on the major routes, but there are long signal cycle times and some bias in allocation of green times towards the main route resulting in lengthy delays on the side roads.

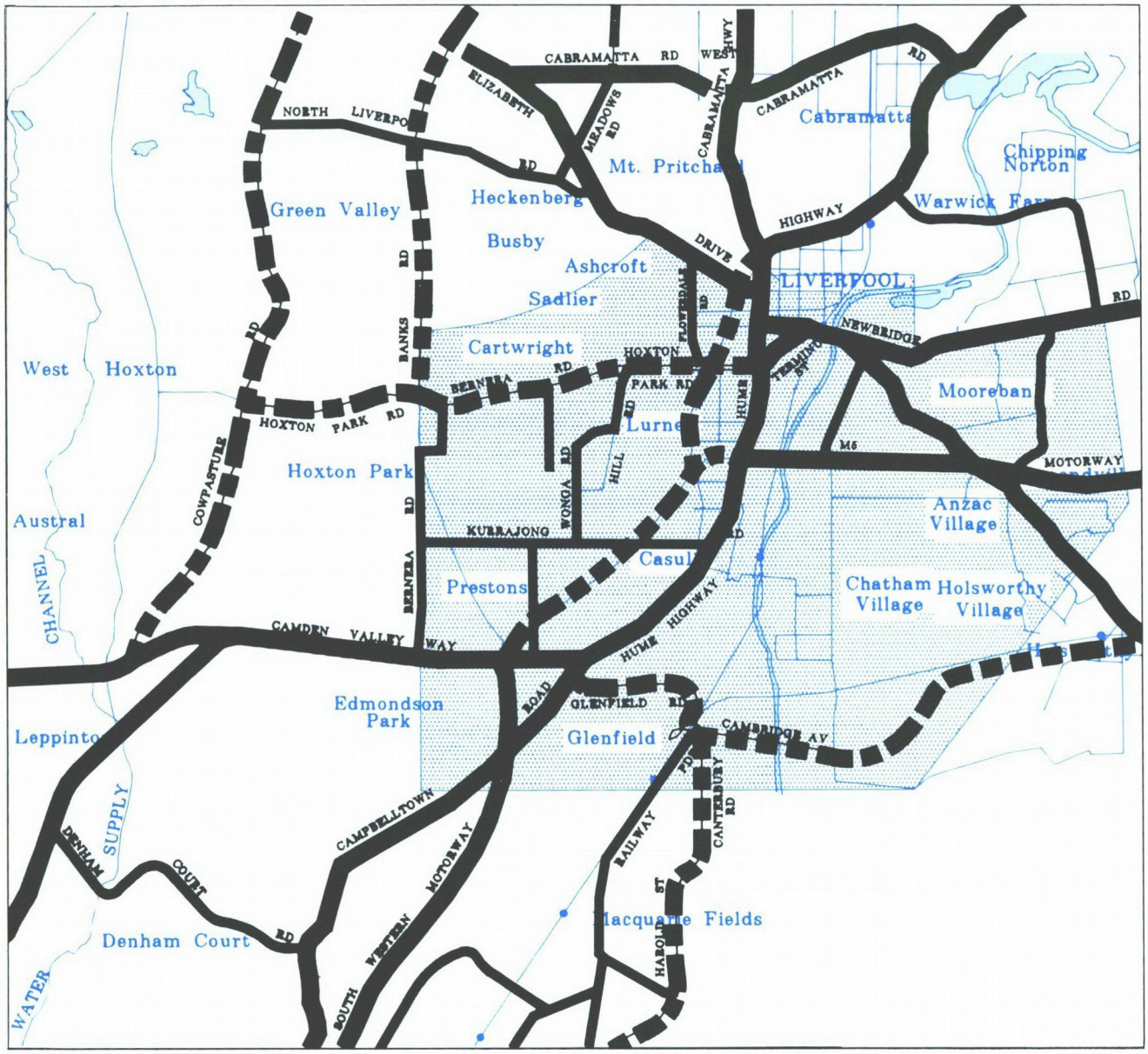
Most roads in the study area are of reasonable quality in terms of pavement condition, lane widths and general design standards.

Traffic volumes

The major routes in the study area are M5, Hume Highway, Cumberland Highway and Newbridge Road. Figure 6.2 provides a graphical representation of the existing traffic volumes on these and other significant routes in the study area prior to the recent opening of the South Western Motorway.

Traffic flows measured on individual routes in the study area in 1991 include.

- Hume Highway south of Cumberland Highway 61000 vpd.
- Hume Highway north of M5 46000 vpd.



State Roads
Future State Roads
Regional Roads
Study Area

0 0.5 1.0 2.0 3.0
Kilometres

FIGURE 6.1
ROAD HIERARCHY

Source: RTA 1992

N

- Hume Highway south of M5 65000 vpd.

- Hume Highway north of Camden Valley Way 73000 vpd.

- Newbridge Road east of Heathcote Road 53000 vpd.

Traffic on these arterial routes shows annual growth rates of between 1.4% and 4.0% for the period 1987 to 1991.

Commercial vehicles

A number of surveys were undertaken on various routes throughout the study area during April 1992.

At most sites the daily truck flows were between 3.8% and 7.0% of the total daily traffic. The exceptions were the Hume Highway at locations north and south of the M5 junction. The highest proportion of truck flows was 8.5% northbound and 8.7% southbound on the Hume Highway north of the M5. These percentages represent about 2000 trucks per day in each direction *(Denis Johnston & Associates, 1992)*.

In addition to classified counts an origin-destination survey was conducted at the Hume Highway/ South Western Freeway intersection. This survey identified some of the major truck routes through the region as:

- Milperra Road, Newbridge Road, South Western Freeway, Hume Highway.

- Woodville Road, Liverpool Road, Hume Highway.

- Cumberland Highway, Hume Highway.

At most sites the proportion of commercial vehicles travelling at night between 12 pm and 6 am were higher than the daily averages. The most significant was the Hume Highway north of M5 with night time truck volumes of 530 in each direction representing approximately 22% of the total traffic movements during this period.

Travel speed

Travel speeds on various arterial routes are regularly monitored by the RTA. Surveys of particular interest in this corridor were undertaken in April 1992 along two routes. These were:

- Camden Valley Way, Hume Highway, M5, Moorebank Avenue, Heathcote Road and Newbridge Road.

- Hoxton Park Road, Terminus Street, Newbridge Road.

The surveys were carried out on inbound traffic during the morning peak and outbound traffic during the evening peak hours.

The surveys indicate average peak hour travel speeds on the Hume Highway of between 33 and 40 km/h south of the South Western Motorway. Camden Valley Way operates during the morning peak period at speeds of about 42 km/h east bound in the morning peak period east of the South Western Freeway and at speeds of up to 90 km/h further west.

Newbridge Road travel speeds have been measured at between 17 and 52 km/h.

About 75% of Sydney's network operates with average travel speeds below 35 km/h in the peak period. Review of the results of travel speed surveys indicate that sections of the Hume Highway and Newbridge Road are operating at speeds lower than 35 km/h. These sections need to be improved considering the infrastructure requirements to service the expected growth in Sydney's south-west region.

Hazardous material/goods

Hazardous materials carried by road vehicles include petrol, liquified petroleum gas, industrial chemicals, insecticides, pesticides and the like.

To indicate the proportion of these vehicles in the study area, a 24 hour survey was undertaken on the Hume Highway and Newbridge Road which identified proportions of 2.5% and 2.1% respectively. These are higher than the NSW average of around 1.2%.

Current legislation is provided by Commonwealth Regulation P15 - The Australian Code for Transport of Dangerous Goods by Road and Rail (1987). This legislation is under review.

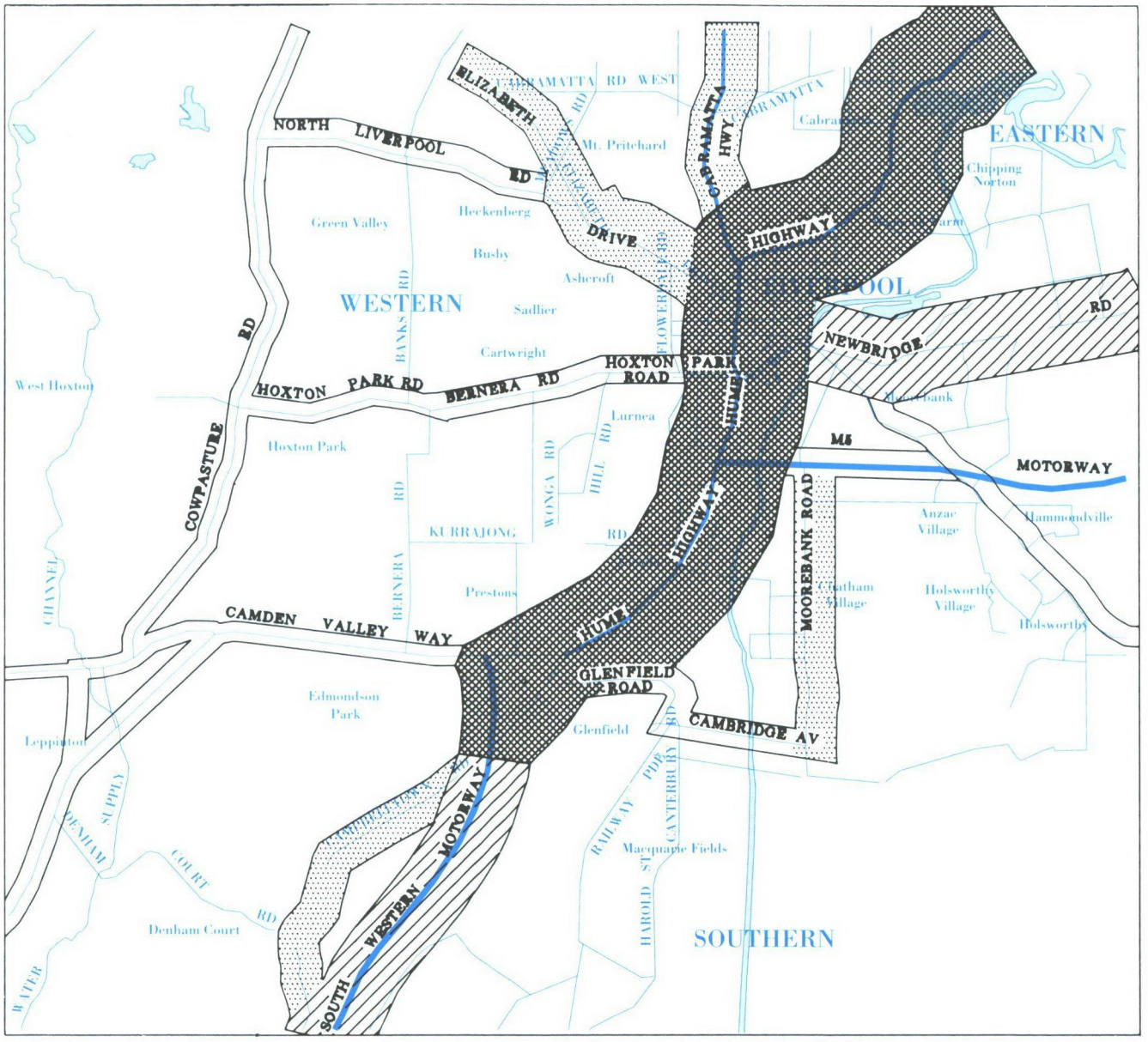


FIGURE 6.2

AADT TRAFFIC VOLUMES 1992

Source: DJA 1992

The need to provide clearly defined routes for hazardous vehicles is based on both the requirement for rapid emergency response measures should there be a serious accident involving a hazardous vehicle, and also so that authorities can more accurately regulate and accommodate the movement of such vehicles.

Accidents

The accident history of the major roads in the study area has been analysed for the years 1989, 1990 and the first three quarters of 1991. The results of this analysis are summarised in Figure 6.3. The data presented has been summarised from the traffic accident data collected for the local government areas of Liverpool and Campbelltown.

There are eight intersections ranked in the State's top 100 listing of Blackspots for 1990/91. These sites and their ranking are noted in Table 6.2.

Accident rates on the major roads in the study area for the 2.75 year period from 1989 are shown in Table 6.3 as well as diagrammatically in Figure 6.3. By comparison an average accident rate for the NSW road network statewide for 1991 was estimated to be 9 crashes per million-vehicle-km and the rate for an motorway is about 0.5 crashes per million vehicle-km.

As a result of the Casula Link a reduction in accidents is expected, of around 1.5%. This represents a reduction of 1 fatality and 45 injuries per year in the south west region of Sydney.

Congestion

The performance of an urban road network is largely controlled by the performance of its intersections. The performance of intersections is generally measured by reference to a calculated theoretical degree of saturation.

Theoretical degrees of saturation ranging from 0.85 to 0.95 are considered to be high and associated with increasing congestion and delay. Values greater than 0.95 are undesirable and generally indicate untenable operation.

Analysis of existing intersections in the study area in July 1992 showed that most intersections are performing at about the upper limit of desirable operation, with three intersections on the Hume Highway at Leacocks Lane, De Meyrick Avenue and Elizabeth Drive operating at the undesirable range. Figure 6.4 indicates the intersections analysed.

The impact of the projected population and traffic growth would be to force most of the intersections on the Hume Highway to operate well beyond the limits of desirable operation. If no major improvements were made to the road network then very high levels of congestion, traffic delays and queuing would be experienced well before the year 2011.

Local access

Access into the Lurnea area from the Hume Highway is via Kurrajong Road, Graham Avenue, De Meyrick Avenue and a number of other more minor access roads. Box, Cedar and Beech Roads all cross the proposed M5 Casula Link reservation.

Major vehicular and pedestrian traffic generators in the Lurnea area which may be affected by the proposed development of the M5 Casula Link include the Casula Mall Shopping Centre and six schools:-

- Lurnea Primary School.
- Casula Primary School.

TABLE 6.2 BLACKSPOT INTERSECTIONS

Rank	Location	Total Accidents 1990/91
18	Hume Highway/Hoxton Park Road	29
21	Hume Highway/Cedar Road	28
27	Cumberland Highway/Hume Highway	27
29	Hume Highway/Elizabeth Drive	27
34	Campbell Street/George Street	26
83	Bathurst Street/Memorial Avenue	21
85	Newbridge Road/Stockton Avenue	21
88	Macquarie Street/Scott Street	21

Source: RTA, 1992

TABLE 6.3 ACCIDENT RATES PER MILLION VEHICLE/KM IN STUDY AREA

Road	Accidents per million vehicle/kms
Heathcote Road	2.6
Hoxton Park Road (Hume Hwy - Banks Road)	2.6
Hume Highway (M5 Motorway - Cumberland Hwy)	1.8
Hume Highway (Cumberland Hwy - Governor Macquarie Drive)	1.6
Newbridge Road (Heathcote Road - Governor Macquarie Drive)	1.3
Hume Highway (Camden Valley Way - M5 Motorway)	1.2
Elizabeth Street	1.1
Cumberland Highway	1.0
Camden Valley Way	1.0
Campbelltown Road	0.9
Moorebank Road (Cambridge Road - M5 Motorway)	0.8
M5 Motorway	0.7
Moorebank Road (Heathcote Road - M5 Motorway)	0.7

Source: RTA, 1991

- Prestons Primary School.
- Casula High School.
- Lurnea High School.
- All Saints Catholic Senior High School.

The Casula Mall Shopping Centre is the local shopping centre for Casula and Lurnea and is situated on Kurrajong Road adjacent to the motorway reservation.

The school catchment areas have generally been defined by the Department of School Education in anticipation of the eventual development of a motorway.

Section 4.4 discusses the school pedestrian surveys which identified the main pedestrian crossing points of the proposed link to be De Meyrick Avenue, Kurrajong Road and Box Road. Between 10 and 20 students from each school cross the road reservation daily.

6.2.2 PUBLIC TRANSPORT

Rail services

The area is served by two railway lines carrying suburban services:-

- The main southern line which extends from Campbelltown to the city via Liverpool.
- The East Hills line which splits from the southern line at Glenfield and continues to the city via East Hills.

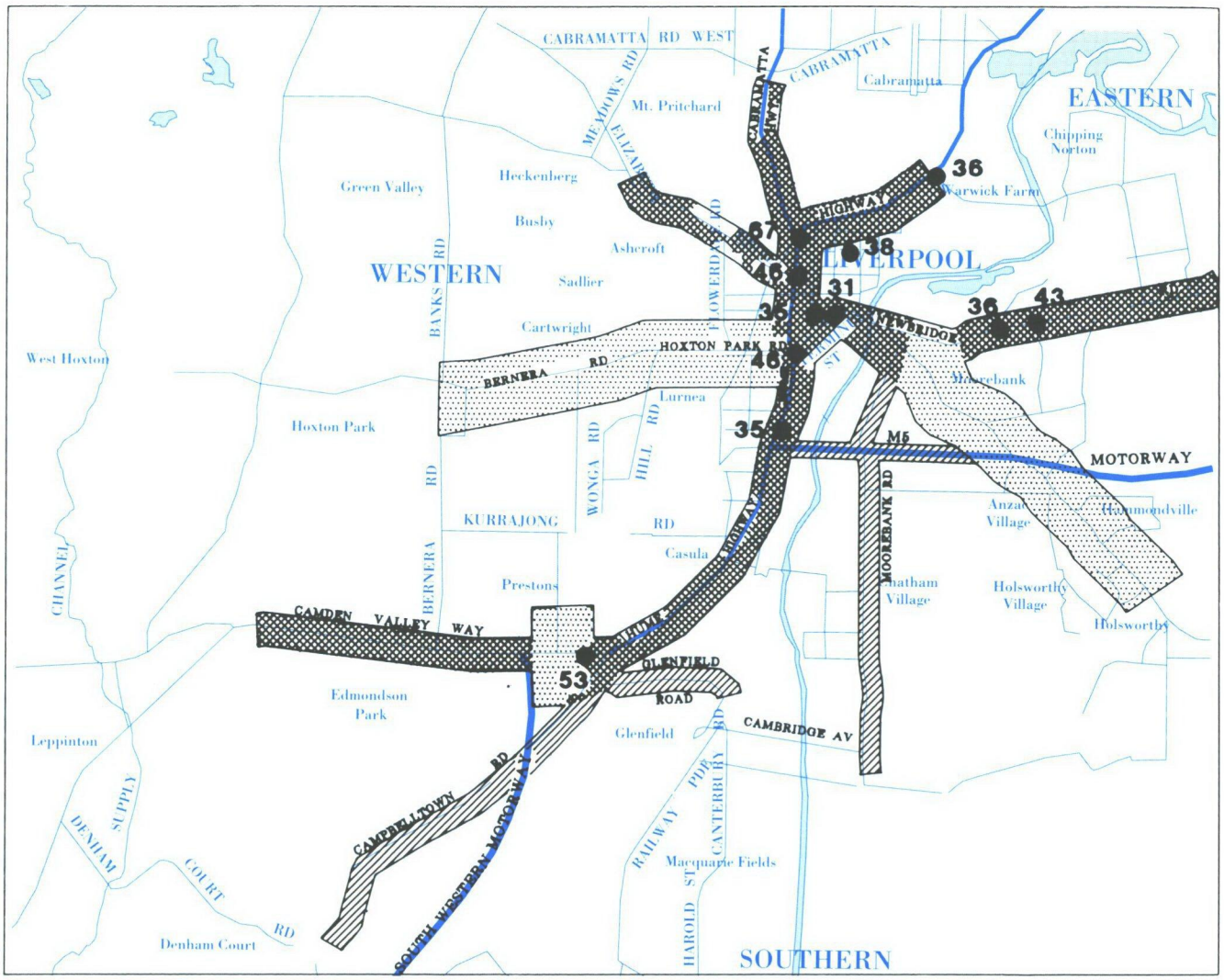
Both lines have regular services throughout the day. Service headways during the morning peak (up till 8.15 am) from Glenfield are 15 minutes on the East Hills line and 8-11 minutes on the Liverpool line. Further trains run from both Liverpool and East Hills making the service headways 5-10 minutes at these stations.

Trains from Liverpool to Central Station take between 45 and 55 minutes depending on the number of stops on the route.

Bus services

Four private bus companies operate buses in the region, although other companies provide inter-regional services connecting Liverpool with Bankstown, Fairfield and surrounding areas.

The existing bus routes extend to most localities with the majority of services connecting with Liverpool



Accident Rate
8.0 Accidents/M-Veh-km

Accident Rate
2.0 Accidents/M-Veh-km

Accident Rate
1.0 Accidents/M-Veh-km

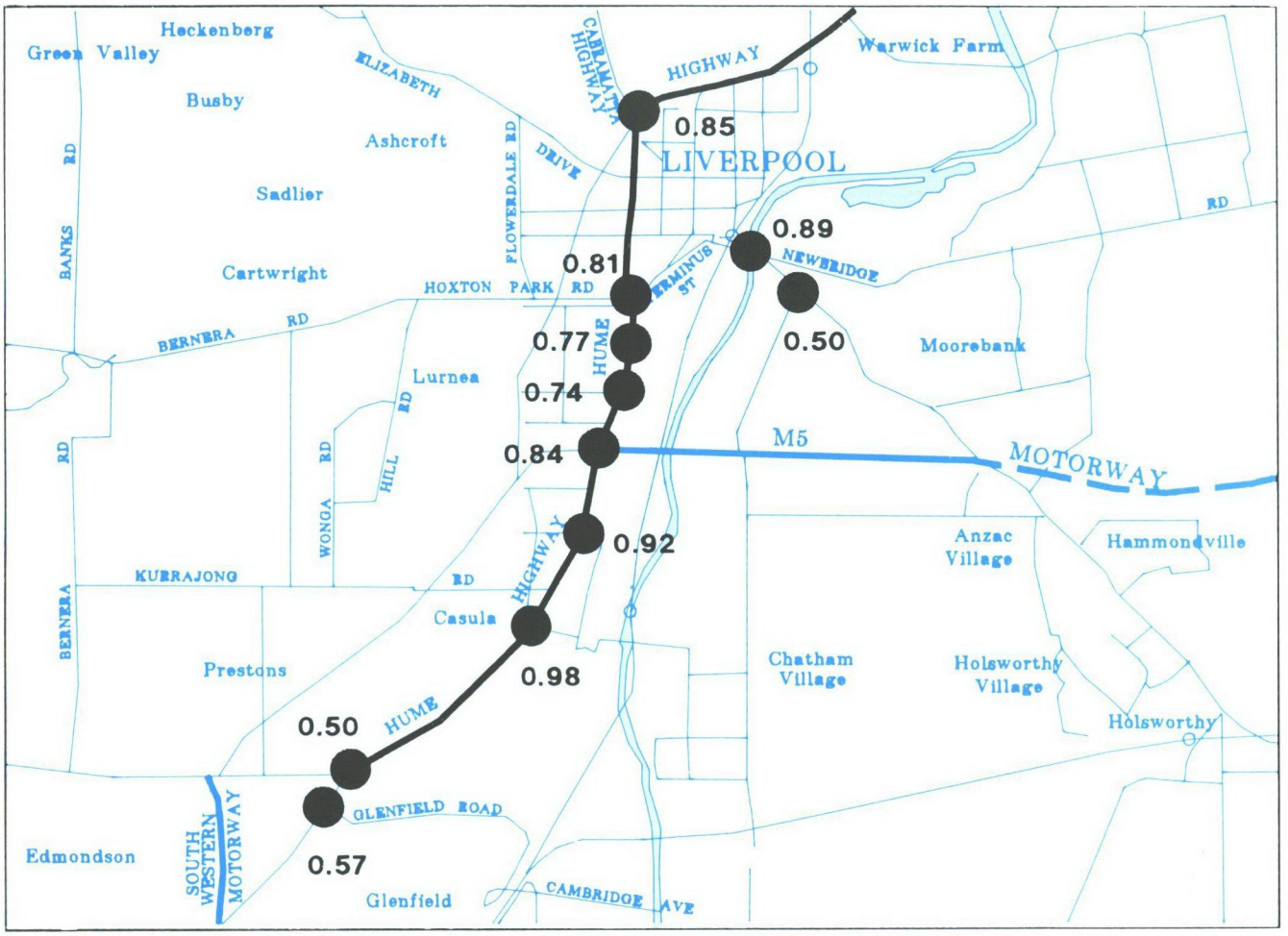
● 58 Total Intersection Accidents
Jan 1988-Sept 1991

0 0.5 1.0 1.5 2.0
Kilometres

FIGURE 6.3
ACCIDENT DATA SUMMARY

Source: DJA 1992

N



0.5 Degree of Intersection saturation (0.85) acceptable upper limit

0 0.5 1.0 2.0 3.0
Kilometres

FIGURE 6.4
EXISTING INTERSECTION CONGESTION
(Theoretical Degree of Saturation AM Peak Hour)

Source: DJA 1992

N

TABLE 6.4 1991 CITYRAIL PASSENGER COUNTS

	0601 - 0930		Total	Daily
Station	Passengers On	Passengers Off	Passengers On	Passengers Off
Liverpool	3945	2659	10023	9597
Casula	136	45	302	299
Glenfield	941	488	2130	1581
Macquarie Fields	930	50	1638	1615
Ingleburn	1772	420	3191	3749
Warwick Farm	563	283	1655	1745
Holsworthy	358	50	521	454

Source: CityRail, 1991

Station. Bus frequencies generally reflect the population density in the catchment areas with the number of buses to Liverpool Station during the morning peak period (7.00-9.00 am) by each of the bus companies varying between only one service and up to nine services. Bus services to Liverpool Station are timetabled to connect with the train services.

In addition to Liverpool Station, Miller shopping centre (Cartwright Avenue) is a regular destination for a number of routes operated by two companies throughout the day.

The bus services provide regular transport for local school children and the timetables reflect time and route changes during school vacations.

Use of public transport

Cityrail undertook counts of boardings and alightings at the stations in the study area in 1991. The results of these counts are shown Table 6.4.

Review of those figures clearly shows the importance of Liverpool Station both as a destination and modal interchange connecting to the supporting bus network.

Continuing deterioration in the traffic conditions on the Hume Highway and the local street network will adversely affect the delivery of reliable bus services and access to the railway station.

Quality of service

Figure 6.5 shows the coverage of the study area by public transport services. This Figure has been developed on the basis that acceptable walking distances to bus routes are about 400 metres and to a railway station about 1 km.

The Figure indicates that the service coverage is extensive however the service frequencies provided on some bus routes is very low with only one or two services provided during the morning peak period. The frequency of services is quite limited in off-peak hours.

6.3 THE FUTURE OUTLOOK

The future would appear to be characterised by:

- High rates of population growth in Campbelltown and Camden LGAs.

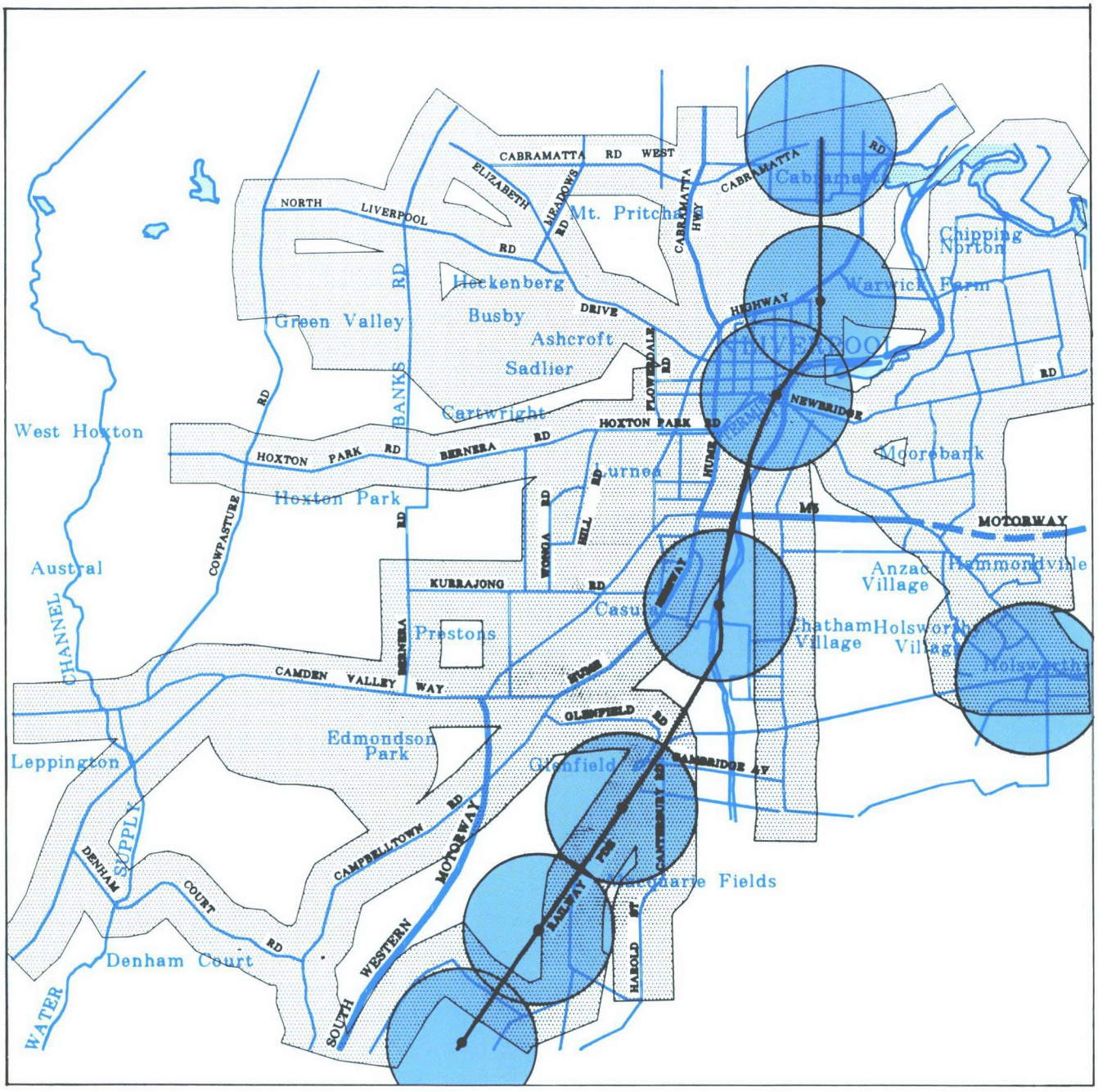
- Expected high rates of employment growth in the corridor, especially in Liverpool.

- Continuing reliance on the private motor vehicle as the main means of travel including for the journey to work despite the increasing levels of congestion.

- Travel patterns continuing to be diverse compounding the difficulty of providing a viable public transport alternative to the private car.

- The levels of congestion implied by the growth anticipated, the pattern of that growth and evident preferences for travel by private vehicle suggest significant reductions in the level of traffic performance on the existing network.

The likely resultant effects of these factors include:



400m Band each side of road on bus route

Railway line with station

1km radius around station

0 0.5 1.0 1.5 2.0
Kilometres

FIGURE 6.5
PUBLIC TRANSPORT COVERAGE

Source: DJA 1992

N

• Peak period spreading: some drivers will choose to start their trips earlier or later or to make their trips at other times of the day.

• Trip suppression: some people will reorganise their lifestyle so that the need to make trips is reduced. This might be achieved for example by changing the work or home location to shorten the journey-to-work trip, use of new technology to allow more work to be done from home, or just going without.

• Land use changes: due to difficulty of access some land use development may be constrained.

• Mode shift: in order to avoid lengthy delays there may be some change to use of public transport services.

6.4 THE CONSEQUENCES OF DOING NOTHING

Doing nothing to improve the transport arrangements (other than the base case as detailed in Section 8.3) is likely to result in the Hume Highway at Casula experiencing extended periods of the day characterised by peak congestion conditions. This will lead to increased traffic on local roads in the study area as they are increasingly used to bypass the resulting bottleneck. The social impacts of this would be considerable in terms of reduced safety and increases in noise, air and light pollution.

In a regional sense, doing nothing would quickly offset the gains in mobility offered by the recently opened M5 Motorway, since this road can feed much higher volumes of traffic to the Hume Highway than can be handled there. This can have a negative impact upon employment opportunities in the south west, since areas south and west of Casula will be disadvantaged relative to the inner and intermediate employment zones for which the current M5 provides much improved access.

Doing nothing also prolongs the uncertainty of future planning for this area.

6.5 CONCLUSIONS

The preceding sections identify a number of areas where the existing transport infrastructure is measurably offering low levels of service. The future prospects are for increased demand for road based movement which can only result in further deterioration in the operation of the transport system. The likely effects described in Section 6.3 are significant not only in terms of short term amenity but would impact on the medium to long term growth of the whole region.

These current and forecast deficiencies provide a compelling case for transport improvement which can address jointly regional travel needs, including the implications of growth and the protection of local area quality from traffic interference.

In sections that follow, the form which such improvements might take is examined and the consequences of those solutions in environmental and transport terms are documented.

alternative ways of responding to the need for transport improvements in the corridor

STUDY METHOD

Section 7 describes the objectives of the study approach and method for this EIS.

ALTERNATIVES FOR TRANSPORT IMPROVEMENTS IN THE CORRIDOR

Section 8 presents an investation of the transport alternatives to respond to the transport need. The identified alternative to the proposal, the upgrading of the existing Hume Highway, is developed and evalued. The "Do Nothing" scenario is also examined.

DETAILED DESCRIPTION OF PROPOSED EXPRESSWAY

Section 9 outlines a detailed description of the proposed M5 Casula Link.

7
STUDY METHOD

7.1 TRANSPORT OBJECTIVES FOR THE STUDY AREA

In order to provide a framework within which alternative ways of responding to the transport needs of the study area can be evaluated, it is first necessary to articulate the transport objectives sought to be fulfilled in the study area. These objectives should obviously be compatible with the objectives set by the government of NSW for its own overall purpose and specifically so as to direct the RTA's performance. They should also reflect local needs. Table 7.1 sets down the proposed transport objectives for the study area and shows how they relate to the State government's and the RTA's objectives.

7.2 STUDY APPROACH AND METHOD

The study approach followed for this EIS has been to investigate the proposal and its alternatives in the following sequence:-

i) Population and employment projections have been determined for Sydney and the south west region.

ii) From these two projections an estimate of trip type and distribution was calculated. This enabled a traffic network model to be developed for the notional year of opening (1996) and for the year 2011. At the same time baseline surveys of the biophysical and human environment were carried out.

iii) The traffic needs of the network (including estimates of through traffic and all turning movements at interchanges) were determined for the years 1996 and 2011 and in terms of traffic type and distribution throughout the day.

iv) Given the future traffic needs and preliminary observations on noise impacts, engineering costs and the biophysical environment, an assessment and ranking of the long list of likely alternatives was made, leaving as a short list the development of the M5 Casula Link and the upgrading of the Hume Highway.

v) These traffic needs then formed the basis of the engineering design of both the proposed M5 Casula Link and the Hume Highway upgrade. This included details such as the number of lanes (to be built now and in the future), the location of on and off ramps and intersection layouts (based on the above traffic volumes for turning movements).

vi) From the engineering design and the environmental baseline surveys, calculations were made by the specialist noise consultant to estimate and mitigate noise levels. Preliminary mounding and noise barrier proposals were then developed in conjunction with the landscape architect and road designer. At this time the air quality specialists also calculated the effects on air quality, taking into account the location and size of noise barriers.

(vii) Given again the engineering design and baseline surveys, the effect of the proposal on local flora and fauna, European and Aboriginal heritage, land use and community services, were all assessed by specialist advisors and mitigative measures proposed.

viii) The last step in the design process was to develop the landscaping proposal including all planting recommendations and integrating the noise mounds and noise barriers.

ix) The overall impact assessment for the whole proposal was then discussed (in Chapter 15).

x) The final step was to develop a comprehensive monitoring and auditing program from the advice offered in steps (v) to (vii) and to present a set of findings for the EIS study.

The results of each of these steps were shared throughout the study with members of the Consultative Committee. The Committee also made worthwhile suggestions on needs and options.

TABLE 7.1 TRANSPORT OBJECTIVES FOR THE STUDY AREA

State Government Objectives	RTA Corporate Objectives	Transport Objectives for the Study Area
Economic development of the state and the nation	To enhance the road and traffic system to support State and national economic development. To plan the road network as part of a total transport system to serve land use, development and tourism. To ensure provision of an appropriate road transport system for growth in population and for changing life styles. To improve total transport efficiency by monitoring and managing the road system as part of the integrated land use and multi-modal transport approach. To secure adequate funding to enable the RTA to finance its program delivery adequately through the development of both traditional and new sources.	Facilitate the efficient and economic movement of people and goods in and through the study area. Provide transport system capacity and connections through the appropriate use of the complementary modes so as to optimise total community transport costs. Provide transport system capacity and connections sufficient to respond to existing and forecast transport demands. Support the land use/transportation plan for the region. Optimise the use of the existing transport resource, in particular the M5 Motorway.
Enhance/protect the social and biophysical environments	To ensure that the roads and traffic system is developed and managed in harmony with the natural and social environment while meeting community needs for the movement of people and goods.	Develop design solutions for road proposals which balance economic and transport efficiency on the one hand and impacts upon the human and biophysical environments on the other. Incorporate environmental management and audit procedures and practices into the road proposals to ensure that the design intent is achieved. Take social justice considerations into account when considering new transport initiatives. Recognise community concerns about the notion of planning certainty. Seek the community's participation at each stage of the process of planning, constructing and operating the road proposals.
Provide for the health and safety of citizens of NSW	To reduce the incidence and severity of road accidents in NSW.	Reduce accidents and accident severity in and through the study area. Incorporate design features which will minimise potential risks and hazards.

Source: Maunsell Pty Ltd, 1992

8 ALTERNATIVES FOR TRANSPORT IMPROVEMENTS IN THE STUDY AREA

8.1 PREAMBLE

Having established the need for improved transport arrangements, the study team investigated the possible alternatives to the proposed motorway. The alternatives considered as described and evaluated in this section were:

- Meeting the demand by other transport modes.
- Upgrading of and improvements to the existing arterial road.
- Other motorway routes.
- Combinations of the above.

The alternatives were evaluated in terms of their ability to meet the broad transport needs identified. The effects of each alternative having regard to social, physical and economic criteria were considered.

This analysis allowed the less effective, or feasible, alternatives to be put aside. A detailed evaluation of the preferred alternative could then proceed with the study team concentrating on developing a design that best responded to the transport need and included appropriate mitigative measures. These requirements were identified by specialists in the team, by the community presenting their interests and concerns, and from RTA policies regarding major new roads (e.g.. Environmental Vision policies).

8.2 ALTERNATIVE TRANSPORT MODES

8.2.1 Preamble

Alternative transport improvements were evaluated relative to a common "base case".

The base case is defined as that set of transport improvements which would occur over the time span of the study (i.e. up to 2011) regardless of whether the M5 Casula Link or another major transport initiative to meet the same objectives proceeds. Its primary purpose is to provide a fully documented baseline against which all the effects (positive and negative) of project options may be tested. The consequences of proceeding only with the base case are described in Section 6.4.

Each of the following projects were added to the base case network.

Details of the base case are given in Section 8.3.

8.2.2 Public Transport Alternatives

Rail services

Rail improvement projects which are currently planned were detailed in Section 5.2.4. The study team did not consider that further improvements to the rail system in the Liverpool - Casula region would satisfy the transport needs of the area. This is largely due to the wide geographic dispersal of jobs and homes, as well as the complex organisation of industry and commerce which would only be poorly served by an extension to the fixed rail network.

Bus services

Any transport alternative must serve both regional and local transport needs. Regional public transport relies heavily on the existing train line. What bus services exist in the region are local and are based on the railway stations and shopping centres at Liverpool, Casula and Campbelltown. Most of these routes tend to cross both the Hume Highway and the proposed motorway. Therefore it is difficult and of little advantage to include lengths of motorway sections in the current bus network.

As a result no major bus projects were considered as feasible alternatives to the proposal.

The possible introduction of bus stops along the proposed motorway was considered but dismissed because of the local nature of the bus network and its concentration of stops at local schools, shops and residential areas.

Interstate and intrastate coach traffic would, of course, benefit from the introduction of the motorway Link due to both reduced travel time and by being able to collect passengers at, say, Liverpool and Campbelltown shopping centres via the proposed and existing interchanges.

8.2.3 Hume Highway Upgrade Alternative

The arterial upgrade of the Hume Highway was considered a feasible alternative to the proposal and is discussed in detail in Section 8.4

8.2.4 M5 Casula Link Proposal

The M5 Casula Link proposal is discussed relative to the alternatives in Section 8.5 and then in detailed terms in Section 9.

8.2.5 Other Motorway Routes

Opportunities for alternative motorway routes were considered. Suggestions for such alternative routes arose as part of the community consultation process. The review of those ideas is summarised in Section 4.7. Overall, the study team concluded that feasible alternative routes are extremely limited as the majority of the land use along the proposed road reserve is residential and creation of an alternative new road reservation would be very time-consuming and costly.

Some scope exists for altering the southern section of the motorway alignment to the south west of Box Road. However, any modification to the proposed alignment to cause it to be located outside the existing reservation would require additional land acquisition.

8.2.6 Combinations of Possible Improvement Projects

Combinations of possible improvement projects were not considered because it was established that either the feasible alternatives or the proposed M5 Casula Link would adequately satisfy the transport needs of the corridor.

8.2.7 Conclusion

An examination of the possible alternatives for transport improvements in the corridor has left only one feasible alternative to the proposal. That is the Hume Highway upgrade. This alternative has been examined in detail and is reported upon on Section 8.4. The M5 Casula Link is described briefly in Section 8.5 and in more detail in Section 9.

8.3 BASE CASE

The assumed base case road network improvements in the region of the project are listed below:

1996

- M5 Motorway between Heathcote Road and King Georges Road.
- Hume Highway - north facing ramps at Brooks Road.

2011

as for *1996* plus:

- Minor traffic management improvements at points of high congestion and blackspots.
- Cambridge Avenue extension to Heathcote Road - 2 lanes undivided.
- Upgrading of Camden Valley Way from Hume Highway to Narellan Road - 4 lanes divided (only required if South Creek Valley development goes ahead).
- Prospect Arterial from Camden Valley Way to The Horsley Drive - 4 lanes divided (only if Federal funding announced in The One Nation Statement of 1992 becomes available).

8.4 HUME HIGHWAY UPGRADING AS AN ALTERNATIVE TO MOTORWAY PROPOSAL

8.4.1 Role and Function

The Hume Highway upgrading alternative is an exploration of the opportunity to provide an arterial road with reduced interference from cross traffic to allow the north-south traffic a freer flow. The capacity increase provided cannot match that provided by an extra link in the network such as the proposed Casula Link; however an initial improvement in level of service would be afforded. The Hume Highway upgrade would essentially be a short term improvement which would not require major changes in the existing land use adjacent to the road.

The Hume Highway upgrade alternative would act as a collector to take westbound traffic from the M5 and southbound traffic from Liverpool and channel this traffic to the "Crossroads" intersection where it could join either the Hume Highway or M5. Similarly

northbound traffic would be collected at the "Crossroads" intersection and be passed either to the M5 to travel east or continue on the Hume Highway north.

The Hume Highway currently has many roles within the State road transport system. It is a National Route joining major cities, an urban arterial distributing traffic between major activity centres and a local road providing access to residential and commercial properties. In trying to fulfil all of these roles the Hume Highway does not provide a high level of service. The alternative of upgrading the Hume Highway attempts to separate these disparate functions as much as possible. The two functions which cannot be separated, because of lack of other suitable network links, are the national route and urban arterial functions. By limiting access to the Highway for local journeys, restricting the number of signal-controlled intersections, and reducing the number of phases at intersections to two, except at Kurrajong Road, local traffic could be diverted to local roads. New connections within the local road system would be required to allow access to facilities such as Casula Railway Station which are currently accessed by right turns from the Highway.

8.4.2 Description of Alternative

The upgrade examined for the Hume Highway alternative follows the existing Highway alignment. To increase capacity and provide fewer interruptions to traffic flow several changes to the existing Highway are envisaged. The basic width of the Highway would be increased to provide a minimum of four lanes in each direction between the M5 Interchange and Kurrajong Road Intersection. From Kurrajong Road south the northbound carriageway would retain four lanes while the southbound carriageway would taper to three lanes.

At intersections where right turns are permitted such as Kurrajong Road, right turn lanes would be provided and, where traffic volume dictates, a left turn lane could also be provided.

Grade separated interchanges are envisaged at both the northern and southern ends of the Highway upgrade to improve the flow of traffic onto and off the F5 Freeway and M5 Motorway. The northern interchange would carry two lanes of traffic over the Hume Highway and onto the M5 Motorway. All other turning movements at the M5/Highway intersection would be at grade and signal controlled.

Campbelltown Road/Camden Valley Way intersection would be grade separated by means of a lowered roadway carrying northbound traffic from Campbelltown Road to the Hume Highway beneath turning traffic to and from Camden Valley Way. The rising grade of the existing Campbelltown Road as it moves northward would allow this roadway to be constructed at a flatter than existing grade underneath the turning roadways. It would then rise to meet the highway north of the "Crossroads".

Traffic turning from the Hume Highway to Camden Valley Way and Camden Valley Way to Campbelltown Road would do so via two bridges over the lowered through roadway.

Details of the Hume Highway upgrade alternative are shown in Figures 8.1.1 to 8.1.8.

Lane widths have been set at 3.5metres for all through lanes, 3.0 metres for turning lanes, and 4.0 metre kerbside lanes for bicycle safe lanes as shown on Figure 8.2.

The width of roadway, number of lanes and turn radii which can be achieved are limited by the space available without wholesale property acquisition and removal of houses and other adjacent uses.

The close proximity of commercial and residential property to the road reserve boundary also represent constraints on the ability to provide grade separated interchanges at other intersections.

A link road would be needed between Leacocks Lane and Casula Road to allow Casula station to be accessed by traffic from the south.

8.4.3 Property Acquisition Effects

Land which would be required for Highway upgrading at an estimated cost of $1.6M is shown on Figures 8.3.1 and 8.3.2. The acquisition

estimate is based on RTA policy (see Appendix F). It has been attempted to reduce the number of properties which would need to be acquired by narrowing medians where possible.

8.4.4 Transport Efficiency Effects

The effects of the Hume Highway upgrade alternative on transport efficiency are measured against several criteria as listed below.

Total travel time

The amount of travel time required to make the estimated number of future trips on the road network is a measure of the network's efficiency. The travel time is derived by the network model for the two-hour morning peak period over the whole of the modelled network which covers all of the south western Sydney metropolitan area. Table 8.1 shows the total travel time for the base case and the Hume Highway upgrade in the year 2011.

Table 8.1 indicates that the Hume Highway upgrade alternative would reduce the travel time on the modelled portion of the network by over 3400 hours or just under 2% per peak period. The significance of this is shown in the economic evaluation in Section 13.4.

Fuel consumption

The fuel consumption estimated by the network model is the total required to operate vehicles on the network and is shown in Table 8.2 below. As for the total travel time this is measured for the two-hour morning peak period.

The fuel consumed depends upon the distance travelled as well as the speed of travel. These are calculated for each link in the network.

The results indicate that the Hume Highway upgrade alternative would result in a reduction in fuel consumption of 2,500 litres, approximately 0.5% during the a.m peak period. Once again the significance of this is given in the economic evaluation in Section 13.4.

Network flexibility

The previous measures indicate the performance of the network under normal conditions. Flexibility is the ability of a network to operate under conditions where problems on one link force traffic to divert to other links. It cannot be measured quantitatively but options which add a new link (rather than upgrade an existing road) would offer benefits in situations where accidents, breakdown, road maintenance or other unusual events close or partially close sections of the network.

While providing additional capacity the Hume Highway upgrade would not result in increased network flexibility.

Public transport operations

The primary benefit to bus operators would be slightly improved operating speeds on the Hume Highway although the need for bus bays along the Highway would remain.

Freight service efficiency

The Hume Highway carries a significant proportion of the heavy commercial vehicle traffic from south of Sydney, both as a distributor to the western suburbs and central Sydney, and as a through route. Heavy vehicle proportions on the Hume Highway are currently around 10% daily and 7% during the morning peak. The extent to which the Highway upgrade alternative would contribute to freight service efficiency is measured by the general travel time performance as already discussed. Naturally, unimpeded travel is preferable for freight movements.

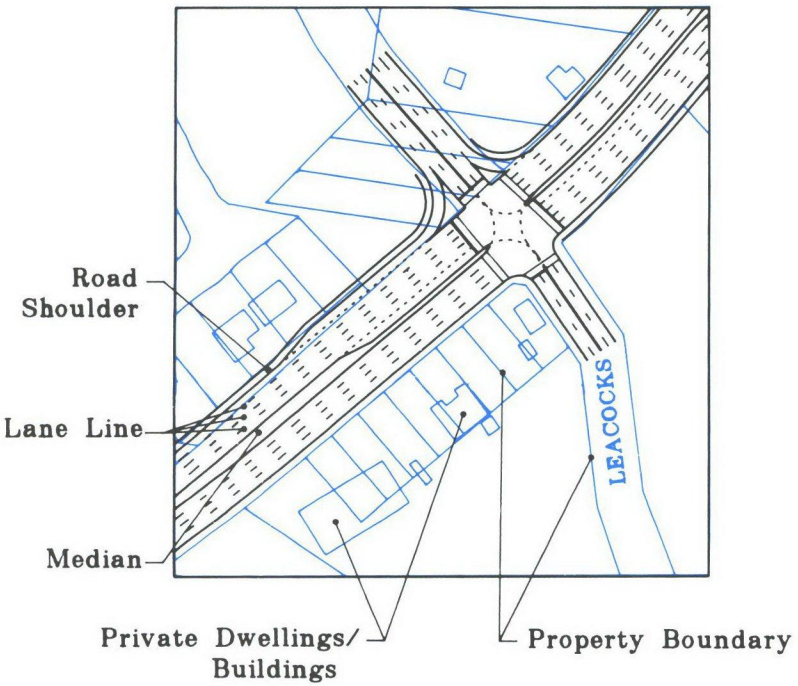
Intersection performance

All intersections along the Hume Highway upgrade alternative have been designed to cope with the predicted traffic flows given the constraints of adjacent land uses.

TABLE 8.1 HUME HIGHWAY UPGRADE PEAK PERIOD TRAVEL TIME

Option	Total Travel Time (Vehicle Hours)
Base Case	180,800
Hume Highway Upgrade	177,400
Travel time saving	3,400

Source: Denis Johnston & Associates, 1992



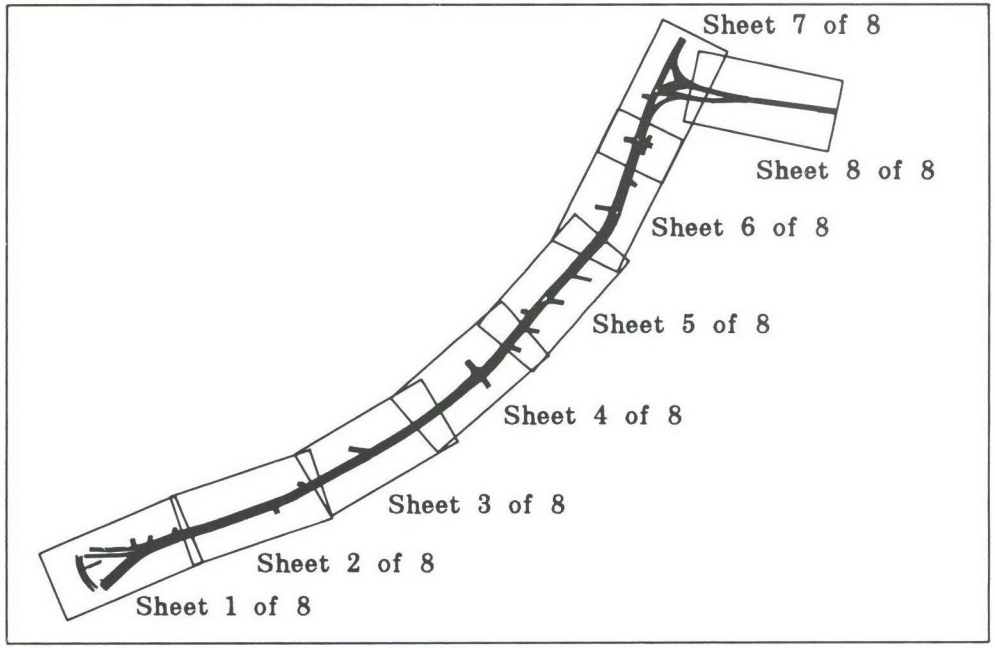
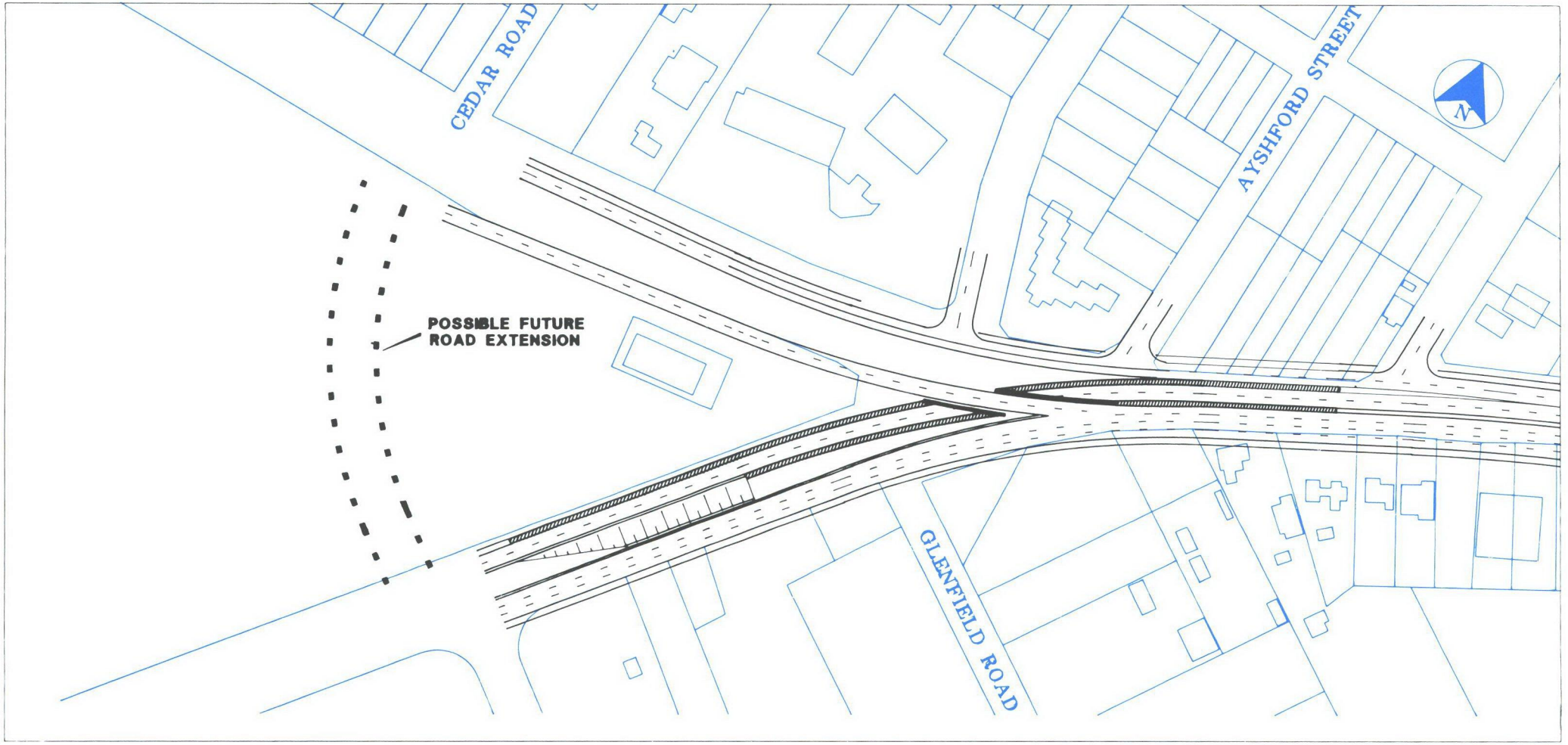


FIGURE 8.1
HUME HIGHWAY UPGRADE LEGEND



LOCALITY PLAN

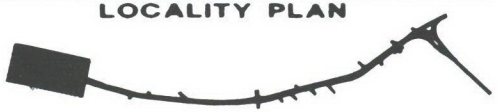
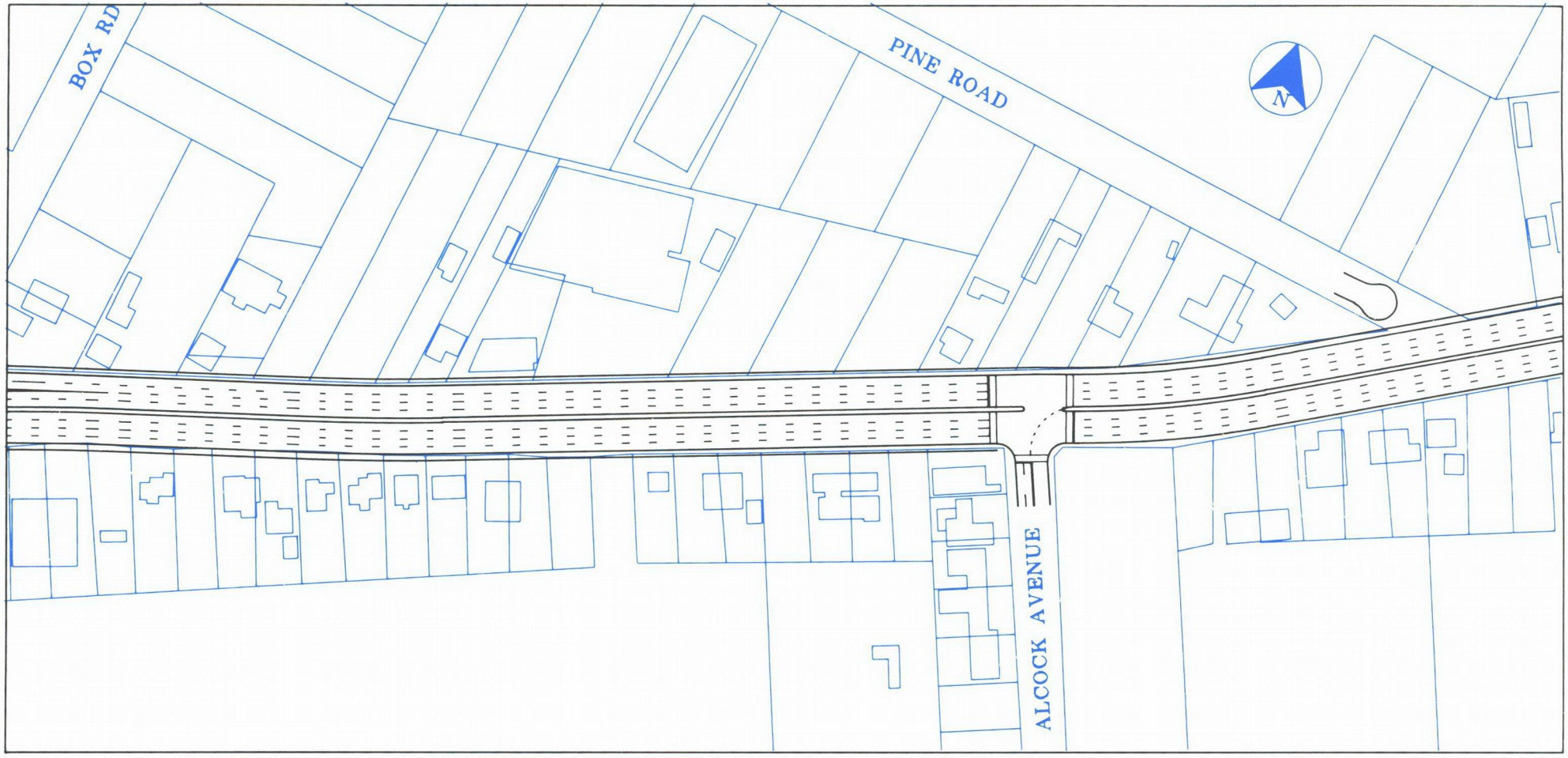




FIGURE 8.1.1
HUME HIGHWAY
UPGRADE ALIGNMENT
THE CROSSROADS

Sheet 1 of 8



LOCALITY PLAN

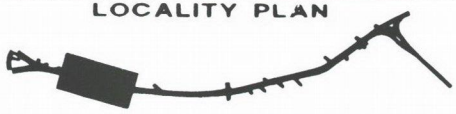
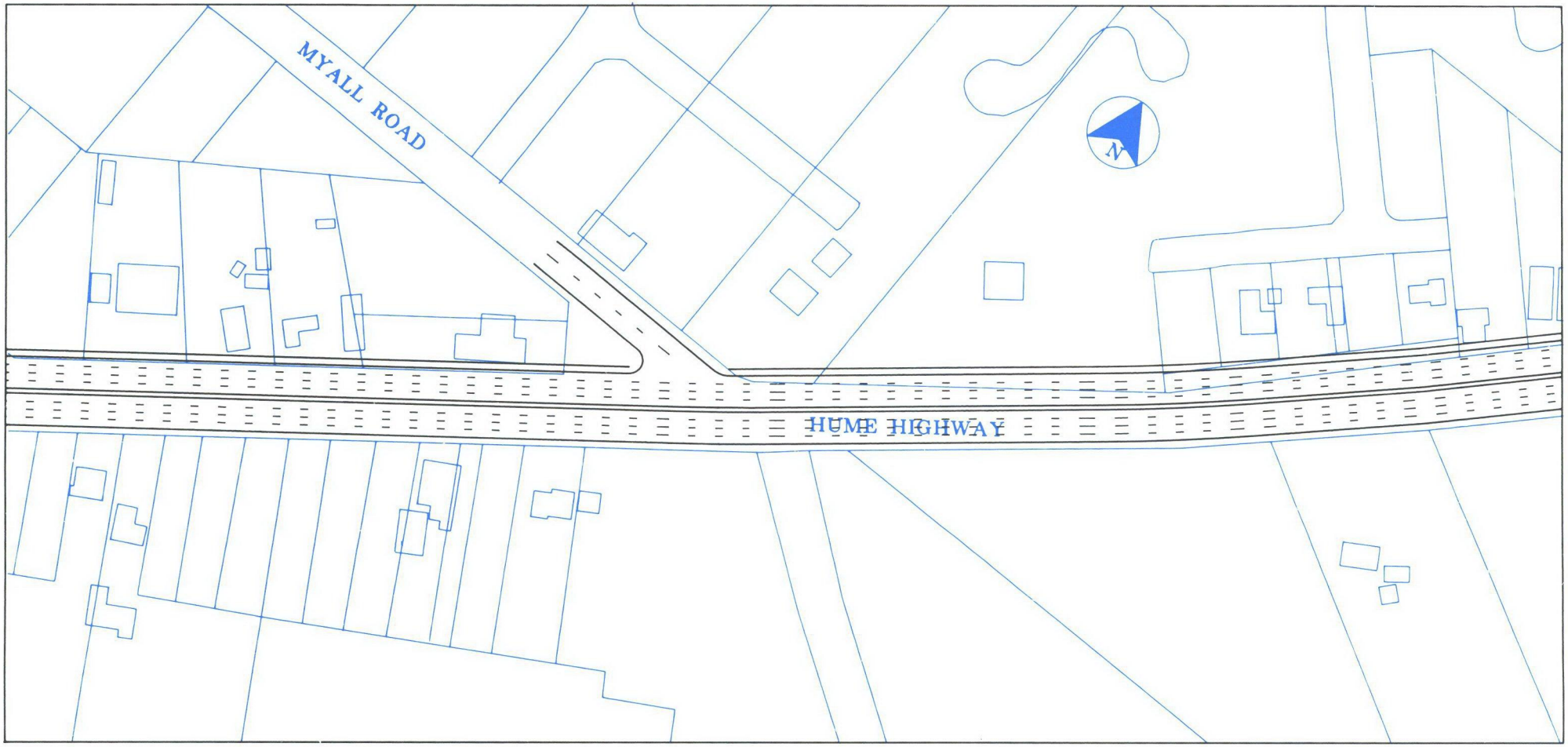




FIGURE 8.1.2
HUME HIGHWAY
UPGRADE ALIGNMENT
ALCOCK AVENUE

Sheet 2 of 8



LOCALITY PLAN

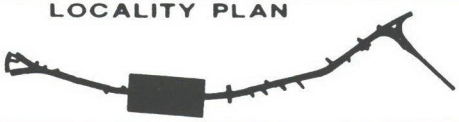
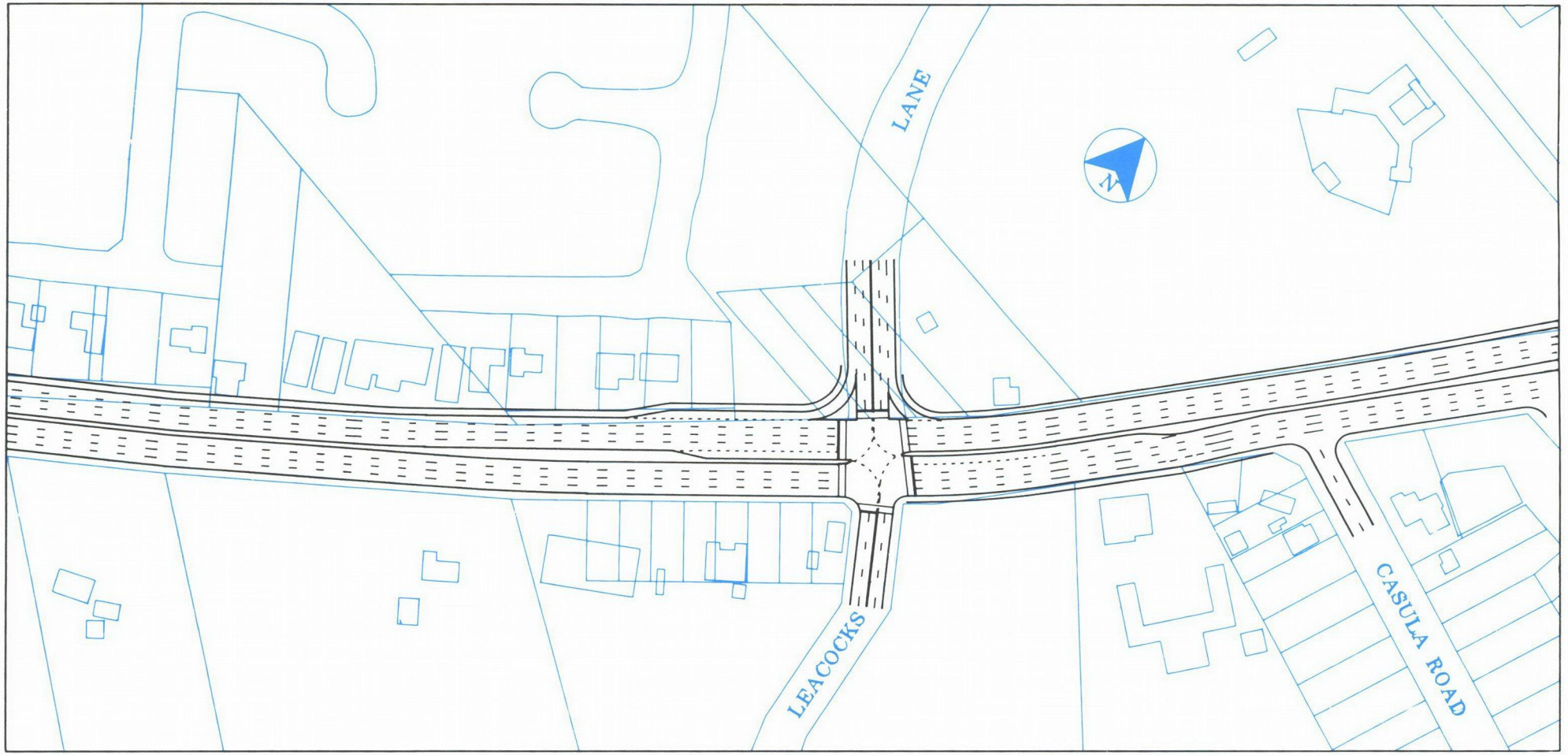




FIGURE 8.1.3
HUME HIGHWAY
UPGRADE ALIGNMENT
MYALL ROAD

Sheet 3 of 8



LOCALITY PLAN





FIGURE 8.1.4
HUME HIGHWAY
UPGRADE ALIGNMENT
LEACOCKS AND KURRAJONG ROADS

Sheet 4 of 8



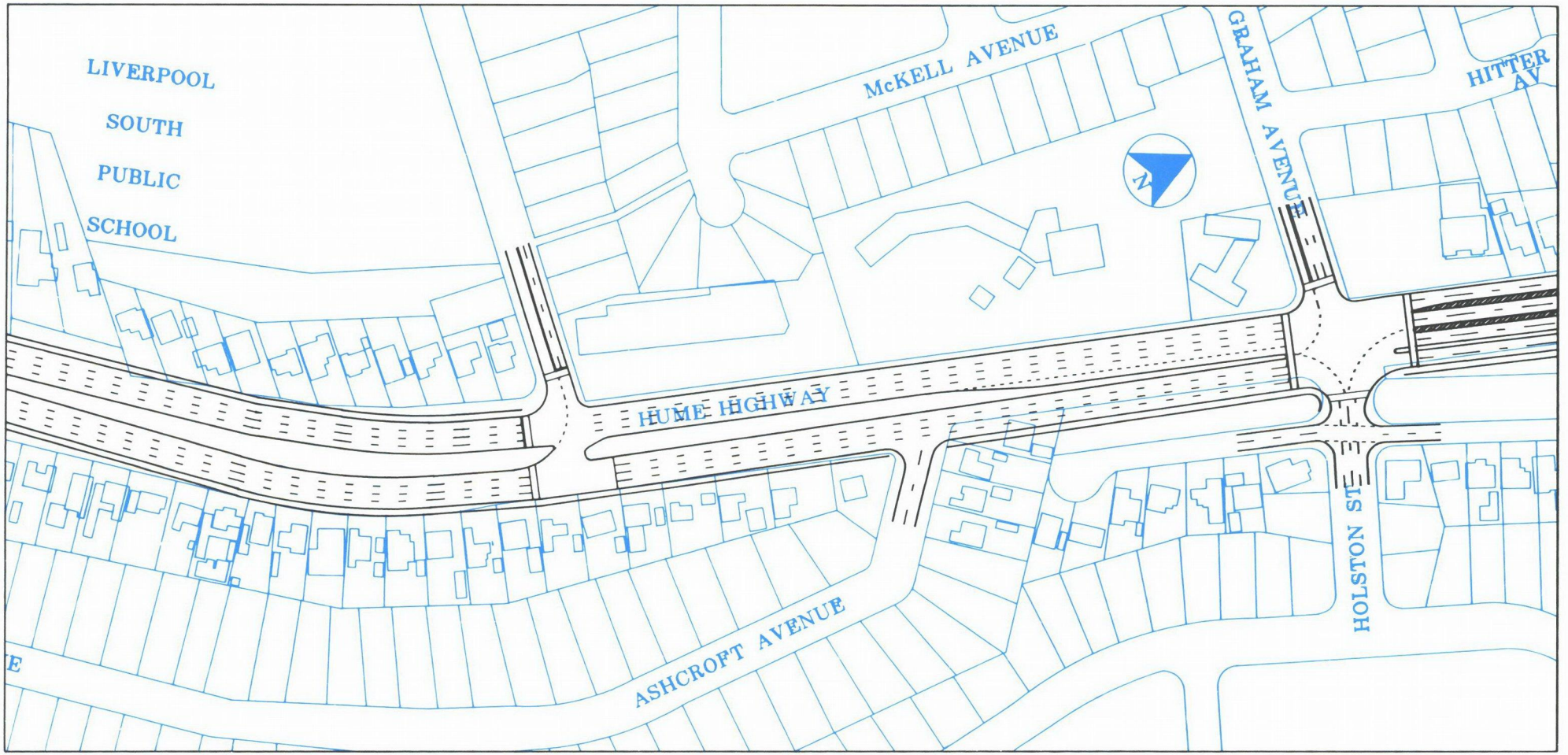
LOCALITY PLAN





FIGURE 8.1.5
HUME HIGHWAY
UPGRADE ALIGNMENT
LANG ROAD

Sheet 5 of 8



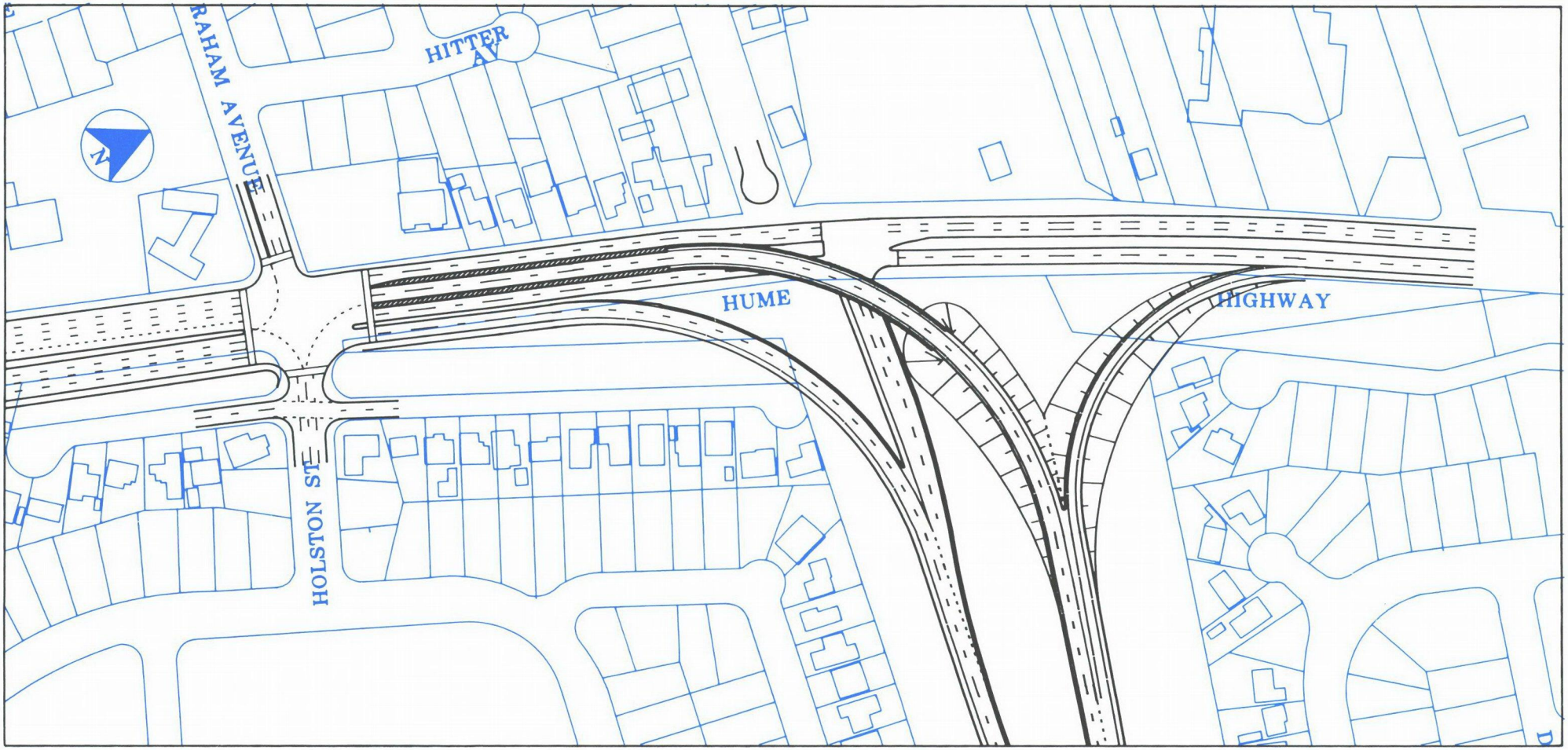
LOCALITY PLAN





FIGURE 8.1.6
HUME HIGHWAY
UPGRADE ALIGNMENT
DE MEYRICK AND GRAHAM AVENUES

Sheet 6 of 8

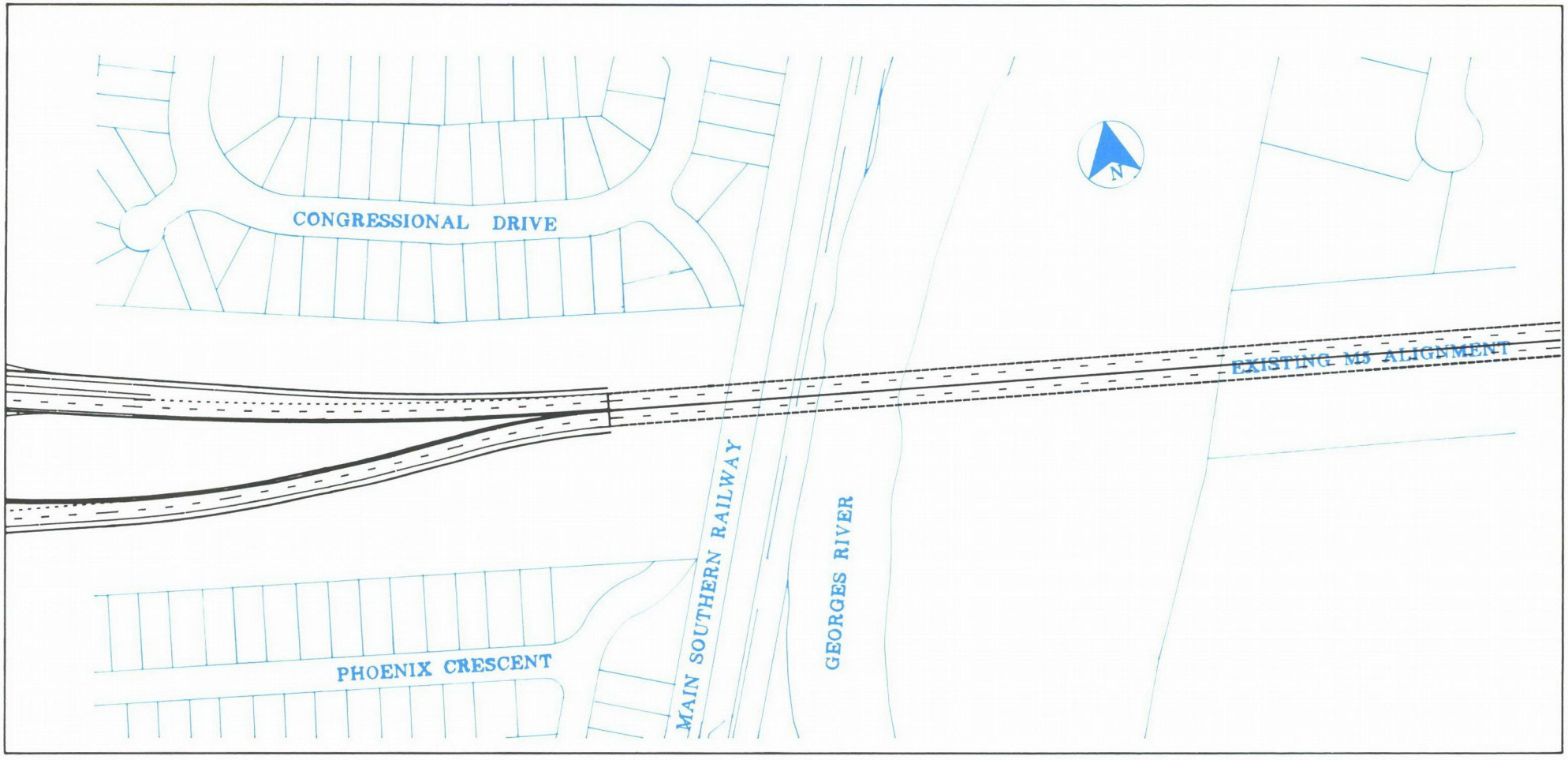


LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 8.1.7
HUME HIGHWAY
UPGRADE ALIGNMENT
M5 MOTORWAY INTERCHANGE

Sheet 7 of 8



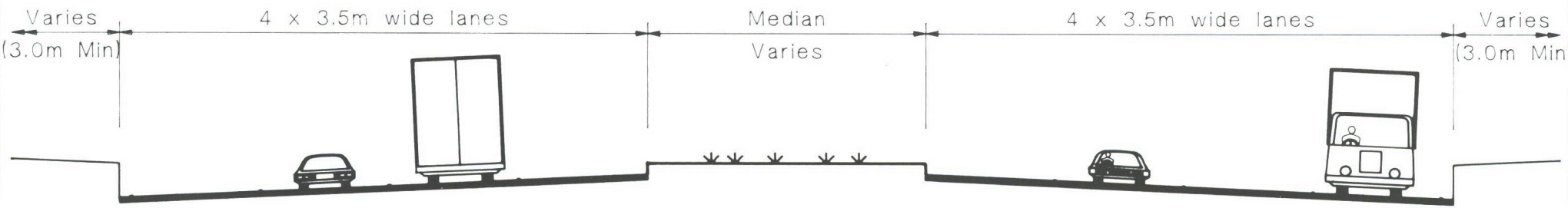
LOCALITY PLAN



0 20 40 80 120
Metres

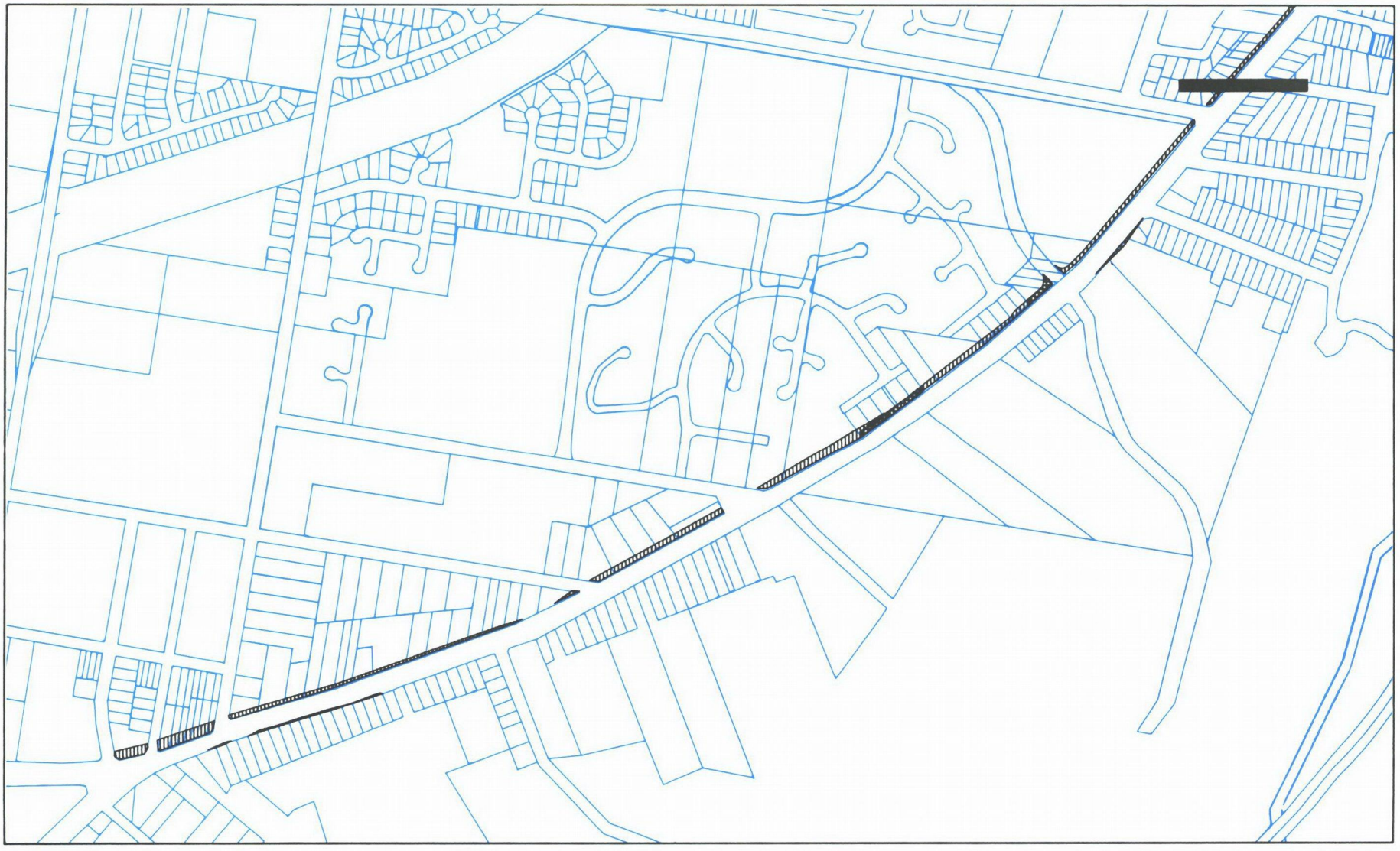
FIGURE 8.1.8
HUME HIGHWAY
UPGRADE ALIGNMENT
GEORGES RIVER BRIDGE

Sheet 8 of 8



TYPICAL CROSS SECTION
HUME HIGHWAY MID BLOCK

FIGURE 8.2
TYPICAL CROSS SECTION
HUME HIGHWAY UPGRADE



Council

Private

0 0.1 0.2 0.3 0.4 0.5

Kilometre

FIGURE 8.3.2.

USE OF LAND FOR ROAD WIDENING HUME HIGHWAY UPGRADE (SHEET 1 OF 2)

Source: Maunsell Pty Ltd 1992

N



Council

Private

0 0.1 0.2 0.3 0.4 0.5

Kilometre

FIGURE 8.3.1.

USE OF LAND FOR ROAD WIDENING HUME HIGHWAY UPGRADE (SHEET 1 OF 2)

Source: Maunsell Pty Ltd 1992

N

TABLE 8.2 HUME HIGHWAY UPGRADE PEAK PERIOD FUEL CONSUMPTION

Options	Total Fuel Consumed (1,000s of Litres)
Base Case	611.3
Hume Highway Upgrade	608.8
Fuel Savings	2.5

Source: DJA, 1992

However, analysis indicates that most of these intersections would be operating at the upper limits of saturation by the year 2011. Large queues and delays are expected to result even with the illustrated upgrading alternative.

Service to specific land uses.

The Hume Highway upgrade alternative would retain the existing network intersections, but the service to abutting land uses would be likely to be reduced because of the need to achieve the through traffic capacity objectives of this option.

Conclusion

The Hume Highway currently serves a dual purpose as an urban arterial and local road. The Highway upgrade alternative seeks to minimise the role as a local road and provide additional capacity for through traffic. The network measures indicate that transport efficiency would improve when compared with the base case. However, the traffic analysis suggests that, as predicted traffic demand grows in the corridor, the upgraded Hume Highway would reach capacity well before 2011. The long term effects would be poor intersection performance along the Hume Highway and increasing traffic on local roads. This would have a direct effect on bus operations and the efficiency of commercial vehicle movements.

8.4.5 Road Safety Effects

Accident performance

The historical accident rate data for Sydney which was documented in the 'DJA-Existing Conditions Report' has been applied to the predicted traffic flows to calculate estimated effects of the upgrade alternative. This was done by projecting the avoidance of traffic accidents and their consequences.

Table 8.3 shows the predicted number of accidents for the Hume Highway upgrade compared with the base case. The Hume Highway upgrade is expected to result in a small reduction in accidents of less than one half of one percent over the modelled network. This represents a reduction of 14 injury causing and 23 property damage accidents per annum but no reduction in fatalities.

The Hume Highway upgrade would thus offer little benefit in terms of reduced accident risk. The road characteristics are essentially the same as the base case although the upgrade alternative has attempted to reduce the number of conflicting movements. The accident savings indicated result from a reduction in the kilometres travelled over the whole network rather than any inherent safety aspects.

Hazard and risks in transport of dangerous goods

Road transport of dangerous goods has the potential, albeit small, of creating a hazardous incident involving release of these goods with resultant effects upon the public and the built and biophysical environments. An assessment of the Hume Highway upgrade has been made to determine the likelihood of

TABLE 8.3 HUME HIGHWAY UPGRADE ANNUAL NUMBER OF ACCIDENTS 2011

Option	Fatal	Injury	Property Damage Only
Base case	77	3065	5294
Hume Highway upgrade	77	3051	5271
Reduction in accidents	0	14	23

Source: DJA, 1992

spillage of hazardous goods and the effect on the environment.

Assessment of effects and mitigative measures

Incident probability, as already mentioned, depends upon road design features, predicted levels of traffic and accident rates for different classes of road. Accident rates of 39 accidents per 100 million vehicle kilometres (MVk) for urban expressways, and 152 per 100 MVk for urban divided roads with 4 lanes or more, were recorded for Sydney in 1988 *(Riskcorp, 1992)*. As would be expected, expressways are inherently safer in terms of accident rates. (Actual rates in the area are given in Table 6.4.)

Table 8.4 shows the estimated number of dangerous goods vehicle accidents per year in 2011 and that the Hume Highway upgrade alternative has the same probability of such an accident as the base case. This is because the character of the network is essentially unchanged in terms of accident risk. Not all accidents would result in a release of dangerous goods from their containment. Most incidents are expected to have minor effects due to the robust nature of transport vehicles, especially those carrying LPG or chlorine in pressurised vessels.

8.4.6 Environmental Effects

The environmental effects of the Hume Highway upgrade alternative are:

Air Quality

The analysis for the Hume Highway upgrade leads to similar conclusions to the Casula Link, which are given in Section 11.6. The predicted maximum 1 hour concentrations of CO, NO_x, NO_2, hydrocarbons and particulate matter are presented in Tables 8.5 and 8.6.

Figures 8.4 and 8.5 show the predicted concentrations of NO_2 and CO respectively for the Hume Highway upgrade alternative.

The predicted CO concentrations for the Hume Highway upgrade are generally higher than for the Casula Link, particularly in the vicinity of the M5 interchange where traffic would be considerably slower than the equivalent section of the Casula Link. Nevertheless the predicted values at residences, taking 'background' levels into account are well below the EPA's 1 hour goals.

The maximum predicted NO_2 concentration at any residence would be approximately 130 $\mu g/m^3$ which is below the EPA's goal of 328 $\mu g/m^3$. However, this is not the 'worst-case'. As for the Casula Link, sections of the Hume Highway upgrade are predicted to experience kerb side nitrogen dioxide concentrations above the EPA goal.

The maximum predicted concentration of hydrocarbons is 1.89 mg/m^3. Use of the same assumptions to calculate benzene concentrations as are presented for the Casula Link in Section 11.6.4 gives a benzene concentration of approximately 0.1 mg/m^3 which is equal to the Victorian EPA's 3 minute goal. Hence, benzene emissions from the Hume Highway upgrade alternative appear to be approximately double the emission from the proposed Casula Link.

Predicted concentrations of particulate matter are marginally

TABLE 8.4 HUME HIGHWAY UPGRADE ESTIMATE OF ACCIDENT RATES FOR DANGEROUS GOODS TRANSPORT (2011)

Road Option	Vehicle Accidents per 100 million Vehicle/Km	Road Length (km)	Projected Average Dangerous Goods Vehicles/Year	Estimated Dangerous Goods Vehicles Accidents/Year
Base Case	152	4.4	58,700	0.39
Hume Highway Upgrade	152	4.4	58,700	0.39

Source: DJA, 1992

TABLE 8.5 ESTIMATED VEHICLE EMISSIONS FOR HUME HIGHWAY UPGRADE IN 2011 (kg/km/hour)

Roadway Section	Carbon Monoxide	Nitrogen Oxides	Hydro-carbons	Particulate Matter
H1	30.87	14.13	5.34	0.55
H2	17.68	8.69	3.08	0.34
H3	31.53	11.97	5.58	0.49
H4	61.75	15.22	11.41	0.65
H5	53.86	14.75	9.88	0.63
H6	61.28	15.85	11.28	0.68
H7	79.30	16.62	14.81	0.72
H8*	80.56	24.67	17.26	0.95
H9	45.06	12.71	8.17	0.51

Source: Stephenson and Associates, 1992

TABLE: 8.6 SUMMARY OF POLLUTANT PREDICTED EMMISIONS WITH A HUME HIGHWAY UPGRADE IN 2011 (10m FROM KERB)

Roadway Section	Carbon Monoxide (mg/m3)	Nitrogen Oxides (µg/m3)	Nitrogen Dioxide** (µg/m3)	Hydrocarbons (mg/m3)	Particulate Matter (µg/m3)
H1	3.7	1697	339	0.64	66
H2	2.1	1044	209	0.37	41
H3	3.8	1438	289	0.67	59
H4	7.4	1828	366	1.37	78
H5	6.5	1771	354	1.19	76
H6	7.4	1903	381	1.35	82
H7	9.5	1996	399	1.78	86
H8*					
H9	5.4	1526	305	0.98	61

Source: Stephen & Associates, 1992

* Sections including ramps

** Assumed to be 20% of total nitrogen oxides

higher than those predicted for the Casula Link. However, concentrations are expected to be well within the EPA's ambient air quality criteria for particulate matter.

Noise

An acoustical assessment of the implications of upgrading the existing Hume Highway between its junction with the existing western end of south western freeway, and Camden Valley Way was undertaken. However, no noise monitoring or modelling was undertaken for this alternative.

The adoption of the upgrade alternative, would involve the addition of a further two lanes of traffic (to the existing six lanes), and the resumption of two strips of land on either side of the existing Highway to provide the appropriate space.

The existing noise levels at the facades of the respective residential and commercial properties facing on to the relevant section of the Hume Highway, are already exposed to noise levels which must be deemed to be excessive and unacceptable. The resumption of a further strip of land which does not result in the full acquisition of the residential and/or commerical properties, would cause a further degradation of the environmental acoustical quality of the subject properties. Whilst the provision of road side barriers may address that issue, the height of the barriers required to maintain the existing 'status quo' in terms of the $L_{10,\ 18\ hrs}$ criteria would require roadside barriers which would be of the order of 3m high, whilst conformance with the criteria presented for the proposed Casula Link in Section 11.5.3, would require barriers whose heights would generally exceed 5m.

Heritage

Within the study boundary, there are 4 heritage listed sites located directly on the Hume Highway, including: House No. 43 Hume Highway; the Collingwood Inn Hotel; Apex Park (formerly the Liverpool cemetery); and Pioneer Memorial Park.

Woodward Park, bordered on the eastern side by the Hume Highway, contains the listed memorial to Private E.A. Smith (Liverpool Heritage Study) and Liverpool Council recognise the Olympic pool as a significant memorial.

Many of the other listed buildings within Liverpool are in the immediate vicinity of, or within 500m of the Hume Highway. Particular reference is made to listed heritage buildings located in streets intersecting the Hume Highway, including: the Rose street buildings; the Passefield Road buildings, Frank Ollis' Printing Factory in Reilly Street; No. 8 Bourke Street House; the Mill Road buildings and; the Collingwood Group, off Birkdale Crescent. Horningsea Park, classified by the National Trust (NSW), while just outside the study boundary, is a heritage site located on the Hume Highway at Prestons.

The National Trust (NSW) has classified the obelisk (60) and five associated sandstone milestones (56A) located on the eastern side of Campbelltown Road, (an extension of the Hume Highway after the Crossroads), between Liverpool and Campbelltown.

The Liverpool Town Centre, as bordered by the Hume Highway, Mill Road, George's River and Manning Street is recognised as being of significant heritage value. This precinct includes historic/ archaeological value in the original street layout, brick drain and other miscellaneous archeological features.

It is argued that the principal heritage significance of the existing Hume Highway route is its largely intact alignment as one of the first roads out of the penal settlement of Sydney. This assessment would need to be confirmed by overlaying early route maps with the current route.

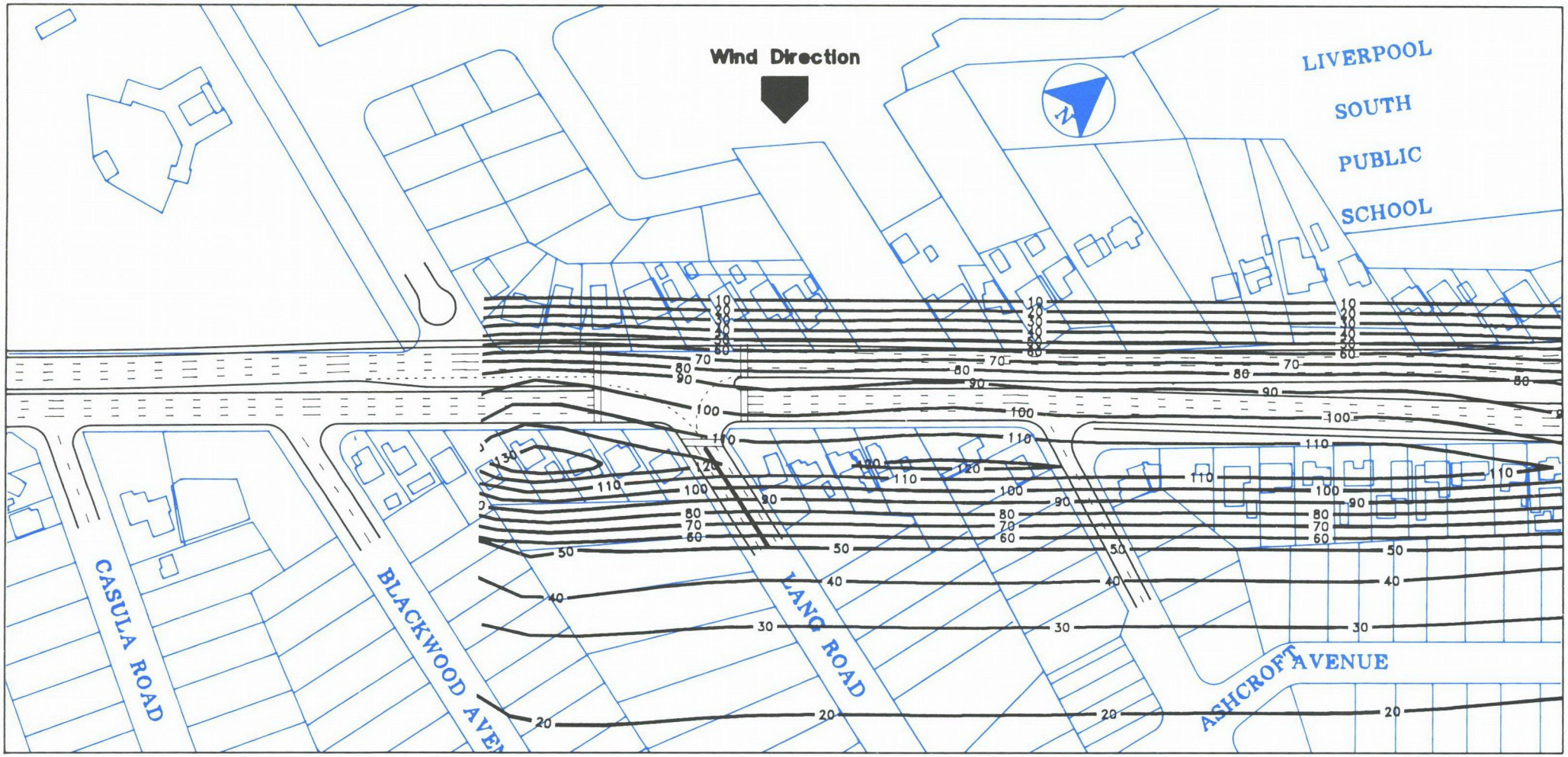
The proposed alternative of upgrading the current Hume Highway was not found to result in any impact on the architectural significance of buildings fronting the alignment.

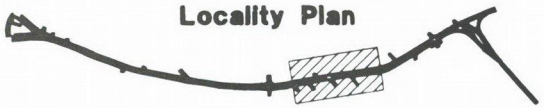
Upgrading of the Hume Highway would not have a direct impact on flora or fauna habitat, apart from remnant trees which occur along the highway. These trees have a low habitat value but may have some landscape significance.

8.4.7

Social and Community Effects

The Hume Highway alternative requires the widening of the Highway.





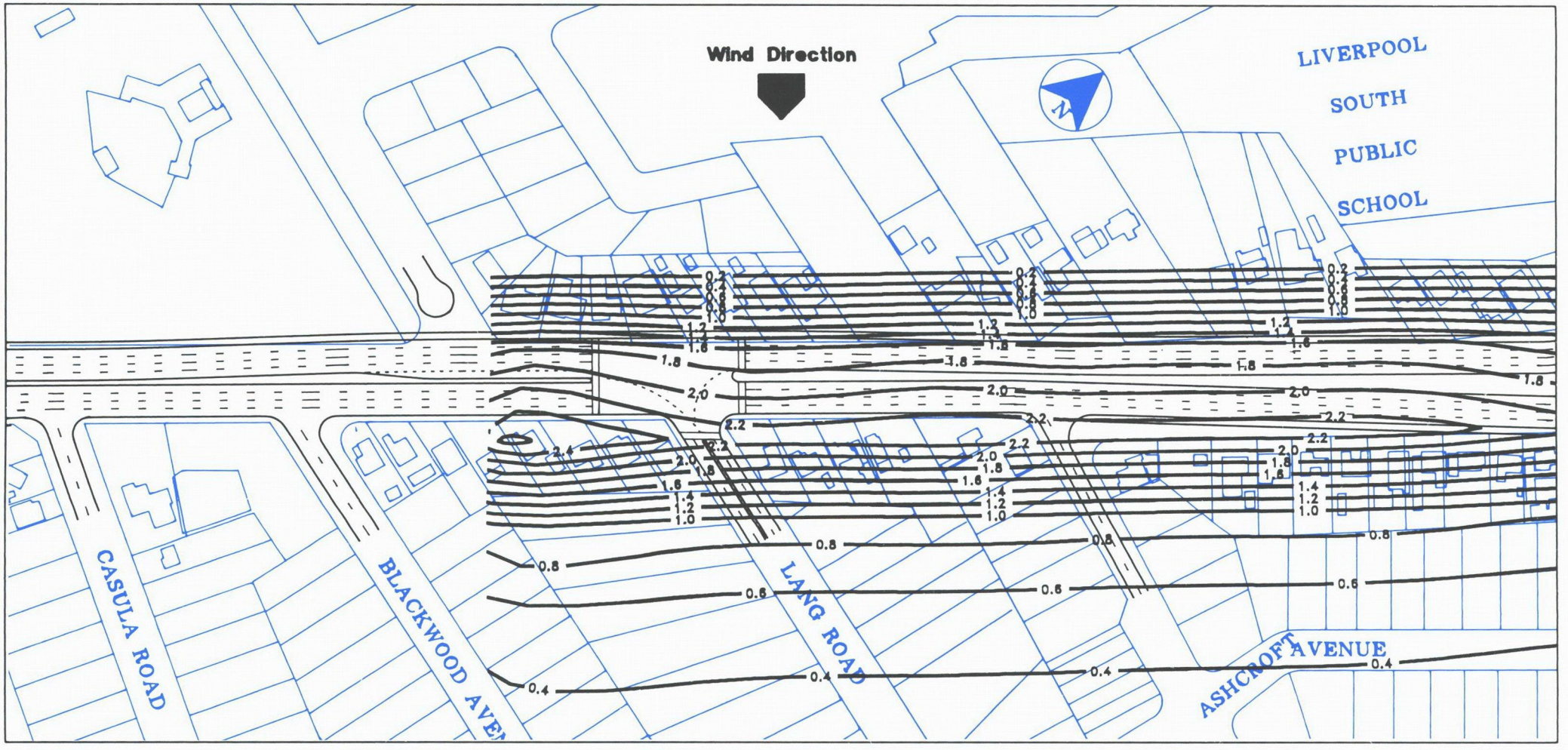
0 10 20 40 60
Metres

Figure 8.4

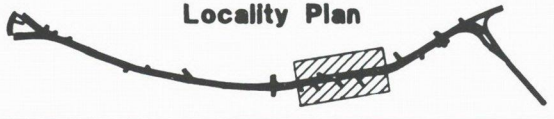
PREDICTED NITROGEN DIOXIDE CONCENTRATION DUE TO HUME HIGHWAY SECTION H6 - $\mu g/m^3$

(Assumed conditions: 0.5m/s wind from NW
stable atmospheric conditions with peak morning traffic)

Source: Nigel Holmes & Associates



Locality Plan



0 10 20 40 60
Metres

Figure 8.5

PREDICTED CARBON MONOXIDE CONCENTRATION DUE TO HUME HIGHWAY SECTION H6 - mg/m^3

(Assumed conditions: 0.5m/s wind from NW
stable atmospheric conditions with peak morning traffic)

Source: Nigel Holmes & Associates

This would produce a larger and more intensively trafficked arterial than at present, with carriageways that are much closer to the building frontages.

The environmental impacts of this change have been outlined above, and would represent a serious deterioration in the living and working environment of properties fronting the highway.

Access to the residential areas on either side of the highway would be maintained, although most minor road junctions would be closed. However the time taken to enter and leave these residential areas and businesses at the major intersections would increase since through traffic would be given increasing precedence. Residents in areas west of the Hume Highway would respond by increasing their use of Hoxton Park Road and Reilly Streets, with consequent increases in traffic on local roads feeding them.

Noise and access limitations would affect businesses and the Casula Primary School which front the highway. The increase in traffic volume and speed would make access in and out of existing roadside businesses more difficult. This would be accentuated in the case of the major junctions - such as at the Crossing and the northbound access onto the M5. On street parking and access to off-street parking would be more restricted, limiting the viability of highway oriented businesses despite increases in traffic passing the door.

The nett effect would be to increase the isolation of developments east of the highway, and to increase all forms of stress on residents and businesses fronting or living in close proximity to the highway.

The Consultative Committee has generally recognised the inadequacy of attempting to satisfy growing traffic demand by upgrading the Hume Highway and leaving the corridor undeveloped, and they have focused most of their effort on mitigating the impacts of a new road development in the planned corridor (see Section 4).

Businesses along the Hume Highway have not responded in a representative way to invitations to participate in the consultative process.

Responses from the wider public through the return of feedback forms that accompanied newsletters describing the proposal and study process have largely been supportive of the road development in the corridor.

8.4.8 Land Use and Urban Design

This section of the Hume Highway is a transitional zone between the free-flowing intercity motorway south of Camden Valley Way, the congested metropolitan road network, and the M5 route being developed eastwards towards the CBD, port and airport.

Properties fronting the highway are already experiencing heavy traffic related impacts, and the highway largely segregates communities on either side. Land uses and the character of development fronting the highway changes progressively between Liverpool and The Crossroads, with the traveller passing through five loosely defined precincts:

- The commercial fringe of Liverpool town centre between Hoxton Park Road and Passfield Street

- A mixed commercial and residential precinct from Passfield Street to De Meyrick Avenue which lacks coherence or strong identity.

- An established residential precinct from De Meyrick Avenue to Casula Avenue characterised by varied housing types, limited setbacks, and a greater abundance of mature eucalypt trees. Some commercial development occurs near Leacocks Lane.

- A developing residential precinct between Casula Avenue and Myatt Road, where subdivision and housing is occurring on the most recent urban rezoning.

- A transitional semi rural precinct, open textured and featuring a scattering of unrelated business developments, most drawing trade from the highway.

Expansion from 6 to 8 lanes, with the

Highway upgrade, would be achieved by eliminating the grassed median and selectively acquiring parts of the frontages of properties along the highway.

The effects of these resumptions would be as follows:

- On residential properties, the opportunity for landscaped screening from the upgraded Highway would be greatly diminished. New residential subdivision, towards the south of the Highway corridor, would have to allow for wider landscape buffer zones. New estates, recently subdivided opposite Myall Road would lose a substantial proportion of the buffer screening recently provided.

- Established stands of groves and *Eucalyptus* and ornamental exotic landscape in private gardens adjacent to the upgraded Highway would have to be removed. The opportunity to re-landscape would be diminished.

- The existing visual quality of the Highway characterised by generous grassed verges in the median and the roadsides, and the soft edge provided by occasional groves of mature trees, would be greatly diminished - especially in the stretch between De Meyrick Avenue and Alcock Road.

- Commercial/retail premises - such as the Cuddles and Mum store and the Jolly Knight restaurant and motel would lose their landscaped verge and possibly some of the car parking at the premise's frontages.

- Access would become more difficult to the retail outlets towards Graham Avenue as the limited approach to the M5 turnoff require motorists to begin choosing right or left lanes.

- The changes to the intersection at the Cross Roads - including an overpass into Camden Valley Way from the Hume Highway may reduce the visibility of the Cross Roads Hotel.

- The increased speed of traffic would make access to adjacent commercial premises more difficult.

Opportunities to produce a more coherent and attractive environment along this section of the Highway would be reduced by this kind of expansion, and the experience of road users would be further degraded by having to cope with greater traffic volumes and more complex manoeuvring associated with frequent intersections and frontage access.

8.4.9 Economic Effects

The economic effects would be difficult to quantify with any confidence either regionally or locally, since the magnitude and severity of additional congestion and localised deterioration in access and amenity are relative rather than absolute i.e. the effects would be compared to conditions in the surrounding area which would also deteriorate as traffic is forced onto an ever widening network of secondary roads in the absence of adequate capacity.

In general however, it is likely that reliance upon a limited upgrade of the Hume Highway would have the following effects:

- Reduction of the viability of businesses in the Campbelltown/ Casula/Wollondilly area that depend upon shipping or receiving goods from other parts of the metropolitan area, or upon access for business visitors or staff from areas north and east of Casula.

- Diversion of non-local business investment from the south west region to other parts of Sydney or to other cities altogether in response to growing congestion and poor transport economy.

- Erosion of commercial growth prospects in the Liverpool town centre due to actual and perceived congestion problems and corresponding effects on amenity.

- Erosion of residential and business property values along the Hume Highway due to a combination of increasing environmental impacts (notably noise and air pollution), loss of

property frontage along some parts of the highway, and difficulties with frontage access and short term kerbside parking due to the volume and speed of traffic and consequential traffic management actions.

8.4.10 Construction and Implementation

Construction of the Hume Highway upgrade alternative lends itself to staging over a period of two to three years, although depending on funding it could take up to five years. The acquisition of properties along the route would be undertaken gradually to spread costs over the duration of the upgrading. Roadworks along the route would be undertaken following relocation or adjustment to any services.

Most careful planning of the construction staging would be required as the Hume Highway is a major arterial and carries very heavy traffic flows. Any upgrading would require extensive use of side tracks, only limited work during peak hours, only limited work at night or possibly all these measures.

The work would by definition thus be disruptive and costly.

The interchange with the M5 motorway would be the first major work of any upgrading. Future traffic demands on this intersection would require construction early in the study period. Since all construction is within land currently owned by the RTA an immediate start could be made on this interchange. It is proposed that the flyover be constructed by narrowing the northbound lanes to two kerbside lanes and utilising the median plus two existing median lanes for construction. Acquisition of additional property required is assumed to have taken place before this work commences. A three span structure is proposed to carry northbound traffic over southbound lanes. The ramp within the highway section would be constructed of reinforced earth to give a vertical facing.

Widening of the Georges River Bridge is essential to the Highway upgrade alternative and forms the critical item for construction. Construction is estimated to take 15 months for completion so it would need to be commenced at the start of the upgrading should it proceed.

A new ramp would be constructed to take southbound traffic wishing to turn east away from the signalised intersection and allow further space to construct the flyover. Once this ramp is complete the southbound traffic lanes on the Highway would be reduced to two.

Westbound traffic would remain on the existing road construction up to the signalised intersection, however, a new ramp for south turning traffic would be constructed with an alignment giving a design speed of 60 km/h.

Table 8.7 shows the main stages of the M5/Hume Highway interchange. Time for construction of this interchange and the Georges River Bridge is estimated as 24 months. Construction along the middle section of the Highway upgrade would proceed progressively as land was acquired. Kurrajong Road intersection forms a vital part of the traffic management and could be constructed concurrently with the M5 interchange.

Major Telecom services are located each side of the existing highway including the Sydney-Melbourne coaxial cable. Such services would have to be relocated which would be extremely time-consuming and vastly expensive.

Camden Valley Way/Campbelltown Road grade separation depends on the future construction of a link road between Glenfield Road and Cedar

TABLE 8.7 CONSTRUCTION SEQUENCE FOR UPGRADED HUME HIGHWAY/M5 INTERCHANGE

Stage 1	Construct Georges River Bridge Construct eastbound on ramp Traffic southbound reduced to two lanes Revise Graham Avenue intersection
Stage 2	Northbound traffic reduced to two lanes Construction of overpass reinforced earth ramp Construct westbound off ramp to south
Stage 3	Complete overpass bridge and structure

Source: Maunsell Pty Ltd, 1992

Road. Without this link road the grade separation would become much more complex if not impossible. Table 8.8 shows the possible staging of the grade separation. This would not be an easy interchange to construct due to the difficult traffic management required.

8.5 MOTORWAY CASULA LINK

This proposal examines the potential for increasing traffic capacity within the study area by providing a motorway Link between the existing M5 Freeway at Campbelltown Road and the M5 Motorway at Hume Highway. The proposed route traverses an existing road reserve set aside for motorway construction.

A motorway would provide additional capacity within the corridor by paralleling the Hume Highway and providing an intersection free link between the two sections of the M5. The capacity increase created by construction of the motorway Link would be far greater than any increase which could be achieved by upgrading the Hume Highway only.

8.6 CONCLUSION

As discussed in Section 5.3.2 the demand for road capacity in the peak period is expected to further exceed the available supply if urban expansion proceeds in accordance with the Metropolitan Strategy.

Due to the fact that the Hume Highway upgrade can only be considered a relatively short term measure, as well as considering the greater benefits that would be provided by the proposed M5 Casula Link, the upgrade alternative has not displaced the proposed Casula Link as the preferred solution to the transport needs of the corridor.

A Casula Link would complete that part of the M5 freeway, the primary purpose of which is to provide a high quality/high volume route for vehicular traffic across the southern half of the metropolitan area. The M5 is an integral part of the road network planned to service business and private travel needs as Sydney grows.

Those travel needs include commuting and some forms of personal travel which can be served to varying degrees by public transport, but the wide dispersal of jobs and homes in Sydney and the complex organisation of industry and commerce severely limit the capacity for substitution.

This is not to dismiss the role of public transport in the corridor but the traffic forecasts recognizes that even with substantial increases in public transport usage, there is still a substantial demand for extra road capacity.

This forecast would involve an increase in peak hour public transport patronage along the corridor.

Part of this demand could be satisfied by additional services on the rail lines linking Campbelltown with Parramatta and the CBD, or by providing additional regional bus services. The development of the Y link of Merrylands will help this.

In any event the provision of additional capacity will provide growth potential for some years.

TABLE 8.8 CONSTRUCTION STAGING AT CAMDEN VALLEY WAY/ CAMPBELLTOWN ROAD

Stage 1	Construct future link road (Glenfield to Cedar) Divert southbound traffic on Camden Valley Way onto more northerly alignment Construct temporary northbound lanes to east off final lanes
Stage 2	Construct underpass up to temporary Camden Valley Way southbound Construct Camden Valley Way overbridge
Stage 3	Revert traffic to Camden Valley Way overbridge and complete Campbelltwon Road off ramp

Source: Maunsell Pty Ltd, 1992

9 DETAILED DESCRIPTION OF PROPOSED MOTORWAY

9.1 DESIGN OBJECTIVES

9.1.1 Design Influences of the Road Reservation

The road reservation is set in an urban fringe area which is presently of mixed land use. Mainly residential with some commercial and industrial developments to the northern end, the reservation grades into rural allotments and full rural landscape to the south. The land use within the corridor is changing with increasing residential development taking place to the west and south. The nature of the land use within the corridor influences greatly the form of the proposed motorway in terms of width of carriageway, placement of noise barriers, landscaping and drainage.

The proposed motorway would be set within a long-defined reserve as evidenced by the development of housing up to the limit of the reserve. Little scope is available for moving the road reserve away from its present position apart from the southern end of the alignment between Box Road and Camden Valley Way.

Several features of the road reservation influence both the plan layout and elevations of the alignment:

- The M5 South Western Motorway and South Western Freeway adjoin the proposed alignment at the northern and southern ends of the proposed Link. The connection of the motorway to these two existing roads sets the initial direction of the ends of the motorway with only very limited ability to change alignments. The new road must link with the existing roads to provide continuity of the route.

- The width of the motorway reserve and the design parameters for the motorway determine the freedom of movement available within the reserve. The reserve width is generally 90 metres which allows a residual of approximately 20 metres each side depending on the width of batter required to match the proposed road edges to the existing surface.

- Water courses crossing or within the road reserve affect the levels adopted for the proposed motorway to a large degree. The grade of the road has to allow stormwater which currently crosses the road reserve to pass either in conduits or via open channels with minimal effect on downstream water quality or quantity, and to allow surface water collecting on the motorway reserve to drain away at low points to existing water courses.

- Maintaining as many of the local street crossings as possible is a major constraint on the alignment. Six local streets cross the road reserve. To maintain the traffic flow on these streets requires either an overpass or underpass to be constructed. Because of the topography of the motorway reserve an overpass for vehicular and pedestrian traffic is planned at one of these streets, another is proposed in principle, and pedestrian links (one overbridge and one underpass) are to be provided at two others.

- Use of existing road formation and bridges is desirable where possible to provide for more economic construction. Particularly east of the Hume Highway at the Georges River Bridge, the existing bridge carrying the M5 over the Georges River has been incorporated into the proposal. The need to duplicate or augment existing structures within the motorway has also determined the final form of the proposal. At Camden Valley Way the existing overbridge has influenced the form of the interchange proposed and the formed southbound carriageway of the M5 is to be retained to save costs.

9.1.2 Specific Design Aims

The following considerations have been taken into account in the design of the proposed motorway:

- Maintain geometric design standards throughout the route compatible with those adopted for the adjoining sections of the M5.

- Ensure drainage of motorway and upstream catchments would meet local authority requirements for water quantity and quality.

- Reduce potential for traffic noise intrusion and improve aesthetic appearance by provision of earth mounds.

- Maintain local street crossings where possible and provide safe crossings for pedestrians at critical locations.

- Provide intersection layouts and ramp configurations to suit projected traffic movements.

- Reduce intrusion of overpass earthworks into local residential area by providing overpasses at locations where cutting occurs on motorway alignment.

- Integrate traffic links with existing traffic management schemes.

9.1.3 Design Criteria and Traffic Requirements

Design speeds on expressways are normally 80 to 110 km/h. This speed determines the requirements for radius of curves, banking on curves, sight distance for merging and diverging and all other operating conditions for the roadway. The corridor available for the proposed motorway would allow a design speed of 110 km/h and this speed has been adopted for design purposes. Grades have been kept low to meet the operating speed requirements, with maximum grades of 3%.

Predicted traffic volumes indicate the need for a minimum of two lanes in each direction. Lane width has been set at 3.5 metres. A typical cross section of the road is shown in figure 9.2. Allowance has been made for widening of each carriageway to three lanes by constructing the two extra lanes within the median. The median width adopted for the design is 8 metres from the edge of the pavement to the edge of pavement. However, the concept design for the proposed motorway is on the basis of a four lane road. The addition of lanes would be examined on its merits at a future date if the need arose, and be subject to environmental assessment at that time.

9.2 DESCRIPTION OF PROPOSAL

9.2.1 General Description

The M5 Casula Link would provide a direct connection from the M5 Motorway at Heathcote Road to the M5 Freeway south of Campbelltown Road. A continuous route providing motorway conditions would thus run from Campbelltown and points south to Beverly Hills. The link is 6.8km long of which 4.3km is entirely new construction, the remainder being duplication of existing single carriageway. Figures 9.1.1 to 9.1.15 show the proposed road with the landscaping master plan and noise barriers. Figure 9.2 shows the typical cross section of the proposed motorway.

The proposed motorway would provide an additional link parallel with the Hume Highway.

Features of the proposed motorway are described below commencing from the southern boundary of the study south of Campbelltown Road and proceeding north then east to the eastern study boundary at Heathcote Road.

Campbelltown Road to Camden Valley Way

The northbound carriageway of the M5 Freeway currently follows the proposed motorway alignment south of Campbelltown Road. The southbound carriageway does not exist at this location however the earthworks and formation have been constructed. The existing alignment has been adopted for the design. A ramp from Campbelltown Road presently carries southbound traffic onto the motorway. The proposed motorway would link to the M5 Freeway south of the Campbelltown Road overbridge, follow the existing northbound carriageway under Campbelltown Road and proceed northward to Camden Valley Way. The route through this section would be within the existing reservation. The adjacent land is heavily treed to the west with open grass farmland to the east.

The motorway cross section through this part of the alignment would consist of two lanes on each carriageway with a median of variable width. This would be essentially a rural cross section and continue up to Camden Valley Way.

The road levels through this section would follow the existing formation

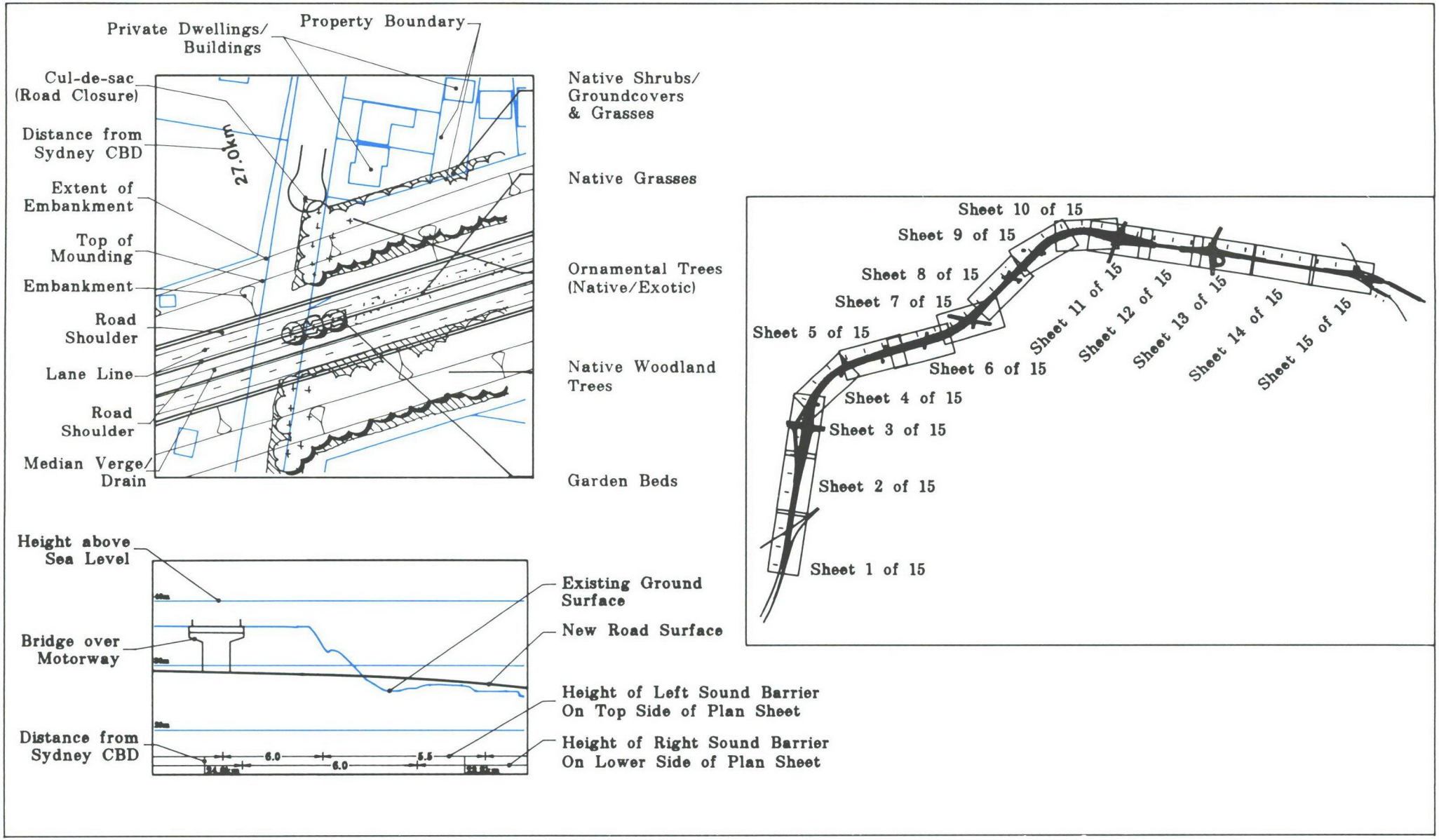
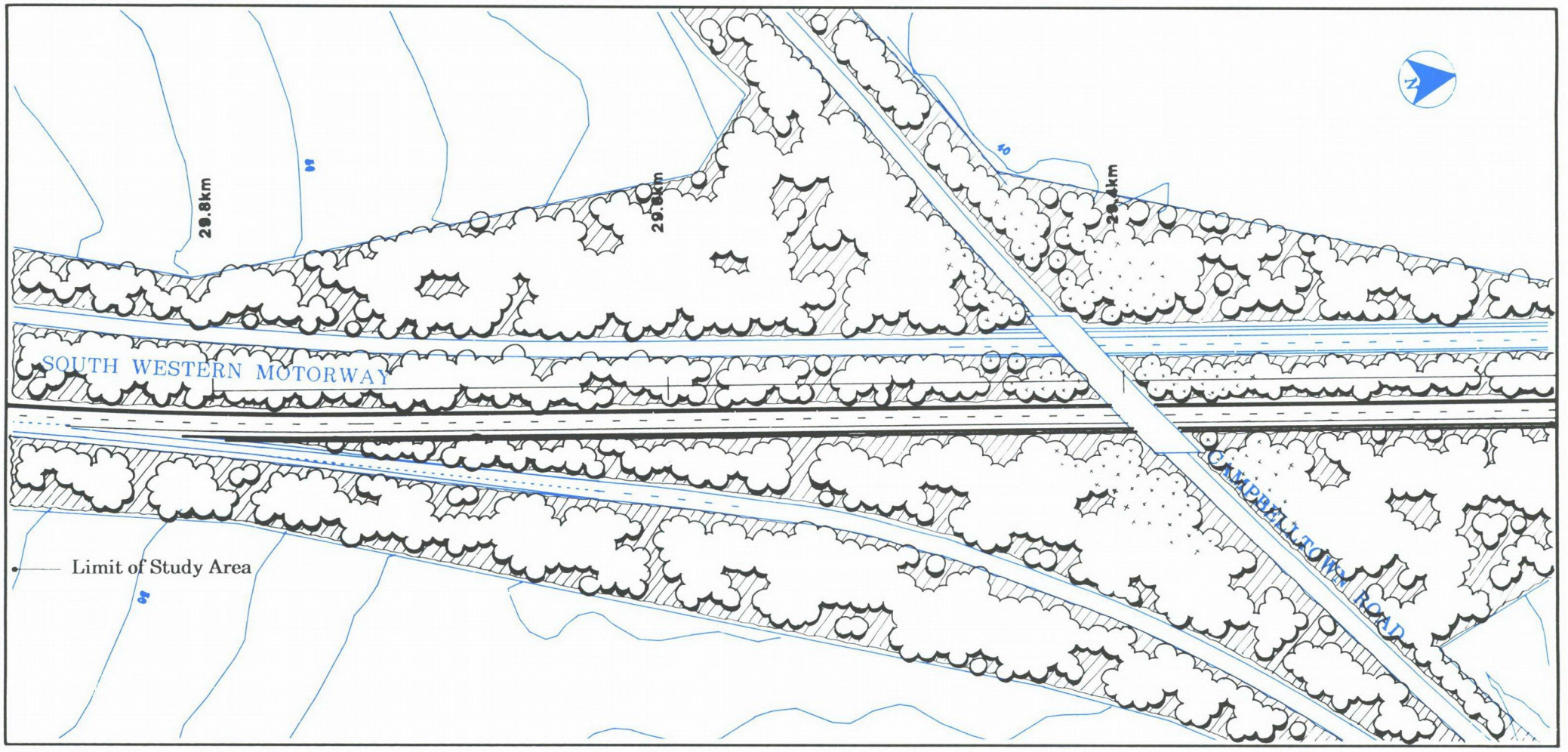


FIGURE 9.1
MOTORWAY ALIGNMENT LEGEND


29.8km
29.8km
29.4km
SOUTH WESTERN MOTORWAY
CAMPBELLTOWN ROAD
Limit of Study Area
N

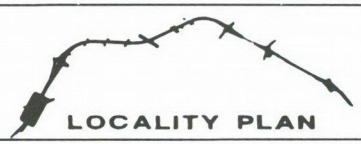
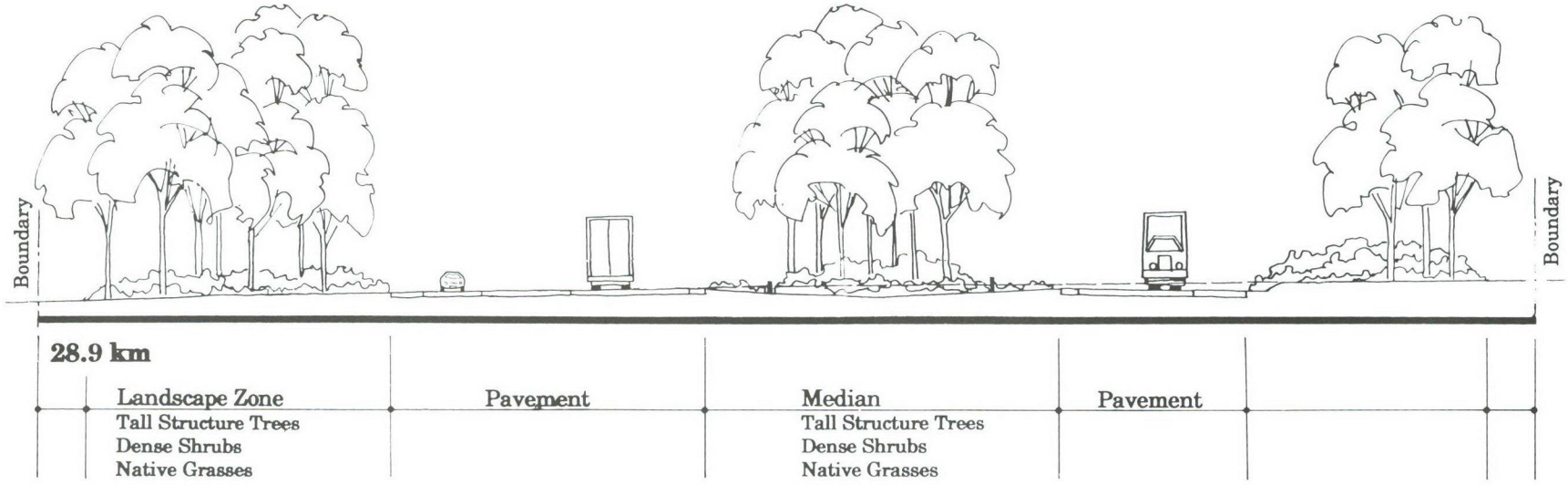




FIGURE 9.1.1
MOTORWAY ALIGNMENT AND CROSS SECTION
CAMPBELLTOWN ROAD

Sheet 1 of 15

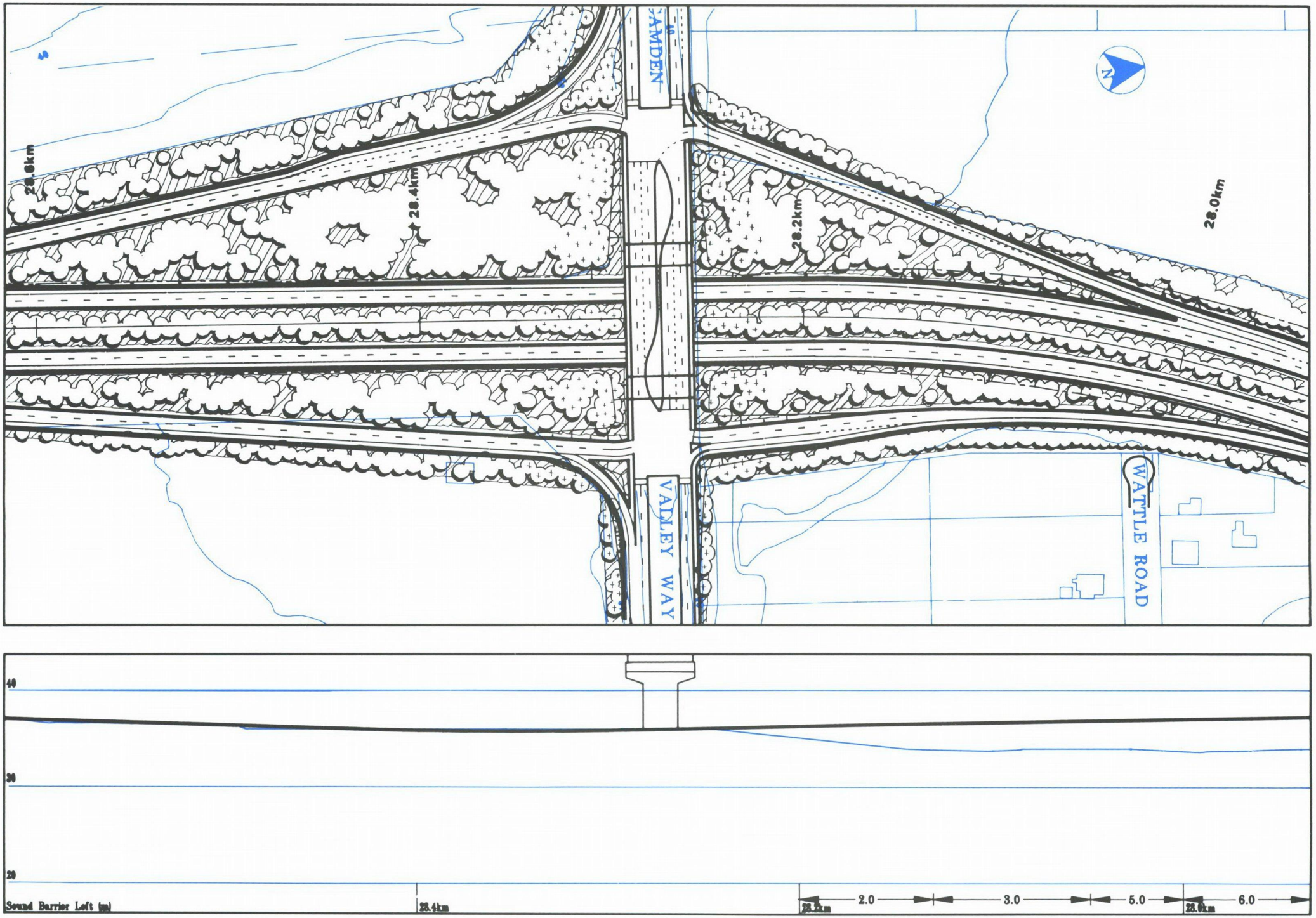
29.2km
EASEMENT
TRANSMISSION LINE
29.0km
SOUTH WESTERN FREEWAY
28.8km
28.6km
N

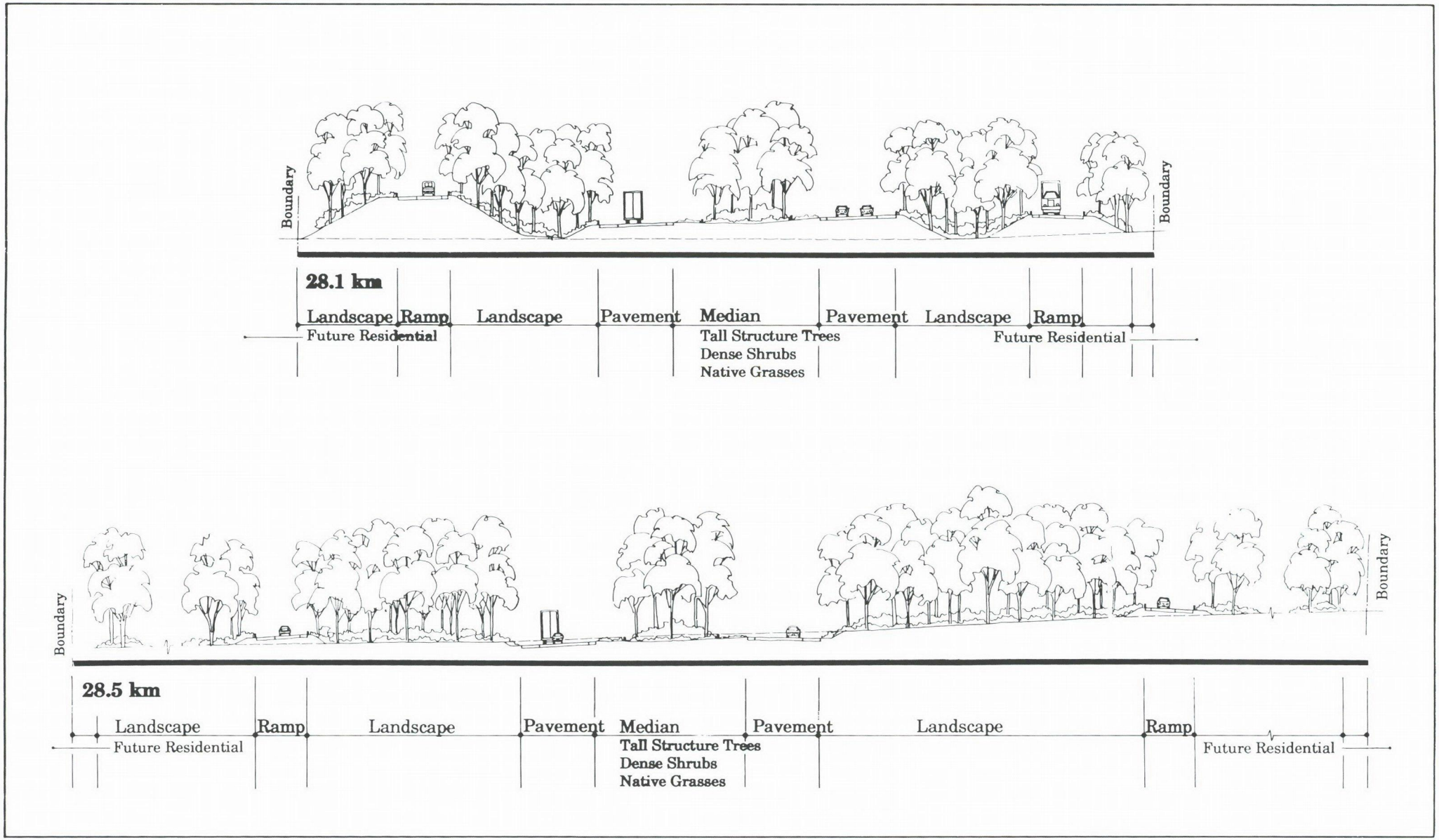


LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.2
MOTORWAY ALIGNMENT AND CROSS SECTION


CAMDEN
VALLEY WAY
WATTLE ROAD
28.6km
28.4km
28.2km
28.0km
N
40
30
20
Sound Barrier Left (m)
28.4km
28.2km
28.0km
2.0
3.0
5.0
6.0

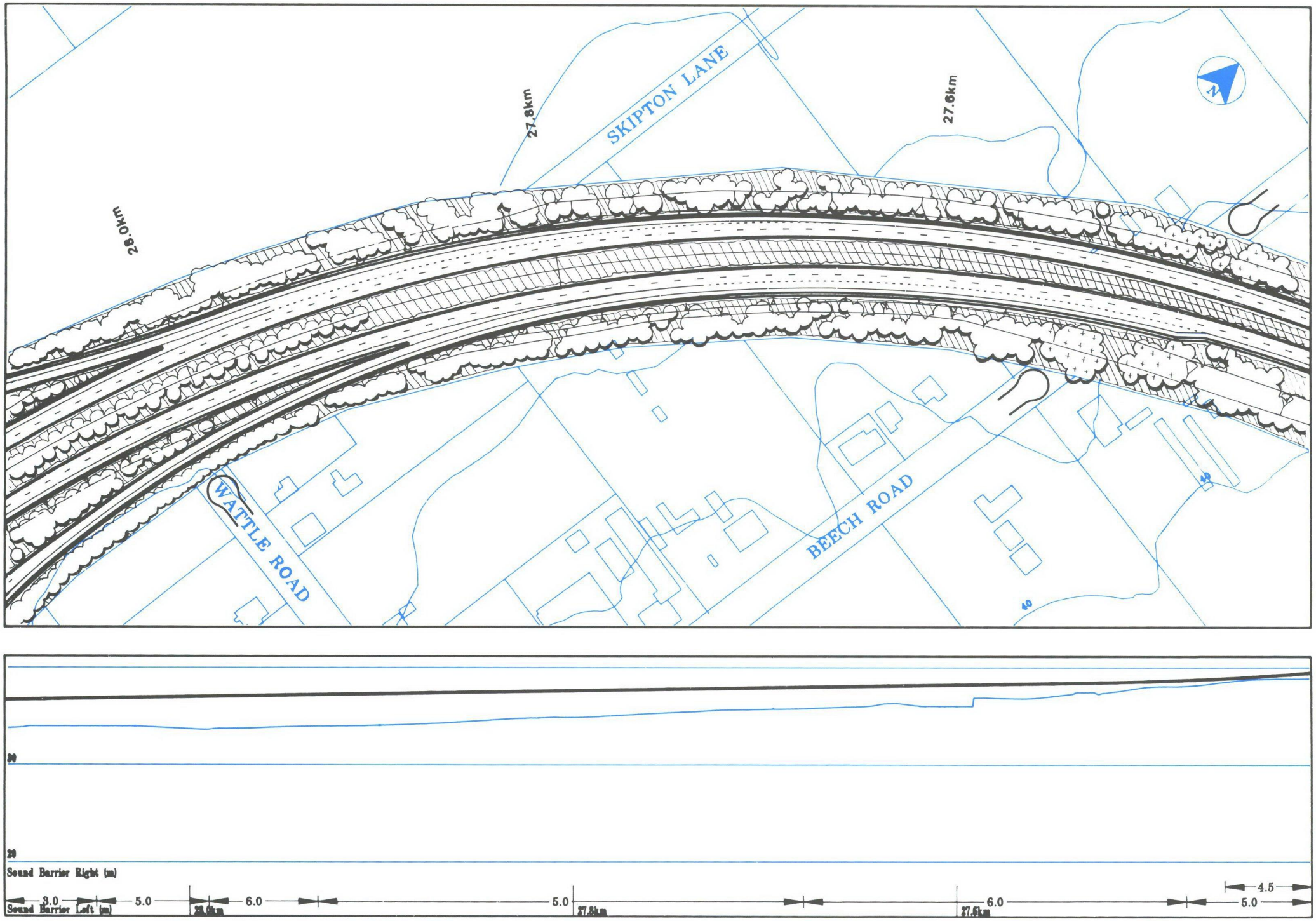


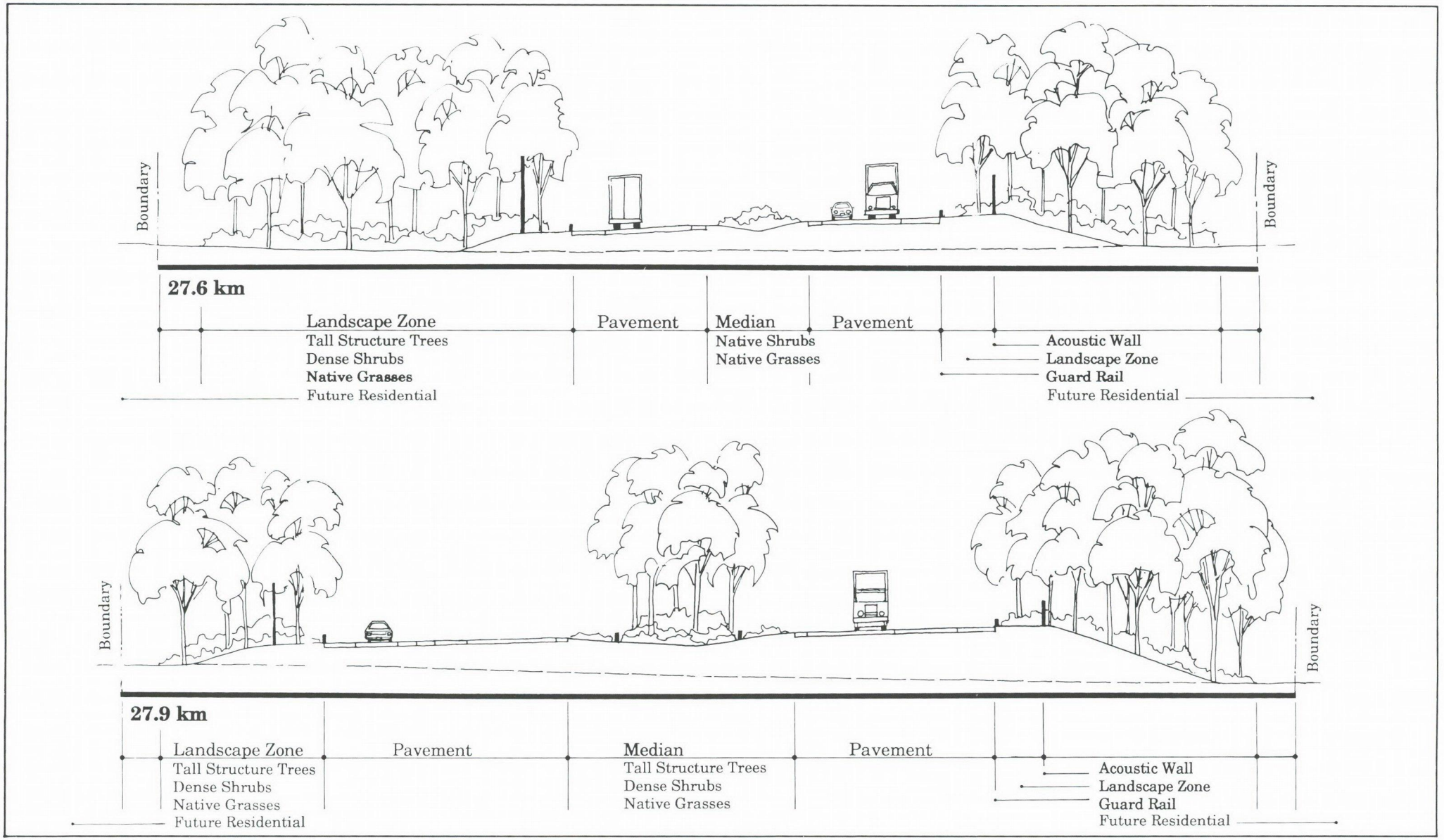
LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.3
MOTORWAY ALIGNMENT AND CROSS SECTION
CAMDEN VALLEY WAY

Sheet 3 of 15


SKIPTON LANE
27.8km
27.6km
28.0km
WATTLE ROAD
BEECH ROAD
40
40
N
30
20
Sound Barrier Right (m)
Sound Barrier Left (m)
3.0
5.0
6.0
5.0
6.0
4.5
5.0
28.0km
27.8km
27.6km

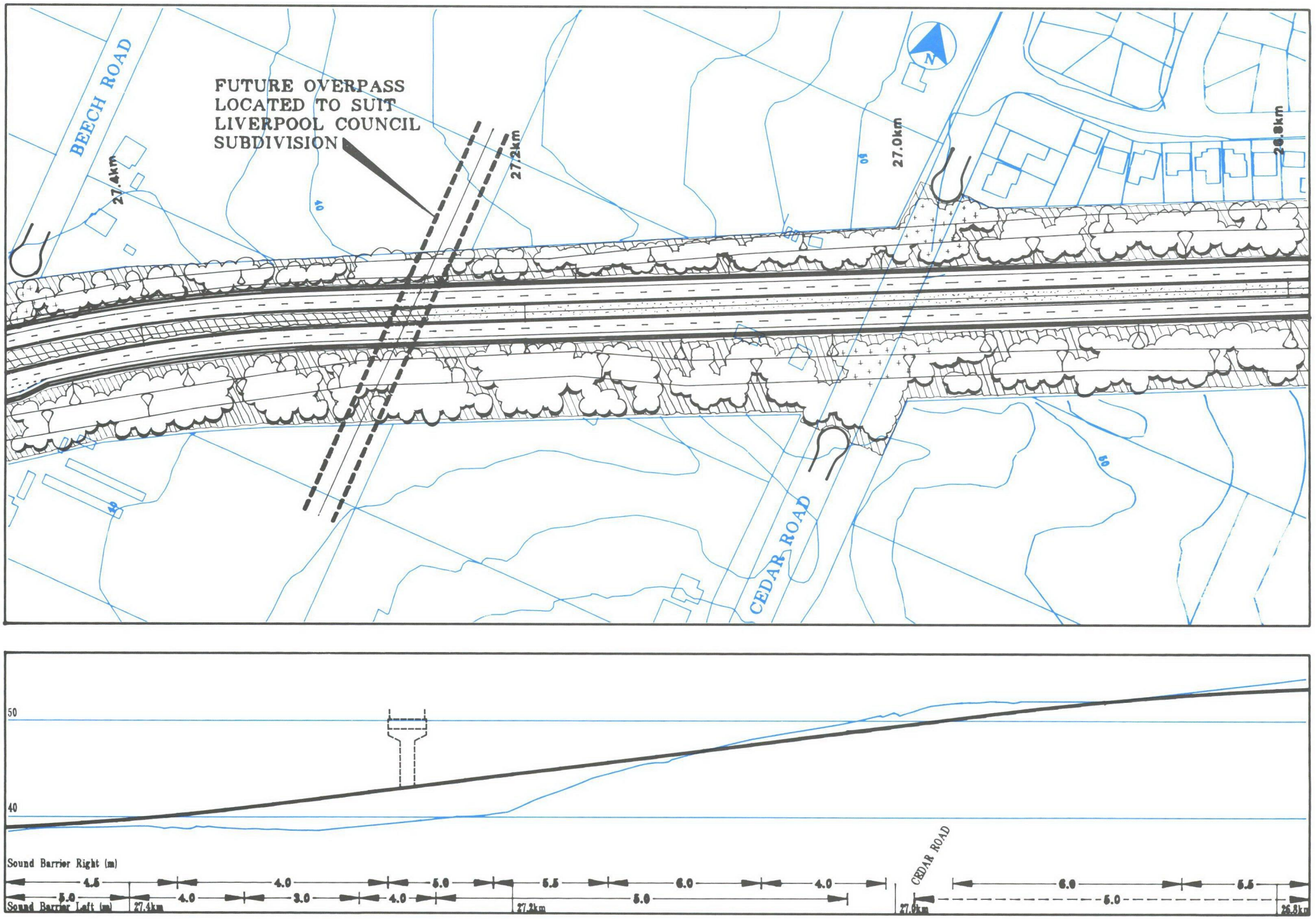


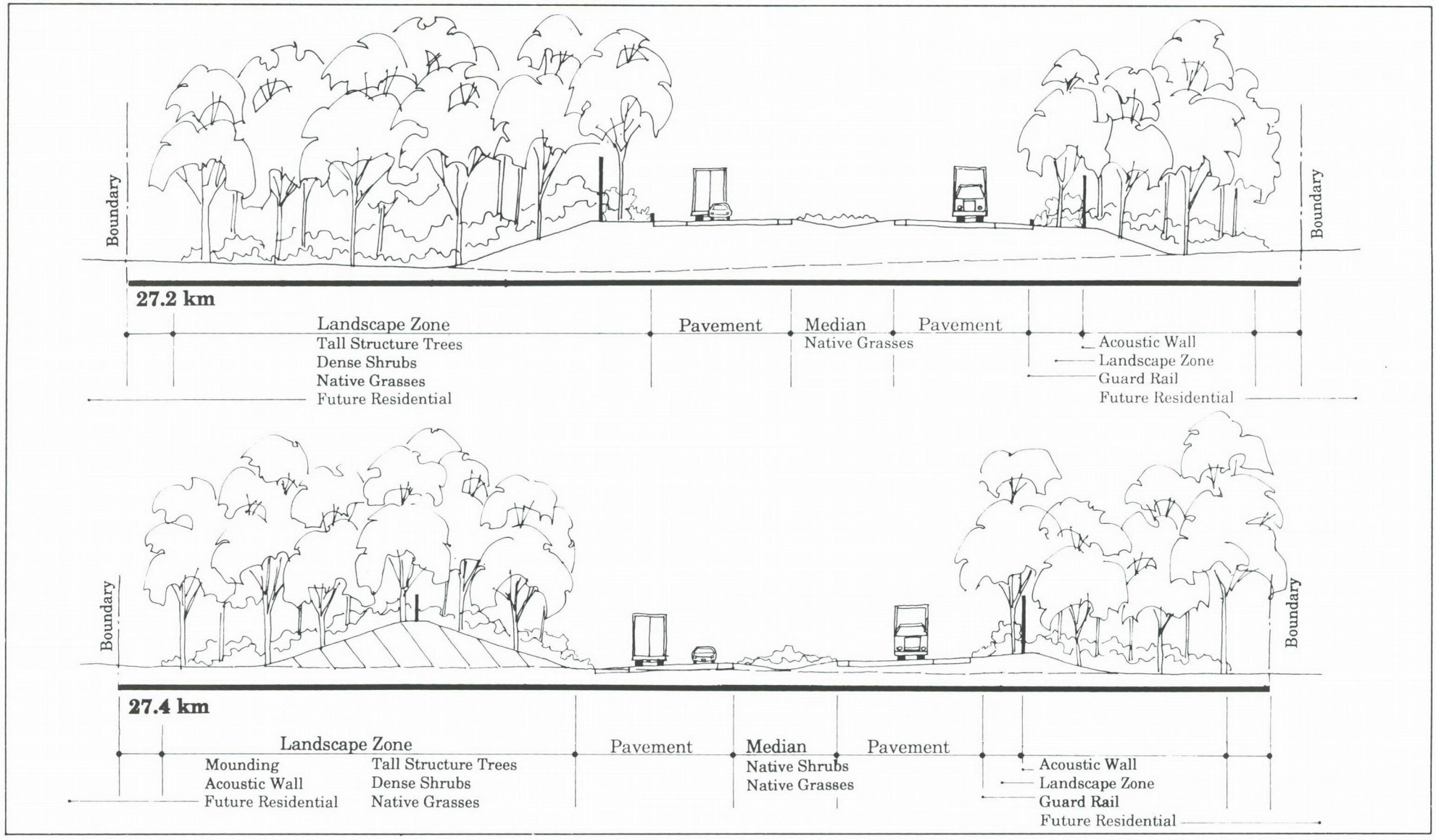
LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.4
MOTORWAY ALIGNMENT AND CROSS SECTION
WATTLE ROAD

Sheet 4 of 15


BEECH ROAD
FUTURE OVERPASS
LOCATED TO SUIT
LIVERPOOL COUNCIL
SUBDIVISION
27.4km
27.2km
27.0km
26.8km
40
50
CEDAR ROAD
N
50
40
Sound Barrier Right (m)
4.5
4.0
5.0
5.5
6.0
4.0
Sound Barrier Left (m)
5.0
4.0
3.0
4.0
5.0
6.0
5.5
5.0
27.4km
27.2km
27.0km
26.8km

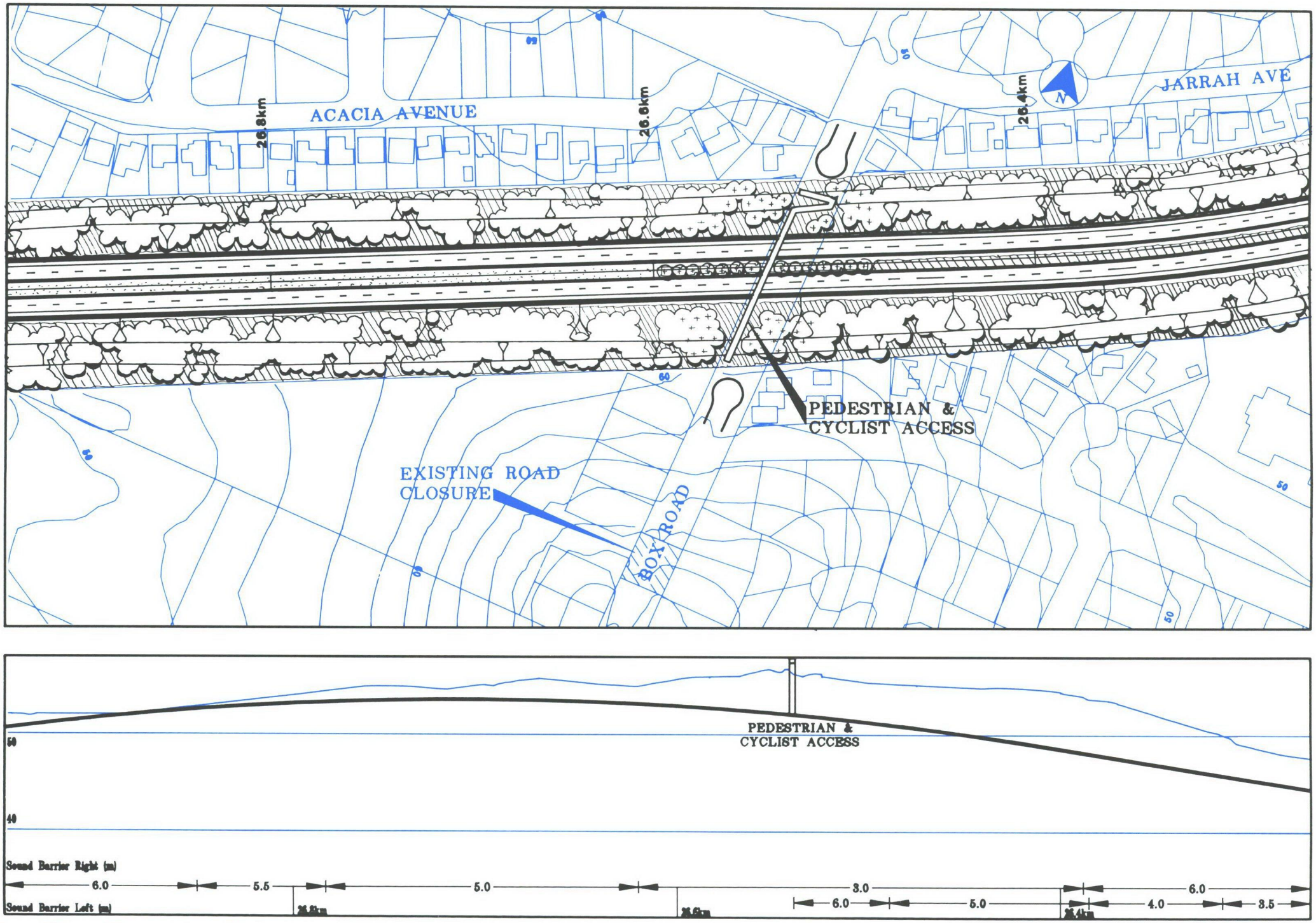


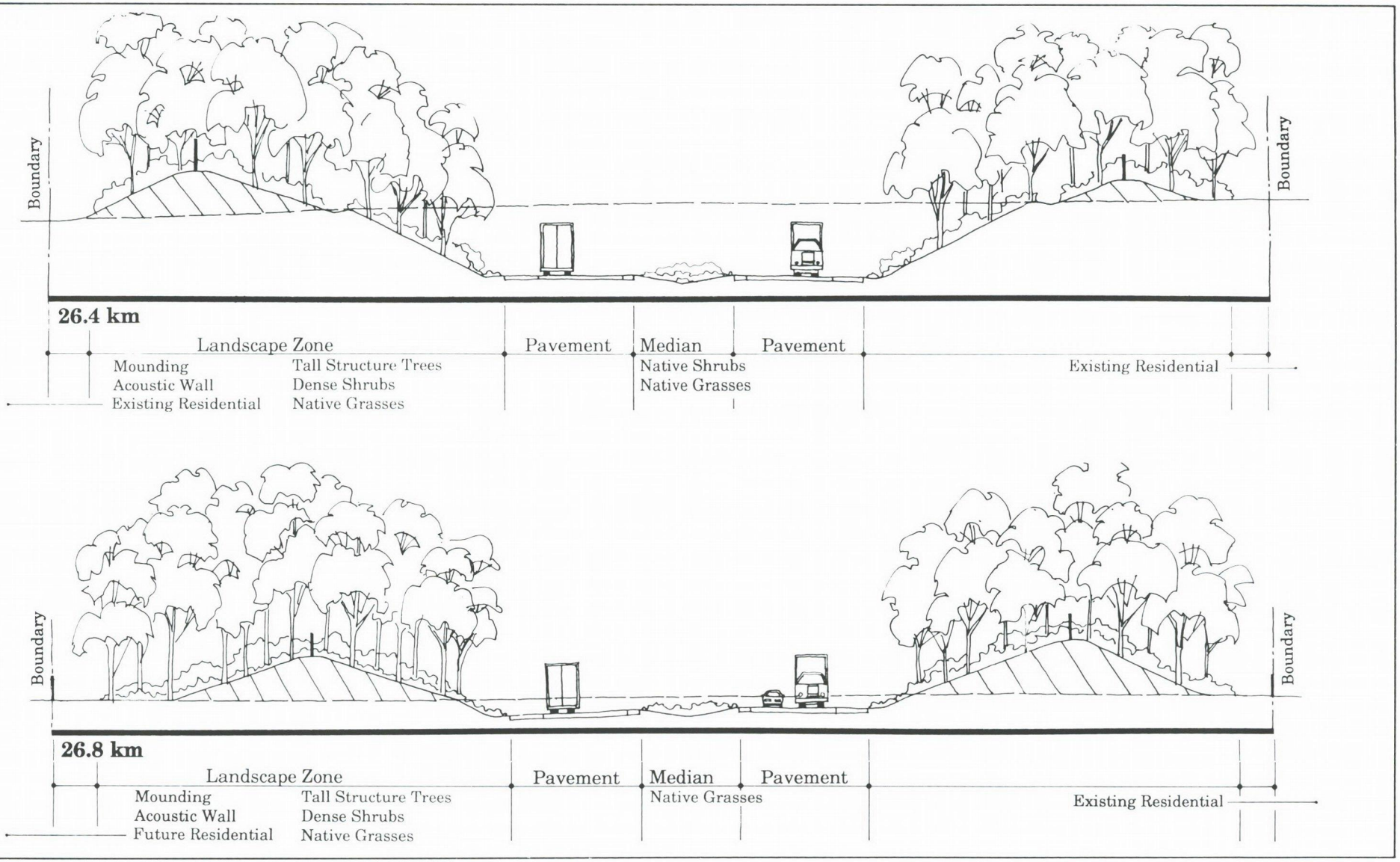
LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.5
MOTORWAY ALIGNMENT AND CROSS SECTION
CEDAR ROAD

Sheet 5 of 15


ACACIA AVENUE
26.8km
26.6km
26.4km
JARRAH AVE
N
PEDESTRIAN &
CYCLIST ACCESS
EXISTING ROAD
CLOSURE
BOX ROAD
50
PEDESTRIAN &
CYCLIST ACCESS
50
40
Sound Barrier Right (m)
6.0
5.5
5.0
3.0
6.0
5.0
6.0
4.0
3.5
Sound Barrier Left (m)
26.6km
26.4km

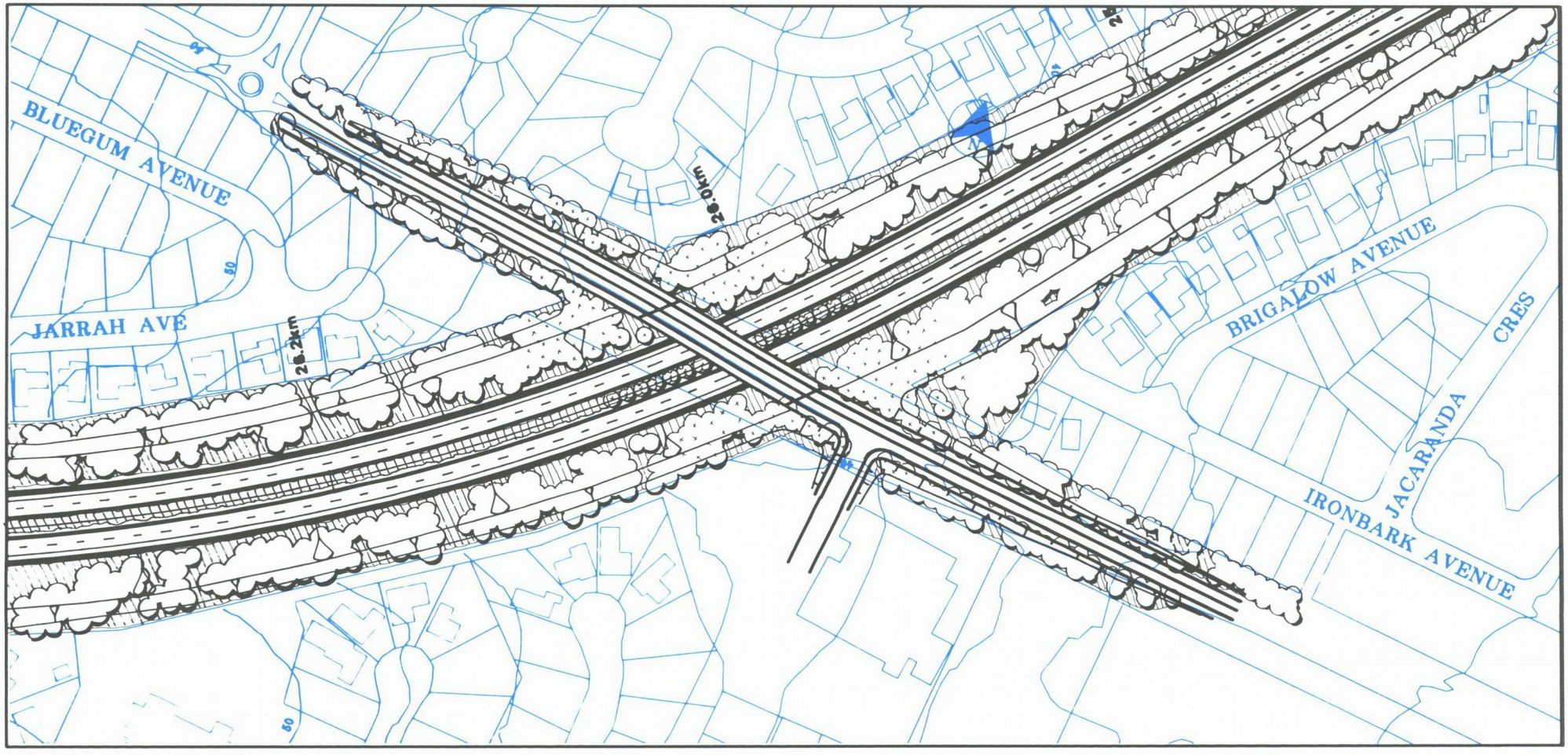


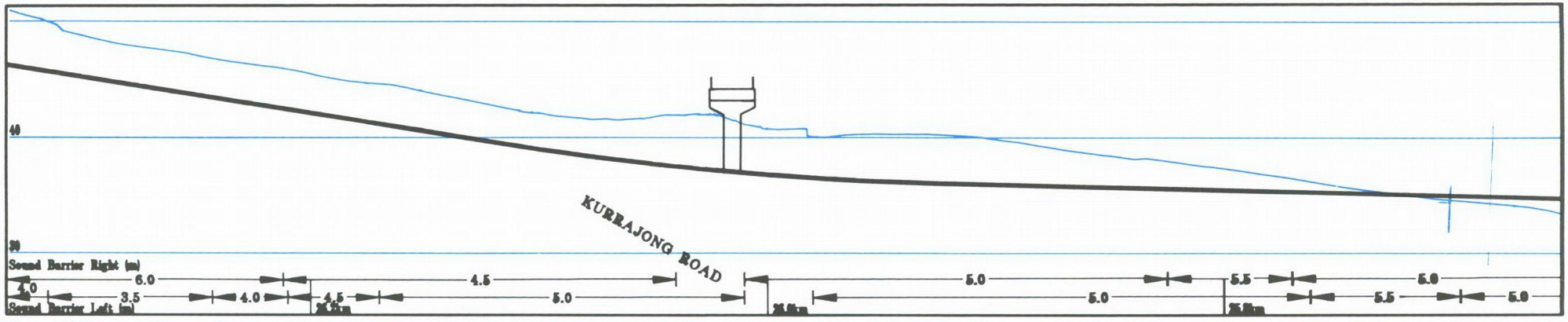
LOCALITY PLAN

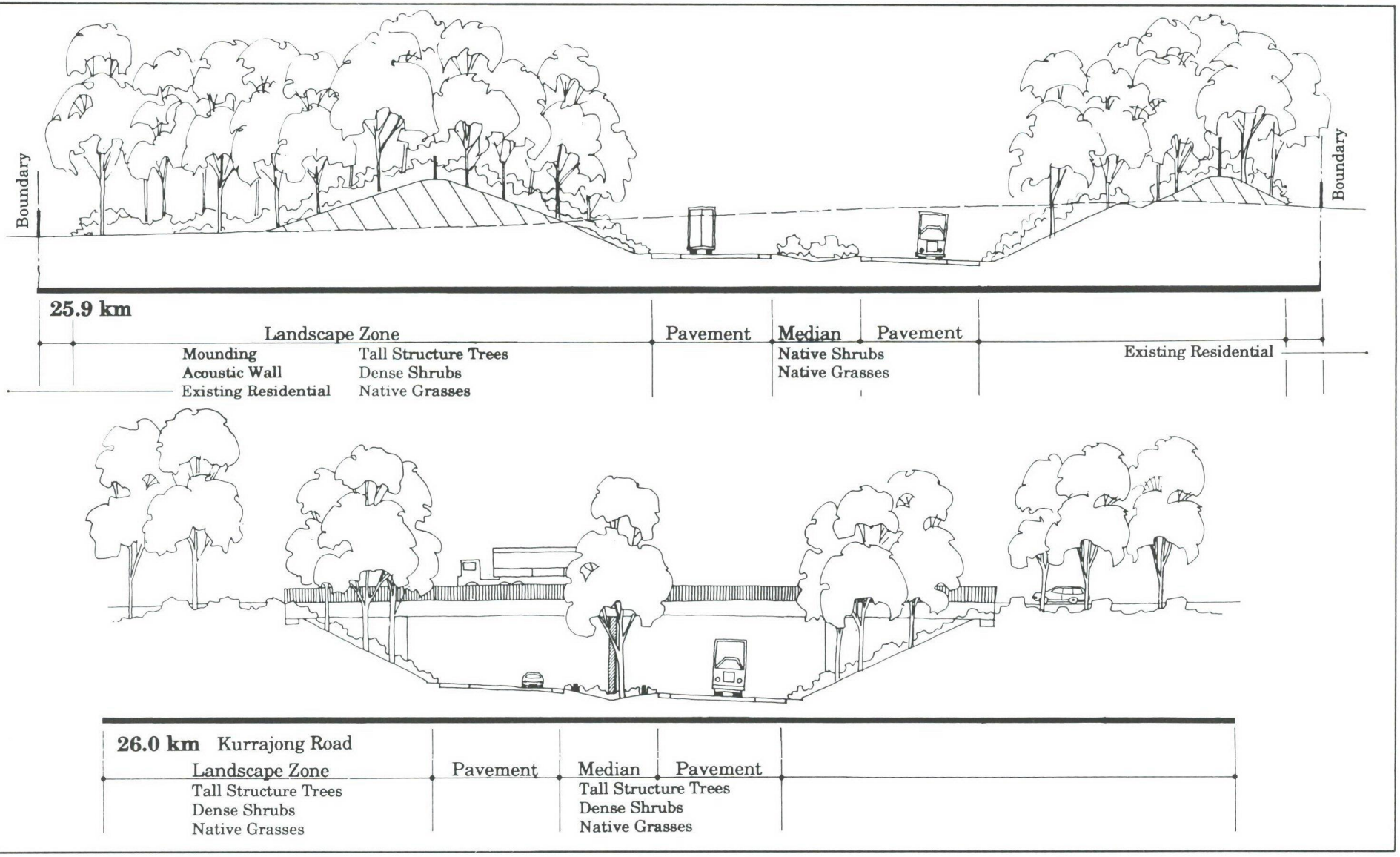
0 20 40 80 120
Metres

FIGURE 9.1.6
MOTORWAY ALIGNMENT AND CROSS SECTION
BOX ROAD

Sheet 6 of 15


BLUEGUM AVENUE
JARRAH AVE
BRIGALOW AVENUE
JACARANDA CRES
IRONBARK AVENUE
25.2km
26.0km
50

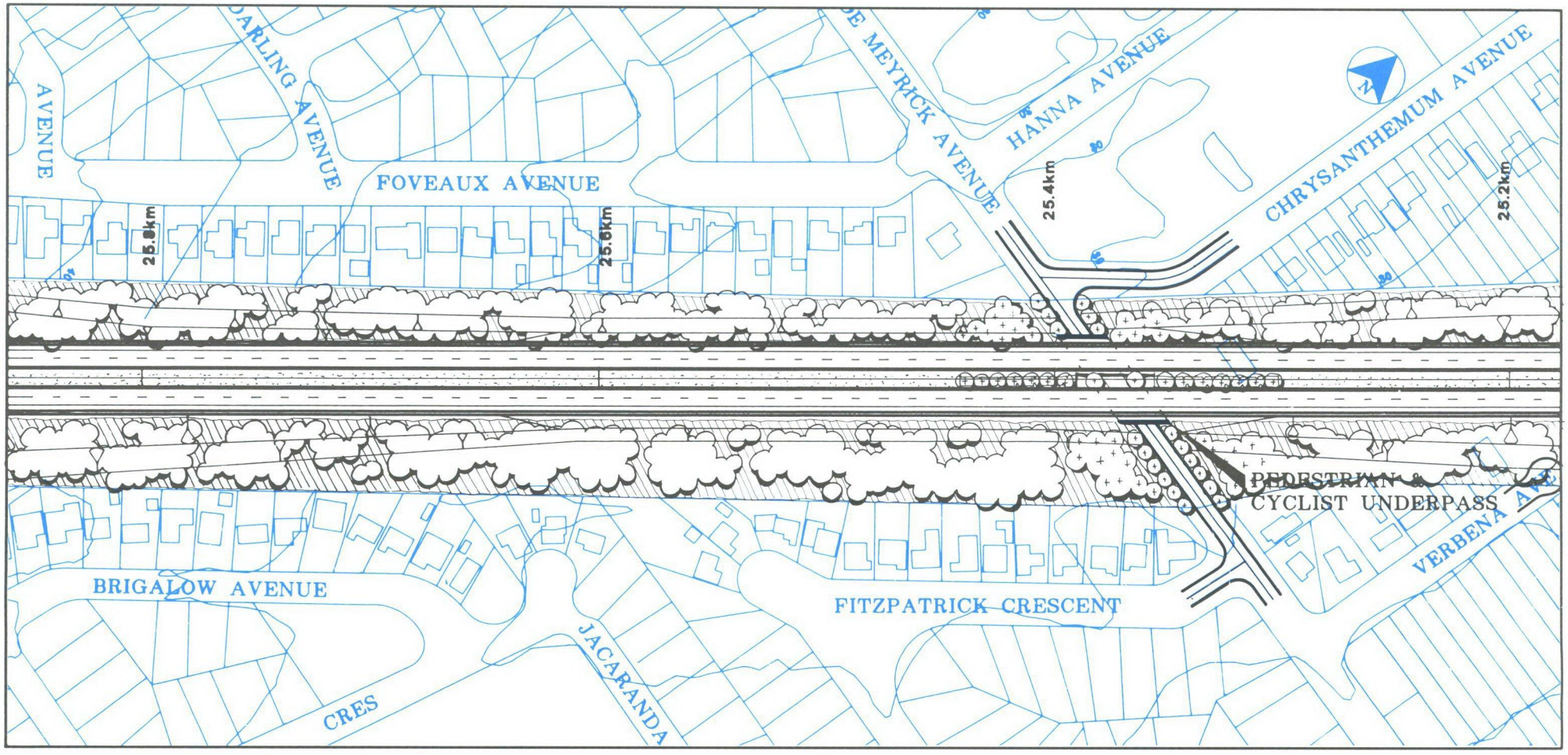

40
30
KURRAJONG ROAD
Sound Barrier Right (m)
Sound Barrier Left (m)
6.0
3.5
4.0
4.5
4.5
5.0
5.0
5.0
5.5
5.5
5.0

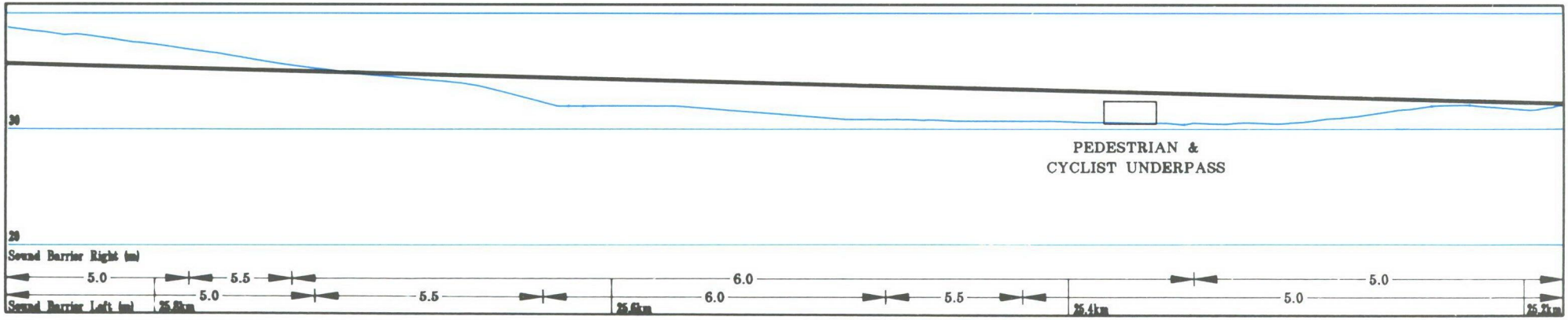


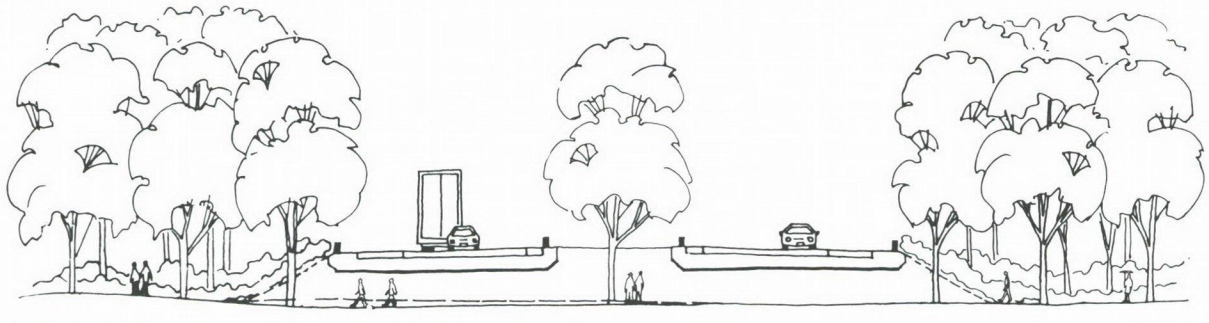
LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.7
MOTORWAY ALIGNMENT AND CROSS SECTION
KURRAJONG ROAD

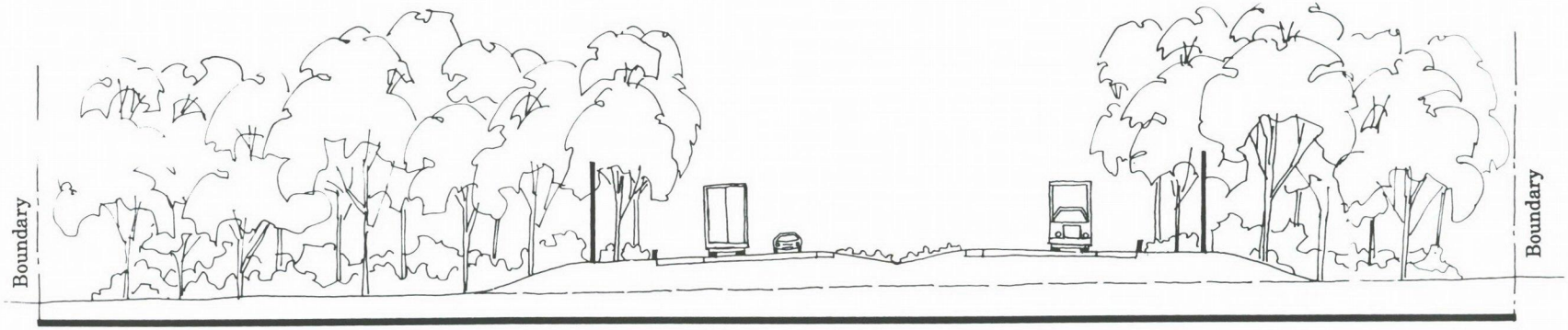

AVENUE
DARLING AVENUE
FOVEAUX AVENUE
DE MEYRICK AVENUE
HANNA AVENUE
CHRYSANTHEMUM AVENUE
25.8km
25.6km
25.4km
25.2km
PEDESTRIAN &
CYCLIST UNDERPASS
VERBENA AVE
BRIGALOW AVENUE
FITZPATRICK CRESCENT
JACARANDA
CRES


30
PEDESTRIAN &
CYCLIST UNDERPASS
20
Sound Barrier Right (m)
5.0
5.5
6.0
5.0
Sound Barrier Left (m)
5.0
5.5
6.0
5.5
5.0
25.8km
25.6km
25.4km
25.2km



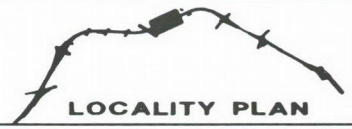
25.4 km De Meyrick Avenue

Landscape Zone	Pavement		Pavement	
Tall Structure Trees Dense Shrubs Native Grasses				



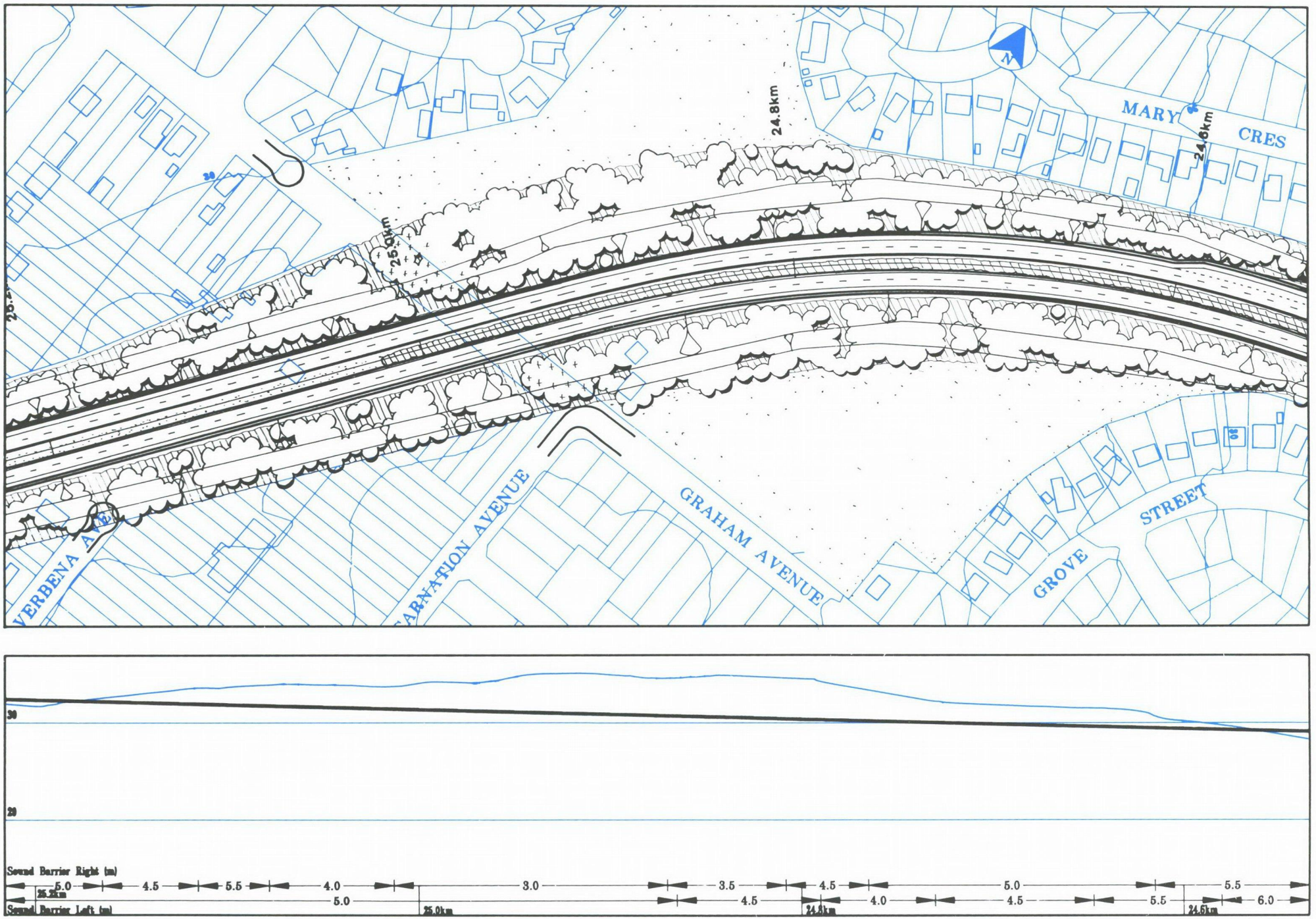
25.6 km

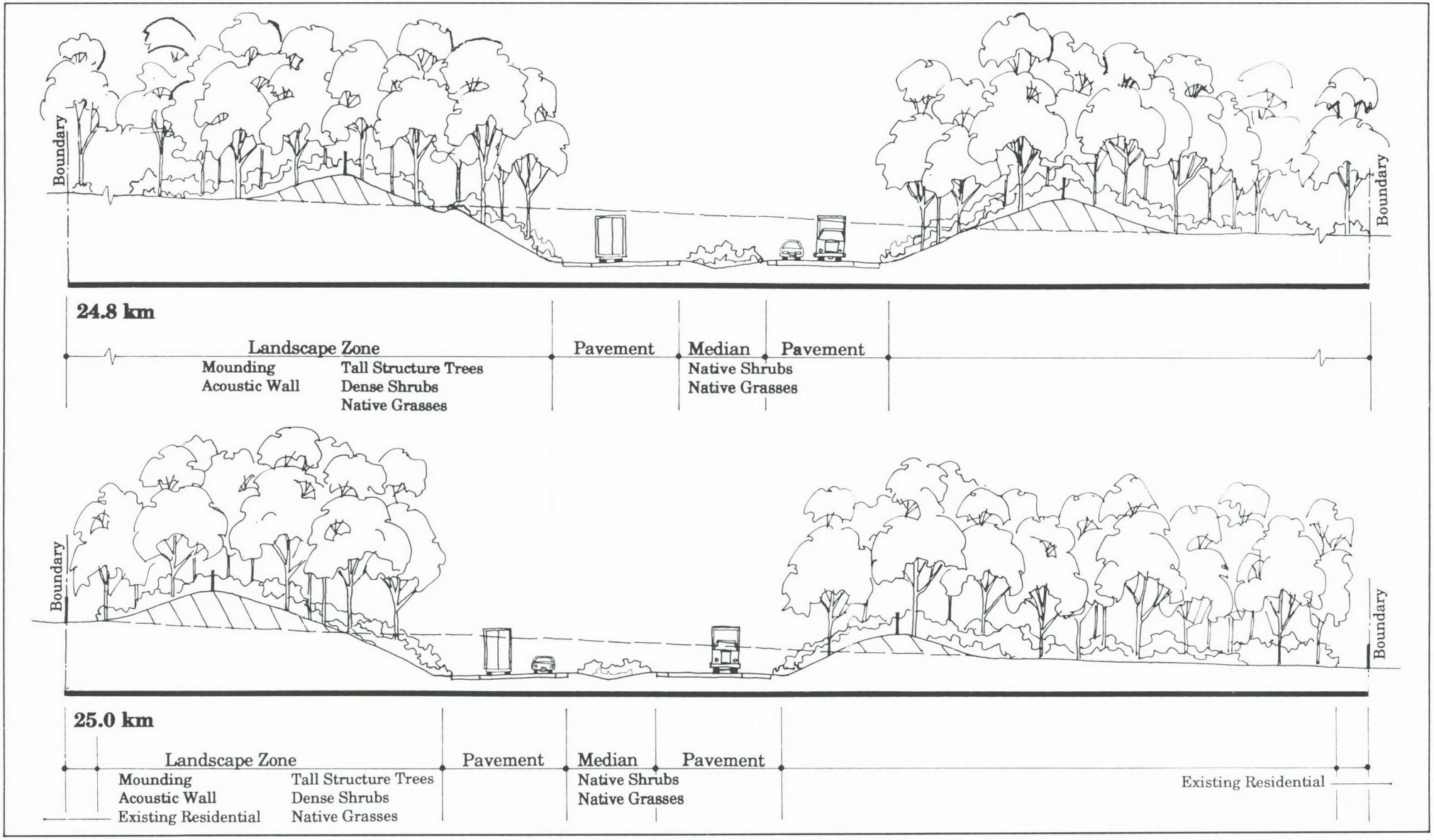
Landscape Zone	Pavement	Median	Pavement		
Tall Structure Trees Dense Shrubs Native Grasses Existing Residential		Native Grasses		Acoustic Wall Landscape Zone Guard Rail	Existing Residential

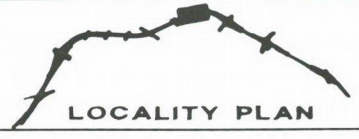


0 20 40 80 120
Metres

FIGURE 9.1.8
MOTORWAY ALIGNMENT AND CROSS SECTION
DE MEYRICK AVENUE

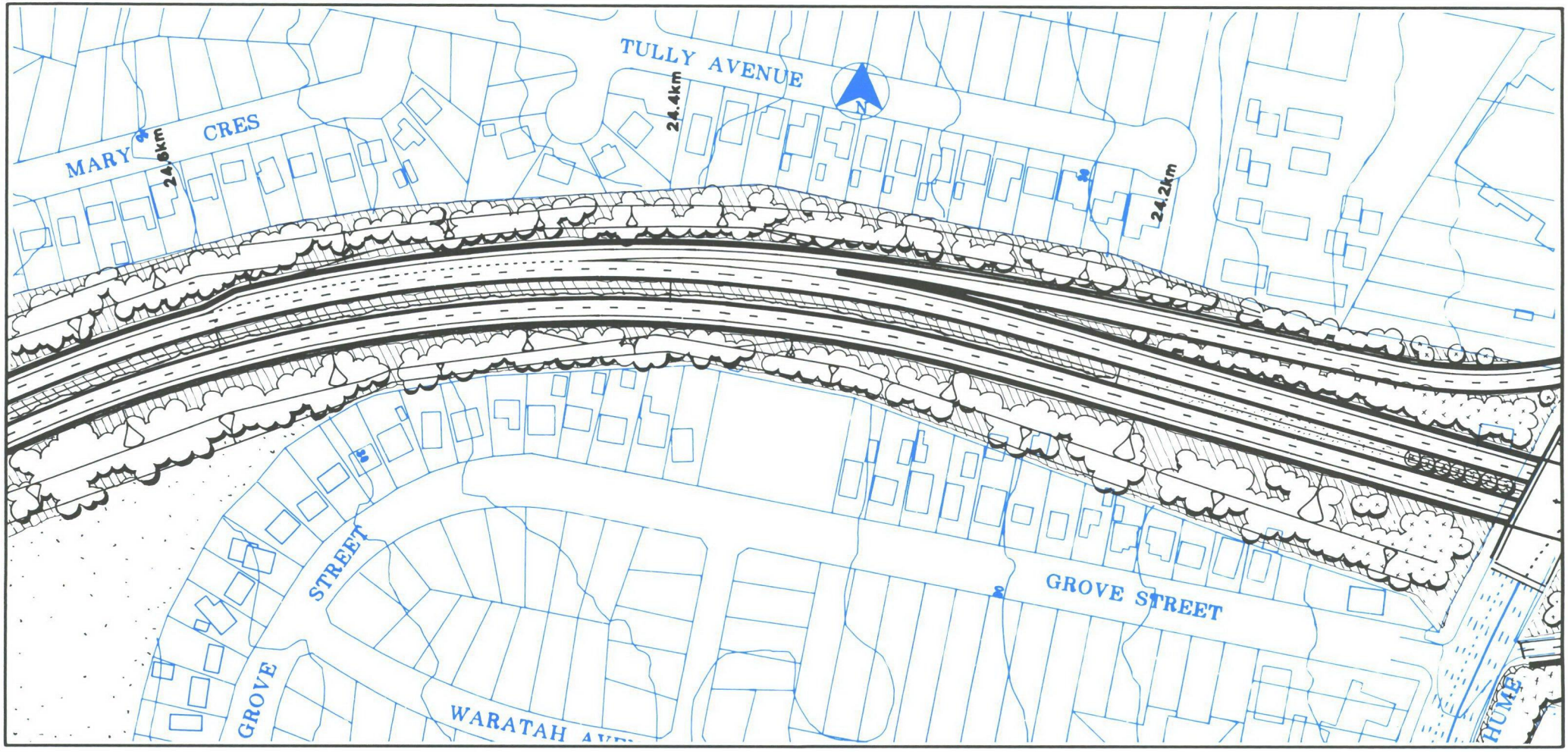

N
24.8km
24.6km
25.0km
MARY
CRES
VERBENA AVENUE
CARNATION AVENUE
GRAHAM AVENUE
GROVE
STREET
30
29
Sound Barrier Right (m)
5.0
4.5
5.5
4.0
3.0
3.5
4.5
5.0
5.5
25.2km
Sound Barrier Left (m)
5.0
4.5
4.0
4.5
5.5
6.0
25.0km
24.8km
24.6km

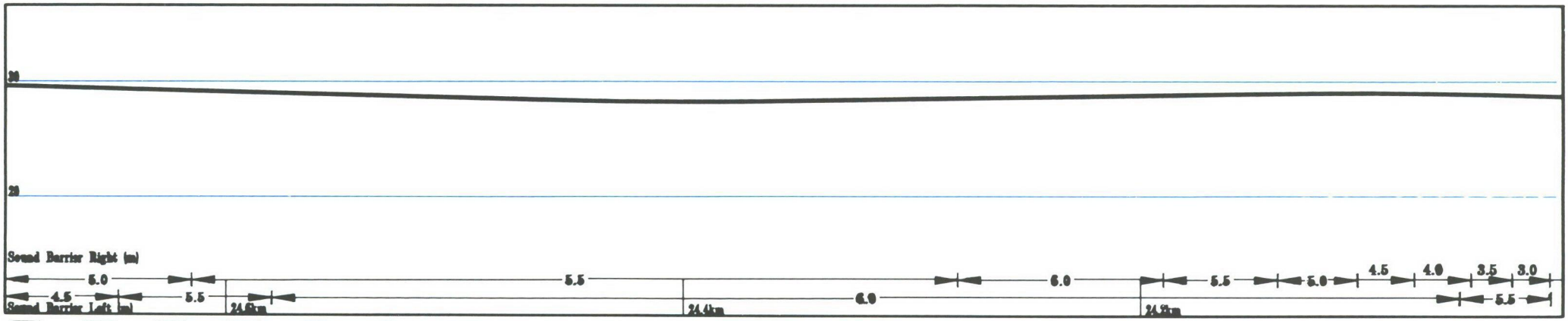


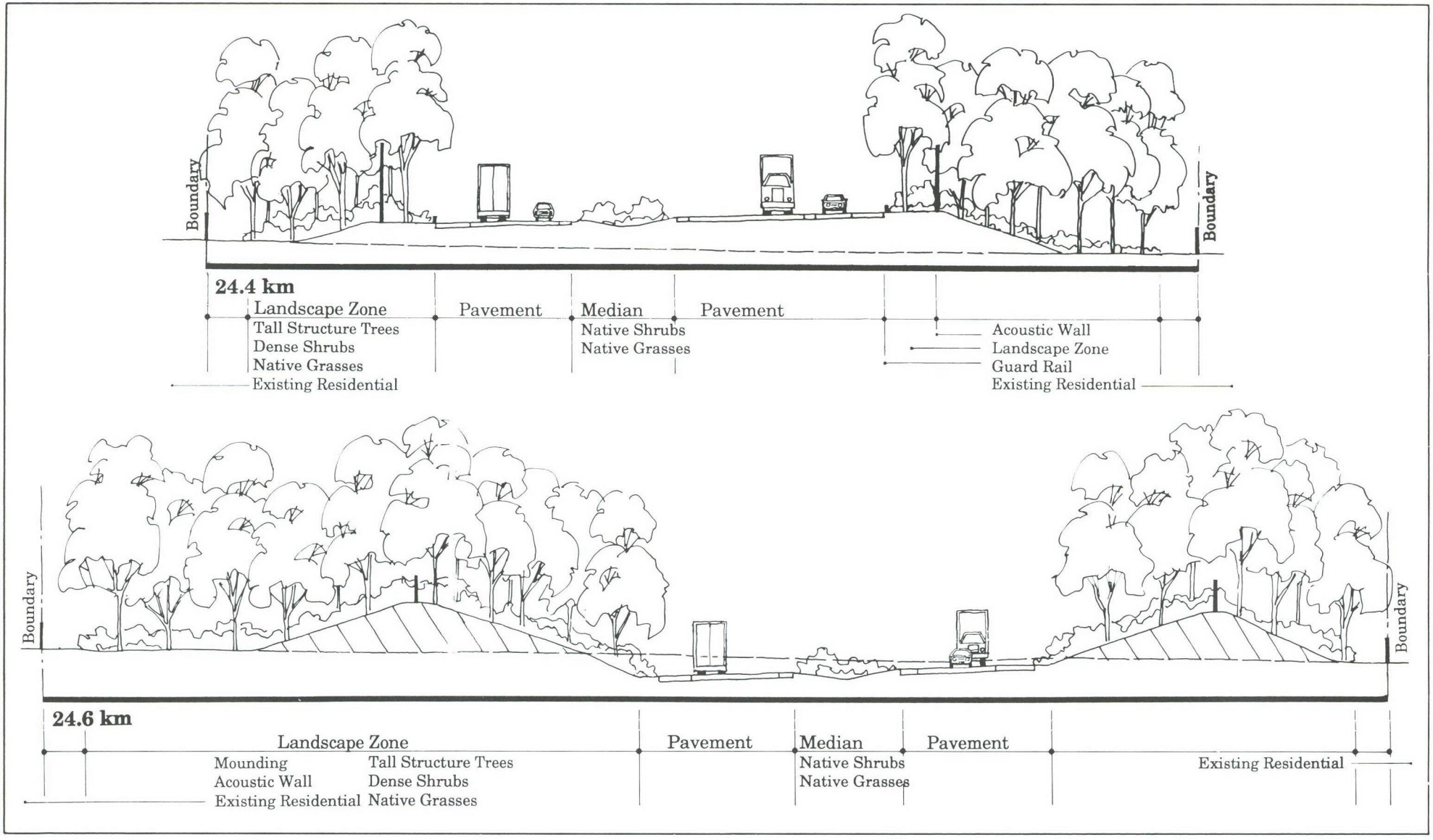


0 20 40 80 120
Metres

FIGURE 9.1.9
MOTORWAY ALIGNMENT AND CROSS SECTION
GRAHAM AVENUE


TULLY AVENUE
MARY CRES
24.6km
24.4km
24.2km
N
GROVE STREET
GROVE STREET
WARATAH AVE
HUME


30
20
Sound Barrier Right (m)
5.0
5.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Sound Barrier Left (m)
4.5
5.5
5.5
6.0
5.5
24.6km
24.4km
24.2km

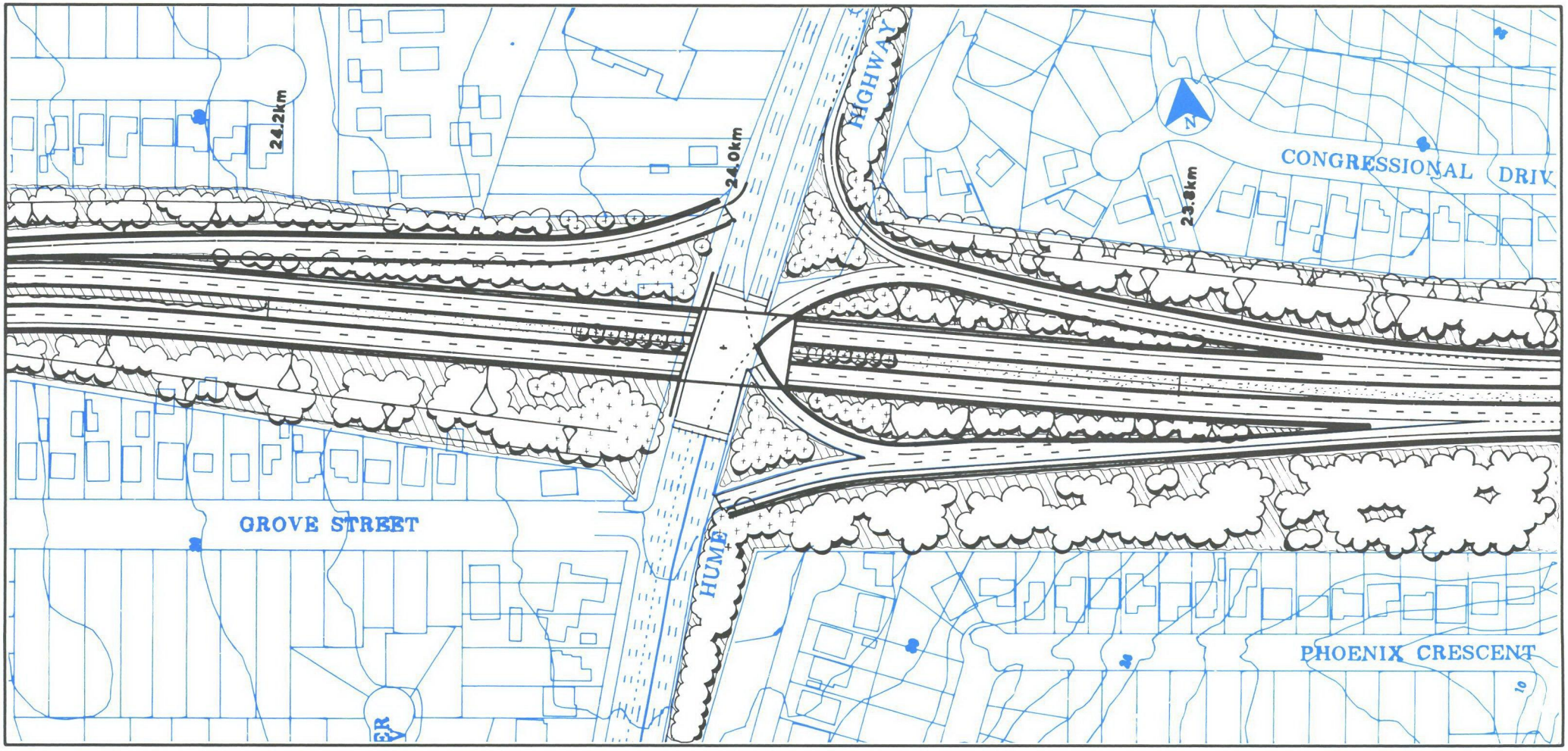


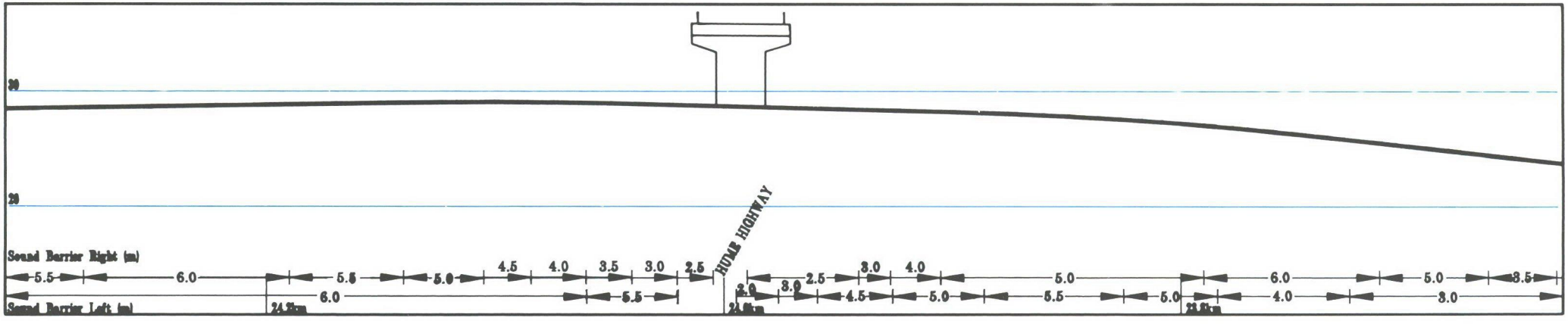
LOCALITY PLAN

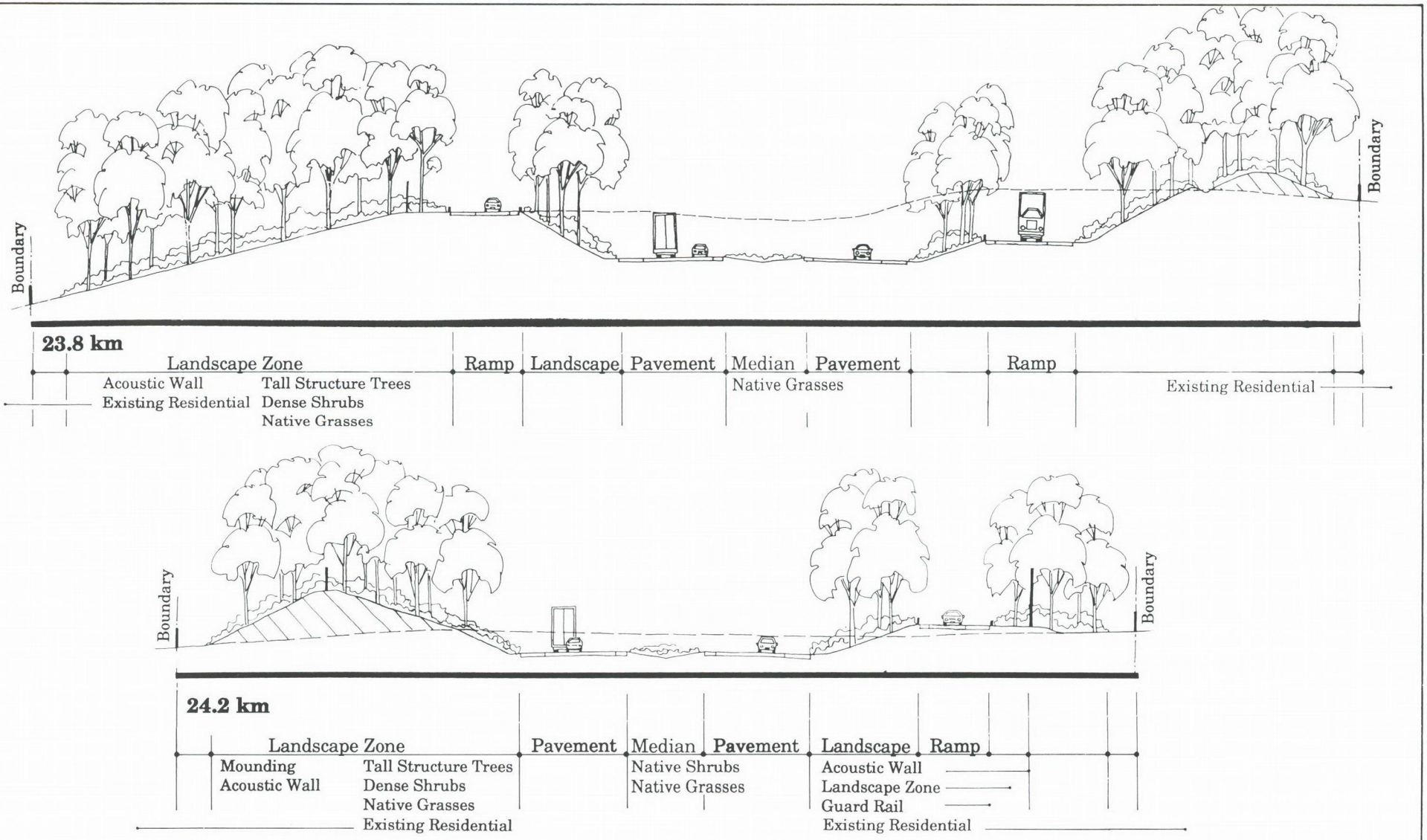
0 20 40 80 120
Metres

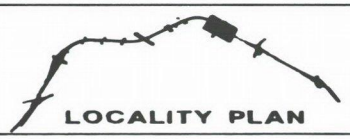
FIGURE 9.1.10
MOTORWAY ALIGNMENT AND CROSS SECTION

Sheet 10 of 15


24.2km
24.0km
23.8km
HIGHWAY
CONGRESSIONAL DRIV
GROVE STREET
HUME
PHOENIX CRESCENT
N

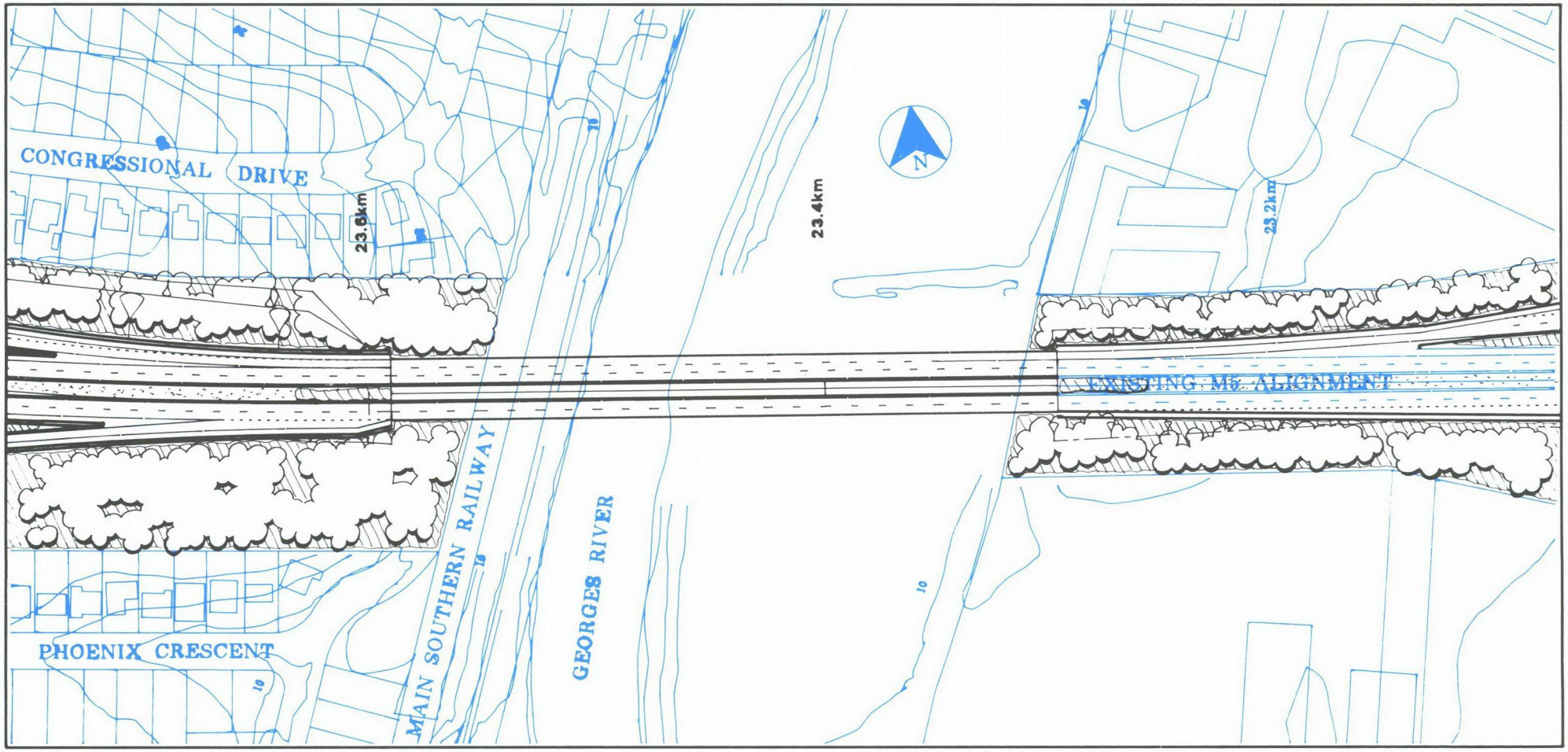

HUME HIGHWAY
Sound Barrier Right (m)
Sound Barrier Left (m)
5.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
6.0
5.5
2.5
3.0
4.0
5.0
6.0
5.0
3.5
3.0
4.5
5.0
5.5
5.0
4.0
3.0

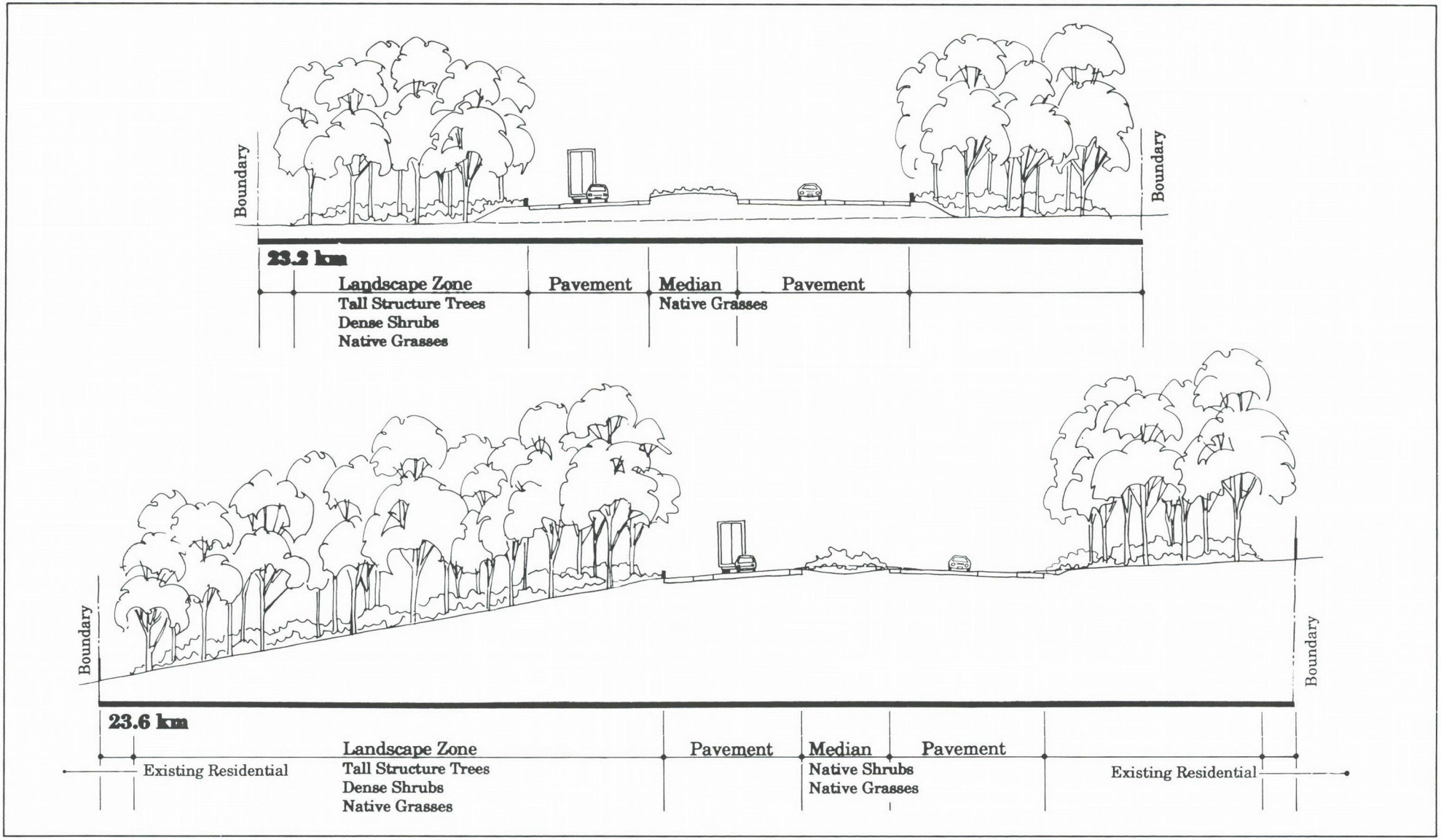




0 20 40 80 120
Metres

FIGURE 9.1.11
MOTORWAY ALIGNMENT AND CROSS SECTION
HUME HIGHWAY INTERCHANGE


CONGRESSIONAL DRIVE
23.6km
23.4km
23.2km
N
EXISTING M5 ALIGNMENT
MAIN SOUTHERN RAILWAY
GEORGES RIVER
PHOENIX CRESCENT
10
20
Sound Barrier Right (m)
6.0
4.0
5.0
3.5
6.0
3.0
Sound Barrier Left (m)
23.6km
23.4km
23.2km

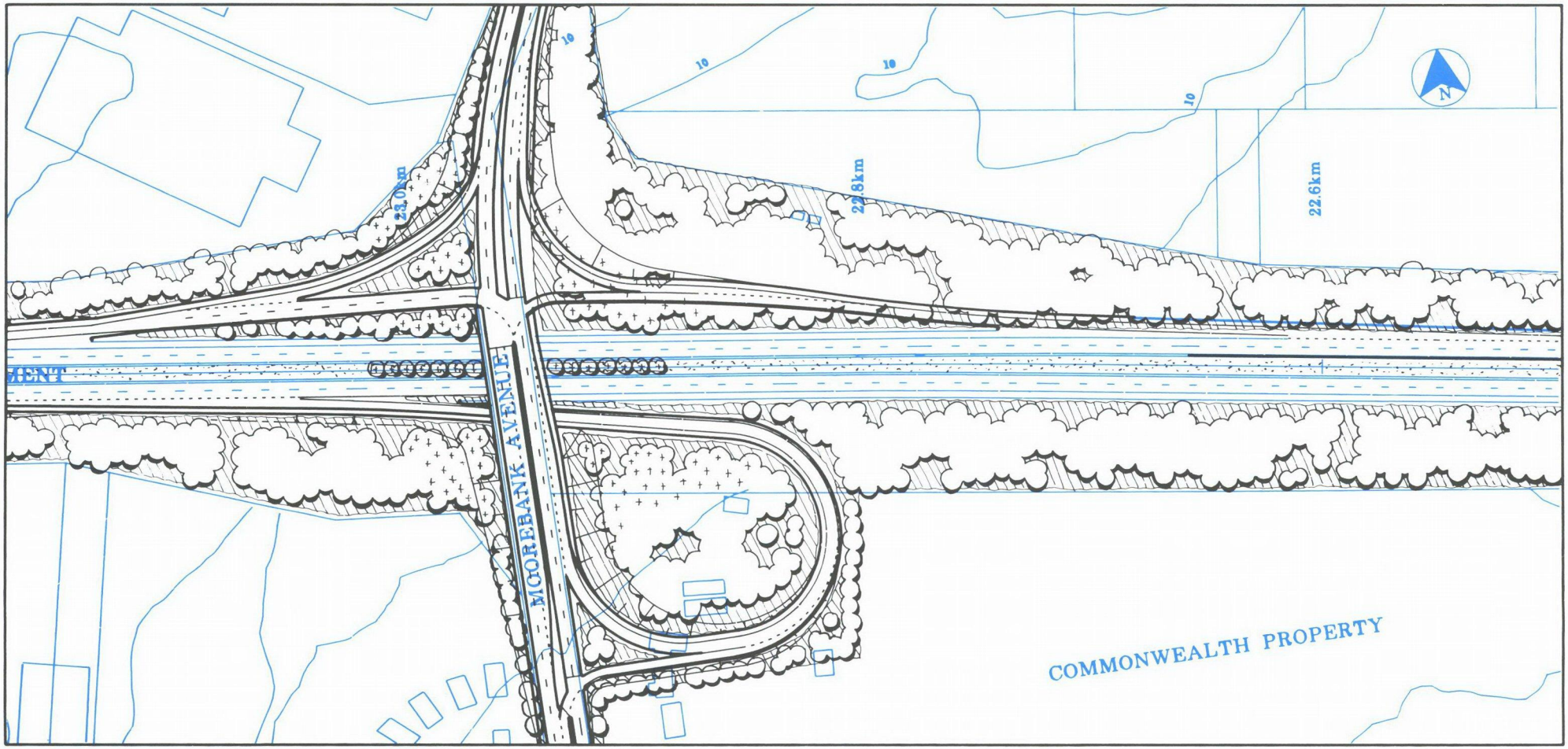


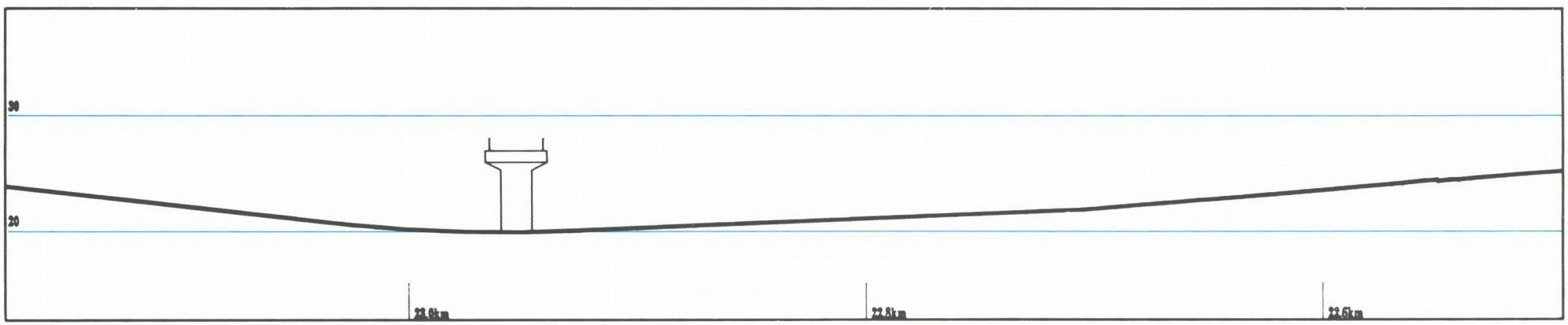
LOCALITY PLAN

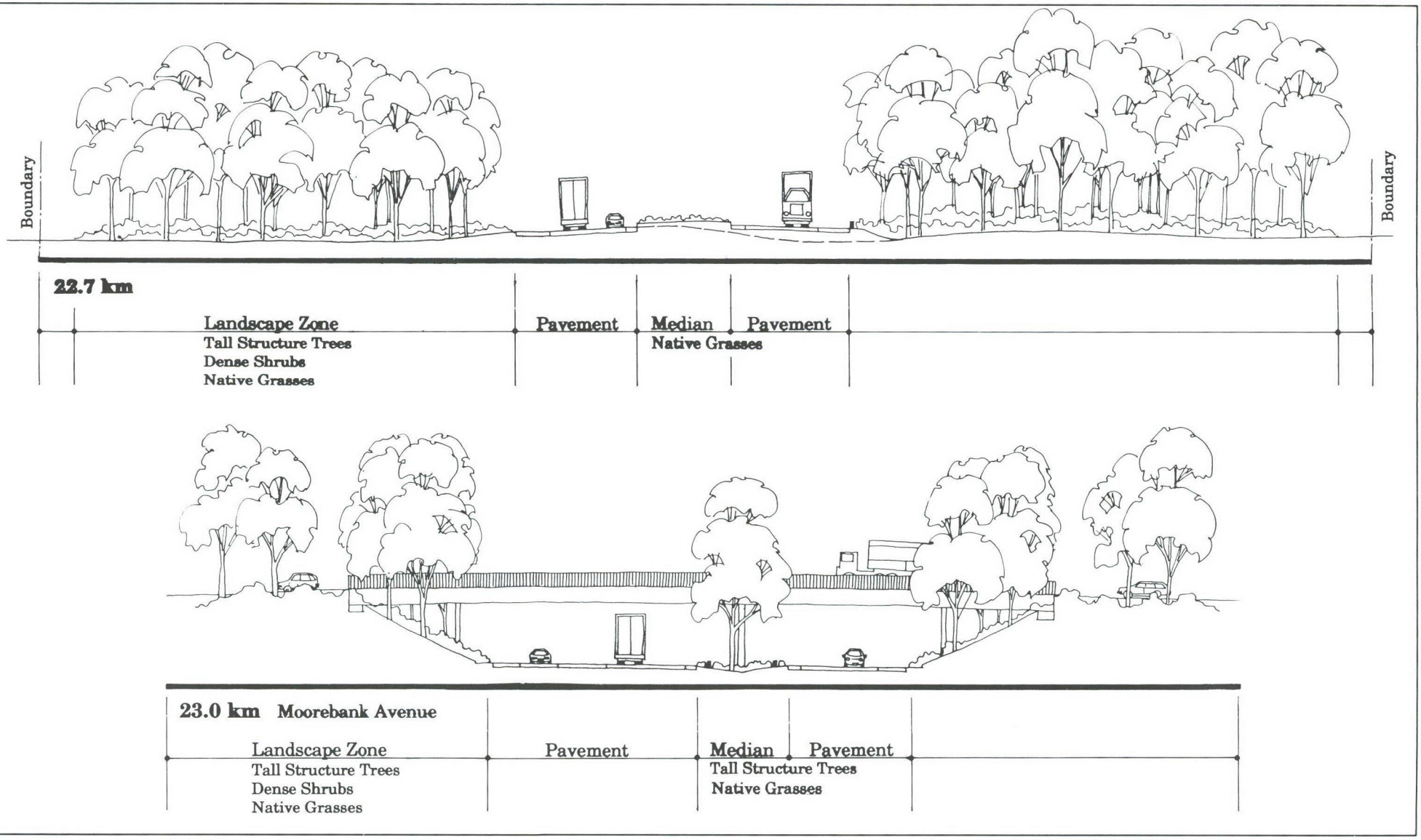
0 20 40 80 120
Metres

FIGURE 9.1.12
MOTORWAY ALIGNMENT AND CROSS SECTION
GEORGES RIVER BRIDGE

Sheet 12 of 15


10
10
10
10
N
23.0km
22.8km
22.6km
MOOREBANK AVENUE
COMMONWEALTH PROPERTY

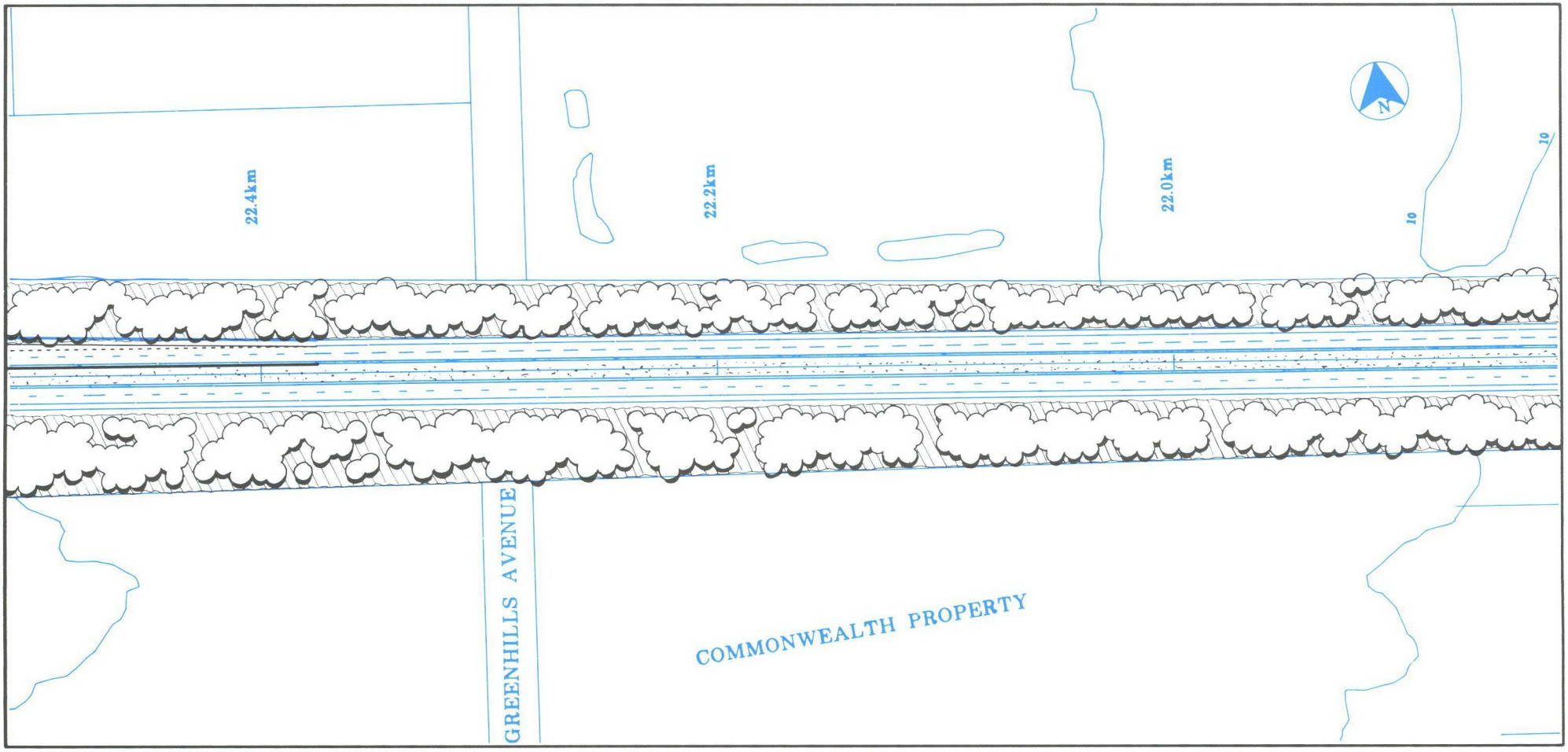

30
20
22.8km
22.6km
22.6km

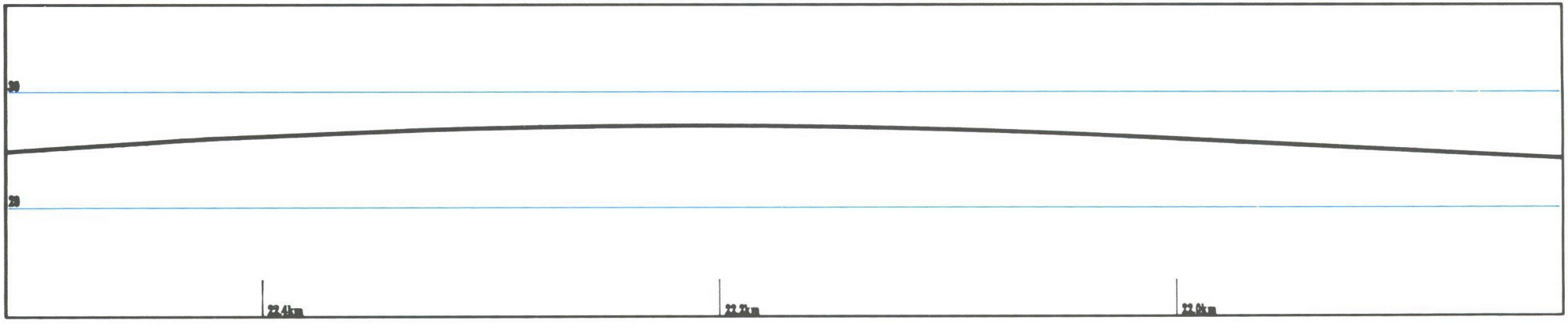


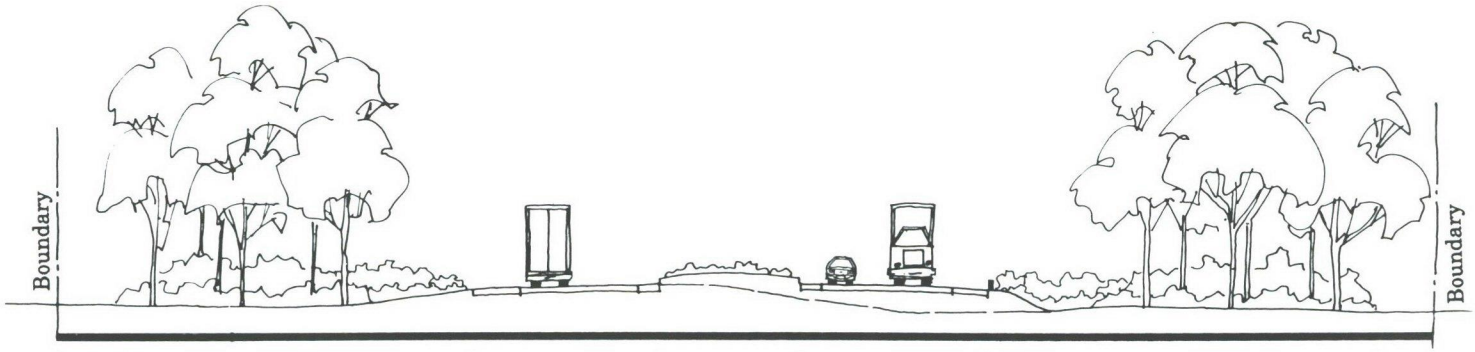
LOCALITY PLAN

0 20 40 80 120
Metres

FIGURE 9.1.13
MOTORWAY ALIGNMENT AND CROSS SECTION
MOOREBANK AVENUE INTERCHANGE

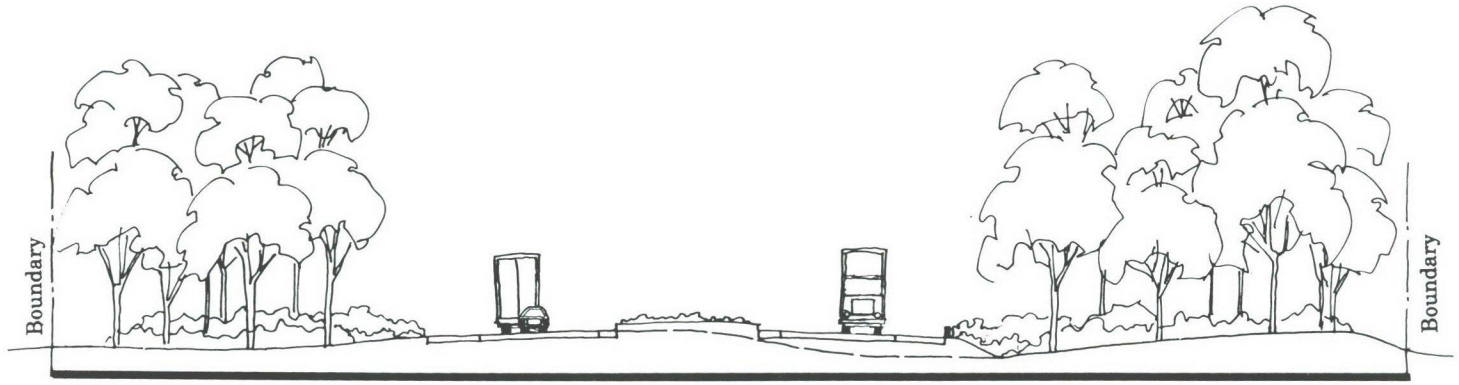

22.4km
22.2km
22.0km
10
10
N
GREENHILLS AVENUE
COMMONWEALTH PROPERTY


30
20
22.4km
22.2km
22.0km



22.0 km

Landscape Zone	Pavement	Median	Pavement
Tall Structure Trees Dense Shrubs Native Grasses		Native Grasses	



22.4 km

Landscape Zone	Pavement	Median	Pavement
Tall Structure Trees Dense Shrubs Native Grasses		Native Grasses	

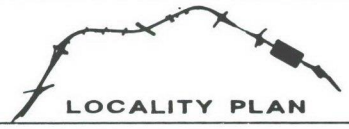
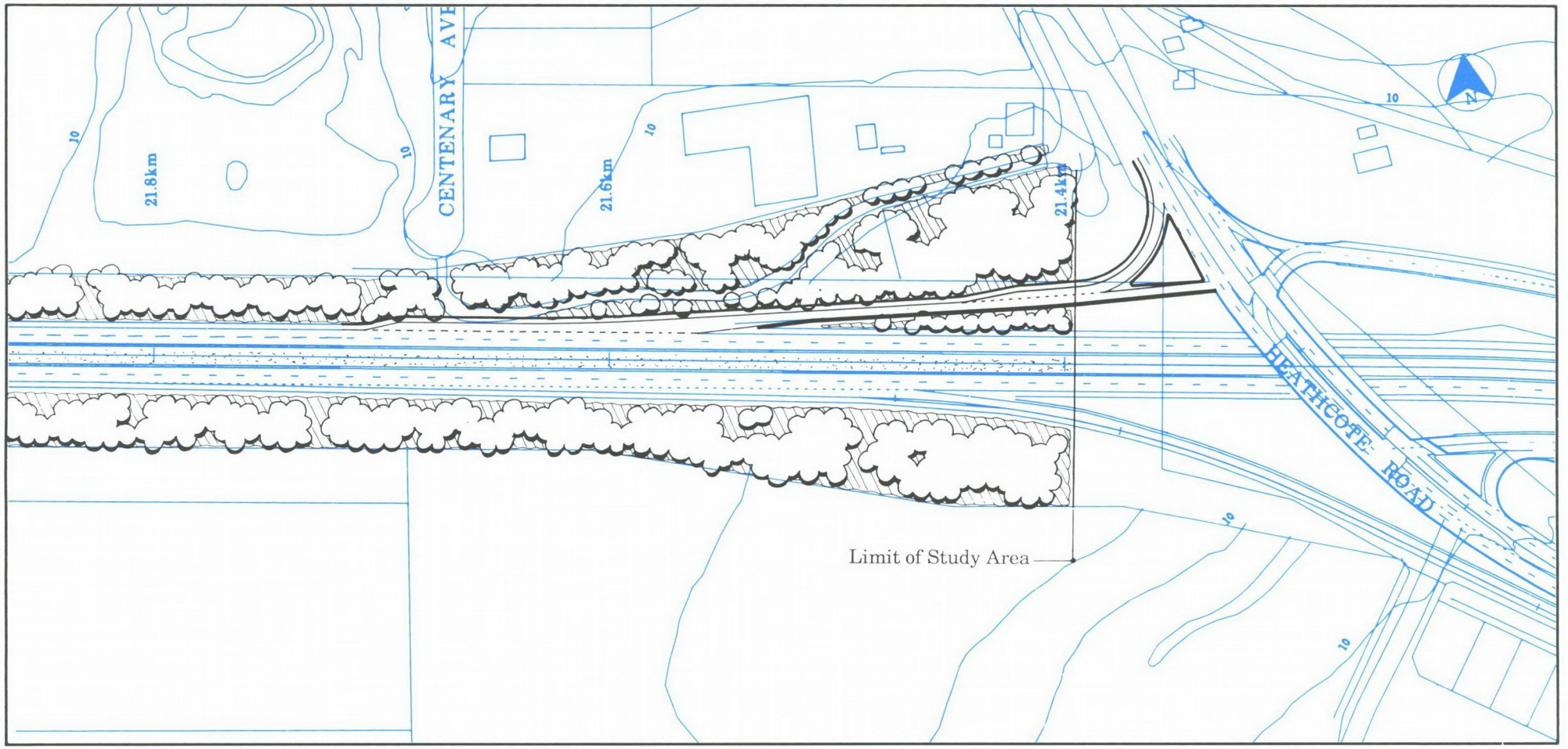
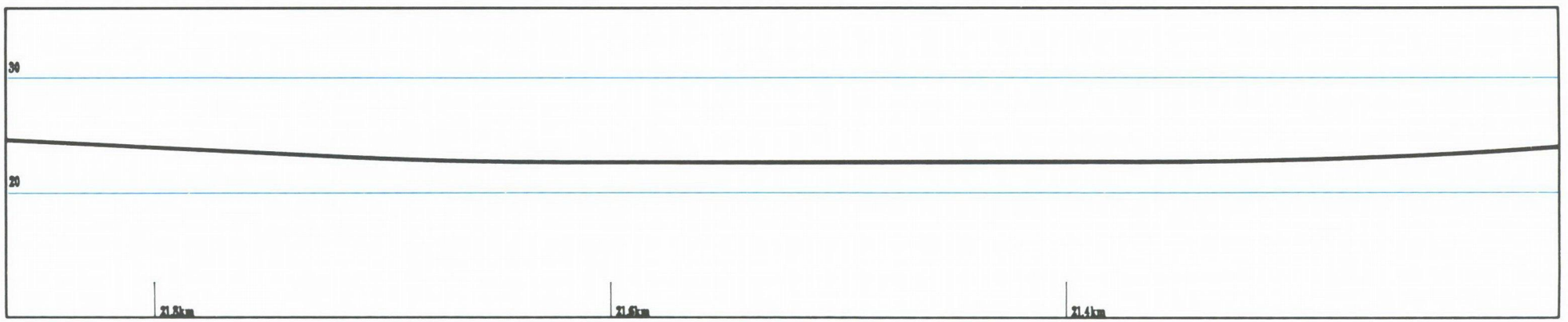
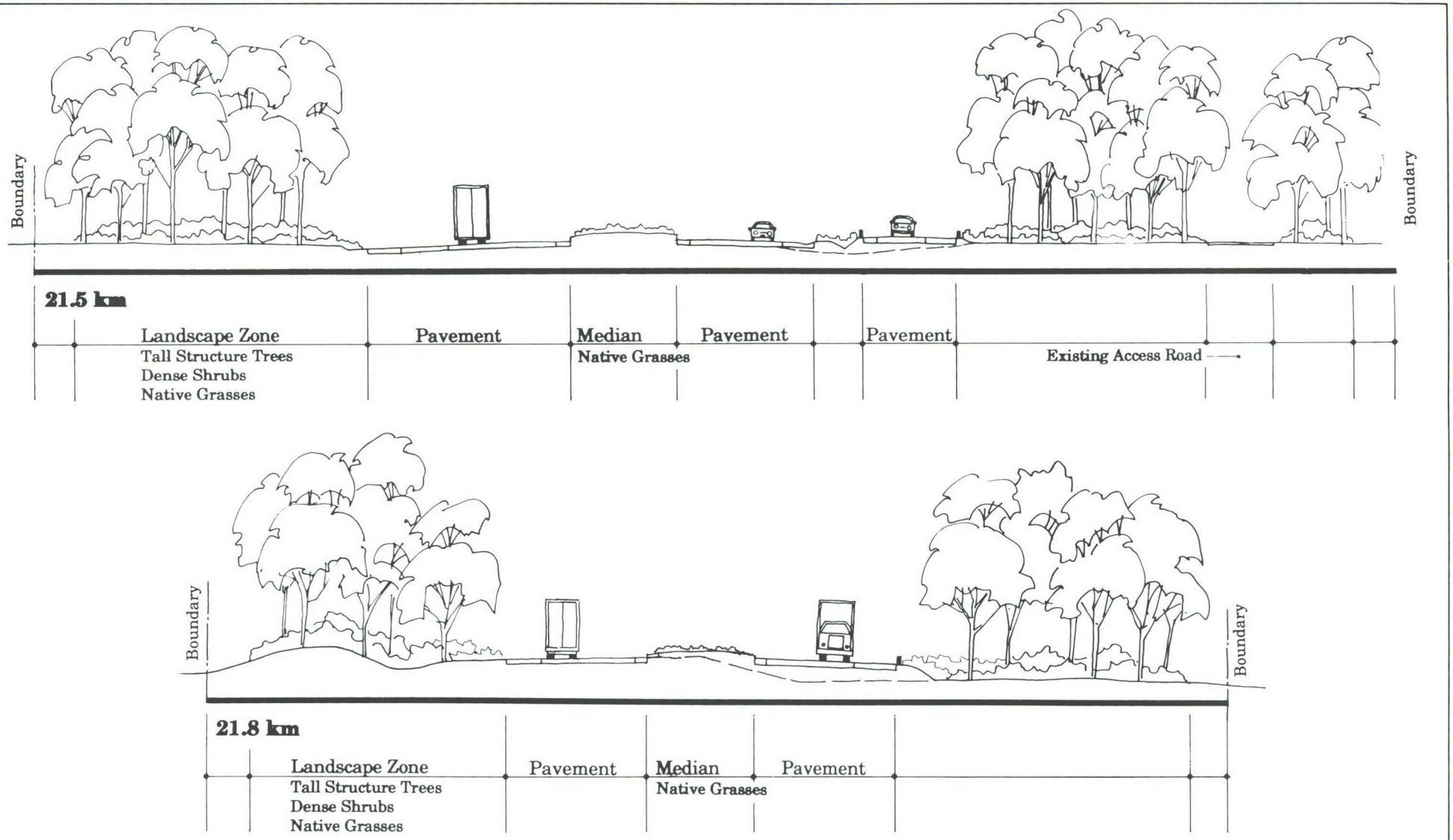




FIGURE 9.1.14
MOTORWAY ALIGNMENT AND CROSS SECTION
GREENHILLS AVENUE


CENTENARY AVE
21.8km
21.6km
21.4km
10
HEATHCOTE ROAD
Limit of Study Area
N


30
20
21.8km
21.6km
21.4km



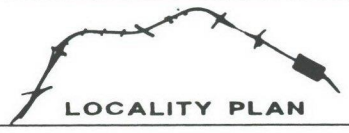




FIGURE 9.1.15
MOTORWAY ALIGNMENT AND CROSS SECTION
HEATHCOTE ROAD

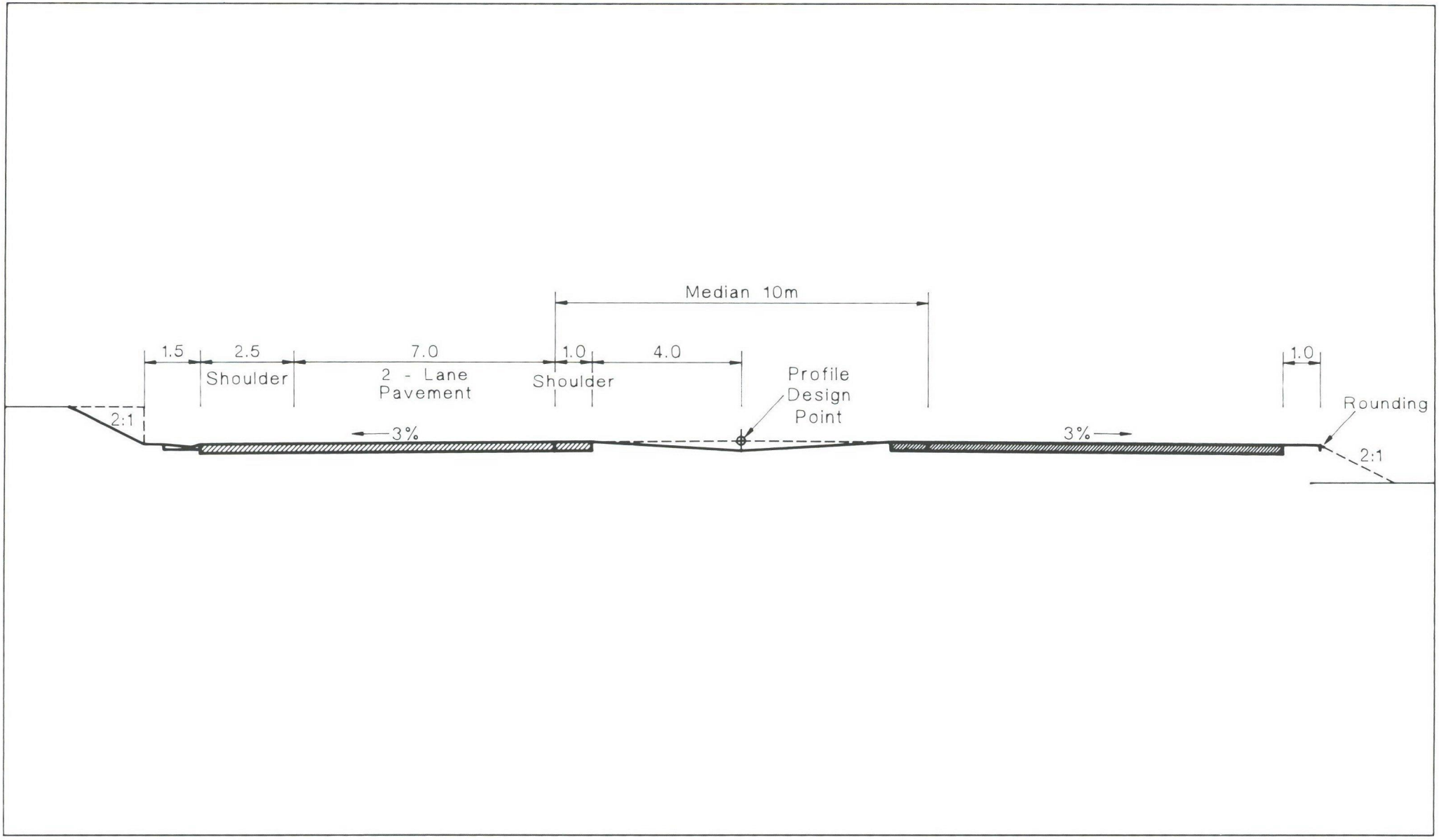


FIGURE 9.2
TYPICAL MOTORWAY CROSS SECTION

grading. Ramps for the Camden Valley Way interchange would adjoin the northern end of this section with the existing northbound ramp at Camden Valley Way maintained as part of the interchange.

Camden Valley Way to Cedar Road

At Camden Valley Way the proposed motorway would pass under the overbridge and continue on to Cedar Road. This section would be on a curved alignment bending eastwards through an 800 metre radius curve, providing a design speed of up to 110 km/h. Through this curve the median would reduce from 15 metres width to 8 metres width which would continue along the remainder of the proposed motorway. The minimum width adopted for the median is 8 metres between the edges of shoulders on each carriageway. This width would allow for future widening by one 3.5 metre wide lane on each carriageway should it ever be required.

Through this section the proposed motorway would pass over low-lying terrain which is flood prone. The upper reaches of Maxwells Creek discharge under Camden Valley Way to the east of the motorway alignment and would need to pass under the motorway close to Camden Valley Way. The proposed motorway would be on embankment up to 4 metres high through this section.

A full diamond interchange is proposed at Camden Valley Way. This type of interchange would allow all on and off movements to be made.

The proposed motorway would then continue past Beech Road which would be cut by the motorway. No reconnection or overpass would be constructed at Beech Road.

Cedar Road to Box Road

Between Cedar Road and Box Road the land use character adjacent to the motorway changes. The western side of the road reserve is bounded by housing lots while the eastern side is open grassed area maintaining its semi-rural character.

As discussed in 9.2.2, an overpass would be provided on or in the vicinity of Cedar Road to maintain a north-south route, but the location has not been determined and is not shown in this EIS. The concept design for the proposed motorway in this EIS could cater for such a future overpass.

The terrain abutting the eastern side of the proposed motorway rises steeply above the alignment and at Box Road the proposed motorway is in cut of approximately 5 metres depth.

At Box Road a pedestrian overpass is proposed to provide continuity of existing movement between east and west sides of the motorway. Box Road is presently closed just to the south of Guise Road. It is proposed that this closure be removed and traffic be allowed to enter Guise Road from Box to assist local traffic flow.

The road would reach its highest point in this section.

Box Road to Kurrajong Road

The alignment of the proposed motorway would curve to the west and fall as it moves from Box Road to Kurrajong Road. This section would remain in cut, resulting in the greatest volume of earthworks on the entire alignment occurring between Box Road and Kurrajong Road.

The level of the proposed motorway at Kurrajong Road is controlled by the need to provide headroom for the overpass at Kurrajong Road. The proposed motorway would pass below Kurrajong Road in cutting with Kurrajong Road lifted over the motorway.

This section of the proposed motorway is bordered by medium to low density housing on both sides.

Figure 9.4 shows an artist's impression of the proposed motorway looking south east from Kurrajong Road.

Kurrajong Road to Verbena Avenue

From Kurrajong Road to Verbena Avenue the proposed motorway becomes straight. The motorway grades down at 0.5% and moves out of a cutting onto a fill embankment up to 2.5 metres high.

De Meyrick Avenue and Verbena Avenue would both be cut by the proposed motorway alignment. No connection by underpass or overpass is proposed for Verbena Ave. An underpass for pedestrians at De Meyrick Avenue is included in the proposed design.



FIGURE 9.4 PROPOSED MOTORWAY LOOKING SOUTH EAST FROM KURRAJONG ROAD

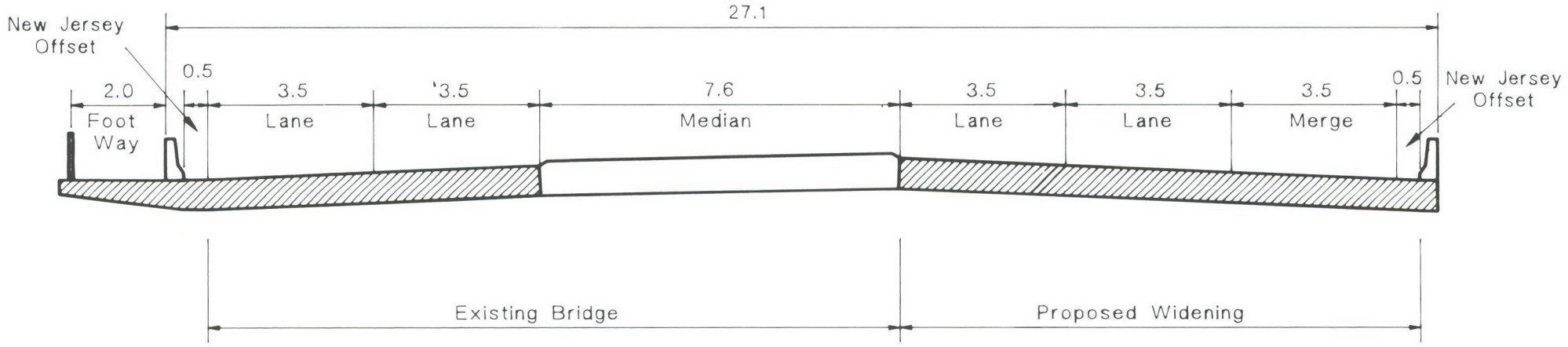


FIGURE 9.3
CROSS SECTION OF GEORGES RIVER BRIDGE-MOTORWAY
GEORGES RIVER



FIGURE 9.4 **PROPOSED MOTORWAY LOOKING SOUTH EAST FROM KURRAJONG ROAD**

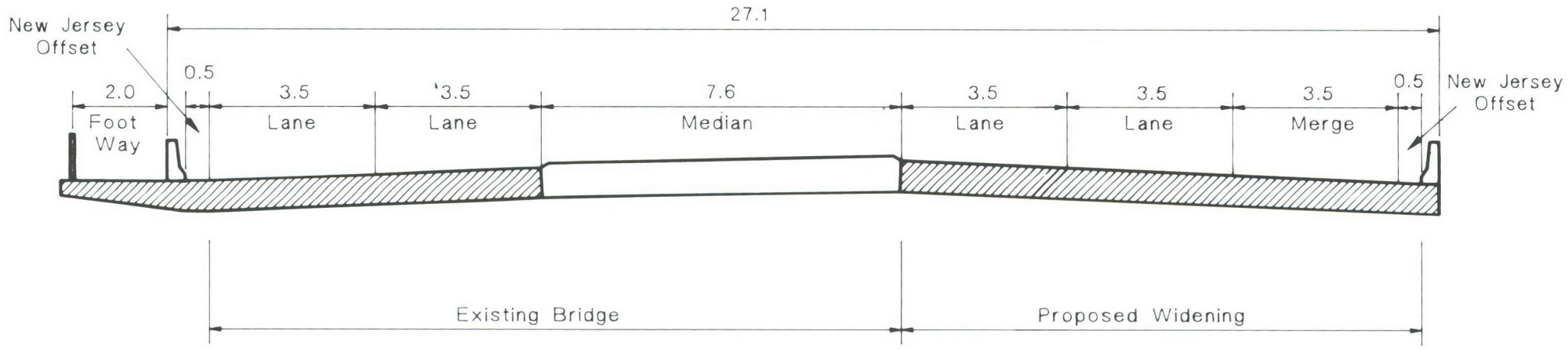


FIGURE 9.3
CROSS SECTION OF GEORGES RIVER BRIDGE-MOTORWAY
GEORGES RIVER



FIGURE 9.4 **PROPOSED MOTORWAY LOOKING SOUTH EAST FROM KURRAJONG ROAD**

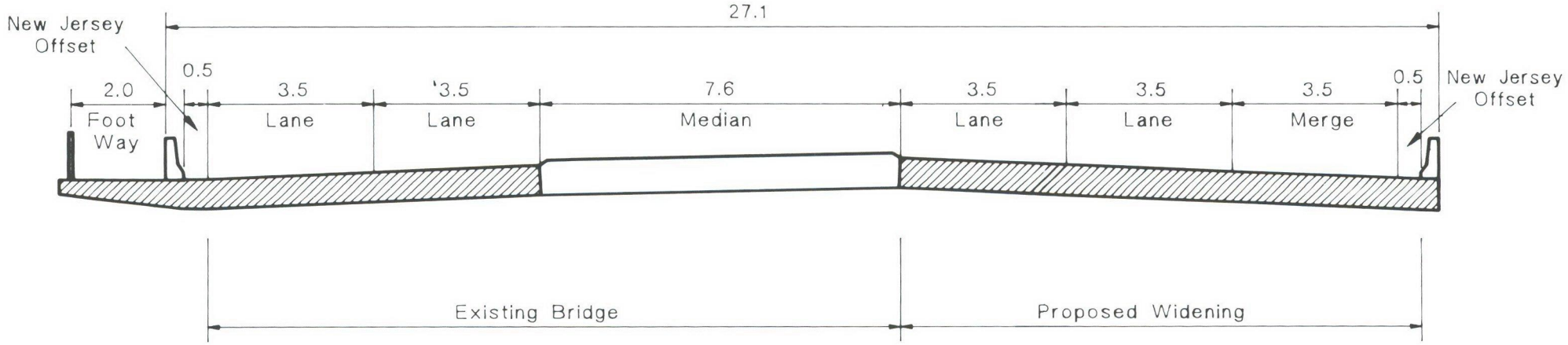


FIGURE 9.3
CROSS SECTION OF GEORGES RIVER BRIDGE-MOTORWAY
GEORGES RIVER

Verbena Avenue to Hume Highway

From Verbena Avenue the motorway enters a cutting and the grade continues to fall all the way to the Georges River Bridge.

The alignment turns eastward in this section via a 640 metre radius curve to align with the approach to the Georges River Bridge.

Graham Avenue would be cut by the motorway. No crossing is proposed.

Between Graham Avenue and Hume Highway the motorway comes out of cut into a fill up to 2.5 metres high before entering cut again to cross under the Hume Highway.

A temporary north bound off ramp would lead from the motorway alignment to allow traffic to join the Hume Highway.

At the Hume Highway the deepest cutting on the motorway is encountered. The motorway would pass under the existing Hume Highway and a cutting up to 7 metres is required to provide vehicle headroom and depth for the highway overbridge structure.

Hume Highway to Moorebank Avenue

After passing under the Hume Highway the motorway would continue to fall toward the Georges River Bridge. On ramps and off ramps are proposed on the eastern side of the Highway to allow traffic to join and exit the motorway. All proposed roadworks are contained within the existing road reservation.

Widening of the Georges River Bridge is proposed to give ultimately seven lanes across the river. Figure 9.4 shows the ultimate cross section for the bridge. Initially, five lanes would be developed on the bridge to give four through lanes and an auxiliary lane on the northern side of the bridge for merging and diverging of traffic on the Hume Highway interchange and at Moorebank Avenue interchange. Future development to seven lanes would reduce the median width to 1.6 metres.

From Georges River the motorway joins the alignment of the existing M5 Motorway. At this section of the alignment the M5 is only single carriageway so duplication is required. A west facing ramp would lead off to Moorebank Avenue which would be grade separated by means of an overpass, allowing east bound off movement. Both east and west bound on movements are to be provided.

Because of the proximity of Hume Highway, Georges River Bridge and Moorebank Avenue there is difficulty in meeting the RTA standard for ramp lengths which would require ramps approximately 400 metres in length for each of the interchanges at Hume Highway and Moorebank Avenue. The distance between Moorebank Avenue and Hume Highway is only 700 metres so ramps will overlap if they are constructed to meet the required standards. This can be overcome on the southern ramp by providing a loop at Moorebank Avenue which extends the ramp length for traffic joining the motorway. The north side ramp cannot be accommodated in this way. An auxiliary lane has therefore been incorporated into the proposed widening of the Georges River Bridge to allow for merging and diverging of traffic using slightly shorter ramps.

Moorebank Avenue to Heathcote Road

No alteration is proposed to the existing M5 construction between Moorebank Avenue and Heathcote Road except that completion of the already formed ramp for eastbound traffic to exit the motorway at Heathcote Road is proposed. This ramp has been built except for pavement and minor finishing works which have not been provided.

In the February 1991 Determination by the Chief Executive of the RTA it was noted that this exit ramp would not be constructed until the tollway agreement with Interlink Roads had run its agreed term.

The arguments in favour of the ramp being part of the M5 Casula Link proposal is that it provides a connection to the South Coast and provides access to Hammondville and Moorebank local communities.

The environmental effects of providing this ramp are considered to be minimal. This is because the ramp would provide improved access for a

strongly desired traffic movement. If this ramp was implemented in conjunction with local area traffic management measures then the negative effects on the local community would be negligible in terms of air quality, noise and traffic intrusion. Thus it is considered that if an agreement could be reached with Interlink Roads to open this egress ramp, then the RTA would be justified in modifying its previous determination.

9.2.2 Access and Interchanges

Access to the motorway would be provided at Camden Valley Way, Hume Highway, Moorebank Avenue and Heathcote Road by means of grade separated interchanges.

No changes are proposed to the existing ramp layout at Campbelltown Road.

At Camden Valley Way a full diamond interchange is proposed. Figure 9.1.3 shows the proposed arrangement. A full diamond interchange would provide flexibility of traffic movements, would meet the traffic demand and would provide for traffic wishing to access future industrial areas to the west as well as the future Badgerys Creek Airport. The motorway profile is constrained by the existing bridge which would be retained as part of the interchange and ultimately to provide a dual two lane carriageway on Camden Valley Way with right turn storage on the bridge. A double opposed right turn (D.O.R.T) interchange which permits control of ramp movements by a single set of traffic signals was investigated at this location however construction of a D.O.R.T would require abandoning the existing ramp and bridge which adds to the cost of construction. It is proposed therefore to maintain the existing bridge at Camden Valley Way and also the existing northbound off ramp. Using these existing structures would also assist the construction staging.

The Hume Highway interchange would provide three out of the four possible ramps. Eastern on and off ramps permit traffic from the Hume Highway to join the eastern traffic stream and west bound traffic to leave the motorway and join the Hume Highway. One ramp on the western side of the Hume Highway allows east bound traffic to exit onto the Highway at this interchange.

The ramps at the Hume Highway interchange are designed as a double opposed right turn style intersection (as shown on Figure 9.1.11).

The north western ramp would be constructed as a left turn only ramp to allow access towards Liverpool. This ramp would be temporary and would be removed in the event of the construction of the Park Road extension, or Liverpool bypass. Construction of the Liverpool bypass has been assumed to occur beyond the design period for this study.

At Moorebank Avenue all ramps would be provided, except a westbound off ramp. This would allow east bound traffic to leave the motorway and traffic wanting to travel both east and west to join the motorway. The west facing ramps are provided in accordance with the demand shown by the traffic analysis. A loop ramp is proposed for west bound traffic joining the motorway to increase the taper and acceleration length of the ramp.

At Heathcote Road the north western ramp proposed in this EIS in conjunction with the three existing ramps permits all on and off movements to be performed. The addition of this ramp completes the interchange.

A vehicle overpass is proposed at Kurrajong Road and a future overpass between Kurrajong Road and Camden Valley Way. These overpasses would provide continuity of local traffic movements.

Kurrajong Road is to be maintained as a sub-arterial road so a crossing of the motorway is essential at this location. Rising terrain on the west of the motorway and falling ground on the east means that a substantial embankment would be required on the east side of the motorway. Access within the adjacent subdivisions has ensured that frontage access along Kurrajong Road has been denied except at Ingham's Chicken hatchery. The existing access to Ingham's would be modified to provide a new ramp offering direct access to the Kurrajong Road embankment. Truck traffic on this ramp would be limited to one truck per week and so no traffic hazard should result.

It is recognised that Cedar Road

currently acts as a north-south access road and future planning for the area includes the proposed Prestons urban release area which would be dependent on access across the proposed motorway alignment.

An overpass would therefore be constructed to cross the motorway between Kurrajong Road and Camden Valley Way for north-south traffic. Several alternatives exist for this crossing including Box Road, Cedar Road and Beech Road. A crossing at Beech Road is unsuitable because of the proximity of the motorway ramps at Camden Valley Way. A crossing midway between Cedar Road and Beech Road is preferred by Liverpool City Council. This crossing would require approach roadworks to be constructed as part of future subdivisional work within this area. Because of the timing of subdivision development with respect to the proposed timing of the motorway construction, a decision of which crossing would be constructed cannot be made at this time. The RTA has undertaken to provide for the construction of bridgeworks once a suitable location can be confirmed by Liverpool City Council.

9.2.3 Tollway Arrangements

The motorway Link would be operated without a toll. The motorway would link to the tolled section of the M5 motorway with opportunities to leave the motorway at Camden Valley Way, Hume Highway, Moorebank Avenue and Heathcote Road (for eastbound traffic).

9.2.4 Provisions for Public Transport

Liaison with local bus operators has provided data on existing route structure and the location of overpasses has been determined to provide, where possible, continuity for existing routes or similar new routes where existing route continuity is impractical.

Due to the current local nature of trips by buses, as described in Section 8.2.2, no dedicated bus lanes have been designed for the proposed motorway. Buses would use the facility on the basis of shared lanes.

9.2.5 Facilities for Pedestrians and Cyclists

Pedestrian movements across the motorway would be made available at all interchanges and overpasses. A pedestrian-only bridge would be provided at Box Road. De Meyrick Avenue would be provided with a pedestrian underpass. An alternative pedestrian and car-only underpass has been considered but would create difficulties with road levels.

Cyclists would be permitted to use the left shoulder of the motorway over its full length. "Bicycle safe" links for cyclists would be available at all overpasses and interchanges as part of the normal traffic arrangements.

9.2.6 Noise Barriers

The entire motorway route west of the Georges River runs through existing or proposed residential areas. Noise barriers are proposed along both sides of the motorway at various heights as indicated on Figures 9.1.1 to 9.1.15. The barriers would be a combination of mounds and walls with landscaping used to soften the appearance of the walls (see Sections 11.4 and 11.5). However it should be noted that these noise barrier heights are based on the R zone criteria prepared by the EIS consultant. It may not be practicable to provide the recommended barrier heights in all areas, but instead lower height barriers would be provided to satisfy the RTA's Interim Noise Policy Guidelines.

9.2.7 Lighting

Lighting would only be provided at interchanges. The lighting system proposed at interchanges is high pressure sodium (SON) lamps mounted on high masts or conventional columns, 12 metres high. Lighting design would be such as to avoid the spill of light from the motorway onto adjacent residences.

9.2.8 Construction Staging

The overall design philosophy of the project is to provide for a four lane motorway which could ultimately be increased (but not widened) by the incorporation of one extra lane in each direction in the median if required. Staging of construction is therefore built in to the proposal, but traffic models indicate that the additional lanes would be required only after 2011, which is the planning horizon for this study.

The timing of overbridge construction is one area where some flexibility exists. Critical structures including Hume Highway overbridge, Georges River Bridge widening, Kurrajong Road overbridge and Box Road pedestrian overbridge would be required before opening the link to traffic. The other structures such as Cedar Road overpass may be deferred until some time after the link is open to traffic.

Staging of construction at Camden Valley Way interchange is also possible. All new ramps at Camden Valley Way could be built after the motorway is open to traffic. This would temporarily shift local traffic wishing to access the motorway on to the Hume Highway interchange, meaning that if the ramps at Camden Valley Way interchange are not constructed initially all three ramps at the Hume Highway interchange must be constructed before opening to traffic.

Widening of the bridge at Camden Valley Way would be required at some future date; perhaps not until construction of the Prospect Arterial.

Relocation of utilities and services is an activity that would occur at an early stage of the construction period.

The construction of the Casula Link is expected to take between 18 months and 2 years. The item requiring the longest construction period is the widening of the Georges River Bridge which is expected to require approximately 15 months for completion.

Earthworks construction is estimated to require approximately 6 months. During this time construction would be undertaken within each section of the project. Construction of the pavement for the ramp at Heathcote Road could be undertaken at any time as a separate stage.

Pavement construction is estimated to require up to 6 months for completion following earthworks completion.

Each construction section would require sound attenuation and erosion control measures to be implemented at an early stage of construction activity.

TABLE 9.1 PROPERTY ACQUISITION REQUIREMENTS FOR THE PROPOSED MOTORWAY

	$M
Value of current land owned by RTA within motorway corridor	6.0
Cost of land to be purchased within the motorway corridor	7.0
Total Land Value within Motorway Corridor	13.0
Capital Cost of Construction	92.0
Total Cost	**105.0**

TABLE 9.2 ESTIMATED CONSTRUCTION COSTS FOR THE PROPOSED MOTORWAY

	Motorway
Full Property Acquisition	
Single detached residential properties	11
Residential Units	0
Vacant Lots	0
Partial Acquisition	
Single detached residential properties	32
Residential Units	0
Vacant Lots	4
Parks, Reserves & Residential Facilities	1
Businesses and special use facilities	0

9.2.9 Property Acquisition

Property acquisition requirements for the proposed motorway are given in Table 9.1. These numbers do not include properties already purchased by Government authorities.

Proposed Government ownership accounts for one of those properties directly affected and six of those which have land only affected.

9.2.10 Construction Costs

The estimated cost of construction and right of way for the proposed motorway is $105 million. This includes all construction, landscaping, noise attenuation and service relocation costs. Right of way costs include both the acquisition of private properties and the notional costs for use of Government-owned land required for the facility, which together represent the economic cost of land-take used in the economic analysis described in Section 13.4. .

The cost of providing emergency telephones on the proposed Casula Link has also been included.

9.3 FEASIBLE VARIATIONS TO THE PROPOSED LINK AND THEIR EVALUATION

9.3.1 Alignment

Variations to the motorway alignment are limited by the tightly controlled reservation. The northern section of the motorway between Box Road and Hume Highway has no feasible variations to the alignment. Several alternative vertical profiles were examined to optimise the drainage on the motorway but given the constraints of drainage levels and overpass headroom at Kurrajong Road the preferred alignment has been determined as optimum.

South of Kurrajong Road between Cedar Road and Beech Road a patch of bushland exists within the motorway reservation. The proposed motorway alignment traverses the southern side of this bushland. An alternative alignment to minimise the impact of the motorway on the bushland was investigated. Investigations of species within the existing bushland indicated that the removal of part of the bushland by roadworks would not represent a significant loss (see Section 12.3). The alternative was therefore not pursued.

9.3.2 Interchanges and Ramps

Variations are possible to the ramp layout at interchanges.

Camden Valley Way interchange was investigated as a Double Opposed Right Turn (or D.O.R.T) interchange. The DORT arrangement allows operation of the interchange using a single signal controlled intersection. This is an efficient arrangement in terms of space requirements; however it does increase the cost of structure because of the need to construct the ramps of the interchange over the through carriageway. The DORT alternative at Camden Valley Way was rejected as it would require demolition of the existing overbridge structure and abandoning the existing north bound off ramp. Both the existing bridge and off ramp would be maintained to reduce construction costs and assist in the staging of construction of the ultimate interchange.

Ramp configurations considered for the Hume Highway interchange ranged from on and off ramps on the east only to provision of ramps for all possible on and off movements. The RTA does not favour west-facing ramps because of potential congestion resulting on the Hume Highway and the M5 Casula Link as well as influences on the Park Road extension scheme discussed below, but their omission excludes use of the link for traffic to and from Liverpool and northwards. Use of the south west on ramp would involve right turns for traffic from the north which could otherwise join the motorway by continuing south on the Hume Highway to the Campbelltown Road ramp, and the ramp is therefore not considered to be cost-effective. Traffic demand for the north west off ramp is high, so its provision as a temporary alternative to the Park Road extension is proposed.

9.3.3 Motorway Crossings for Vehicles and Pedestrians

In developing the preferred design for the proposed motorway the design team has evaluated a number of possible crossings of the Casula Link. Crossings, as over or under passes to the motorway, have been considered at:

- Box Road.
- Cedar Road or nearby (discussed above).

- Kurrajong Road.
- Graham Avenue.
- De Meyrick Avenue.

Each has been evaluated in terms of likely effects on traffic, social and community functions (such as access severance), environmental aspects, engineering feasibility and cost implications. The conclusions of these analyses are summarised in Table 9.3.

9.3.4 Park Road Extension

Apart from traffic aspects discussed above, on and off ramps to the west of the Hume Highway might also jeopardise the future provision of the Park Road extension/Liverpool By-

TABLE 9.3 SUMMARY OF EVALUATION OF VARIATIONS CONSIDERED FOR MOTORWAY DESIGN

GRAHAM AVE OVERPASS
Recommendation: No overpass

Reasons	For	Against
Traffic	Current East-west traffic flows (ie. over the proposed link) show volumes on Graham Ave are low with the proportions of the flows being: Graham Avenue - 20% De Meyrick Avenue - 40% Kurrajong Road - 40% Predicted 2011 traffic figures are likely to continue this trend. East-west through-traffic will be concentrated on Kurrajong Road (for domestic and commercial/heavy vehicles).	Post construction east-west traffic access would be redirected to Reilly Street and Kurrajong Road and De Meyrick Avenue if an underpass for vehicles is constructed there.
Social Effects & Severence	Avoids construction of large loop ramp required for future Park Road traffic flows onto the Motorway with attendant visual effects. School and recreational area access not adversely affected.	Increased isolation of community west of Hume, because of congestion on Hume Highway and because of need to travel longer route for access, unless De Meyrick Avenue remains open for car traffic, in which case the effect of closure to cars and pedestrians would be minimised.
Engineering & Cost	Park Road extension (linking Cumberland Highway) is supported by RTA and Liverpool Council. The extension can be designed to connect to the M5 Casula Link at significantly less cost and with a cleaner/neater design for traffic flow. Turnaround circles adjacent to expressway designed to enable service and emergency access e.g. garbage truck movements.	Through traffic or 'rat runs' would be concentrated along Reilly Street, De Meyrick Avenue and Kurrajong Road. Constraints on emergency vehicle through movement. Local traffic increase on Reilly Street. Or the traffic may either stay on Kurrajong Road or go direct to Hoxton Park Road via Wonga/Hillview Road. Cost of overpass - $1.4m

Source: Maunsell Pty Ltd, 1992

Pass. This link would better serve the future growth of Liverpool and be a good candidate for funding by the Federal Government, as it links to the Cumberland Highway which then connects the current points of termination of the National Highway system in Sydney.

This EIS is based on no on ramp to the south west and an off ramp to Liverpool at the Hume Highway as a temporary measure pending work between the RTA and Council to determine how the Park Road route might be developed and in what stages. For example Stage 1 could provide for the construction of a temporary exit for traffic from the Casula Link to Hoxton Park Road and into Liverpool.

TABLE 9.3 SUMMARY OF EVALUATION OF VARIATIONS CONSIDERED FOR MOTORWAY DESIGN

KURRAJONG RD **Recommendation:** **Overpass. Traffic lights at access to Casula Mall car park. Access to Inghams factory at an intersection with Kurrajong Road**		
Reasons	**For**	**Against**
Traffic	Traffic below capacity, but catering for 40% of east-west movements. Road can cater for commercial and domestic vehicular traffic with only minor modifications recommended. Kurrajong will continue to be a major access route for local traffic (cars and pedestrians).	
Environmental	No known detrimental effects as area is developed residental.	Increased traffic noise due to westerly urban extension generating greater traffic that would largely use Kurrajong Road unless it were interrupted.
Social	Maintains convenient access to Casula Mall for all residents west of the M5. Grade separated pedestrian access provided for school children and other residents. Would tend to keep through traffic out of Casula/Lurnea by virtue of its directions and managed access to the highway.	Increasing local traffic may be perceived by local residents as a negative effect. Pedestrian access will need to conform to designated traffic lights / walkways.
Engineering & Cost	Crossing positioned at an awkward topographic location but traffic demand justifies this route rather than another local road. No access problems except at Inghams factory. Inghams access requirements to be catered for an intersection with Kurrajong Road. Cost of overpass - $2.0m.	Upgrading of roundabout may be required to allow U-turn by semi-trailers.

Source: Maunsell Pty Ltd, 1992

Should early agreement be reached after public consultation and study that such a Stage 1 connection could be provided within say two years, then it would be sensible to defer the proposed off-ramp to the Hume Highway in favour of proceeding with the Park Road extension.

TABLE 9.3 SUMMARY OF EVALUATION OF VARIATIONS CONSIDERED FOR MOTORWAY DESIGN

DE MEYRICK AVE **Recommendation:** **Pedestrian traffic underpass**		
Reasons	**For**	**Against**
Traffic	Kurrajong Road and Reilly Street would cater for vehicular and Hume Highway access. Commercial access to De Meyrick Avenue only required from Hume Highway.	Increased commerical vehicle (east-west) access confined to Kurrajong Rd.
Social	Pedestrian underpass maintains access to schools. De Meyrick Ave shops (both Hume Highway frontage & corner of Fitzpatrick Crescent) benefit from pedestrian traffic. Would tend to remove unwanted commerical traffic crossing through the residential area between the motorway and the highway.	Shops lose passing vehicular traffic business. Only partly caters for existing and committed land uses in area that depend on De Meyrick Avenue.
Engineering & Cost	Cost of underpass approximately $0.65m. Compared to Graham Ave - overpass and associated design requirements for Park Road extension at approximately $1.4m. De Meyrick Ave underpass design assumes height of 2.8m.	More complex drainage system required. Turnaround circles for all heavy / high vehicles would be required both sides of underpass. Access for domestic, commerical and emergency vehicles limited to Kurrajong Road and Reilly Street crossings of expressway.

Source: Maunsell Pty Ltd, 1992

TABLE 9.4 SUMMARY OF EVALUATION OF VARIATIONS CONSIDERED FOR MOTORWAY DESIGN

BOX ROAD **Recommendation:** **Pedestrian and Bicycle Overpass**		
Reasons	**For**	**Against**
Traffic/Social	Pedestrian access to schools maintained. Traffic impacts on school and preschool avoided on Box Road; avoids compounding the effects of more traffic on Kurrajong Road, as Prestons urban release area extends. Removal of current closure on Box Road would facilitate car and bus access between new residential areas and Casula Mall without loading Box Road at the primary school.	Bus movements may be affected by lack of efficient access to school.
Engineering	Ideal location for crossing as minimal ramps required on approaches.	

Source: Maunsell Pty Ltd, 1992

assessment of effects and mitigative measures

TRANSPORT AND SAFETY EFFECTS

Section 10 outlines the effects of the proposal on transport efficiency, road safety and energy consumption.

HUMAN ENVIRONMENT AND COMMUNITY EFFECTS

Section 11 describes detailed effects on the human environment and community effects such as traffic noise and proposed mitigative measures are also set out.

EFFECTS ON THE BIOPHYSICAL ENVIRONMENT

Section 12 describes the detailed effects and proposed mitigative measures on the biophysical environment of soil, water, flora and fauna are given.

ECONOMIC EFFECTS

Section 13 gives an analysis of the economic effects of the project including costs, benefits and funding issues.

CONSTRUCTION EFFECTS

Section 14 provides an environmental management plan to minimise effects during the construction phase of the project.

SUMMARY OF EFFECTS

Section 15 summarises the impact of all factors discussed in the EIS.

10 TRANSPORT AND SAFETY EFFECTS

10.1 TRANSPORT EFFICIENCY

Transport efficiency is measured against several performance criteria. These are explained in detail in Sections 8.4.4 and 8.4.5 and are discussed below for the proposed Casula Link motorway.

10.1.1 Global Measures

Total travel time

The total travel time is the amount of time required to make the estimated number of future trips on the road network. It is derived from the network model for the two-hour morning peak period over the whole of the modelled network. Table 10.1 shows the total travel network time for the base case and Casula Link proposal.

Table 10.1 indicates that the Casula Link would reduce total travel time across the network being analysed by about 6900 hours, or just under 4%, during the morning peak period in the year 2011.

Fuel consumption

The fuel consumption estimated by the network model is the total litres of fuel required to operate vehicles on the network and is shown in Table 10.2 below.

The value of this fuel consumption has been included in the overall vehicle operating costs used in the economic evaluation. Again it is emphasised that these fuel consumption comparisons are simply another way of viewing the efficiency and not an additional benefit over and above the economic benefit.

The fuel consumed depends upon both the amount of travel and the speed of travel.

The results indicate that the Casula Link proposal would save 11,500 litres of fuel which is a reduction of just under 2%.

Network flexibility

As discussed in Section 8.4.4 flexibility is the ability of the network to operate under conditions where problems on one link force traffic to divert to other links. The Casula Link would provide an additional parallel link to the Hume Highway. This route 'duplication' would provide substantial benefits in case one of the roads would need to be closed or partially closed for any reason.

10.1.2 Modal Measures

Public transport operations

Bus operations would improve significantly with the addition of the Casula Link. The reduction of through traffic on the Hume Highway would result in improved operating speeds and reliability of service for buses using it. The proposed Casula Link would also provide a direct non-stop link for services between Camden Valley Way and Liverpool, bypassing Casula and Lurnea.

TABLE 10.1 PEAK PERIOD TRAVEL TIME (2011)

Option	Total Travel Time (vehicle hours)
Base Case	180,800
Casula Link	173,900
Travel time saving	6,900

Source: Denis Johnston and Associates, 1992

The time savings have been converted to a monetary value which have been used in the economic evaluation. The time savings are another way of looking at the performance of the network.

TABLE 10.2 PEAK PERIOD FUEL CONSUMPTION (2011)

Option	Total Fuel Consumed (1,000s of Litres)
Base case	611.3
Casula Link	599.8
Fuel Savings	11.5

Source: Denis Johnston and Associates, 1992

Freight service efficiency

As discussed in section 8.4.4 the Hume Highway corridor carries a significant proportion of heavy commercial vehicle traffic. The extent to which the Link would contribute to freight service efficiency is measured by the general travel time performance. Thus a 4% saving in travel time during the morning peak is expected. Commercial vehicle through traffic would benefit in terms of travel time and fuel costs by the non-stop connection between the South Western Freeway and M5 provided by the Link.

10.1.3 Geographic Specific Measures

Intersection performance

All intersections within the study area of the proposal have been designed to cope with the predicted traffic flows which will be experienced in 2011. The costs of provision of these facilities have been included in the estimates of project capital costs.

The discussion in section 8.4.4 outlines the effects of no road improvements as represented in the base case. To summarise, the likely effects would be peak period spreading, trip suppression, land use changes and mode shift.

All the intersections associated with the Casula Link motorway would operate satisfactorily, at acceptable levels of service, while significant improvements in intersection performance along the Hume Highway are expected.

Service to specific land uses.

The Casula Link would provide increased levels of service to land uses adjacent to the Hume Highway by reducing the proportion of through traffic. This would allow more emphasis to be placed on local access/ egress. In particular the release of capacity along the Hume Highway in the period after the opening of the Link would enable the adoption of traffic management measures to increase local amenity.

10.1.4 Conclusion

The Casula Link proposal would provide a large increase in corridor capacity which would enable a large proportion of through traffic to be eliminated from the Hume Highway. Based on the measures of network efficiency discussed above, the Casula Link would result in greater savings than the upgrade alternative while providing the opportunity to address local issues along the Hume Highway. The associated benefits would be passed on to private and commercial users and bus operators.

10.2 ROAD SAFETY

10.2.1 Accident Performance

Application of historical accident rate data for Sydney to the predicted traffic flows allows calculation of estimated accident savings. These savings represent the projected avoidance of fatalities, injury and property damage resulting from accidents.

In common with other measures of traffic performance discussed in Section 10.1, these improvements are valued in monetary terms in the economic evaluation.

Table 10.3 shows the estimated number of accidents. The Link is expected to result in a reduction in accidents of around 1.5% in the south west region. This equates to a reduction of 1 fatality and 45 injury causing accidents.

10.2.2 Hazard and Risks in Transport of Dangerous Goods

The use of roads for the transport of dangerous goods has the potential although slight, for creating a hazardous incident involving release of these goods with consequent impacts upon the public and the built and biophysical environments.

Major incidents involving dangerous goods are rare and most hazardous goods incidents do not result in the release of hazardous materials or injury. Petrol represents 68% of dangerous goods traffic, 50% of accidents involving petrol tankers result in spillage and only 10% overall result in a fire, not all of which would be a major incident. LPG and chlorine spillages are less likely because of lower transport volumes and special robust design of pressure vessels. Table 10.4 shows the breakdown of dangerous goods vehicles. Even though the likelihood of a major incident is low, it is

TABLE 10.3 ANNUAL NUMBER OF ACCIDENTS (2011)

Option	Fatal	Injury	Property Damage Only
Base	77	3065	5294
Casula Link	76	3020	5216
Reduction in Accidents	1	45	78

Source: Denis Johnston and Associates, 1992

necessary to maintain high standards for dangerous goods transportation and to develop mitigative measures should they occur.

Table 10.5 shows the estimated number of dangerous goods vehicle accidents per year in 2011. The likelihood of an accident is predicted to be considerably less than in the base case and upgrade alternative. This is to be expected as expressways are inherently safer in terms of accident rates. Of course accidents could still occur on the Hume Highway if the Link were to be built since this would still carry a proportion of hazardous goods vehicles. Even with this inclusion, Table 10.5 shows the link would be more favourable in terms of the level of accidents involving dangerous goods vehicles.

The Casula Link was assessed to determine the likelihood of spillage of hazardous goods and the effect to the environment of major fires, explosions or release of toxic substances.

Assessment criteria

Important factors are the risk and hazard involving major releases of dangerous goods, spills of toxic material and the effects of fire or explosion, the nature of the material, size of the release and site characteristics including population densities and geographical location.

A route alignment may contribute to the levels or risk within the corridor either by being close to a fixed installation which stores or handles hazardous materials or from transportation of dangerous goods along the route.

A major incident risk must be assessed cojointly with the severity of the incident's impact on the surrounding environment.

TABLE 10.4 DANGEROUS GOODS VEHICLE TYPE AS A PERCENTAGE OF ALL HEAVY VEHICLES IN NSW

Vehicle Type	% of Total Heavy Vehicles
Petrol	0.75
LPG	0.1
Chlorine	0.1
Poisons	0.1
Other Dangerous Goods	0.1

Source: WorkCover Authority in RiskCorp 1992

To assess the risks and effects of a dangerous goods accident the following criteria were examined:

- Road design and standard.
- Volume and type of dangerous goods traffic likely to be carried along the route.
- Accident rates and likelihood of a major incident at selected sensitive locations.
- Proximity and extent to which populations border the route (public environment).
- Proximity and extent of environmentally sensitive watercourses or bushland which could be affected (biophysical environment).
- Proximity and extent of man made constructions such as buildings, parks, roads and bridges which could be damaged by fire or explosion events (built environment).
- Feasibility of providing mitigative measures to minimise the associated risk.

Assessment of effects and mitigitive measures

Statistically if an accident were to occur it would be at an intersection rather than on the motorway link. The grade separated interchanges would have full signalised control and so the possibility of accidents occurring is minimised. Thus possible

TABLE 10.5 ESTIMATE OF ACCIDENT RATES FOR DANGEROUS GOODS TRANSPORT (2011)

Road Option	Vehicle Accidents per 100 Million Vehicle/KM	Road Length Km	Projected Average Dangerous Goods Vehicles/Year	Estimated Dangerous Goods Vehicles Accidents/Year
Base Case	152	4.4	58,700	0.39
Casula Link	39	4.3	42,300	0.07
Casula Link including Hume Highway	39 + 152	4.3 + 4.4	58,700	0.18

Source: Denis Johnston and Associates, 1992

locations of an accident are the motorway on and off ramps.

10.3 ENERGY STATEMENT

10.3.1 Energy Consumption During Construction

Energy consumption during construction has been examined. The amount of fuel consumed would depend on the construction fleet proposed by the contractor. It is estimated that 3.5 million litres of fuel (distillate) would be consumed. Factors affecting this value of fuel consumption include the age of the construction vehicles, the speed at which they work, and the softness or hardness of the ground conditions.

10.3.2 Energy Consumption During Operation

Savings in energy consumption during the operation of the network result from two primary sources:

- Shorter travel distances for some vehicles using the new link.
- Improved operating conditions on adjoining roads as a result of traffic diversion to the link.

Offsetting these benefits would be a slight increase in consumption of fuel by vehicles which choose the new link to save travel time at the expense of a longer distance trip.

The net result of these effects is discussed in Section 10.1.1. Savings of 11,500 litres of fuel are predicted during the morning peak period. This compares to an estimated savings of 2,500 litres of fuel if the Hume Highway upgrade were to proceed rather than the Link.

TABLE 10.6 FUEL CONSUMPTION DURING CONSTRUCTION

	Diesel Fuel (mega litres)
Hume Highway Upgrade	2.4
Casula Link	3.5

Source: Maunsell Pty Ltd, 1992

11

HUMAN ENVIRONMENT & COMMUNITY EFFECTS

11.1 THE AFFECTED COMMUNITY

The residential area directly and indirectly affected by the proposed motorway development lies within the Liverpool LGA and is basically confined within the bounds defined by Hoxton Park Road in the north; Hill Road; Wonga Road; Kurrajong and Ash Roads to the west; Camden Valley Way and Glenfield Road to the south, and the Campbelltown rail line to the east. It should be noted that the study area (Figure 1.3) is somewhat larger than the affected residential area. Population characteristics of the study area are summarised in Table 11.1.

1986 census

As the data from the 1991 census was not available at the time of this study, the 1986 census data has been used. A total of 13,866 people were resident in the study area at the 1986 census. The population exhibited a high proportion of young people (26% aged 14 and under), and people born overseas (29%). Major overseas born groups include Italians (5%) and Yugoslavs (4%). (Ref: ABS)

Approximately 57% of people over the age of 15 were employed, 7% were unemployed, and 34% were not in the labour force. The majority of the population received an *individual* annual income of $22,000 or less, and approximately 50% of *households*

TABLE 11.1 POPULATION CHARACTERISTICS OF THE STUDY AREA

Characteristic		No.	%
Gender			
	Males	7015	50.6
	Females	6854	49.4
Age			
	14 and under	3617	26.1
	15-59	9091	65.5
	60+	1161	8.4
Birthplace			
	Australia	9796	70.6
	(incl) Aboriginal and TSI	158	1.1
	Overseas	4070	29.4
	(incl) Italy	722	5.2
	England	660	4.8
	Yugoslavia	480	3.5
Labour Force Status (of people aged 15 and over)			
	Employed	5853	57.1
	Unemployed	711	6.9
	Not in labour force	3476	33.9
Annual Income			
	Individual		
	$22,000 and less	8414	87.9
	Over $22,000	1153	12.1
	Household		
	$26,000 and less	1761	49.9
	$26,001 - $40,000	1053	29.8
	Over $40,000	714	20.2
Occupation			
	Tradespersons	1141	19.5
	Clerks	1095	18.7
	Labourers and related workers	1072	18.3
Industry			
	Manufacturing	1352	23.1
	Wholesale and retail trade	1212	20.1

Source: 1986 Census

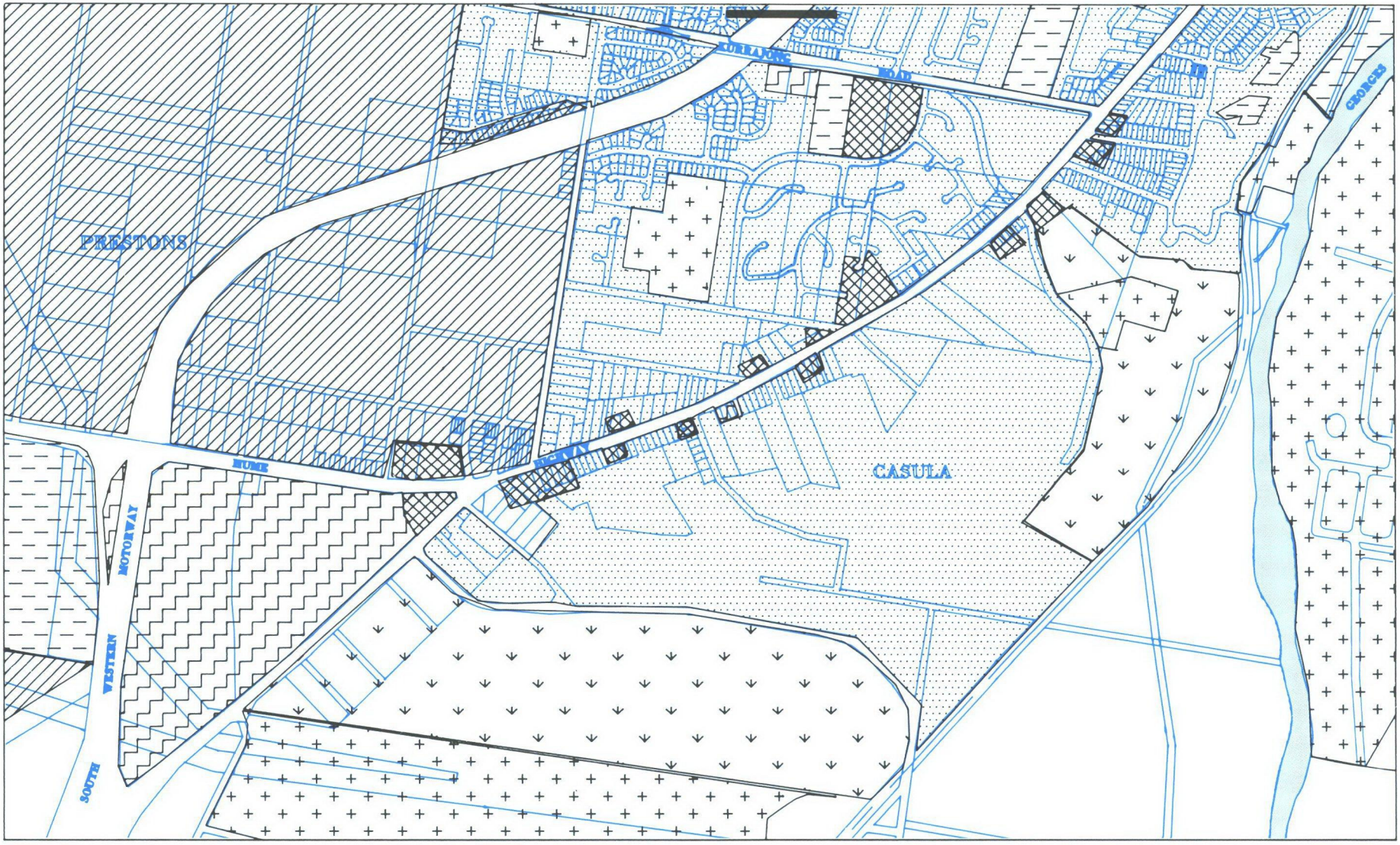


FIGURE 11.1.1

STUDY AREA LAND USE AND ZONING



FIGURE 11.1.2

STUDY AREA LAND USE AND ZONING

received an annual income of $26,000 or less in 1986.

Almost 57% of the population were employed as tradespersons, clerks or labourers. Approximately 43% were employed in either manufacturing or wholesale/retail trade.

Within the study area in 1986, minor variations between census districts occurred in respect of percentage of residents born overseas, incomes, etc., but these variations are not significant.

The average ratio of cars per dwelling was 1.5 in 1986, but 10% of households had no car while 45% had one car and the remaining 45% had two or more.

Residents in the area made heavy use of cars for their journey to work. On the census day in 1986, 80.8% of those journeying to work travelled by car, motorcycle or taxi, 3.2% walked or cycled, and 16% used public transport (bus, train or both).

11.2 LAND USE AND OWNERSHIP

11.2.1 Existing Land Uses & Zoning

The proposed Casula Link would largely be confined within a reservation zoned for a proposed county road under the Liverpool Planning Scheme, that has been in force since 1972. That plan also includes another county road reservation leading to Liverpool Street. This would form one section of a road to bypass the Liverpool town centre to the west that is commonly known as the Park Road Extension.

The Liverpool Planning scheme has been amended a number of times since its gazettal, either to facilitate urban expansion by converting large tracts of rural zoned land to urban zonings, or to allow localised changes in permissible land uses. The most significant of these amendments with respect to the Casula Link were IDO17 and LEPs 80 and 103 which rezoned land from rural to urban use between 1972 and 1984.

Roads are permissible forms of development in all of the zones affected by the motorway proposal.

Existing land uses and zoning in the vicinity of the Casula Link and the Hume Highway are shown on Figures 11.1.1 and 11.1.2.

North from Camden Valley Way the corridor passes through a rural residential area as far as Box Road, then through urban residential areas until it reaches the railway and Georges River. Industrial properties flank the route between the river and Moorebank Road where it joins the existing section of the M5.

The existing rural residential area is scheduled for urban expansion under the State Government's Urban Development Program.

Casula Mall provides comprehensive retail services, and is supplemented by local shops in De Meyrick Avenue and Boundary Street, and by fruit markets and groups of shops along the Hume Highway.

A commercial chicken hatchery is located on the edge of the reservation at Kurrajong Road, while the existing residential areas are confined on their western side by communications facilities that require extensive open ground.

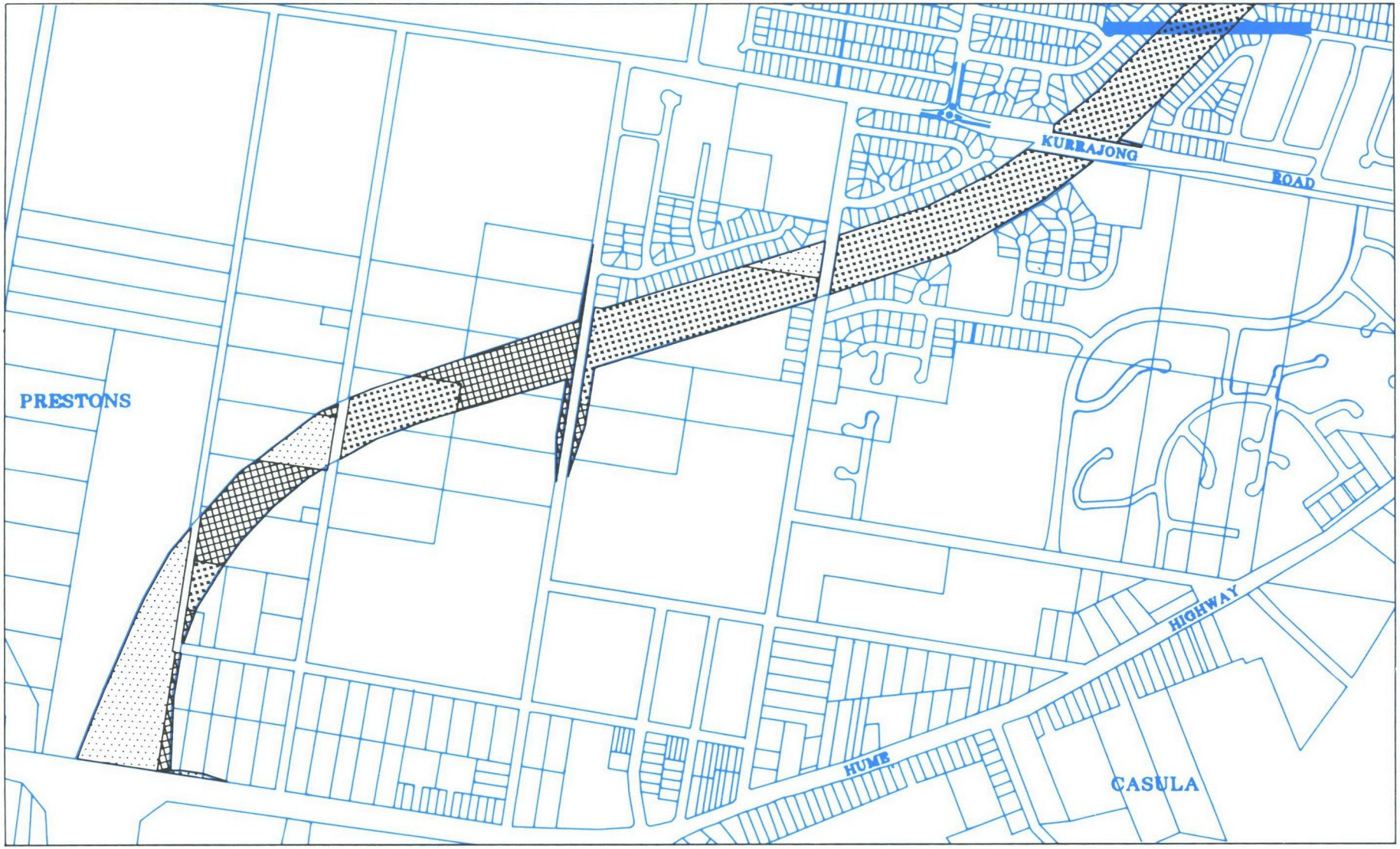
There are two large open space areas between the reservation and the Hume Highway, but the bulk of the open space and playing fields are located west and north of the corridor.

An area of natural bushland situated between Cedar and Beech Roads in the existing rural residential area is subject to State Environment Planning Policy 19 (SEPP 19) which is intended to protect significant pockets of bushland within urban areas. SEPP 19 generally requires that development consent be sought for any disturbance to bushland of this kind. While the construction and maintenance of main roads is exempt from this requirement, minimisation of disturbance remains a significant planning objective.

The student catchment of two high schools, two state primary schools, one church primary school and one preschool overlap both the motorway reservation and the Hume Highway.

Proposed developments

There are plans to develop the triangular site between the highway, the existing motorway exit road, and



RTA
Department of Planning
Council
Dept. of Housing
Private

0 0.1 0.2 0.3
Kilometres

FIGURE 11.2.1
RESERVATION OWNERSHIP (SHEET 1 OF 2)

N



RTA
Department of Planning
Council
Dept. of Housing
Private

0 0.1 0.2 0.3
Kilometres

FIGURE 11.2.2
RESERVATION OWNERSHIP (SHEET 2 OF 2)

N

Camden Valley Way as a truck stop and maintenance facility.

Access requirements for this development are currently being negotiated and direct access from the proposed motorway is unlikely due to constraints of space for traffic movements as well as cost. The Casula Link is likely to benefit this proposal by improving access conditions from Camden Valley Way to the site.

The Army is also planning to redevelop part of the existing base and logistics complex on Moorebank Avenue to provide a central logistics and storage facility for the three services. This re-development has been accounted for in the traffic modelling and therefore its effect on the proposed Casula Link has been included.

11.2.2 Land Ownership

Land within the reserve is under various ownership. Figures 11.2.1 and 11.2.2 show the existing ownership.

Ownership falls within the following categories:

- Roads and Traffic Authority.
- Department of Planning.
- Department of Housing.
- Liverpool City Council.
- Private Ownership.

The majority of land within the reserve is owned by public authorities including RTA (59.7%), Department of Planning (28.6%) and Department of Housing (0.1%). Liverpool City Council owns less than 0.1% while private ownership accounts for 11.5% of land within the road reserve.

Outside the road reserve the corridor is predominantly privately owned residential lots.

Some land still remains to be acquired within the reserve. Table 9.2 summarises the property acquisition required.

11.2.3 Community Severance, Local Access and Traffic Intrusion Matters

Community severance would be largely overcome by maintaining Kurrajong Road as a grade separated overpass for vehicles and pedestrians, and De Meyrick Avenue as an underpass for pedestrians.

The access arrangements on De Meyrick Avenue would ensure that students living on the other side of the corridor from Lurnea High School and Casula Public School could access these facilities without hindrance or risk.

Closure of Graham Avenue would have a limited impact on residents in the area between Graham and De Meyrick Avenues and east of the motorway reservation, confined to increasing the distance between their houses and the Amalfi Park recreation complex.

Box Road, which has been closed for some time to prevent unwanted through vehicle movements, would be provided with a foot bridge to maintain pedestrian and bicycle access between the developing residential areas south of Kurrajong Road and the Prestons Primary School and the Prestons Preschool which share the site on the corner of Kurrajong Road and Box Road.

Closure of Beech Road would have a minimal effect on access across the corridor, since the Cedar Road would be replaced by a new road and bridge on what the Council sees as being a more suitable alignment for future urban development of this area. The cost of the bridge would be met by the RTA.

Reduced traffic loads on the Hume Highway and rationalised intersections along this route, would contribute to improved access to and across the highway.

Severance would be avoided by these measures, and careful design would minimise the inconvenience associated with changing ground levels to achieve grade separation on Kurrajong Road.

Existing local traffic movements

Traffic movement through the existing street network follows well defined routes with major east-west movements along De Meyrick Avenue and Kurrajong Road and lesser movements along Graham Avenue. Major north-south movements through the local area are either

along the Hume Highway or via Cedar Road to Wonga Road. Some rat runs are used especially when volumes on the Hume Highway are high such as during peak hours. Liverpool Council has attempted to reduce the use of local streets by through traffic by introducing measures such as speed humps on certain routes (e.g. Amalfi Street), by stopping through traffic altogether in some roads (e.g. Box Road), and by introducing roundabouts on streets where intersection conflicts need to be reduced such as Reilly Street.

Effects of proposal

Construction of the proposed motorway would sever the major north-south and east-west routes currently used by local traffic and pedestrians unless mitigating arrangements are made. The proposal includes replacements for some of the severed routes using overpasses or underpasses as shown on Figure 11.3. Not all existing routes which cross the motorway corridor would be maintained but sufficient crossings would be provided to allow projected traffic volumes to move through the network with a reasonable travel time, and to facilitate pedestrian movements. These were outlined above.

Traffic on Kurrajong Road would increase due in part to severance or downgrading of other cross traffic routes but more significantly by the proposed expansion of residential areas in Prestons. Routes such as Graham Avenue, De Meyrick Avenue and Cedar Road would experience reduced traffic volumes. With the severance of Box Road by the motorway the existing closure would be removed to allow traffic to flow from Box Road into Guise Avenue and vice versa. This would increase the traffic through Guise Avenue as this becomes a link from Box Road to Kurrajong Road.

Replacement of the north-south traffic movement currently provided by Cedar Road and Beech Road is unable to be defined within this study. Options which have been investigated include overpasses at Box Road, Cedar Road and an intermediate overpass midway between Beech Road and Cedar Road. The overpass midway between Beech Road and Cedar Road is preferred by Liverpool City Council and is proposed to connect to future roads developed as part of the subdivision of land in this location. The timing of the subdivisions is such as to post date the opening to traffic of the motorway link. It would be unrealistic to construct the overpass between Beech Road and Cedar Road as part of the motorway project without having approach roads which are to be constructed as part of the future subdivision work. It is proposed, therefore, that no overpass be constructed over the southern section of the motorway as part of this project however, several future options are available when subdivision layouts become more defined.

11.2.4

Mitigative Measures

To provide vehicular and pedestrian access across the motorway three crossings would be provided. At Kurrajong Road a high standard overpass is proposed to allow all vehicle types and pedestrians to cross. At De Meyrick Avenue a limited height underpass will be constructed to provide access for pedestrians only.

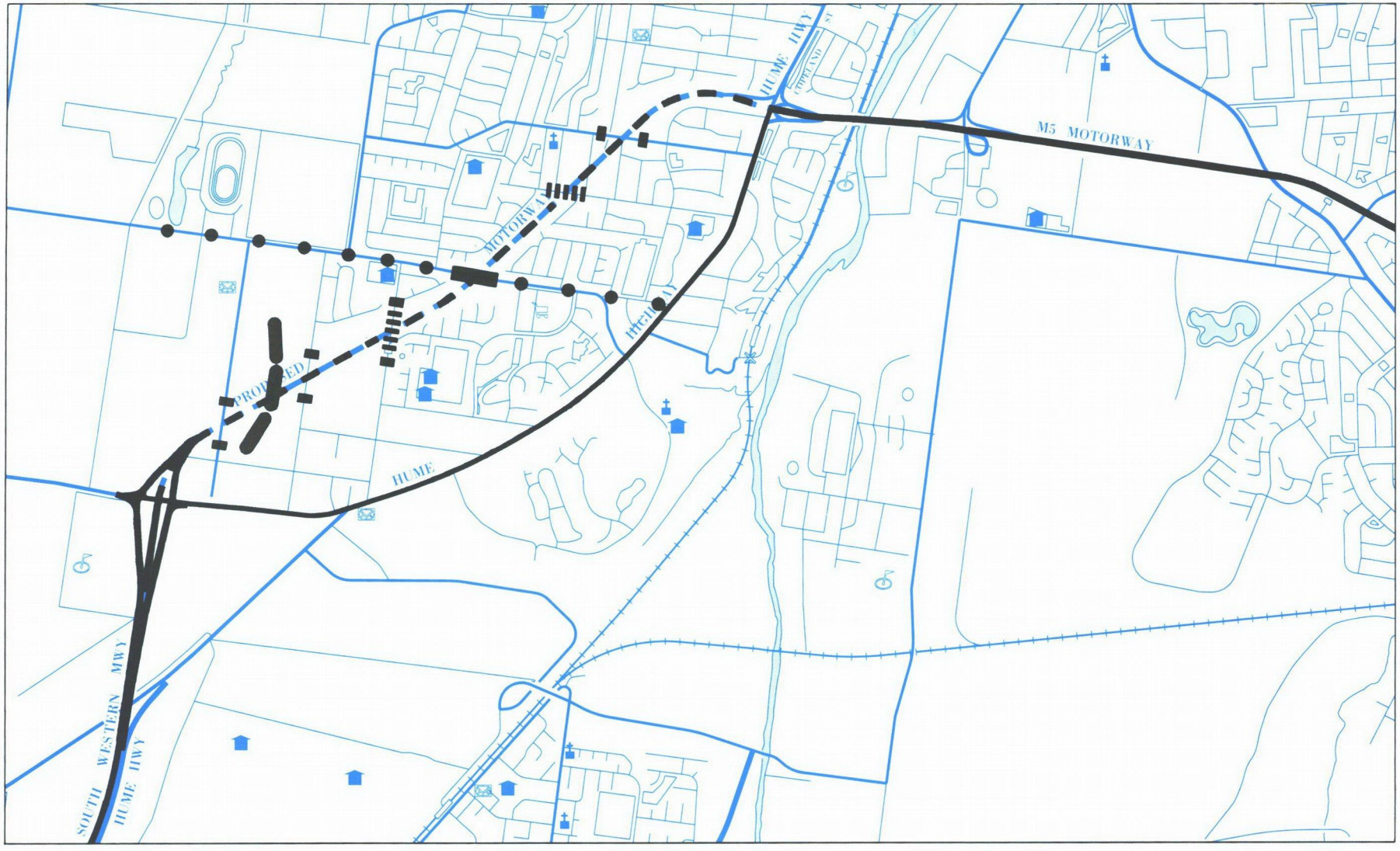
The overpass at Kurrajong Road would have substantial benefits for reducing traffic intrusion into the local area. However this would, of course, come at the cost of greater traffic volumes using Kurrajong Road itself.

An overbridge for pedestrians is proposed at Box Road to secure pedestrian access between Prestons School and Preschool and the expanding residential areas south of the motorway.

In terms of the potential for community severance in existing developed areas arising from construction of the motorway, it is therefore critical to ensure that the proposed under and overpasses for pedestrians, bicycles and cars are implemented without any reduction in their extent.

Provision of a pedestrian overpass at Box Road is also critical to ensure primary school access for the increasing number of families living south of Casula Mall.

Detailed land use planning in the Prestons release areas could further reduce severance effects by ensuring a high degree of self containment of local facilities.



Vehicular Overpass

Possible Future Motorway Crossing

Major Local Traffic Movement

Road Closure at Motorway Reserve

Pedestrian Crossing of Motorway

0 0.5 1.0
Kilometres

FIGURE 11.3

FUTURE LOCAL TRAFFIC NETWORK

Source: Maunsell Pty Ltd 1992

N

11.2.5 Conclusion

Between Kurrajong Road and the Hume Highway at Casula, the motorway reservation draws an arbitrary line through an interactive community, and the severance effects of developing the M5 Link would be considerable without the maintenance of adequate and convenient road and pedestrian crossings.

Construction of the proposal would reduce the percentage of through vehicles using local streets to bypass existing congestion on the Hume Highway.

Severance or downgrading of existing cross streets such as Graham Avenue, De Meyrick Avenue and Cedar Road would increase the volumes of traffic on Kurrajong Road although much of this growth would stem from the urbanisation of Prestons. The importance of Kurrajong road as a connecting link within the network would therefore increase. Certain areas such as around Graham Avenue would experience reduced traffic intrusion from through traffic. Local amenity for pedestrian access at De Meyrick Avenue would be maintained.

The over and underpasses incorporated in the proposal have been specifically designed to overcome the potential severance, and the net severance effect is likely to be minimal if they are implemented.

11.3 OTHER SOCIAL EFFECTS

Other social effects are discussed in other sections of this study. Noise levels and air quality are discussed in Sections 11.5 and 11.6 respectively while community severance and traffic intrusion is discussed in Section 11.2.3.

11.4 URBAN DESIGN AND LANDSCAPING

11.4.1 Preamble

This section addresses the visual and landscape issues relating to the motorway easement and its environs. The existing physical conditions, potential visual exposure, and landscape impact of the proposed motorway are described. The proposed landscape development, and other mitigative measures are described, including details of the recommended landscape construction process. The landscape masterplan is illustrated on the alignment plans. (Figures 9.1.1-9.1.15)

11.4.2 Existing Conditions

Topography

The topography of the study area can be considered as having three distinct zones, each with its own particular characteristic, as described below.

Unit 1: Heathcote Road to Georges River

This unit is predominantly flat land with little to no natural undulations. The land use comprises large industrial buildings, bushland and grassed floodplains/open recreation areas adjacent to the river. The Hume Highway sits atop a prominent north-south ridge, on the west side of the Georges River.

Unit 2: Georges River to Cedar Road (west of existing vegetation stand)

This unit is essentially undulating, with predominantly established residential developments of various eras (1930's to 1990's), as well as areas of future residential development - particularly in the south. It has a number of major north-south ridgelines, occurring in the vicinity of the Hume Highway, Graham Avenue, and Box Road. The highest point is situated at the water tank site off Box Road, (approx. 72.0m AHD). The low points occur at Georges River, adjacent to the park in Grove Street, and west of De Meyrick Avenue.

Unit 3: Cedar Road to Hume Highway (west)

This landscape unit is flat and low lying with little to no natural undulations. Maxwells Creek and the drainage lines, or small creeks, which feed into it are low banked and generally comprise meandering channels with a wide floodplain.

Vegetation

The vegetation survey *(Mt. King Ecological Surveys, 1992)* identified two plant communities along the

proposed route. An area of degraded western Sydney Woodland, is located west of Cedar Road. The other community consists of cleared land with scattered remnant trees, extending over the majority of the site. Road side landscaping between Moorebank Avenue and Hume Highway comprises mainly introduced native species, planted as amenity landscaping at the time of construction of that portion of the carriageway. Roadside vegetation between Heathcote Road and Moorebank Avenue consists of remnant bushland and recent revegetation, associated with the construction of the M5. These communities appear as four distinctive patterns, Grassland, Open Woodland, Wetland and Bushland.

Grassland: Occurring all along the easement, the grassland component is the predominant vegetation type. Whether on its own, or associated with trees, this grassland comprises mostly exotics, such as kikuyu, paspalum, couch, and other crop grasses. Previous land uses have caused the removal of the vast majority of native grasses and small plants.

Open Woodland: An open woodland appearance is established by the presence of isolated pockets of large sized *Eucalyptus* specimens. These predominantly occur within the area between Graham Avenue and Box Road. These mature trees include *Eucalyptus moluccana*, *Eucalyptus fibrosa*, *Eucalyptus eugenioides*, with *Eucalyptus tereticornis* on the higher land. The trees occur as isolated specimens, or widely spaced in groups, within the exotic grass understorey.

Wetland: There are two areas of wetland vegetation. The main area occurs just north of Camden Valley Way, and is associated with the environs of Maxwells Creek. Plant species here include *Casuarina glauca*, *Eucalyptus amplifolia*, and *Melaleuca decora*. A smaller wetland is associated with the area upstream of Brickmakers Creek, west of De Meyrick Avenue. Plants occurring here are recent regrowth stands of *Melaleucas*.

Both areas comprise isolated tree specimens in a disturbed grassland, which are predominantly exotics.

Bushland: A single area of disturbed bushland is present immediately west of Cedar Road. A relatively large part of this bushland (30-40%) falls within the area of the motorway easement. It comprises a canopy of predominantly *Eucalyptus moluccana* and *Eucalyptus tereticornis*, with a shrub layer of *Acacia parramattensis*, *Acacia decurrens*, and *Bursaria species*, and grasses including *Mircrolaena* and *Eragrostis*, *Echinopogon* as well as a large assortment of exotic grasses. The Flora Study does not identify this area as containing significant, or rare, or threatened species. A separate site, north of Graham Road, and far from the motorway easement has been identified as a location containing a rich assortment of rare and threatened plant species.

11.4.2 Assessment Methodology

The engineering design of the proposed motorway includes grade separated crossings, intersections and access ramps, acoustic barriers and cutting and filling all along the motorway. The methodology for assessing the visual impact of these works on the adjoining properties involved the landscape architects making onsite inspections, and referring to the engineering design drawings.

Based on the onsite inspection and mapping, visual and landscape assessment drawings have been prepared for the whole route. These also contain a listing of the detailed observations, potential problems, and recommended amelioration or design opportunities which exist along the route of the proposed motorway. The Community Consultative Committee reviewed these plans and notes, and provided comments and additional information which has been incorporated into the landscape masterplan. The detailed analysis and notes are included in the "Landscape and Visual Assessment" working paper.

Visual exposure

Visual exposure is any situation where traffic on the proposed roadway would be readily visible to occupants of adjacent and surrounding properties, and vice versa. Visual exposure requires a high degree of visual recognition between potential observers (i.e. facial identification, or details of

clothing, or distinguishing physical characteristics).

Direct illumination of windows or private living spaces by headlights also constitutes visual exposure. The degree of exposure is dependant upon a combination of factors, including distance between observers, height of residence/building, the presence and size of cut/fill embankments, general topography and roadway alignment.

Design elements such as acoustic walls, mounding, and landscape plantings are used to reduce or eliminate such visual exposure.

In considering the visual assessment of the motorway, the adjacent properties have been categorised into three classes of potential visual exposure, as follows:

1. Low visual exposure

2. High visual exposure

3. Very high visual exposure

These categories are applied to properties which are directly adjacent to, or close to the actual carriageway of the proposed motorway. Whilst many other properties are also within the visual catchment of the motorway, affording glimpses, or possibly even clear views of the carriageway, the notion of clear visual recognition is generally absent once the separation is in excess of 80 metres or so.

Factors effecting visual exposure are summarised below.

Distance

A property which is close to the roadway is potentially more visually exposed than one situated at some distance away.

Height of structure

A single storey structure (dwelling) which is adjacent to the road easement is relatively less exposed than one which is double storey and in a similar location.

Cut/Fill embankments

The deeper the cut the less visually exposed the adjacent property becomes. Similarly, the higher the fill the greater the degree of potential visual exposure.

Topography

A property which is situated on the side of a hill and which overlooks the roadway is considerably more visually exposed than one which is located at a similar distance from the road, but in a relatively flat area.

Roadway alignment

A property which is located on the outside bend of the roadway is potentially subjected to headlight glare from oncoming traffic, more so than one which is located adjacent to a straight section of the roadway, or on the inside of the bend.

11.4.3 Effects of the Proposal and Mitigative Measures

Changes to local pedestrian and car traffic

Access to roads and houses next to the overpasses would be ensured by changes in local road and traffic arrangements. The way of achieving this would differ depending on the final function and alignment of each overpass.

Visual and noise exposure

The proposed road construction would result in the clearance of most of the existing tree specimens which are scattered throughout the alignment, as well as a significant proportion of that bushland which exists within the road reserve, west of Cedar Road.

The engineering design of the vertical alignment, the grade separated crossings, and the intersections and access ramps necessitates cutting and filling all along the motorway. The visual impact of these works on the adjoining properties is recorded on the landscape and visual assessment plans.

The landscape masterplan describes the landscape works which would be an integral part of the construction of the motorway. The reserve width is sufficient to accommodate a landscape band between the carriageway and the easement boundary which is 25 to 35 metres wide. This landscape treatment would

create a continuous woodland corridor of indigenous trees, shrubs and ground covers which would be effective in screening the visual impact of the roadway and acoustic barriers from the adjacent properties.

As discussed in Section 11.5.6, acoustic barriers and mounding in the height range of 4-5 metres would be required over most of the alignment. Barriers of such heights would not only reduce noise levels at the adjoining properties, but also visually screen the traffic and eliminate direct headlight glare from the carriageway onto the residences. The visual impact of the barriers themselves is an important design issue.

Mitigative measures

The ease with which visual exposure can be minimised, or eliminated, is greatly dependant upon the width of the area available for landscaping between the carriageway and the adjacent properties. The wider the available landscape 'verge', the greater the opportunity to implement mitigative solutions, such as earth mounding, and screen planting. Acoustic walls would also serve the purpose of reducing visual exposure. The landscape, in turn, reduces the impact of the walls themselves.

The relatively wide motorway easement creates the opportunity for extensive stretches of revegetation all along the motorway, between the carriageway and the adjacent properties. Building on the existing vegetation structure of the surrounding areas, and any of the retained trees, the new landscape development of the motorway would be distinctly 'natural'. This landscape structure would emphasise the endemic species, and associations. The result would be a natural bushland corridor of trees, shrubs and grasses. This design approach is consistent with that implemented on the existing M5.

The survey of existing flora has identified the species of trees, shrubs and ground covers which currently exist along the corridor. These species, and others which are known to naturally associate with them, would form the basis for the landscaping.

Seed from the existing plants, and nearby bushland plants, would be collected prior to the construction of the motorway. These seeds would be used to propagate the container grown plant stocks of trees for the revegetation of the corridor, as well as being used in the hydrospraying of shrubs and ground covers. Native grasses for revegetation would be harvested elsewhere. All other seed stock would be harvested from the corridor itself, or from suitable bushland within the district.

Disposal of existing timber would be by woodchipping to be re-used in the final landscaping works. No timber would be burnt or buried.

Major landscape design opportunities exist at many locations for the development of 'special' landscape responses. These include the treatment of land parcels associated with street closures, stormwater management basins, intersections and overpasses. For instance, mini-parks at road closures, the introduction of accent planting at road junctions ('gateways'), and even the inclusion of flowering trees, exotics and other non-endemic plant species could be considered at isolated, but important locations along the motorway. In this way, some reference to the cultural landscape can be included in the overall scheme.

'Gateways' would be achieved by pursuing a totally integrated design solution which considers the full range of issues, including the engineering components such as batters, walls, bridges, etc., as well as feature landscape plantings. Major opportunities for appropriate gateway designs occur at the intersection of the motorway with Moorebank Avenue, Hume Highway at Liverpool, and Camden Valley Way.

Other design opportunities arise at the overpass at Kurrajong Road and the future road to be located between Cedar and Beech Roads. Road closures at Verbeena Avenue, Box Road, and Beech Road are suitable locations for mini-parks.

Figures 11.4.1 and 11.4.2 show the gateways and design opportunities for the proposed Casula Link.

An important aspect of the visual design of the corridor is the form of the earthworks. The road would

blend into the landscape better when the new roadside landform is more responsive to the existing one. Where possible, slopes of cut and fill batters should be variable, and formed to smoothly blend into the surrounding topography. The width of the easement is sufficient to enable the careful shaping of mounds and batters to ensure a more natural appearance than that resulting from the adoption of a minimum earthworks engineering approach.

Maximum batter slopes of 1:2 should only be used in the deepest cuts and fills, with gentle transitions to average slopes in the order of 1:3 to 1:6 wherever possible. Such flatter slopes, together with rounded crowns and batter toes, not only reduce the visual impact of the road from the viewpoint of drivers and residents, but also provides a superior foundation for the growth of plant material. Flatter slopes reduce soil losses due to erosion, and increase water retention in the planted areas. Water availability is the limiting factor in all roadside bush regeneration projects.

Acoustic walls, by virtue of their height and extent, would be the single most dominant visual elements in the roadscape. As such, their detailed design should be undertaken so as to minimise their negative visual impact on the environment, from the perspective of the adjoining properties and road users alike.

Barrier heights are largely determined as a result of scientific study, as well as the local community's wishes in respect of the relative acceptability of noise levels versus wall size. Once the required top level of the barrier has been established, variable alignments, materials and colour schemes, together with combinations of earthforms and walls could all serve to reduce the visual impact of such walls. With skilful design, these walls could even prove to be a visual asset. The masterplan illustrates general arrangements which would serve to reduce the visual impact of the acoustic walls.

Wherever possible earth mounding, surmounted by low walls, has been proposed for the acoustic barriers. In cut batters, low fill or 'on grade' situations, it is possible to provide earth mounds with a 2 metre tall wall on top, in order to achieve the required acoustic barrier height. The mound could be easily landscaped, and the low wall more easily constructed, and camouflaged, than a taller wall.

In locations where the carriageway would be constructed on fill, at a level significantly above the existing ground, it would not be economically feasible to construct a composite barrier of mounding and low walls. Full height walls would provide the acoustic protection, with a minimum landscape width of 4 metres on the carriageway side, and a topsoiled batter slope not exceeding 1:3 on the residential side providing a workable environment to achieve substantial landscape development on both sides of the wall.

Functionally, the landscape would provide visual screening of the carriageway, traffic, and acoustic barriers, from the adjoining residences.

For those on the motorway, the landscape would present a natural and informal setting through which to travel. The landscape itself would not be a feature, but an incidental backdrop to the journey itself. As discussed above, landscape 'gateways' would provide special landscape treatment at intersections and overpasses which would heighten the visual experience for the road user.

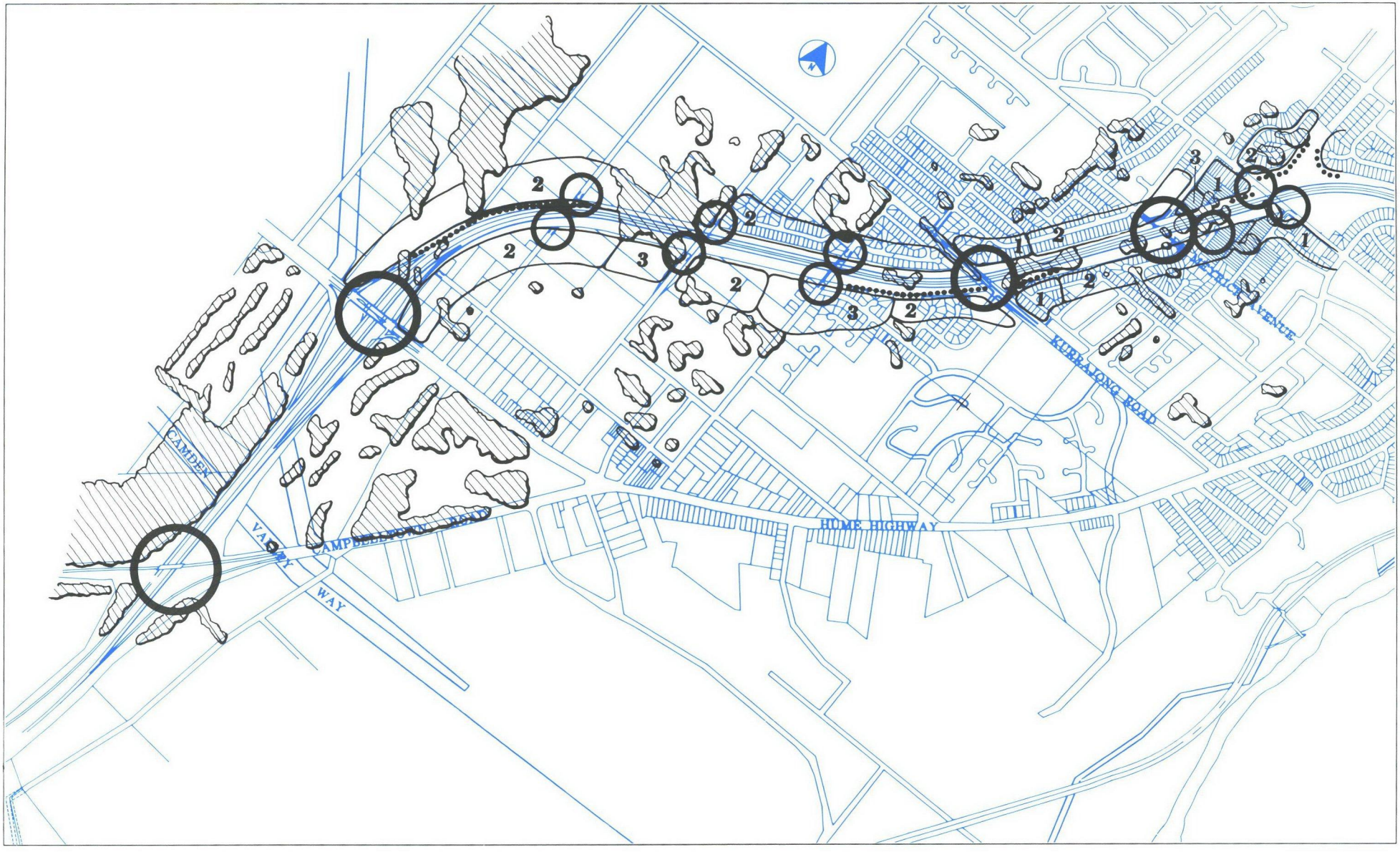
The masterplan and accompanying cross section sketches illustrate the integrated landscape design solution for the proposed motorway, addressing the issues arising from the landscape and visual assessment for the proposed motorway scheme.

Refer to Figures 9.1.1-9.1.15 for the motorway alignment and landscaping details.

Implementation strategy

The landscape design intent for the proposed M5 Casula Link is to eventually establish a natural looking open woodland landscape, characterised by local native species. This includes taller growing trees, with an understorey of small trees, shrubs and native grasses.

The first stage in this process would involve preparation and grooming of the batters and slopes with site



Design Opportunity 'Gateway'

Design Opportunity

Existing Trees

Area of Potential Headlight Glare

1 Area of Low Visual Exposure

2 Area of High Visual Exposure

3 Area of Very High Visual Exposure

0 5 10 20 30

Kilometres

FIGURE 11.4.1

LANDSCAPE AND VISUAL ASSESSMENT

Source: Tract Consultants 1992

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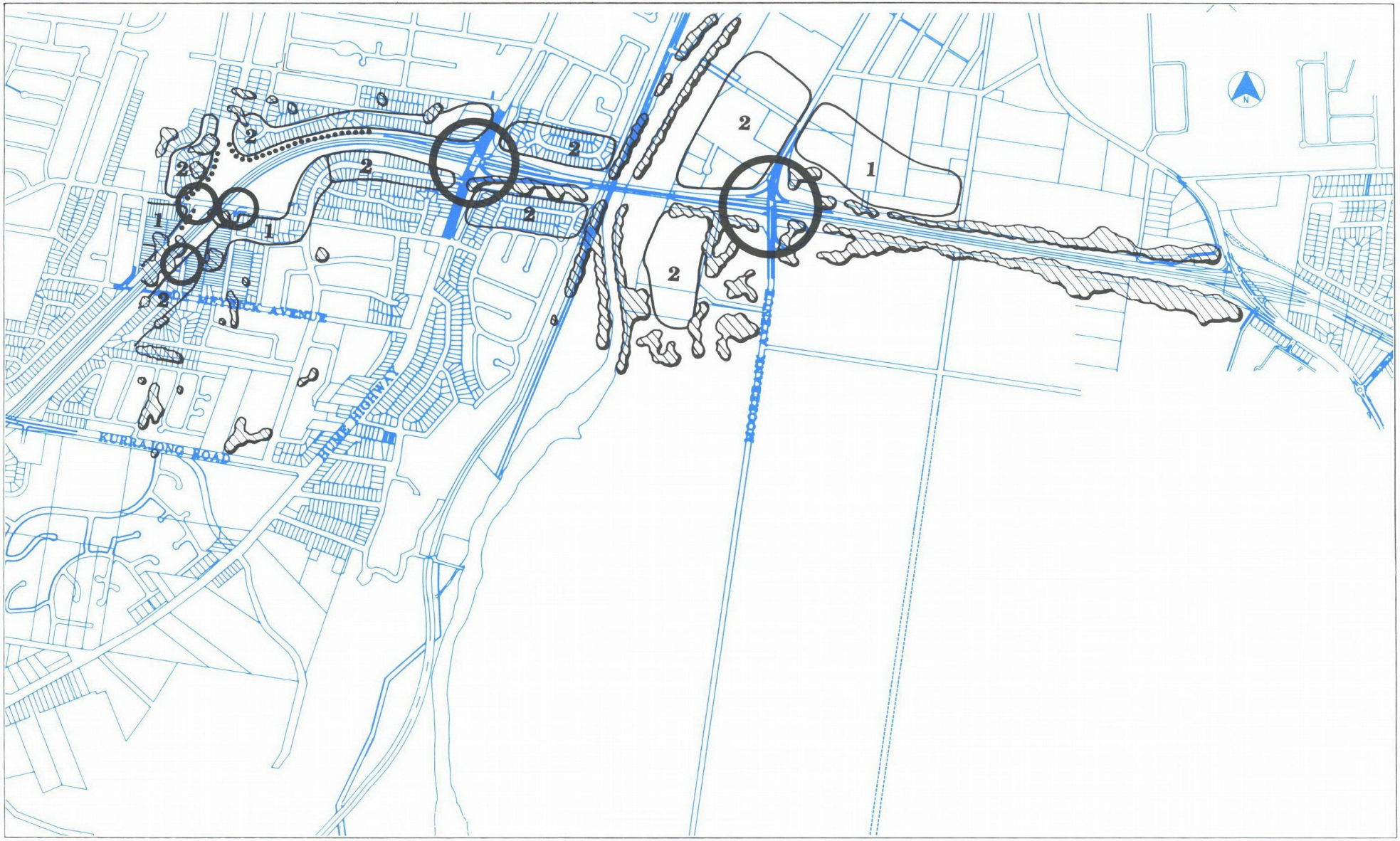


Design Opportunity 'Gateway'

Design Opportunity

Existing Trees

Area of Potential Headlight Glare

1 Area of Low Visual Exposure

2 Area of High Visual Exposure

3 Area of Very High Visual Exposure

0 5 10 20 30

Kilometres

FIGURE 11.4.2

LANDSCAPE AND VISUAL ASSESSMENT

Source: Tract Consultants 1992

N

topsoil, and then hydromulching the entire area with seed mixes of cereal cover crops and quick growing native shrub species. These species provide early protection for the soil and soften the visual impact of the construction earthworks. Within this protective cover would be planted the future 'structure trees'. This structure planting would be established from container grown plants.

Experience shows that the optimum size plant for mass planting of indigenous species is that which is supplied in 'grow tubes' (75mm dia. x 120mm long) and 2.5 litre containers. Such plants are of the order of 200-500mm tall, with a well established root mass. Once planted, such specimens achieve superior growth and survival rates than those which are planted out from larger sized containers. Mass planting of larger sized container growth specimens is considered impractical due to the long lead time required to produce plants, greatly increased production and handling costs, and the characteristic 'dormancy' which is generally observed in the 2-3 years following planting. The difference in initial visual impact would be marginal, due to the spindly appearance of stock grown in close rows in nurseries. Over the initial 2-3 years, the performance of the smaller container size is generally far superior.

However at 'gateway' locations and other isolated areas it may be possible to plant larger specimens (say, 1m high) to provide a somewhat greater initial effect at important locations.

It is important to recognise that the establishment of the new landscape would take a number of years. The initial visual softening would occur over the first year or so, with the eventual structure becoming apparent after three years or more. The pace at which the landscape establishes is entirely dependent on the prevailing environmental conditions. Favourable seasonal rainfall is the critical factor.

The landscape development would be achieved through the following steps:

1. Surface Preparation: The eradication of all weeds from the existing topsoil layer, together with the proper stripping, stockpiling and respreading and ongoing protection and management of the existing topsoil would be the basis for all further progress in the evolution of the new landscape. Full details of specifications, work program, and Quality Assurance procedures for this element would need to be prepared and implemented prior to commencement of on-site construction.

During the detailed design and construction process, emphasis must be placed on the retention of as many existing trees as possible. Approved protective fencing, sensitive earthworks design, and strict site management practices would need to be included in the scope of works. Those trees which would be removed to enable the construction of the carriageways would be shredded, mulched and carefully stockpiled for future use on site, as mulch for new planting beds. This mulch can form a valuable seed source for the eventual regeneration of the landscape.

2. Hydrospraying of shrubs, groundcovers, and temporary cover crops: The harvesting, storage and preparation of seed from endemic and other approved species must be completed prior to the commencement of any on-site construction. This would ensure the availability of adequate supplies of suitable species from the outset, enabling early placement of plant seeds with all erosion control activities. Adequate water supplies must be provided, to ensure the germination and initial establishment of the sprayed seeds, in the absence of natural rainfall. Once the initial cover has been established, the landscape would be expected to develop without artificial irrigation. Natural rainfall is the long-term source of all water for the landscape. Additional seed supplies would be reserved for the purpose of retreatment of any areas which fail to establish. Continued weed control would be mandatory, to promote the establishment of the seeded native plants.

3. Planting trees and other container grown stock: The

proper nursery production of large quantities of high quality plant stock necessitates careful planning of the total construction process to ensure that the plants are available, and to a high standard, at the time of planting. Plants require water and ongoing maintenance and monitoring. Dead plants would be replaced within one month.

All landscapes need ongoing maintenance and management. The M5 landscape would be no different to any other, except that as it would intended to establish a 'natural' woodland environment, its development would rely on the evolution of the native plant associations, over time.

The structure planting (container grown trees) would be visible as small green leafy objects from the moment they are planted, people would recognise them and understand that they have been planted for the purpose of creating a woodland.

The hydrosprayed landscape would take much longer to materialise. Initially, the cover crops would appear as tall (600mm+ or -), open grassy crops e.g. like a sparse crop of oats or wheat. At the end of the growing season, these cover crops would 'die', leaving a thatch mulch on the ground. Within this thatch, some of the early emerging acacias would start to germinate and even emerge. Nothing much would be very visible in the first 12-18 months... what would really be happening would be that the seeds would be germinating, seedlings would be emerging and eventually a succession of the other plants would materialise.

This process is proven, and has been successfully employed on the broadscale landscape development of roadscapes, for example the F3 (Sydney - Newcastle Freeway) and the Hume Highway south of Berrima.

The M5 motorway landscape development proposal aims to emulate the 'natural' bush regeneration process. The soil treatments, hydrospraying, and ongoing maintenance are the mechanisms necessary in this totally disturbed environment in order to have any chance that the 'natural' process would work.

The other big factor in the process would be **water.** The natural system relies on an adequate supply of water (rain) to ensure the emergence and robust development of the native seeds and seedlings. The M5 motorway 'natural' system would be no different. The rate, and extent to which the landscape evolves would be dependent on the prevailing environmental conditions. In the event that drought conditions are experienced in the formative months and years, resulting in sparse development of the landscape, then the maintenance program should follow up with work to replant and reseed when the (cyclic) weather conditions are more favourable.

Plant species

An overall open woodland appearance would be achieved along the corridor, with additional zones of dense planting to screen residences from the roadworks, traffic, and to reduce headlight glare. Isolated ornamental planting is appropriate at some locations. The masterplan, and cross sections illustrate the landscape earthworks and planting proposals which have been developed in response to the visual and landscape assessment of the motorway scheme.

The detailed design phase would refine the actual combinations and locations of species, as well as introduce other appropriate ones.

The following list includes all the plant species which should be considered for inclusion in the landscape development of the corridor.

Landscaping, noise barriers and mounding along the wide easement between the roadway and adjacent properties would be used to reduce traffic noise and screen buildings from headlight glare and visual exposure.

The height and alignment of roads that pass over the motorway would be designed to minimise the visual intrusion on adjacent homes.

Loss of natural setting and open space

The reservation is sufficiently wide to allow extensive replanting along the

11.2 PLANT DETAILS

Western Sydney Woodland Species		
Tree species include:	*Eucalyptus eugenioides* *Eucalyptus fibrosa* *Eucalyptus tereticornis* *Eucalyptus moluccana*	
In the wetland areas:	*Eucalyptus amplifolia* *Casuarina glauca* *Melaleuca decora*	
Shrub species:	*Acacia parramattensis* *Acacia decurrens* *Acacia falcata* *Bursaria spinosa*	
Other Regional Species		
Trees:	*Eucalyptus crebra* *Eucalyptus bauerana* *Eucalyptus maculata* *Eucalyptus sideroxylon* *Eucalyptus globoidea*	*Allocasuarina littoralis* *Melaleuca linariifolia* *Melaleuca styphelioides*
Shrubs:	*Acacia implexa* *Banksia spinulosa* *Daviesia ulicifolia* *Hakea sericea* *Indigofera australis* *Kunzea capitata*	*Melaleuca ericifolia nana* *Melaleuca nodosa* *Oleria microphylla* *Pultenaea villosa* *Leucopogon juniperimus*
Ground Covers:	*Hardenbergia violacea* *Lomandra longifolia/multiflora* *Dianella revoluta*	
Native Grasses:	*Themeda triandra* *Danthonia setacea* *Bothriochloa macra* *Dichanthium sericeum*	(Kangaroo Grass) (Wallaby Grass) (Red-leg Grass) (Silky Bluegrass)
Cover Crops:	Japanese millet Rye corn	
Ornamental Plants	*Araucaria sp* *Ficus hillii* *Jacaranda mimosifolia* *Livistona australis*	*Populus sp.* *Quercus sp.* *Schinus sp.* *Tristania sp.*

Source: Mt. King Ecological Surveys, 1992

edge of the new roadways. The new landscape could build on the existing planting and any retained trees, to produce an apparently natural corridor of trees, shrubs and grasses.

Subject to negotiation between Council and the RTA, opportunities to provide new neighbourhood open spaces might be exploited at a number of locations along the reservation, notably:

- At pedestrian crossings over the corridor,

- Where some existing local roads would be closed at the corridor

- By exploiting pockets of residue open space between the surrounding development and the corridor.

The opportunity exists to provide a pedestrian and cycleway network linking these neighbourhood open spaces.

11.4.4 Design Opportunities for the Hume Highway if the M5 Casula Link is Built

If the M5 Casula Link is built, the function of the Hume Highway would change and traffic on the Highway would decrease. Lessened traffic on the Hume Highway would provide a number of opportunities for beneficial redevelopment as shown on Figure 11.4.3. These might include:

- Creation of a series of strongly marked intersections providing easily identified access to the residential areas, schools and shopping centres on either side of the road.

- Strengthening the identity of groups of shops along the Highway and providing more parking for them.

- Improvements for local residents with regard to noise and privacy. This could be done through the provision of trees, shrubs and mounding in selected areas where there are wide roadside verges such as between Reilly and Marsh Streets, and along the outer edge of the road curvature where visual exposure is high.

- Linking the various developments along the Highway through new landscaping to reduce the present haphazard appearance of the entrance to Liverpool and metropolitan Sydney.

These opportunities are matters for the local community and Council to develop.

11.4.5 Conclusion

The implementation and ongoing management of the landscape scheme as proposed by the masterplan, and this report, would, in the longer term, result in the establishment of an indigenous woodland throughout the entire length of the motorway corridor. This woodland would replace a largely disturbed existing grassland. Ongoing and effective maintenance and management of this community landscape would be assured by the provisions of this EIS and subsequent management plans.

The landscape plantings, earthworks and acoustic barriers would ensure the visual separation of the traffic from residential areas. The landscape masterplan includes recommendations for supplementary landscape improvements beyond the motorway easement.

11.5 TRAFFIC NOISE

11.5.1 EIS Approach

The evaluation approach adopted for this EIS is based on:

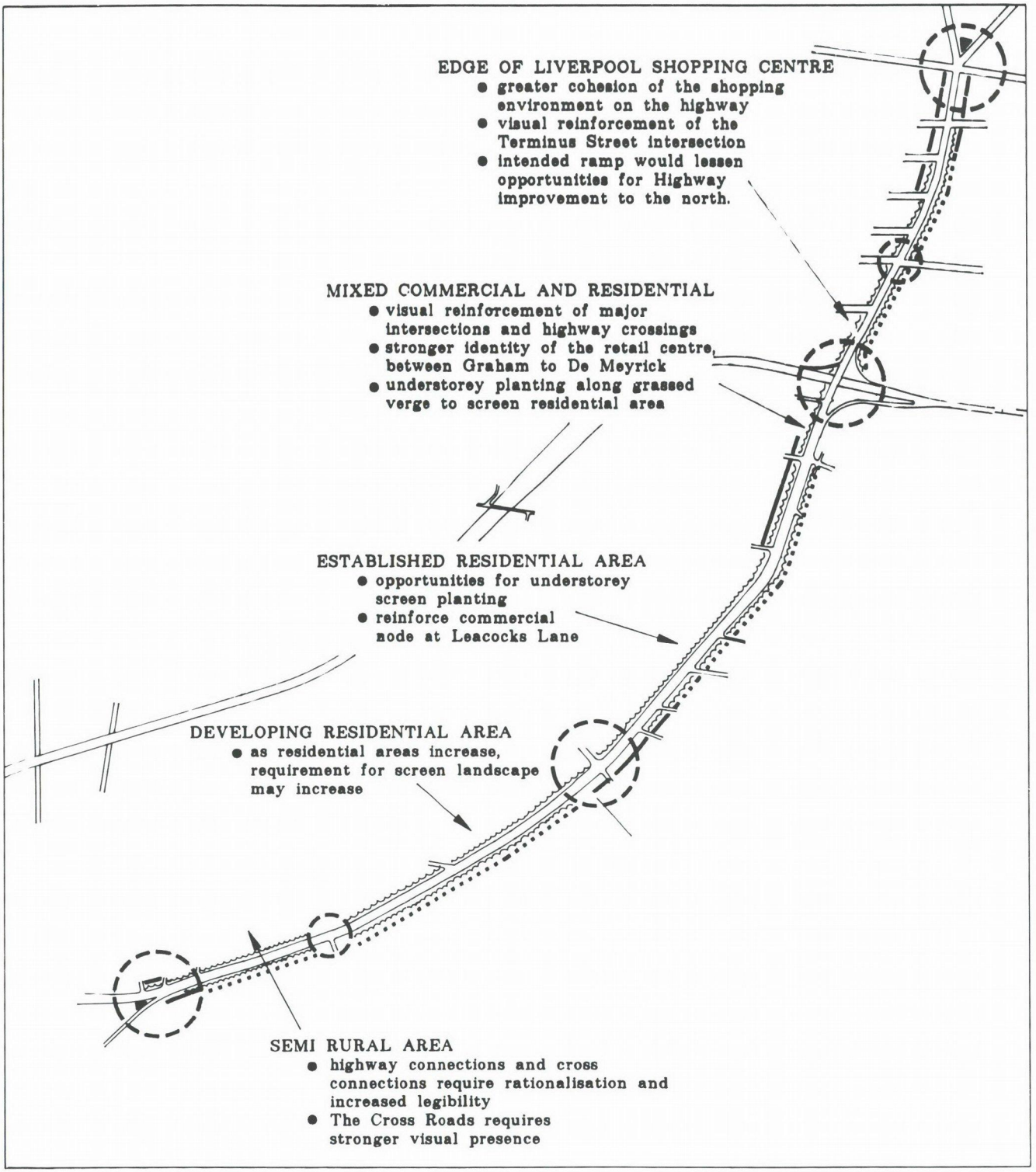
- Measuring the existing noise environment.

- Determining environmental goals (or standards) specific to this project against which the impacts would be measured.

- Analysis of the noise impacts of the proposal.

- Identification of mitigative measures required to meet the environmental goals established for the corridor.

To ensure that the roads and traffic system is developed and managed in harmony with the natural and social environment while meeting community needs for the movement of people and goods.



Major Intersection

Secondary Intersection

Avenue Planting

Understorey Screen Landscape

Commercial Centres

0 0.2 0.4 0.6

Kilometres

FIGURE 11.4.3

HUME HIGHWAY URBAN DESIGN OPPORTUNITIES

Source: MSJ KEYS YOUNG 1992

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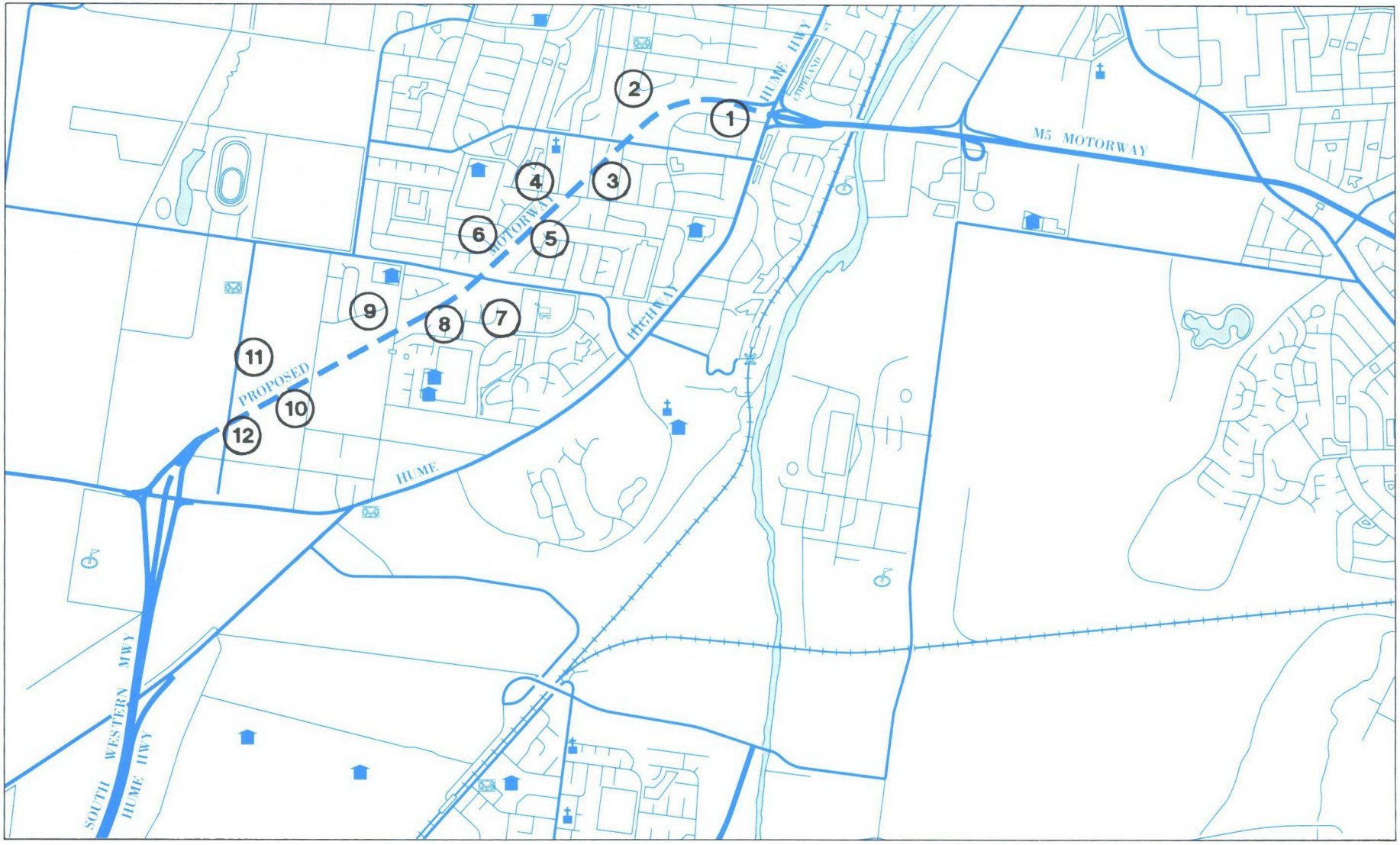


② Noise Monitoring Site

0 0.5 1.0
Kilometres

FIGURE 11.5
LOCATION OF NOISE MONITORING SITES

Source: Louis Challis & Assoc. 1990

N

TABLE 11.3 EXISTING NOISE LEVELS

	Pos No.	00.00 to 0600 hrs				0700 to 1800 hrs				0600 to 2400 hrs	ZONE
		Leq	L1	L10	L90	Leq	L1	L10	L90	L10, 18hr	
Min	1	51.2	58.3	53.9	46.7	55.6	65.1	59.0	50.1	58.1	R3/R4
Max		57.4	62.4	59.7	54.7	62.4	73.5	65.1	56.3	64.0	
Min	2	40.5	44.7	42.2	38.7	49.8	58.4	52.7	42.0	51.7	R2
Max		49.1	61.8	52.0	42.9	53.5	62.6	56.5	50.2	54.9	
Min	3	50.6	58.0	53.3	47.2	58.7	67.6	62.4	52.4	61.5	R2/R3
Max		60.1	72.0	63.6	49.6	64.8	76.0	68.2	55.4	66.4	
Min	4	46.9	56.2	49.8	41.4	57.1	66.9	60.8	48.6	59.4	R2/R3
Max		52.3	64.6	55.4	43.2	62.3	74.2	66.0	50.6	64.4	
Min	5	37.3	42.4	39.5	34.8	47.5	57.0	51.0	41.0	49.9	R1/R2
Max		39.2	43.5	40.6	37.7	60.8	75.6	62.1	44.0	60.0	
Min	6	47.7	63.0	46.1	41.3	57.5	69.0	60.6	48.9	59.2	R2/R3
Max		54.9	67.3	58.5	42.3	63.6	70.5	66.2	59.2	64.3	
Min	7	45.2	50.5	47.2	42.9	52.0	60.9	55.6	46.1	54.8	R2/R3
Max		47.6	56.0	49.9	44.6	60.0	69.0	63.1	54.2	61.1	
Min	8	Six	Hours	of	Data	Only					-
Max											
Min	9	48.8	57.9	50.3	44.8	56.6	68.0	59.2	48.6	59.0	R2/R3
Max		51.6	59.3	52.6	49.7	64.6	72.1	67.8	58.5	66.0	
Min	10	49.6	59.5	54.0	40.0	61.2	71.1	65.3	48.5	64.7	R2/R3
Max		52.0	64.0	55.9	42.1	63.5	75.2	66.8	49.9	66.0	
Min	11	45.9	56.4	47.6	41.6	53.8	62.5	57.3	46.5	56.5	R2/R3
Max		53.2	63.7	54.1	50.0	56.5	69.8	58.3	50.7	57.5	
Min	12	47.4	55.5	48.1	39.6	48.7	59.6	50.7	41.1	50.6	R1
Max											
Min	1-12	37.3	42.4	39.5	34.8	47.5	57.0	50.7	41.0	49.9	
Max		60.1	72.0	63.6	54.7	64.8	76.0	68.2	59.2	66.4	

Source: Challis and Associates, 1992

• Summary evaluation of the effects of the proposed motorway with the mitigative measures in place.

11.5.2 Existing Conditions

The environmental noise measurements, supplemented by a concurrent meteorological study, were simultaneously recorded at twelve locations adjacent to the proposed Casula Link during the period 29 June to 6 July 1992. The locations are shown on Figure 11.5.

To gauge the condition of the existing noise environment, the twelve measurement locations were classified according to the Australian Standard 1055.2 - 1989 standard categories. This Australian community noise standard defines background noise criteria by neighbourhood descriptions and the estimated average background A-weighted sound levels which constitute acceptable levels for each zone category ("R zones"). Relevant categories for the corridor (as shown below in Table 11.3) are defined as follows:

R2 : Areas with low density transportation

R3 : Areas with medium density transportation or some commerce or industry

R4 : Areas with some commerce or industry or with dense transportation

R5 : Areas in commercial districts or bordering industrial districts or with very dense transportation.

The two other noise zones R1 and R6, were not applicable to this study.

Noise levels

Data collected at the twelve monitoring locations indicates that the existing day time and night time noise levels within the corridor are comparatively low at the majority of the monitoring locations, but not where the measurement locations are relatively close to the through traffic routes such as Beech, Cedar, Box and Kurrajong Roads.

Night-time noise levels during the critical period 1.00 am to 4.00 am are noticeably low compared with other residential areas in close proximity to a major highway.

The data recorded at Position No. 13 (during a previous study by Challis and Associates) indicated extremely high noise levels at all times of the day and night. The noise levels conformed to a noise area category of 'R5/R6' and, based on the increases in traffic since they were recorded in 1988, those levels are now likely to be marginally higher, and equally unacceptable.

The levels provide an indication of noise characteristic of this traffic stream in the absence of roadside barriers and other related engineering noise control procedures.

The zoning classification applicable to the sections of Casula, Prestons and Lurnea in which the recent noise monitoring program was conducted ranged between extremely quiet or a noise zoning classification of 'R1/R2' (for Position No. 5), through to noise zoning classifications of 'R3/R4' (for Position No. 1). The remaining 10 monitoring locations fall between these two general classifications on the basis of their daytime background noise levels. The night-time average background noise level at a few of the monitoring locations warrant a lower noise zoning classification than would be applied solely on the basis of the day time criteria nominated by AS1055.2.

It is apparent that the design criteria for the corridor should be reviewed both on the basis of the standard RTA criteria and on the basis of the comparatively quiet background noise levels, and the comparably low mean peak noise levels, over a relatively large area within the corridor.

11.5.3 Assessment Criteria

State policies

In September 1992 the RTA released its Interim Traffic Noise Policy. The Policy recognises that traffic noise is one of the costs associated with the development of NSW's transport network. The Policy is included in full in Appendix D.

The Interim Policy reflects the environmental goal in the RTA's Corporate Plan:

The Interim Policy extends the challenge of addressing traffic noise by inviting a co-operative effort between government agencies, the community and industry for:

- Assessing and managing noise impacts of road related projects.
- Reducing noise at the vehicle source.
- Land use planning, site design and building layout.
- Managing traffic.

The key policies relevant to this EIS include:

- *The RTA will endeavour to meet the Noise Level Objectives (in Table 11.4) for new RTA road and bridge projects subject to the practicality and cost-effectiveness of the measures taken.*
- *Appropriate measures will be implemented to reduce noise levels ... when:*

  - The appropriate Noise Level Objective ... has been exceeded; and

  - There is an appreciable noise increase (i.e. greater than 3 dBA); and

  - ...such measures ... are cost-effective and practical.
- *During the design phase of a proposed new road ... if noise barriers are considered appropriate, then the height and location of these will be established after community consultation ...*
- *... remedial measures will be undertaken if, within one year after the opening, the actual noise levels exceed those predicted in the EIS for the end of the 10th year after opening ...*
- *The RTA will request local councils to use planning instruments and development approvals to ensure that proposed developments next to main roads are not 'sensitive' to traffic noise.*
- *The RTA will ... investigate the practicality of appropriate night-time truck controls for local residential streets.*

Recognising that further noise reduction can be achieved by suitable site design and building layout, the Policy assumes that property owners will take appropriate action in new buildings to minimise the impact of road traffic noise.

Notes to Table 11.4

(1) The Noise Level Objective is the noise level which the RTA aims to achieve. It generally reflects the noise from the ultimate predicted traffic flow.

(2) An assessment site is a location being investigated to determine possible noise impacts. The noise level at the site is determined at the 'Assessment Point'. For all assessment sites other than classrooms in educational institutions, the assessment point is outside a building at 1.2 metres above ground or floor level (whichever is the appropriate),

11.4 RTA TRAFFIC NOISE LEVEL OBJECTIVES FOR NEW ROAD AND BRIDGE PROJECTS

Assessment site category (2)	Descriptor	Base Objective (dBA)	Lower noise areas	Higher noise areas
Residential buildings	"Daytime" (24 hour) Leq (24 hour)	60	Ambient (3) + 12 dBA	Ambient +3 dBA
	Night-time (10pm-6am) Leq (8 hour)	55	Ambient + 12 dBA	Ambient +3 dBA
Classrooms	8.30am-3.30pm Leq (1 hour) internal	45 (4)	45	Ambient +3 dBA

Source: RTA, 1992

and one metre from the ground floor window or door which is most exposed to traffic noise.

(3) The ambient noise level is the total noise at the assessment site excluding extraneous noises, such as cicadas, before the road project commences.

(4) This is the Noise Level Objective used by the Public Works Department for inside classrooms. The RTA will endeavour to meet this objective in those cases where a classroom has been located, designed and constructed to meet 45 dBA.

The current EPA view on traffic noise is that an environmental goal based on the human response to traffic noise is needed to ensure a meaningful and accepted fundamental reference point. A description based on L_{eq} (equivalent noise level) and a modification for heavy-vehicle noise is considered by the EPA to provide a good correlation with annoyance. The description is called Traffic Noise Level (TNL).

One important limitation attached to the use of TNL as an environmental goal is that it does not take account of the cost nor the technical constraints of achieving that level. The second regime of levels called design goals, reflect the offsets needed to account for cost and technical limitations.

The EPA considers that design goals and conditions for their use need to be developed so that factors affecting the cost of controls and their technical effectiveness can be addressed consistently.

If during the EIS assessment process relevant state policies are introduced requiring additional mitigation measures above those proposed in the EIS, these would be incorporated by the RTA during the detailed design and implementation phase of the project.

Project-specific criteria

For this evaluation, defined numerical noise criteria appropriate to each R zone, as shown in Table 11.5, have been used as the design goals for the determination of mitigative measures.

In developing the approach for evaluating noise effects in the corridor, the weight needing to be given to the noise assessment criterion applying to the sensitive night time period became apparent. The period between midnight and 6.00 am is important to most of the resident population as the critical period for sleep disturbance. At the majority of residential locations for which the future daytime and night-time noise levels were computed in initial assessments, the night-time criterion became the limiting factor.

For the night-time design goal, $L_{eq,6hr}$ has been adopted as the most valid assessment criterion of sensitivity to night-time environmental amenity.

The reasons for adopting this specific approach for the M5 Casula Link proposal include:

- The residences adjacent to the proposed M5 Casula Link would be potentially exposed to a high proportion of truck traffic during the night time and early morning periods. As a result of this the peak noise generation levels would be very high.

- The adjacent residential premises have maximum occupancy at night time.

- The public is much more sensitive to traffic noise impact when sleeping, and the results of such impact gives rise to a wide range of psychological and potential medically-related problems.

11.5 TRAFFIC NOISE DESIGN GOALS FOR DESIGNATED 'R' ZONES IN 2011

Zone	Day L_{10} (18 hrs)	Night L_{eq} (6 hrs)
R2	60	48
R3	65	52
R4	68	58
R5	68	58
RTA desirable limits	63	55

Source: Challis and Associates, 1992

• It would be inappropriate to adopt design criteria which would result in extremely high nocturnal (peak) noise levels. That is, the adopted criteria and evaluation must respond to the unusual noise component of the expected future traffic on this proposed Link.

11.5.4
Effects of the Proposal

The noise evaluation of the proposal has involved:

• Identification of representative affected residences along both sides of the route.

• Acoustical computer analysis of each representative residence examining incremental heights of roadside barriers until the design goals appropriate to the existing noise environment (Table 11.5) are met.

The evaluation has thus assumed the provision of the mitigative measures as discussed in Section 11.5.6, and has been directed specifically at determining their necessary extent.

Approximately 100 properties that inspection indicated to be either typical or "worst-case for the particular locality were selected for the analysis and the highest exposed window of each was identified as the point to be studied. Traffic volumes and truck numbers at relevant times of the day were derived from forecasts 2011 conditions for use in the noise modelling.

The barrier heights determined in the noise analysis and the corresponding contours of noise exposure along the route for 2011 traffic levels are shown in Figures 11.5.1 to 11.5.13. The contours indicated are for the night time descriptor $L_{eq, 6hr}$ since this was found generally to govern the barriers heights required, but it should be regarded as indicative only.

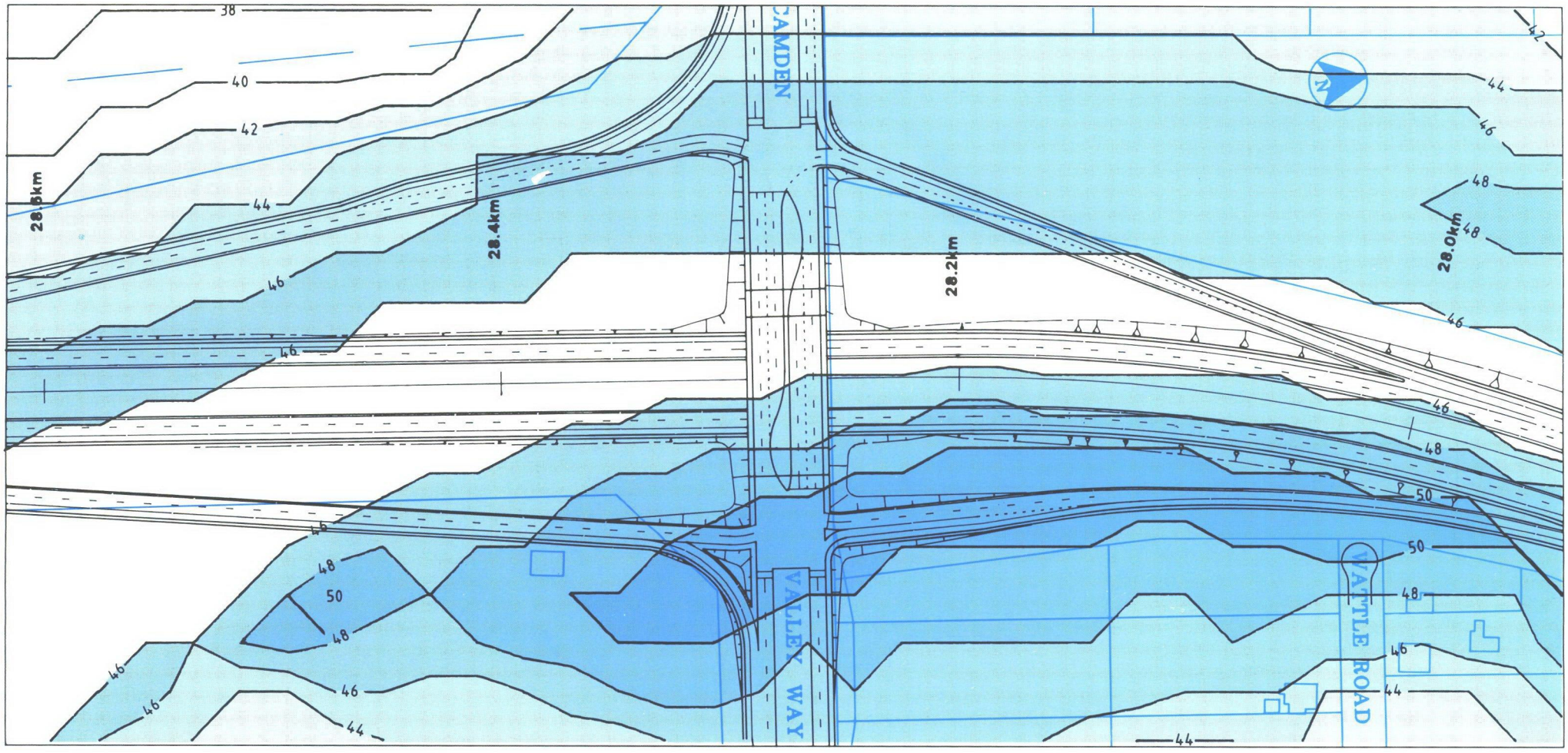
The evaluation was performed on the basis of a motorway cross section having an 8m wide median ultimately between dual 3 lane carriageways. Subsequent refinement of the proposal, however, has reduced the proposed ultimate median width by 5m. This would improve noise levels from those calculated by an estimated 1 db (A) approximately.

11.5.5
Changes in the Noise Levels on other Roads

Construction of the proposal would divert substantial volumes of traffic from other nearby routes; most particularly from the Hume Highway through Casula and to its north and south. It is likely that the long distance truck traffic would be diverted in even greater proportion in view of the linking to the national highway route, and this has been taken into account in the evaluation described in the preceding section. Noise exposure of residences adjoining the Hume Highway and other roads, which do not enjoy the benefits of any current mitigative measures, would accordingly be reduced, and it is likely that the reduction would be substantial in the case of the Highway.

11.5.6
Mitigative Measures

The approach generally adopted to achieve the design goals for traffic noise established in Section 11.5.3 is the provision of noise barriers on the roadway margins. The barriers could take the form of walls, earth mounds or a combination of both, depending on whether the road is in cut or fill, the space available, visual and cost considerations. The noise barriers vary in both height and location along the proposed motorway alignment. The locations and heights of the noise barriers determined for the proposal are shown on Figures 9.1.1 to 9.1.15. Other figures in Section 9 illustrate in cross-section the arrangement of noise barriers at representative locations along the route. On the southern sections of the Link, barriers are not generally included in the proposal because the land is largely not developed. Future residential development in these areas would be required to provide noise mitigation as part of the developments, should the motorway proceed. Figures 11.5.1 - 11.5.4 show the determined roadside barrier heights, based on largely single storey residences set back 40m from the motorway with window heights 3.0m above the ground. (whichever is the appropriate). Other methods discussed later in this section might be adopted, according to the preference of the developers. Comparison with the RTA's traffic noise objectives (as set out in Table 11.4) shows that reductions in height of less than 1m (for barriers less than 3m high) to 2m (for barriers between 5&6m in height) may be achieved.



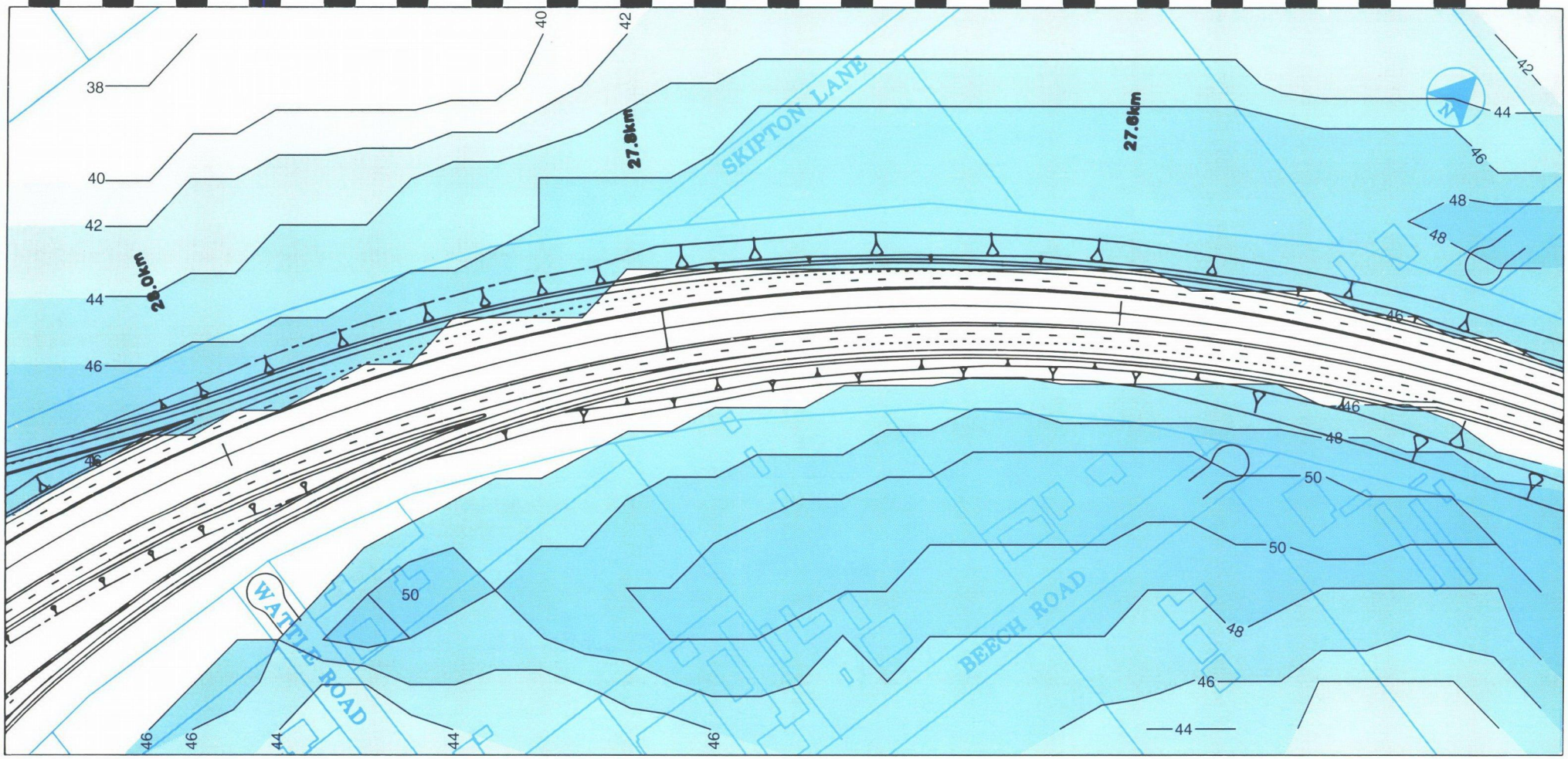
11.28

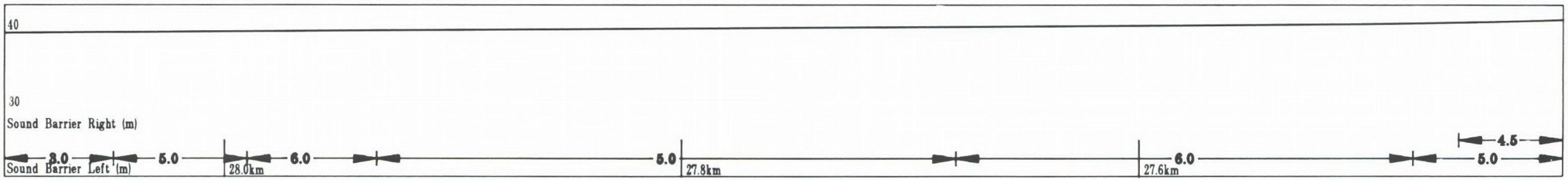
40
30
20
Sound Barrier Right (m)
Sound Barrier Left (m)
28.4km
28.2km
2.0
3.0
5.0
28.0km
6.0
Future Barrier
2.0

48 dBA values are for $L_{Aeq, 6}$ for night time

0 10 20 40 60

Figure 11.5.1
NOISE CONTOURS
MOTORWAY ALIGNMENT
CAMDEN VALLEY WAY
(Sheet 1 of 13)



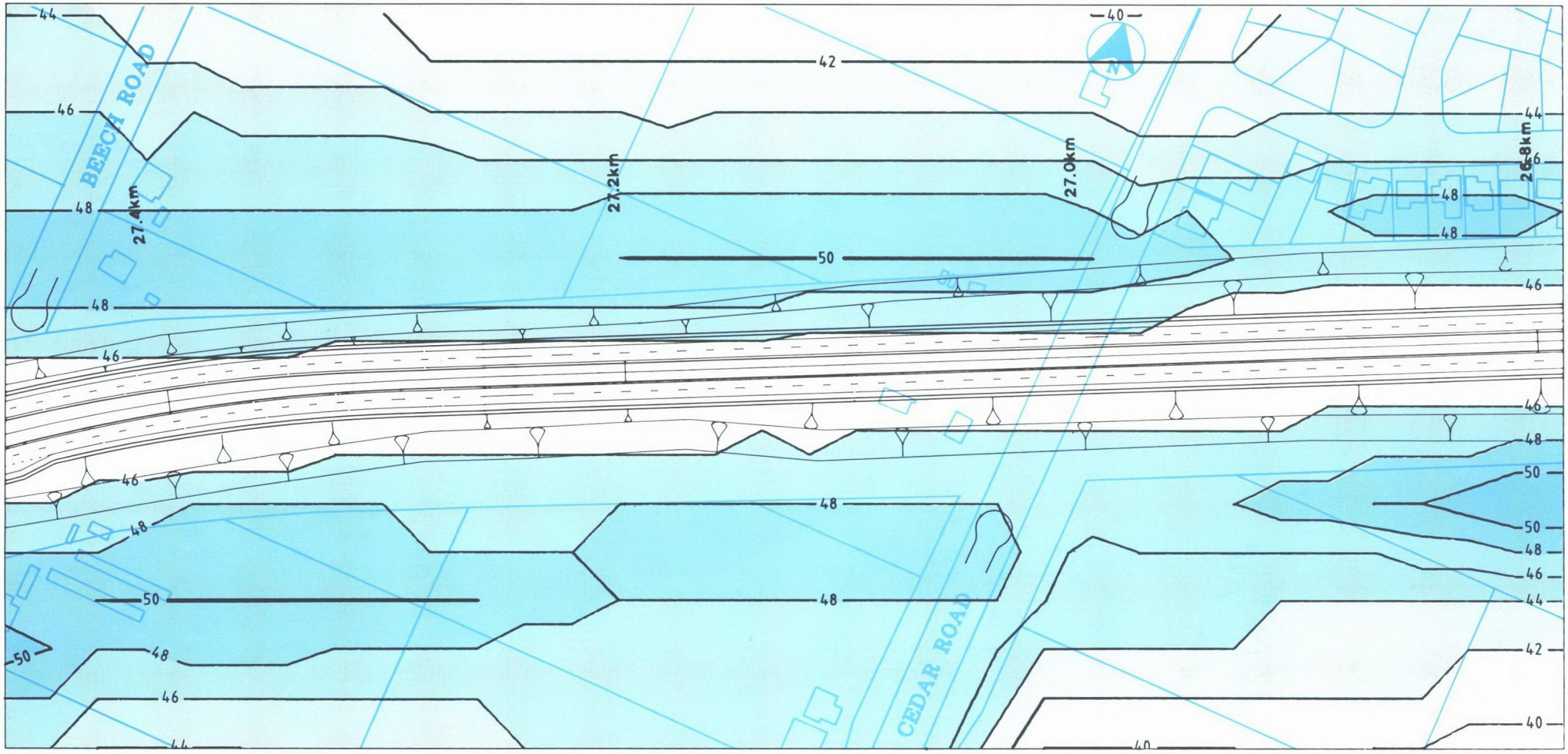


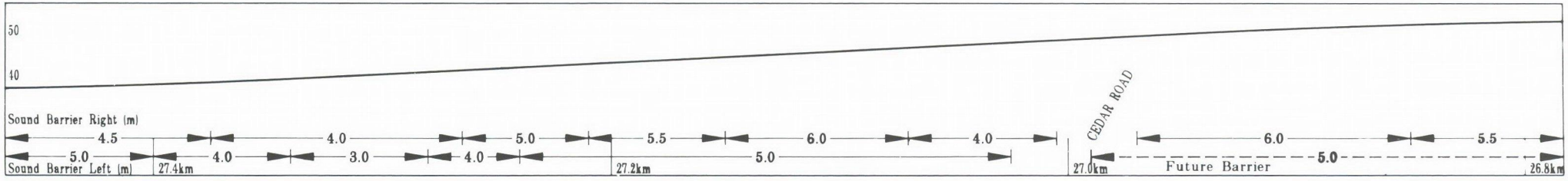
48 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.2
NOISE CONTOUR
MOTORWAY ALIGNMENT
WATTLE ROAD

(Sheet 2 of 13)

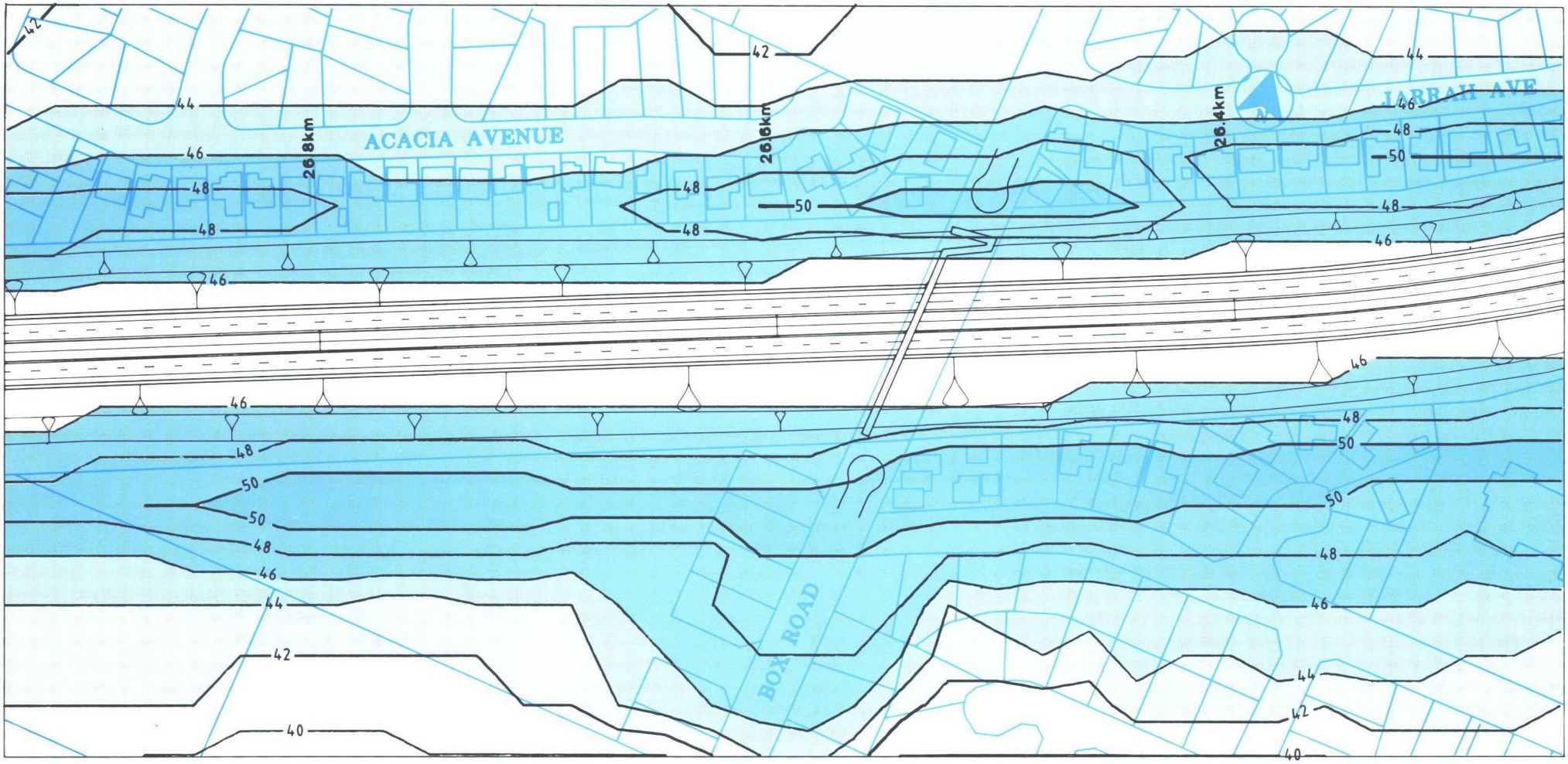


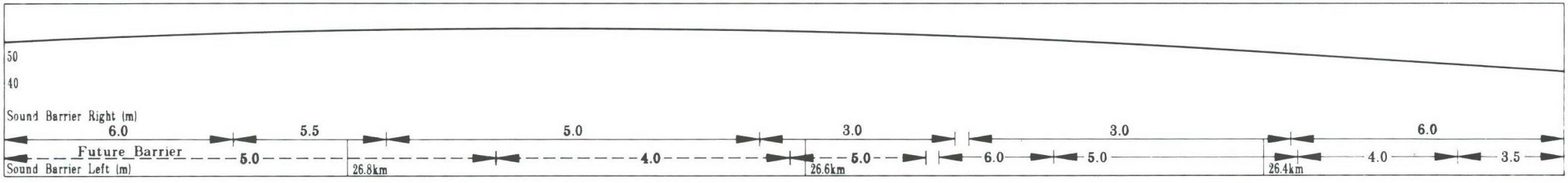


48 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.3
NOISE CONTOURS
MOTORWAY ALIGNMENT
CEDAR ROAD
(Sheet 3 of 13)



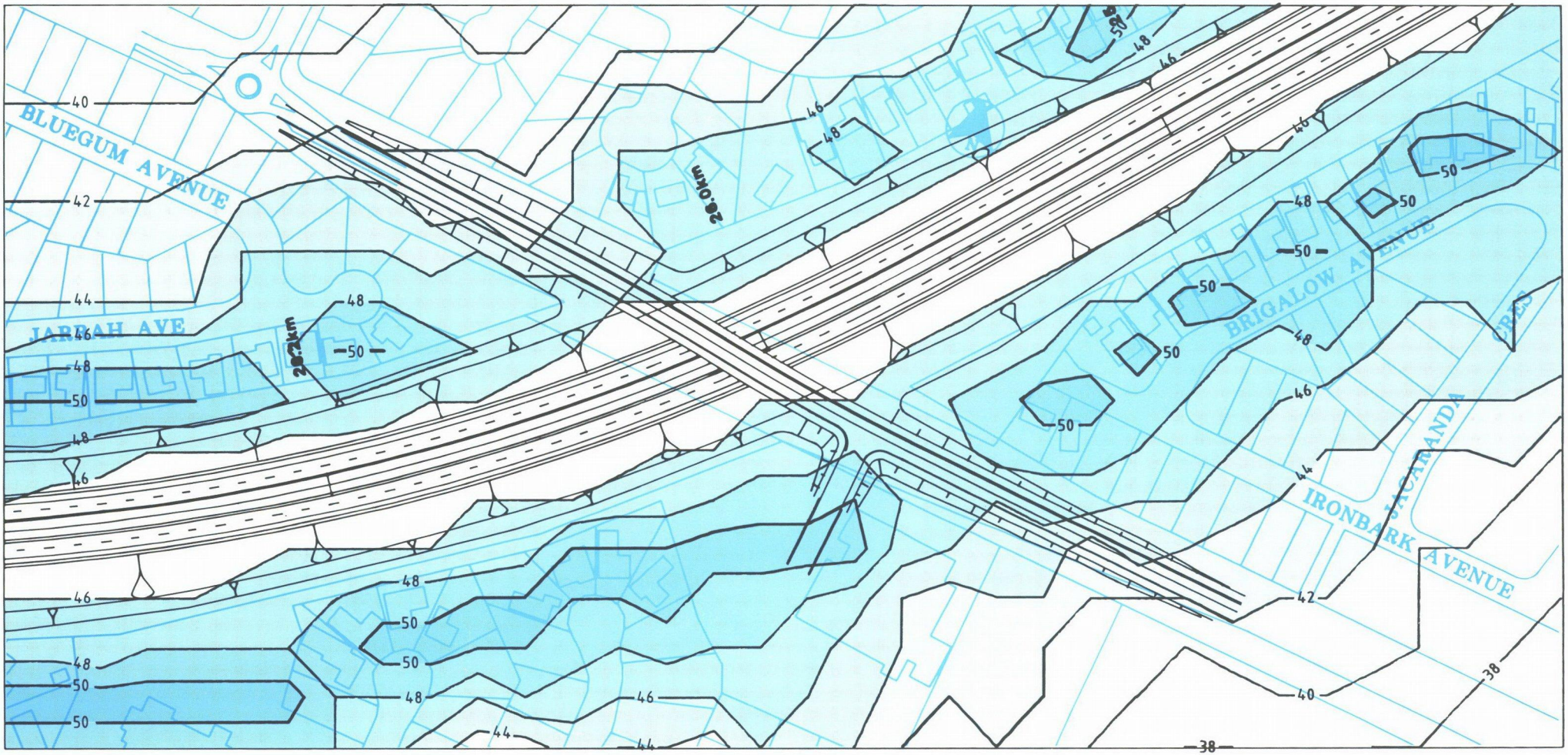


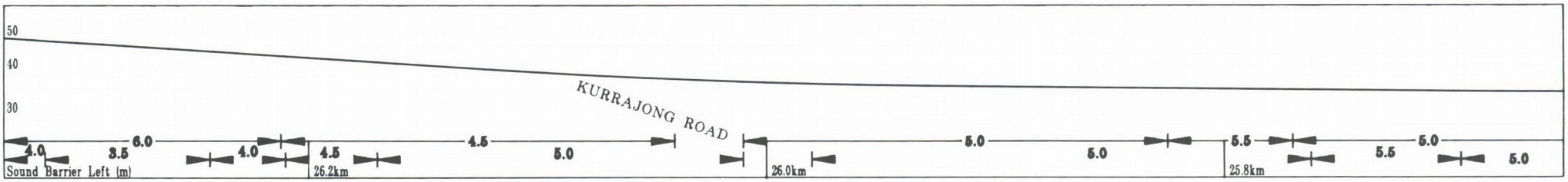
18 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.4
NOISE CONTOURS
MOTORWAY ALIGNMENT
BOX ROAD

(Sheet 4 of 13)



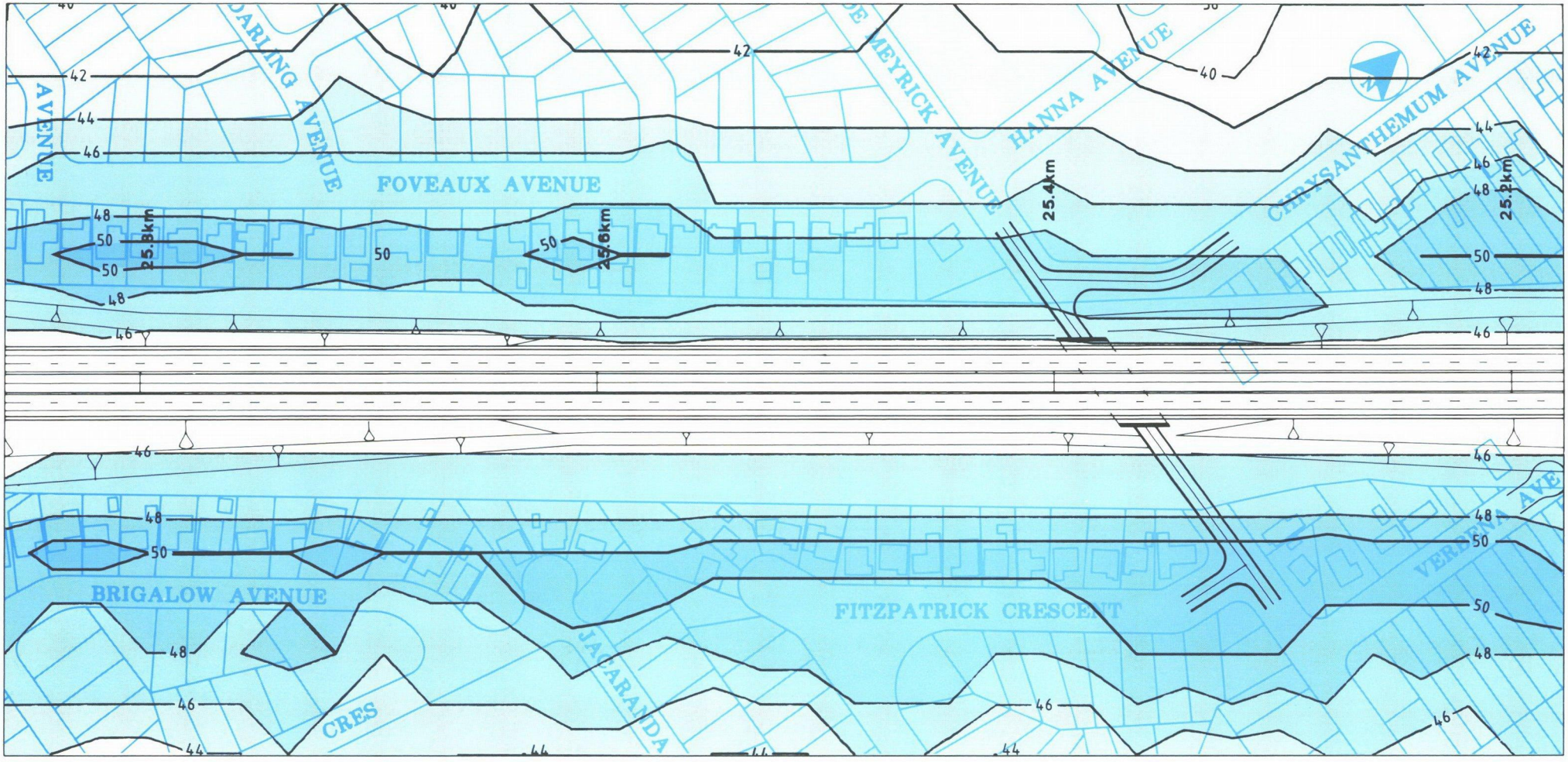


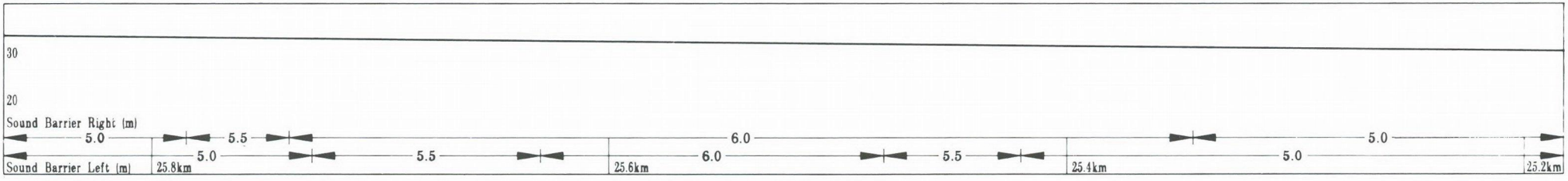
48 dBA values are for $L_{Aeq, 6}$ for night time

0 10 20 40 60

Figure 11.5.5
NOISE CONTOUR
MOTORWAY ALIGNMENT
KURRAJONG ROAD

(Sheet 5 of 13)

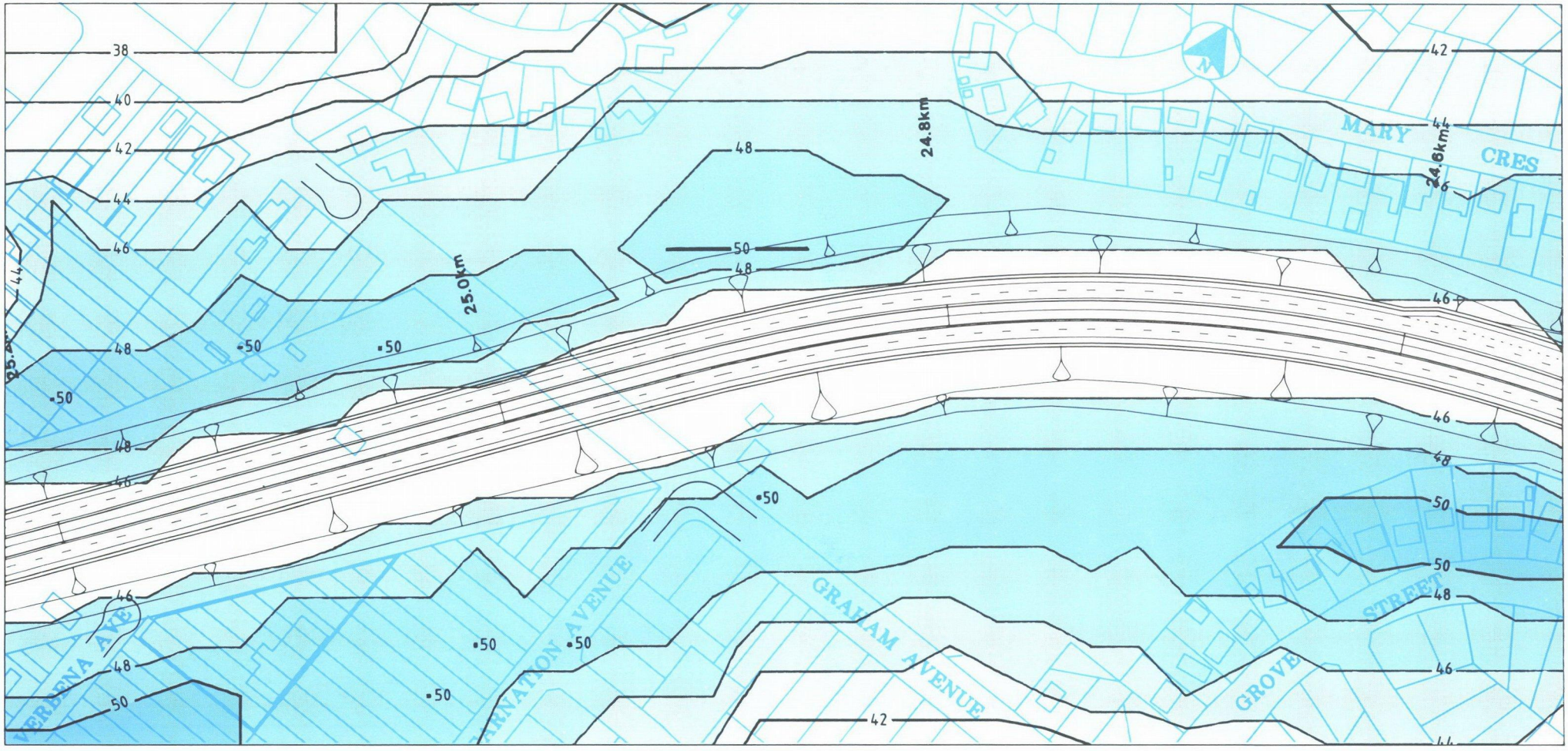


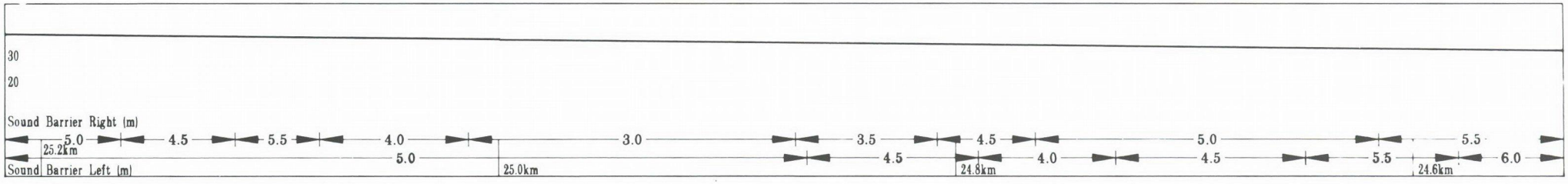


18 dBA values are for $L_{Aeq, 6}$ for night time

0 10 20 40 60

Figure 11.5.6
NOISE CONTOURS
MOTORWAY ALIGNMENT
DE MEYRICK AVENUE (Sheet 6 of 13)





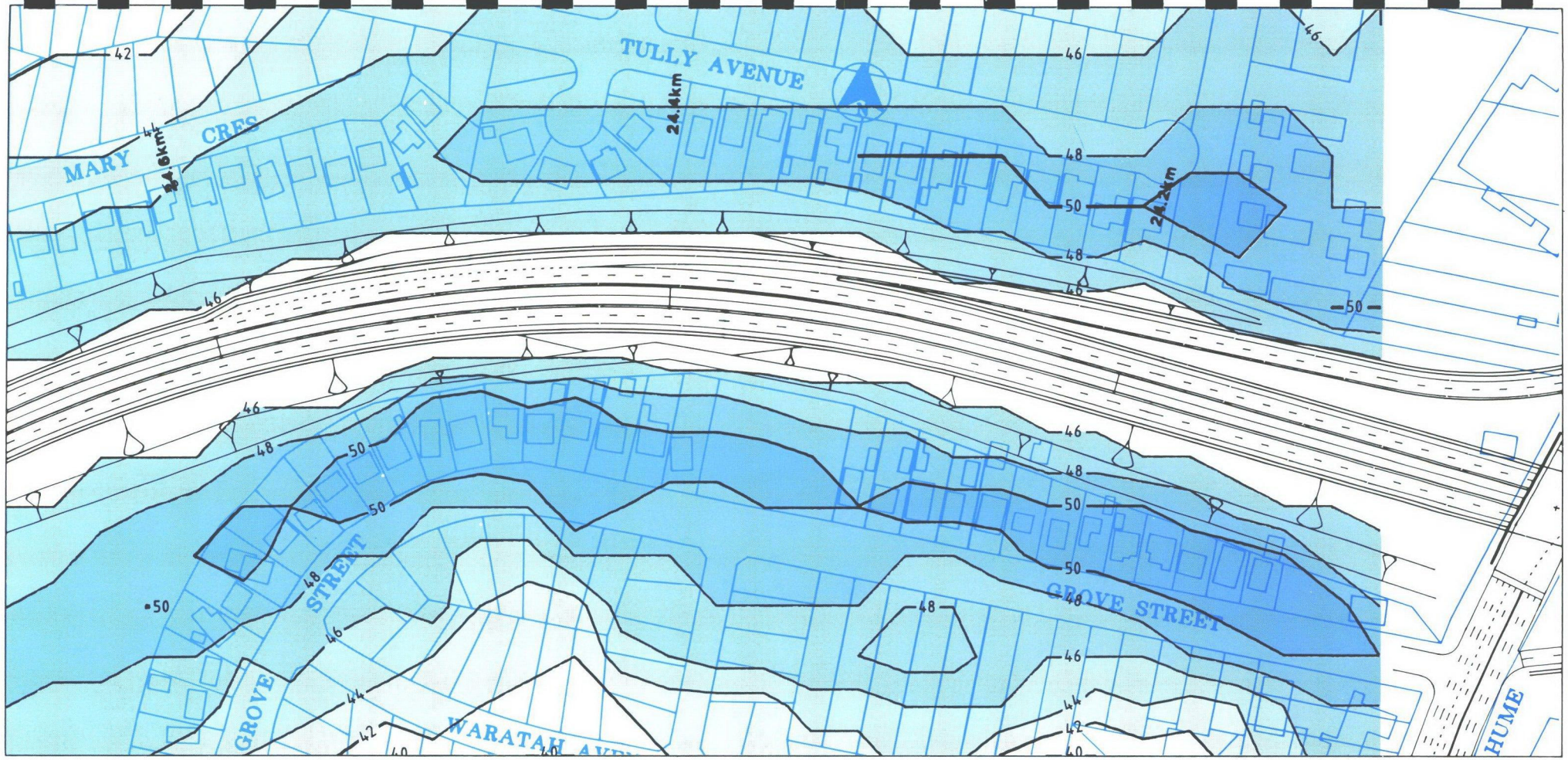
18 dBA values are for $L_{Aeq,\ 6}$ for night time

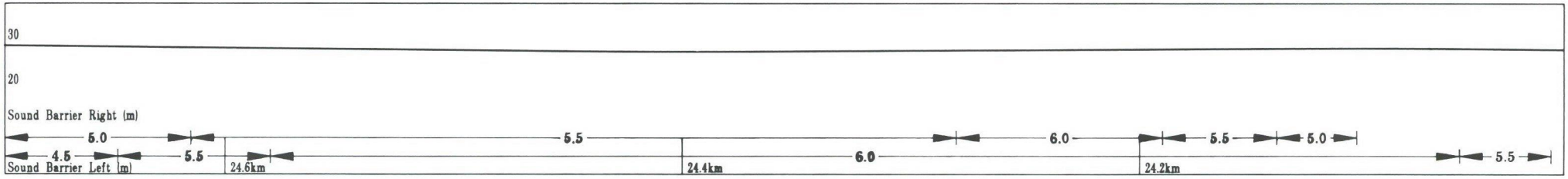
0 10 20 40 60

Figure 11.5.7

NOISE CONTOURS
MOTORWAY ALIGNMENT
GRAHAM AVENUE

(Sheet 7 of 13)

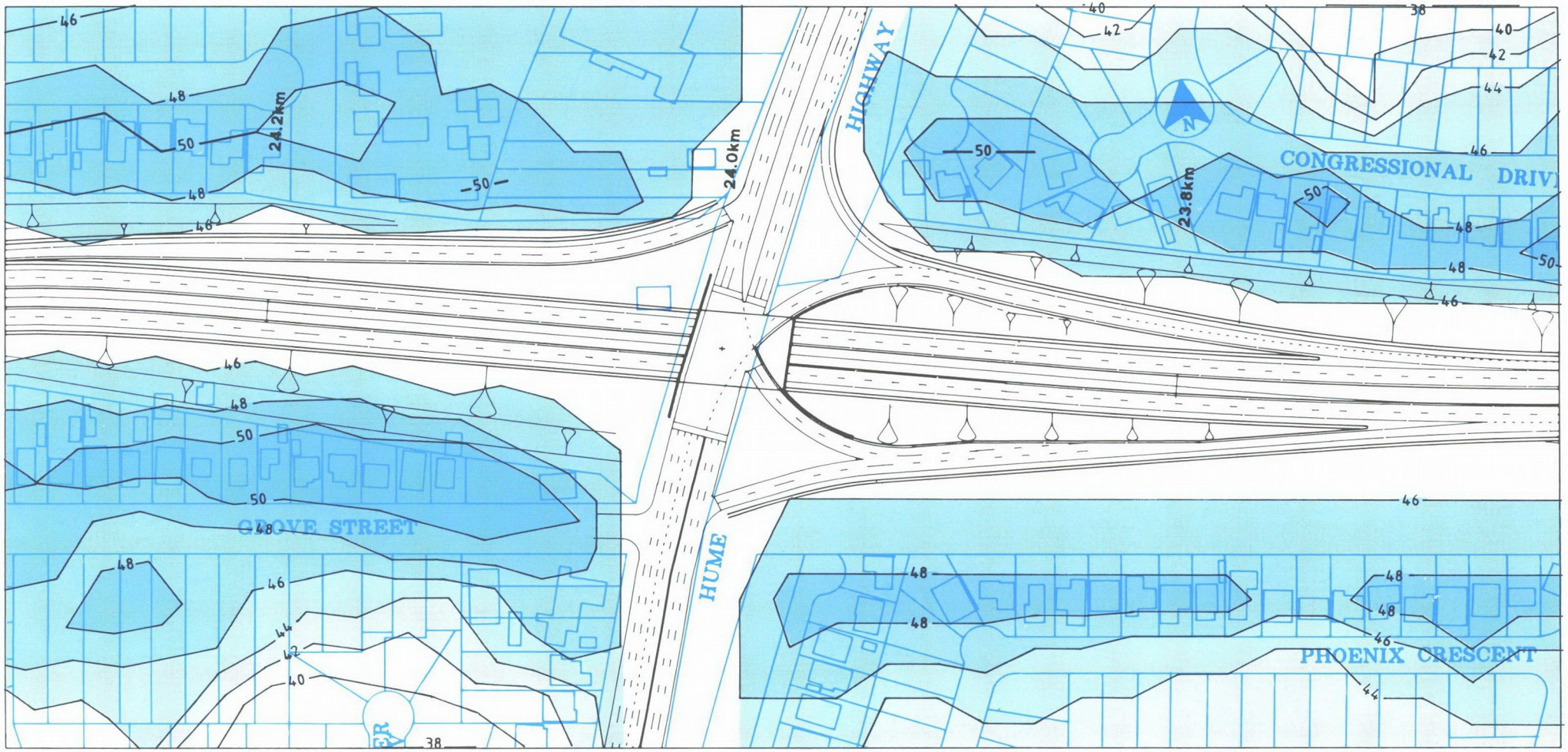


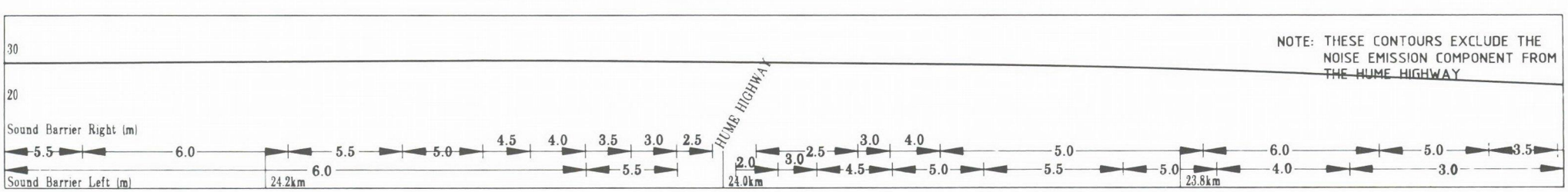


48 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.8
NOISE CONTOUR
MOTORWAY ALIGNMENT
(Sheet 8 of 13)

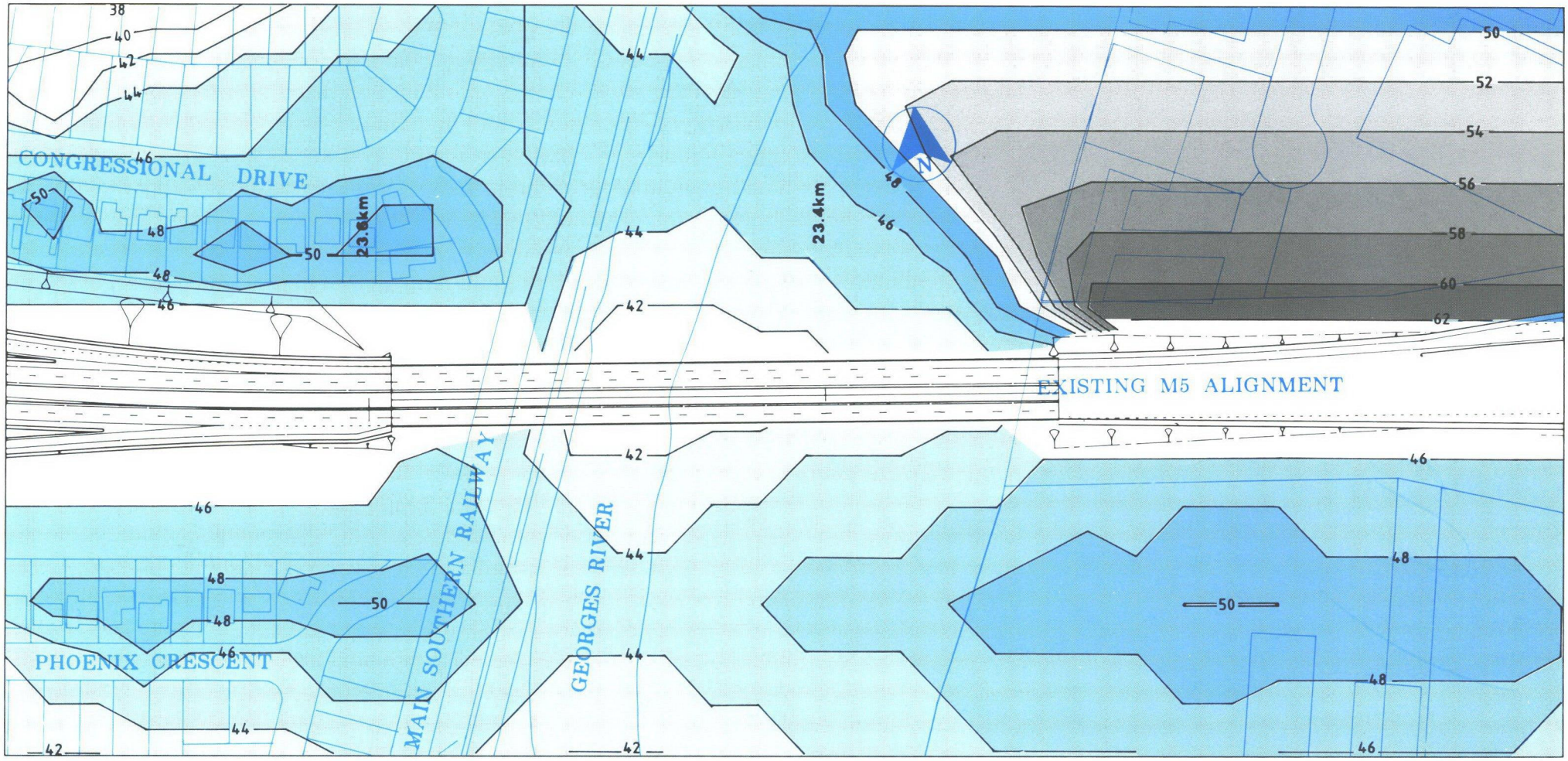


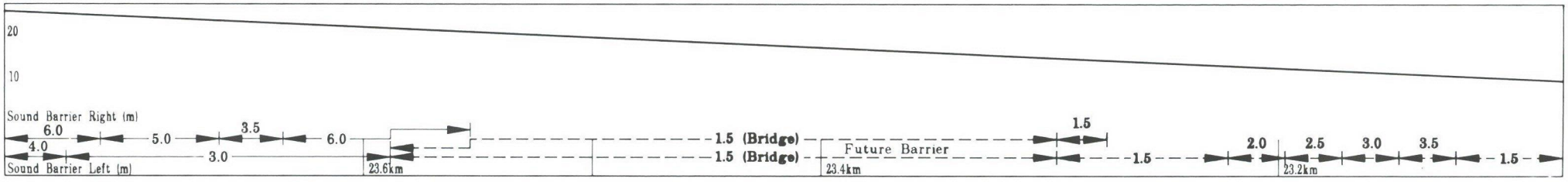


18 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.9
NOISE CONTOURS
MOTORWAY ALIGNMENT
HUME HIGHWAY INTERCHANGE (Sheet 9 of 13)



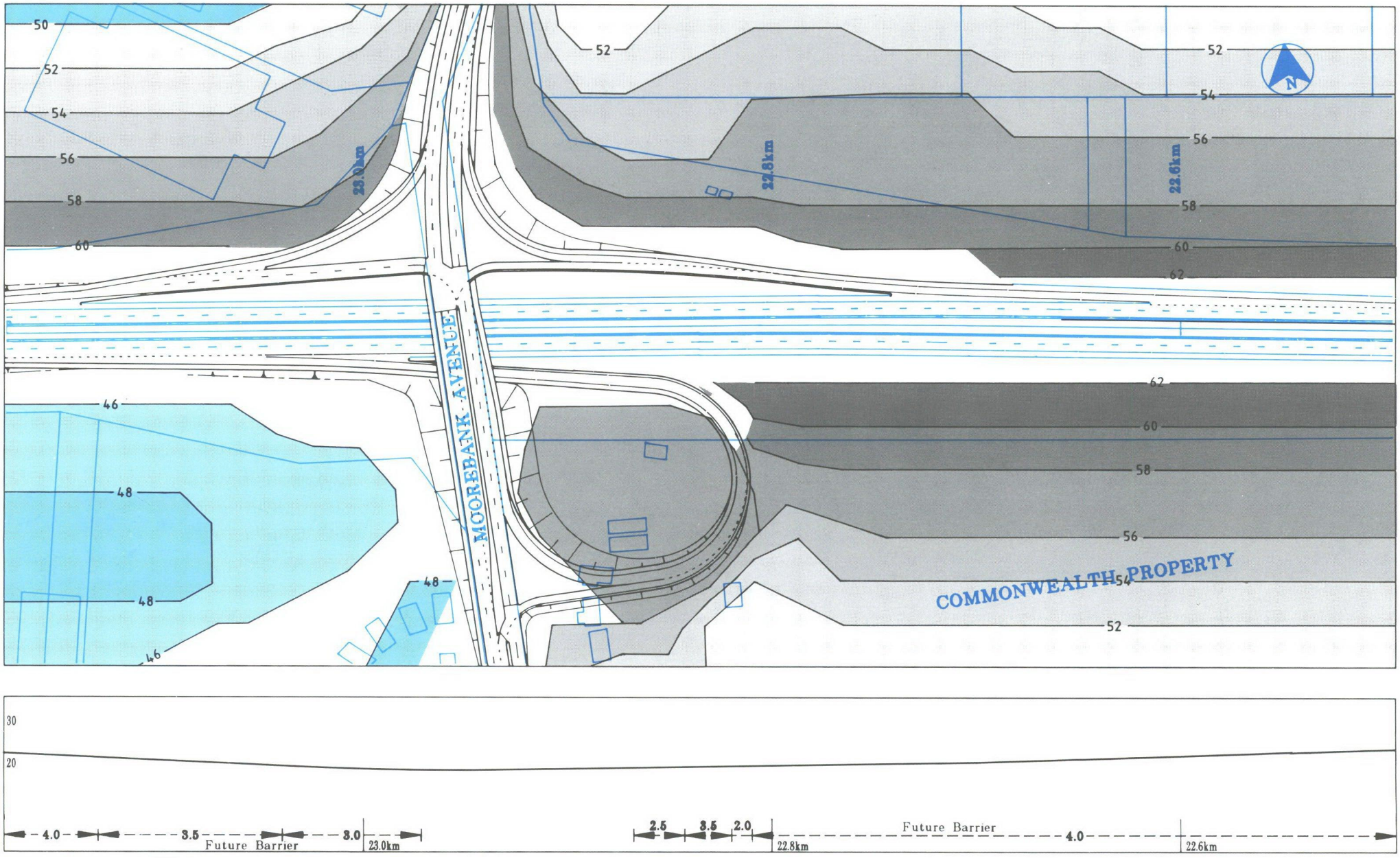


48 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.10
NOISE CONTOURS
MOTORWAY ALIGNMENT
GEORGES RIVER BRIDGE

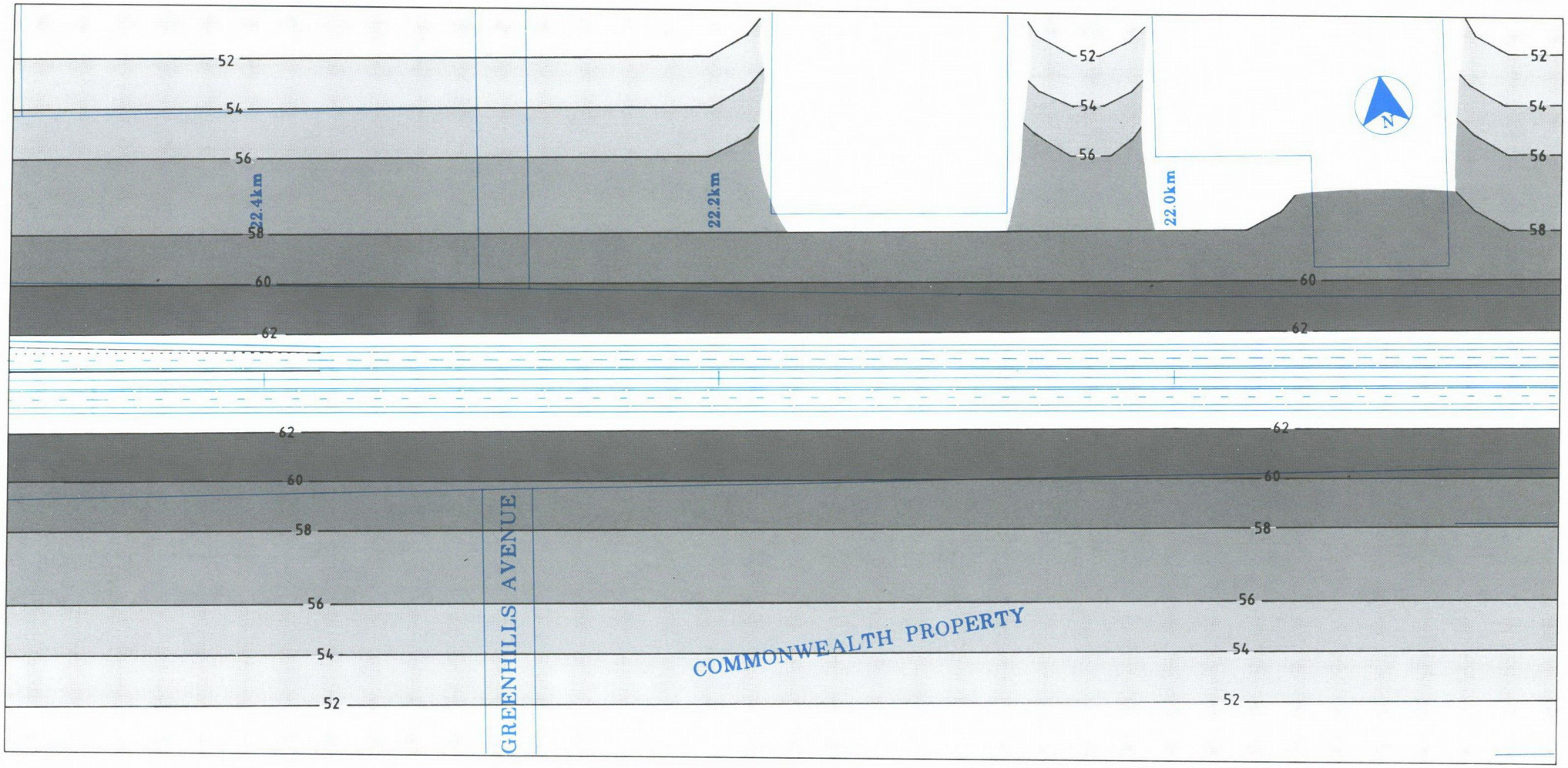
(Sheet 10 of 13)

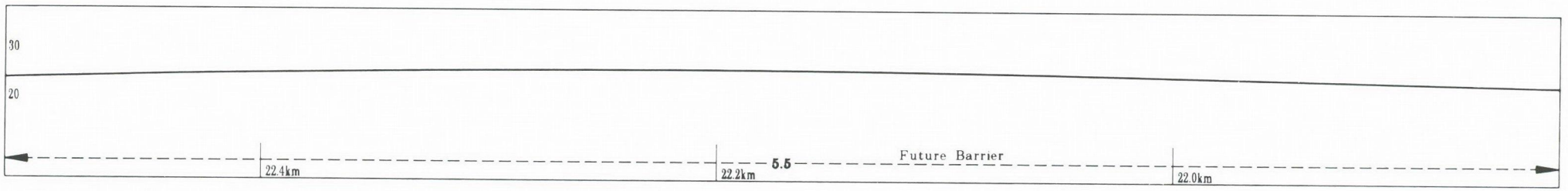


48 dBA values are for $L_{Aeq, 6}$ for night time

0 10 20 40 60

Figure 11.5.11
NOISE CONTOUR
MOTORWAY ALIGNMENT
MOOREBANK AVENUE INTERCHANGE (Sheet 11 of 13)

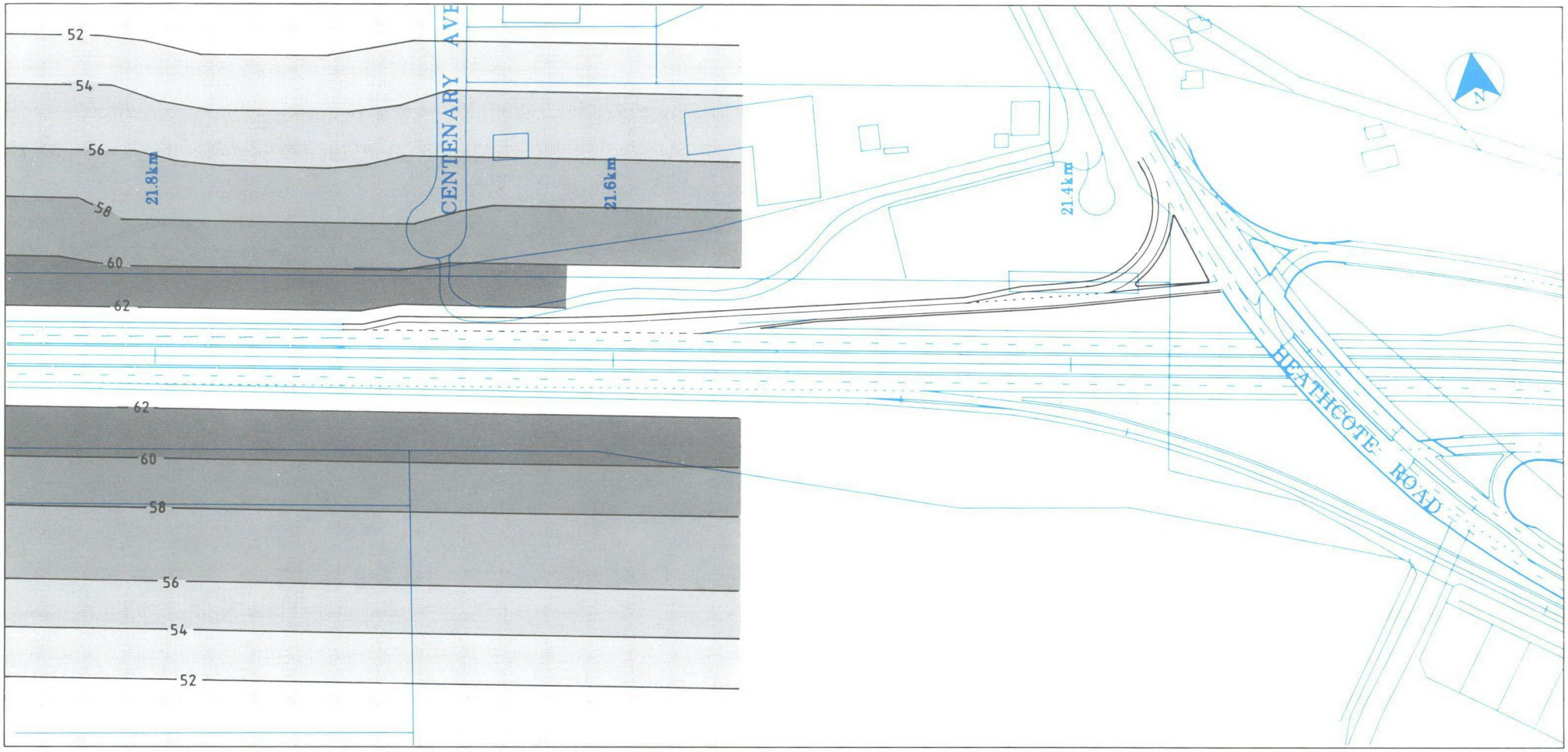


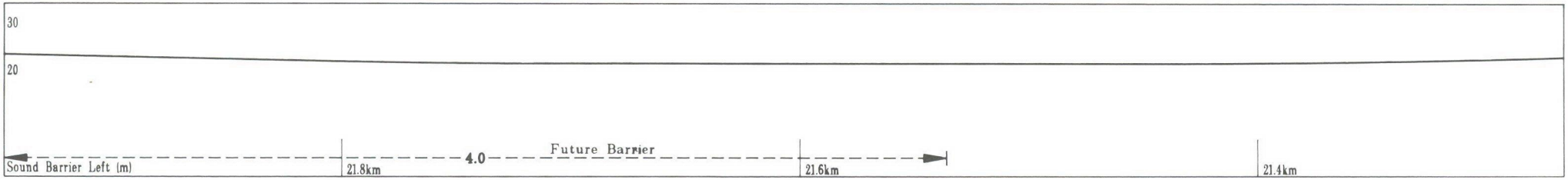


18 dBA values are for $L_{Aeq, 6}$ for night time

0 10 20 40 60

Figure 11.5.12
NOISE CONTOURS
MOTORWAY ALIGNMENT
GREENHILLS AVENUE





48 dBA values are for $L_{Aeq,\ 6}$ for night time

0 10 20 40 60

Figure 11.5.13
NOISE CONTOURS
MOTORWAY ALIGNMENT
HEATHCOTE ROAD
(Sheet 13 of 13)

The recommended noise barrier heights shown on Figures 9.1.1 - 9.1.15 are measured from the road surface level where the road would be on fill, or from the natural surface level where the road would be in cut. They have been determined by acoustical computer analysis of noise exposure of the potentially worst affected adjoining residences. In areas of fill, noise barriers are typically located at the top of the batter directly adjacent to the road edge. In cut areas, the barriers would also be placed at the top of the batter to add further screening to that created by the cut itself.

The cross-section width of the proposed motorway is 32m. As discussed above, however, the noise impact evaluation has been calculated on a wider alignment which is considered to result in a minor overestimate of noise impact.

Earth mounds, as a noise attenuation measure can reduce the visual impact created by vertical sound barriers. They would be typically 2 m or more in height with batter slopes of 2 or 3 horizontally to 1 vertically. Where necessary, a supplementary barrier can be placed at the top of the mound to provide further attenuation. The appearance of the barrier can be further softened by appropriate planting.

The traffic noise analysis in this EIS has been based on the use of conventional non-absorptive noise barriers to achieve appropriate levels of attenuation.

Conventional non-absorptive barriers up to 6 m high are considered technically feasible but very costly. Where barriers over 5 m would be required along the alignment to achieve the design goals the use of absorptive type or curved top barriers may be considered, each of which performs better than conventional barriers for a given height.

Rather than specify the exact design and the aesthetics of the barriers in the EIS, the local community would be consulted on the recommended materials and appearance of the noise barriers. Where the recommended noise barrier heights exceed 3 m local residents would be consulted prior to the decision on the final height to be adopted for construction.

There are alternative methods to control vehicular traffic noise, including quieter vehicles and road surface types (such as open - graded asphalt pavement), restricted use of roadways, absorptive barrier facing materials, property barriers, and a variety of building attenuation methods. These are discussed more fully in the Working Paper *(Challis and Associates, 1992)*.

One of the mitigative measures available if the proposed motorway proceeds would be to impose a vehicular weight limit, say between the hours of midnight and 6.00am, as well as restricting motorcycle use during the period. The adoption of such a stringent approach would enable the reduction of peak noise levels by an increment of the order of 8-10dB(A), and by a margin of L_{eq} of between 3 and 5dB(A). The RTA does not favour such a proposal as it would restrict the use of the new facility by those vehicles and maintain their use on roads which have no noise attenuation facilities.

Another acoustical treatment is to reduce noise levels through facade improvements including (in order of effectiveness) enhancing the facade by double glazing windows, acoustical treatment of external doors and doorways by seals and deadening material, and roof sealing. Improvements in the internal noise level by these measures can be between 10 and 30 decibels, before the forms of construction required become unreasonably complex or expensive.

As a rule the RTA does not treat individual properties but consideration can be given where the specified goals are not achieved.

If the proposal proceeds then the specific locations mentioned in the following discussion should be assessed at the detailed design stage to determine the size and type of barrier and any additional acoustical treatment required:

- The houses lying between Kurrajong Road and Graham Avenue on both sides of the route have been found to require barrier heights ranging between 5m and 6m. The potential visual impact of such barrier heights would necessitate particular care in finalizing design solutions.

- Some two storey houses have been recently been constructed on steeply rising land on the eastern side near Box road. Noise barriers can be provided to meet the RTA's ground level noise criteria for a reasonably sized building but to meet any higher standard, more directed solutions would need to be developed by the owners.

11.5.7

Conclusion

The noise assessment of the proposal is summarised as follows:

- Measurements of existing noise levels indicate as expected quiet conditions in most of the areas which the proposed Link would traverse.

- Because of the above, design goals for noise which include particularly stringent night time requirements have been recommended. The RTA will provide attenuation barriers to meet their traffic noise objectives set out in Table 11.4 and will endevour to meet the indicated noise barrier heights to comply with the R zone criteria where practicable or as and when required.

- Roadside barriers, chosen as the preferred means of noise control, can satisfy design goals with the exception of a single small area which would need supplementary acoustic treatment. The required barrier heights on parts of the route are such that particular care would be needed to provide effective noise control in a visually satisfactory design. Consultation with neighbouring residents would be undertaken to explore preferences.

- The design of the M5 Casula Link places the road in cut for much of its length. In addition, surplus cut will be used to form ecerta mounds there -by producing a more environmentally sencitive design.

11.6

AIR QUALITY

11.6.1

Preamble

There are four air pollutants which have been measured for this study, namely carbon monoxide, nitrogen dioxide, hydrocarbons and particulate matter. Lead pollution has not been considered in this study. This is because the major source of lead in Sydney's atmosphere is from lead additives in petrol which have, and are continuing, to reduce with the introduction of unleaded petrol in all new cars since 1986.

Carbon monoxide is formed during the incomplete combustion of fuels. Concentrations of carbon monoxide tend to be localised with high values being recorded in high traffic density areas where vehicles travel at reduced speed and with poor dispersion of the emitted pollutants.

Photochemical smog is formed by the reaction between oxides of nitrogen and reactive hydrocarbons in the presence of sunlight. Models for the formation of photochemical smog envisage hydrocarbon emissions mostly from motor cars, facilities for the storage of hydrocarbons or spray painting operations and mixing with oxides of nitrogen from either industrial sources or from motor cars. The mixture of pollution from these sources then reacts photochemically to form the smog which comprises mainly ozone. This smog is the familiar brown haze which occurs over Sydney from time to time.

Photochemical smog can be controlled by either reducing the amount of hydrocarbons or by reducing the amount of oxides of nitrogen.

In the past **hydrocarbons** have been targeted by the State Pollution Control Commission (SPCC), now EPA. It was decided to control smog by reducing the amount of hydrocarbons emitted into the Sydney air, mainly through the use of catalytic converters on motor cars using unleaded petrol. This has led to a substantial reduction in hydrocarbon emissions and despite the increase in motor vehicles in the Sydney area hydrocarbon emissions have declined slightly.

At the same time as hydrocarbon emissions have held steady or undergone a slight decline, emissions of **oxides of nitrogen** from industry and motor cars has substantially increased over the decade to 1986.

The increase in NO_x emissions is

continuing while the change in hydrocarbon emissions will begin to trend upwards again before the year 2000 as the effect of increasing numbers of cars tends to overwhelm the effect of reduced emissions from each individual vehicle.

Air quality standards for total nitrogen oxides (NO_x) do not exist in New South Wales, therefore the EPA has adopted the Australian NH&MRC and USEPA ambient air quality standards for NO_2 in the total nitrogen oxide emissions. However the proportion of NO_2 in the total NO_x concentration in the ambient atmosphere varies according to the source from which it was generated and hence the form of nitrogen oxide species at point of emission. For example, for combustion sources, high temperature boilers and furnaces and motor vehicles, the majority (approximately 90%) of the total NO_x emitted consists of NO (nitric oxide) with the remaining 10% generally being NO_2.

Over time this NO oxidises to NO_2 - the more toxic form of the NO_x family and a major precursor to the photochemical smog reaction.

The rate of reaction of this oxidation of NO to NO_2 is controlled by a multitude of variable factors which include the amount of available sunlight and the concentration of reactive organic carbon (ROC) in the atmosphere associated with that particular parcel of NO. The greater the concentration of ROC and available sunlight, the faster the conversion of NO to NO_2. The reaction time, however, can vary from hours to 1-2 days. It is not instantaneous. At night the reaction stops, or is negligible.

Typically, the Sydney urban atmosphere contains an average of 35% NO_2 in the total NO_x concentration based on SPCC/EPA long term ambient air quality measurement.

It should also be noted that this reaction is occurring continuously in a constantly moving air space. Hence a fixed concentration in any particular location cannot be expected.

Thus in summary, emissions of NO_x typically contain 5-10% NO_2 at the point of emission, with the proportion increasing with time and distance as the pollutant disperses and the total NO_x decreases.

For the evaluation of the proposal, the concentrations to be predicted are reasonably close to the source, and it has been assumed that the proportion of NO_2 is 20%. This is a reasonably conservative assumption.

11.6.2 Existing Meteorology and Air Quality

The best overall description of **meteorological** conditions of the study area (except for winds) is the climatic survey published by the Bureau of Meteorology for Liverpool. This contains details of temperatures, rainfall and humidity for each month of the year (see Table 11.6).

Temperatures

Table 11.6 shows that mean maximum temperatures in the study area range from 28.0 degrees Centigrade in January to 17.2 degrees in July. Mean minimum temperature is 17.5 degrees in February falling to 4.2 degrees in July.

Rainfall

Mean annual rainfall in the study area (based on 25 years of records) is 851mm. Conditions are wetter on average in the first six months of the year, with average monthly rainfalls between 62mm in May and 110mm in March. In the second half of the year, mean monthly rainfall is lower but relatively similar each month with values between 33mm in July and 78mm in November.

Wind direction

Two sets of wind data collected by researchers at Macquarie University have been analysed to provide representative wind patterns at either end of the Casula Link. Hourly measurements of wind speed and direction collected at Warwick Farm Racecourse are representative of wind conditions at the northeastern end of the Link. Data from Campbelltown provide information on the pattern of winds at the southwestern end. For Warwick Farm (on an annual basis), the most common winds are from the west, west southwest and west northwest. A similar pattern is seen in autumn, winter and spring, while in summer the winds swing to the southeast.

11.6 METEOROLOGICAL DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9 am Mean Temperatures (C) and Relative Humidity (%) (24 years of record)													
Dry-bulb	21.8	21.5	20.4	17.0	12.7	9.7	8.4	10.7	14.3	17.6	19.4	21.2	16.2
Humidity	72	78	76	77	81	83	79	72	67	66	67	67	74
3 pm Mean Temperatures (C) and Mean Relative Humidity (%) (24 years of record)													
Dry-bulb	26.5	26.3	25.2	22.8	19.5	16.8	16.4	17.8	19.9	21.8	23.7	25.8	21.9
Humidity	53	57	55	51	54	56	49	46	44	49	51	49	51
Daily Maximum Temperature (C) (24 years of record)													
Mean	28.0	27.6	26.4	23.9	20.3	17.7	17.2	18.8	21.2	23.3	25.3	27.5	23.1
86 Percentile	33.2	32.0	30.6	27.3	23.0	19.7	19.4	21.6	25.3	28.4	31.0	33.3	
14 Percentile	23.3	23.3	22.6	20.6	17.7	15.6	15.0	16.1	17.3	18.6	20.6	22.2	
Daily Minimum Temperature (C) (24 years of record)													
Mean	17.3	17.5	15.7	12.2	8.6	6.0	4.2	5.6	8.0	11.3	13.6	15.9	11.3
86 Percentile	20.0	20.0	18.5	15.5	12.3	9.7	7.5	8.9	11.5	14.8	16.7	19.0	
14 Percentile	14.5	15.0	12.8	8.6	5.0	2.5	1.1	2.2	4.7	7.5	10.9	12.8	
Rainfall (mm) (25 years of record)													
Mean	102	86	110	72	62	79	33	53	44	68	78	64	851
Median	86	80	77	55	44	64	20	21	44	60	61	37	841
Raindays (Number) (25 years of record)													
Mean	10	10	10	8	8	8	6	7	8	10	10	9	104

Source: Bureau of Meteorology, 1988

For the annual and seasonal windroses for Campbelltown there is a strong drainage flow from the southeast which persists throughout the year, consistent with the local topography. In summer, autumn and spring winds also commonly occur from the northeast to southeast sector.

Fogs

Information from the Bureau of Meteorology shows that the Casula area experiences only about six days fog per year on average. Fog is therefore not considered to be a cause for concern in the proposed Casula Link.



F1 Graham Ave east of Verbena Ave
F2 Demeyrick Avenue east of Chrysanthemum Ave
F3 Kurrajong Rd west of Wonga Rd
F4 Cedar Rd between Pine Rd and Acacia Ave
F5 Wattle Rd at intesection of Beech Rd

H6 Hume Highway between SW Freeway and Graham Ave
H7 Hume Highway between Demeyrick Ave & Marsh Ave
H8 Hume Highway between Casula Pl & Leacock Ave
H9 Camden Valley Way west of The The Crossroads & East of Cedar Rd
H10 Campbelltown Rd south of The Crossroads & north of Glenfield Rd

0 0.5 1.0
Kilometres

FIGURE 11.6.1

LOCATION OF AIR QUALITY SAMPLING SITES

Source: Stephenson & Assoc. P/L 1992

N

11.7 SUMMARY TABLE OF SAMPLING SITE CHARACTERISTICS - TRAFFIC DATA AND EMISSIONS CONCENTRATIONS

Sampling Site +	Topographical and Meteorological Type	Road Configuration and Character	Typical Range of Values CO (ppm)	NO2 (ppm)
F1	Top of Ridge E/W orientation	2 lanes S	0.3 - 2.4	0.01 - 0.02
F2	Flat E/W orientation	2 lanes S	0.6 - 3.6	0.01 - 0.03
F3	Flat E/W orientation	2 lanes S	0.7 - 3.4	0.01 - 0.02
F4	Bottom of Hollow N/S orientation	2 lanes Q	0.6 - 1.8	0.01 - 0.02
F5	Background - Flat - ** Intersection	2 lanes Q	0.5 - 2.4	0.01 - 0.02
H6	Top of Slope Undulating N/S orientation	7 turns 4/3 (1 turning lane) H	0.9 - 7.3	0.01 - 0.03
H7	Flat N/S Orientation	6 lanes 3/3 H	1.5 - 4.8	0.01 - 0.05
H8	Flat NE/SW orientation	7 lanes 4/3 (1 turning lane) H	0.5 - 6.7	0.01 - 0.04
H9	Top of Slope E/W orientation	7 lanes 4/3 (2 turning lanes) H	1.2 - 7.2	0.01 - 0.03
H10	Top of Slope NE/SW orientation	6 lanes 3/3 H	0.6 - 7.0	0.01 - 0.03

Source: Stephenson Associates, 1992

Air quality

The existing **air quality** of the corridor was measured in terms of carbon monoxide (CO) and nitrogen oxides (NO_x). These pollutants are most characteristic of motor vehicle emissions. Typically around 90% of CO emissions come from motor vehicle exhausts. Nitrogen oxides are a major precursor to photochemical smog and have documented health effects.

Ten locations as shown in Figure 11.6.1 were chosen for measuring air quality. The samples were collected over peak traffic and minimal wind periods, in July & August 1992. Each sampling site was chosen to be representative within the corridor of a particular combination of road width, traffic volume and speed, coupled with a specific set of topographical and meteorological parameters which are described in Table 11.7 with the measurement results.

Three representative situations of existing air quality in the corridor, defined by the volume of traffic affecting the site's air quality, have been categorised as:

Footnote:
*** Background samples, taken to represent air quality conditions without through traffic*
***H** Heavy vehicle road*
***S** Suburban traffic road*
***Q** Quiet suburban/bushland setting*

- Heavy traffic roads, with relatively high CO and NO_x concentrations.

- Suburban traffic road sites with approximately half the concentration levels of heavy traffic sites.

- Quiet suburban/bushland settings where low air pollutant levels can be expected.

Of the monitoring data for CO, NO_x and NO_2 collected at 10 sites, five of these (F1-F5) are close to the proposed motorway location, but presently in a suburban traffic area or quiet suburban/bushland settings. The other five (H6-H10) are on the Hume Highway and therefore are representative of worst-case ambient concentrations in conditions of heavy congested traffic.

The results indicate that, for the limited number of monitoring occasions, the roadside concentrations of CO and NO_2 did not exceed their respective 1 hour maximum air quality goals (see below). For CO the highest 1-hour average was 9.1mg/m^3 (7.3ppm) and the highest NO_2 1-hour average concentration was 103 µg/m^3 (0.05 ppm). Concentrations of both pollutants were generally higher in the vicinity of the Hume Highway and generally higher on the busier side of the road except under conditions when the wind was flowing from the monitor towards the road.

11.6.3 Assessment Criteria

The EPA has adopted air quality goals for nitrogen dioxide, carbon monoxide and particulate matter determined by the World Health organisation (WHO), the United States Environment Protection Agency (US EPA) and the National

11.8 SELECTED AIR QUALITY CRITERIA AND AGENCY SOURCES

Pollutant	Standard and Averaging Time	Agency
Carbon Monoxide	25ppm-31mg/m3 (1 hour max) 9ppm-11mg/m3 (8 hours max)	WHO/USEPA NHMRC
Nitrogen Dioxide	16pphm-0.33mg/m3 (1 hour max) 5pphm-0.10mg/m3 (annual mean)	NH&MRC/ USEPA
Total Suspended # Particulates	90µg/m3 (annual mean)	NH&MRC
Particulate Matter Less than 10µ	150µg/m3 (24 hour max) 50µg/m3 (annual mean)	USEPA USEPA
Lead	1.5µg/m3 (90 day average)	NH&MRC
Ozone	12pphm-0.26mg/m3 (1 hour max)	NH&MRC
Sulphur Dioxide #	50pphm-1.43mg/m3 (10 min max) 25pphm-0.71mg/m3 (1 hour max) 2pphm-0.06mg/m3 (annual mean)	NH&MRC

Source: Stephenson Associates, 1992

Footnote:

 # Total suspended particulates and sulphur dioxide are to be considered in conjunction with one another.

***µg/m³** micrograms (10^{-6}g) per cubic metre*

***mg/m³** milligrams (10^{-3}g) per cubic metre*

***ppm** parts per million*

***pphm** parts per hundred million*

Health and Medical Research Council of Australia (NH&MRC). Air quality goals for hydrocarbons have been used previously, but these have been abandoned recently because they are not specific for reactive species which are the important element in the formation of photochemical smog.

Table 11.8 lists the EPA's air quality goals for New South Wales.

The evaluation of the proposal has considered the effects on the levels of selected pollutants, viz: Carbon monoxide (CO); nitrogen oxides (NO_x); hydrocarbons (HC) and particulate matter.

The setting of standards to meet air quality goals tends to change over time, to meet community demands or in response to improved scientific knowledge. In NSW this has resulted in amendments to standards. The basis for the current air quality criteria, or goals, and the safety margins which they provide are outlined below.

Carbon monoxide can be harmful to man. When it is inhaled it is taken up by the blood and therefore reduces the capacity of the blood to transport oxygen. Symptoms of carbon monoxide intoxication are generally not reported in conditions corresponding to an ambient atmospheric concentration of more than 70mg/m^3 for a person engaged in light activity. However there is evidence that there is a risk for individuals with cardiovascular disease from lower concentrations. The 1 hour and 8 hour goals adopted 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, the elderly and the infirm.

Nitrogen oxides (NO_x) emitted by motor vehicles are comprised mainly of nitric oxide (NO, approximately 95%) and nitrogen dioxide (NO_2, approximately 5% at the point of emission). Nitric oxide is much less harmful to humans at the concentrations normally found in urban environments. 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 quality goals for nitric oxide however it is rapidly converted to nitrogen dioxide for which the EPA has set 1 hour and annual average goals.

The previous **hydrocarbon** criteria were set primarily for the management of photochemical smog rather than to protect directly against health effects. The US EPA air quality goal for hydrocarbons has been discontinued because of its lack of specificity for the reactive species which contribute to photochemical smog. However, hydrocarbon emissions and predicted concentrations have been considered in this report, as they are relevant to the air quality issues being considered, and some hydrocarbons, such as benzene, are known to have an adverse effect on human health. Although this is thought to occur at concentrations much higher than those which result from traffic emissions, there is growing pressure for the control of benzene in motor vehicle emissions. At present NSW has no air quality goals for benzene while the Victorian EPA's current limit is 0.10 mg/m^3 (3 minute average).

The presence of particulate matter in the atmosphere can have an adverse effect on health and amenity. Particles lodged in the lungs can affect the respiratory system, especially if they contain absorbed acid gases such as sulphur dioxide. The EPA adopts the NH & MRC goal for total suspended particle matter and the USEPA standards for particles less than 10µm. Particulate matter criteria should be used primarily to assess the areas affected by dust emissions during construction. Particulate matter emissions from traffic exhausts fall into the under 10µm category.

11.6.4 Effects of the Proposal on Air Quality

Emission rates of carbon monoxide, oxides of nitrogen and hydrocarbons vary with speed, by amounts which depend on the vehicle emission controls. Both carbon monoxide and hydrocarbon emissions decrease as speed increases while those of oxides of nitrogen gradually increase. Therefore any change in the road system that allows an increase in traffic speed will reduce the total emissions of carbon monoxide and hydrocarbons but may increase amounts of oxides of nitrogen.

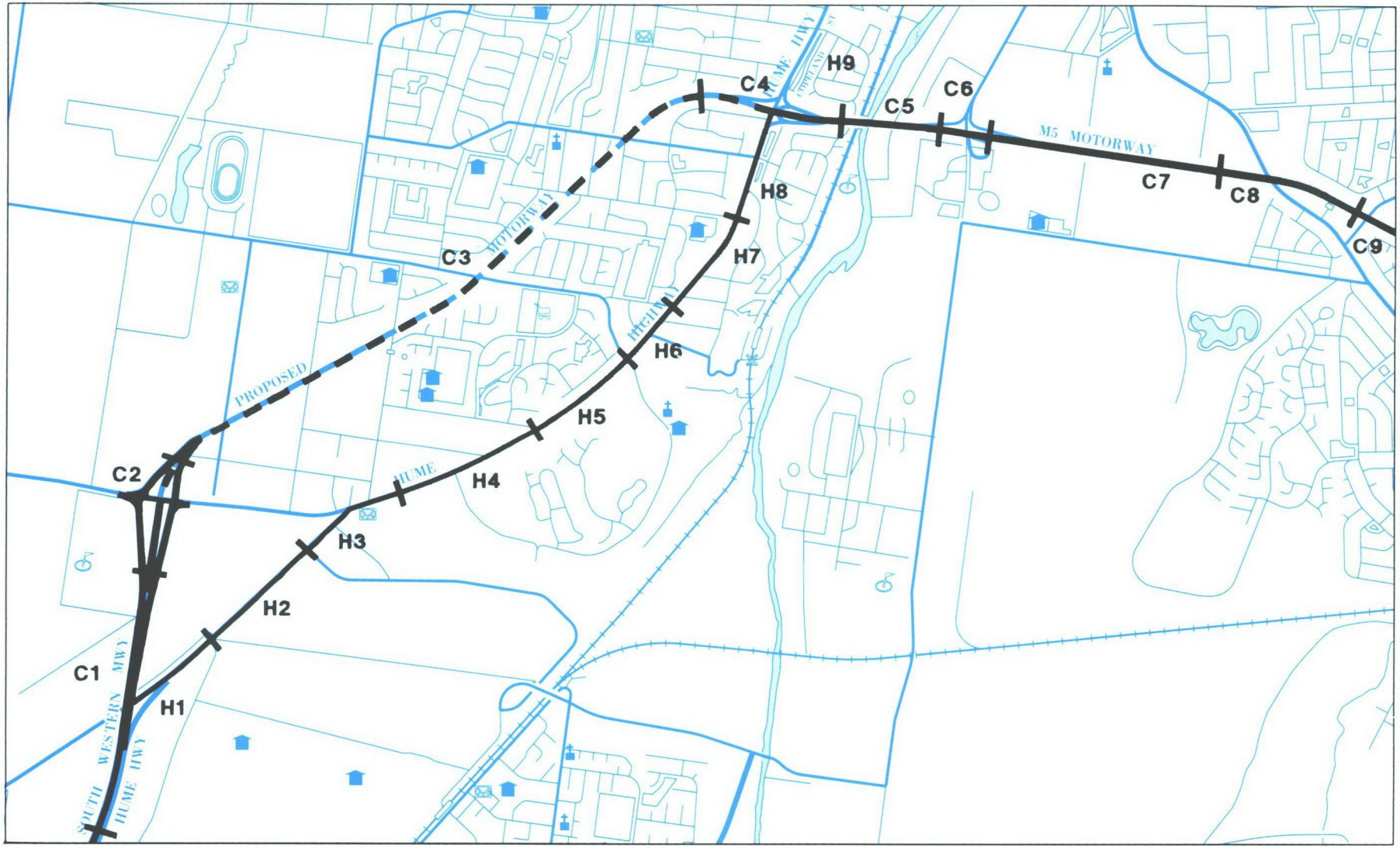


FIGURE 11.6.2

LOCATION OF PROPOSED LINK 'SEGMENTS' USED FOR AIR QUALITY ANALYSIS

Source: Nigel Holmes & Associates 1992

Accordingly, the global effects of the proposal on the airshed of Sydney and the study corridor would be as just described, in consequence of higher traffic speeds on the new Link and freeing up of traffic on the nearby Hume Highway and other routes. The amount of change related to vehicle emissions over the whole of the region would however be trivial, and the analytical work for this study has concentrated on local effects of vehicle emissions of the roadside and nearby.

The analysis approach has been based on the fact that the concentration of pollutants adjacent to the roadway would depend on the dispersion conditions along the roadway and the rate of emission of pollutants from vehicles on the roadway. The emission of pollutants depends on the volume of traffic, the type of vehicles involved and their speed.

Vehicle emissions in the morning peak period have been estimated for each of the four main pollutants on the basis of modelled two-way traffic flow. The emissions have been calculated for light and heavy vehicles and different fuels, taking into account the emission controls of the vehicles, and the age structure of the vehicle fleet.

For the purpose of analysis, the route has been divided into sections over which the emission rate has been taken as constant. The nine sections for the Casula Link are shown in Figure 11.6.2.

The predicted maximum increase in ground-level concentrations (above background levels) of carbon monoxide, hydrocarbons, nitrogen oxides, nitrogen dioxide and particulate matter at a distance of 10m from the roadside at selected points along the proposed route is summarised in Table 11.9.

These points are representative of the "straight" sections of the route between interchanges. Figures 11.6.3 and 11.6.4 show the computed dispersion of carbon monoxide and nitrogen dioxide respectively for a typical section (C7) under "worst-case" conditions of a light cross-wind carrying emissions towards neighbouring properties on one side.

Table 11.9 excludes the route sections where interchanges occur and emissions generation and dispersal are more complex than elsewhere, and representation of modelling results is more difficult. Figures 11.6.5 and 11.6.6 illustrate typical results for the worst-case interchange at the Hume Highway under the most prevalent adverse weather conditions of a light westerly wind.

The noise control barriers as proposed in Section 11.5.6 would not be high enough to shield the road from wind or trap vehicle emissions, and the turbulence created by the traffic flow would ensure that no build up occurs.

11.9 SUMMARY OF PREDICTED POLLUTANT CONCENTRATIONS FOR 2011 10m FROM KERB

Roadway Section	Carbon monoxide (mg/m3)	Nitrogen oxides (µg/m3)	Nitrogen dioxide* (µg/m3)	Hydro-carbons (mg/m3)	Particulate matter (µg/m3)
C1	4.2	2070	414	0.73	78
C3	3.8	1442	288	0.67	56
C5	3.2	2122	424	0.54	77
C7	2.1	1391	278	0.36	51
C9	1.6	1179	236	0.26	42

Source: Nigel Holmes and Associates, 1992

** Assumed to be 20% of total nitrogen oxides*

Note: Worst case predictions for Sections C2, C4, C6 and C8 (interchange locations) are represented by Figures 11.6.5 and 11.6.6.

Carbon monoxide

It can be seen from Table 11.9 that the highest predicted increase in 1 hour carbon monoxide concentration is 4.2 mg/m^3. This is well below the EPA's 1-hour goal of 31 mg/m^3. Adding this value to the highest observed present background level which was not influenced by specific sources (3.6 mg/m^3) gives a figure of 7.8 mg/m^3 as the maximum predicted concentration, which is still well below the EPA goal. Concentrations

over longer averaging periods would always be lower than the maximum 1-hour concentration and so the predicted 8 hour maximum increase in concentration would certainly be less than 4.2 mg/m^3. Since the EPA's 8 hour goal is 11 mg/m^3 it can be inferred that it would be readily met.

Figure 11.6.3, while relating to a section of the link with lower predicted concentrations, indicates the characteristically rapid decrease of concentration as the distance from the road increases.

At the Casula Link/Hume Highway overpass, where the total carbon monoxide emissions are highest, because of the combination of the two heavy traffic streams, the ramps and intersection, predicted dispersion of CO assuming a westerly wind is blowing is shown on Figure 11.6.5. It can be seen that the maximum increase predicted at any of the residences is less than 1.5mg/m^3 . Taking account of background CO, this means that the maximum predicted concentration is less than 5.1 mg/m^3. Again this is below both the EPA's 1 hour goal of 31 mg/m^3 and the 8 hour goal of 11 mg/m^3. It can therefore be concluded that neither the 1 hour nor the 8 hour air quality goal would be likely to be exceeded under the projected traffic flow conditions to 2011. This result is to be expected as the free movement of traffic results in comparatively low carbon monoxide emission per vehicle kilometre travelled.

Nitrogen dioxide

Estimating nitrogen dioxide concentrations is more complicated than estimating carbon monoxide concentrations. As discussed in Section 11.6.1, initial emissions contain a mixture of nitrogen dioxide and other oxides of nitrogen, which are rapidly oxidised to nitrogen dioxide.

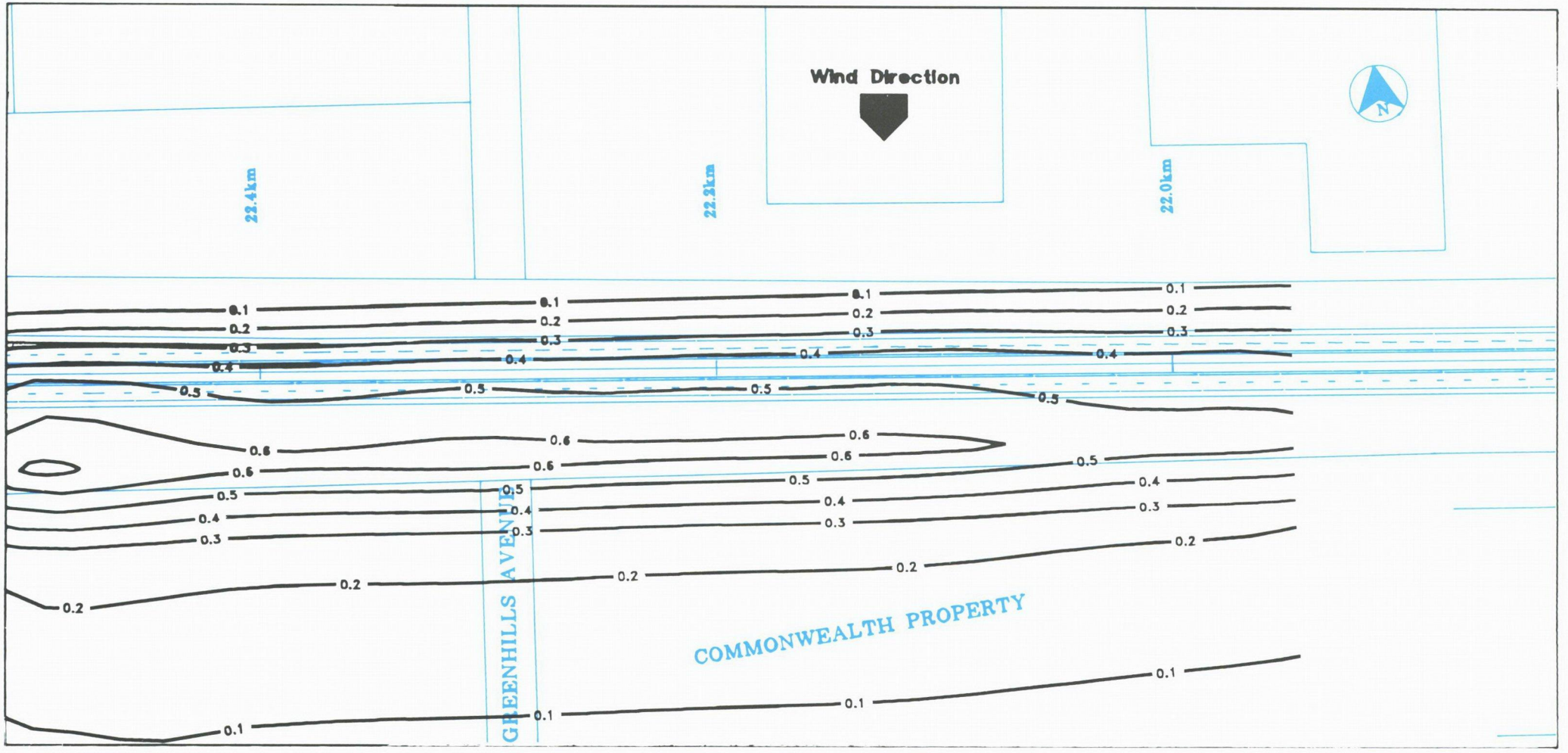
Adopting the conservative estimate of 20% by mass for the ratio of nitrogen dioxide to nitrogen oxides, then the maximum increase in 1 hour nitrogen dioxide concentration at ten metres from the road segment with the highest estimated nitrogen oxide emissions (Segment C5) would be approximately 424 µg/m^3. As the closest private land to this segment of the Link is at least 40m from the edge of the road, the concentration of nitrogen oxides would be approximately 25% of the concentration at 10m while the proportion of nitrogen dioxide in the mixture would increase perhaps to as high as 50 percent. The resultant concentrations of nitrogen dioxide would be below the EPA's 1 hour goal of 328 µg/m^3. The same circumstances would apply for road segment C1 where the predicted kerbside 1 hour nitrogen dioxide concentration is 414 µg/m^3, but the road reserve ensures that residences are well removed from the road.

Figure 11.6.4 shows the predicted dispersion pattern of nitrogen dioxide from a straight section of the link (Segment C7) with a light northerly wind blowing to indicate the rapid rate at which concentration is expected to decrease moving away from the road.

Figure 11.6.6 shows the predicted dispersion of nitrogen dioxide for the interchange at the Hume Highway which has the highest estimated nitrogen oxide emissions, again due to two traffic streams being superimposed along with their interconnections. The prediction is for a westerly wind, which is the most likely direction for low wind speeds in this area. The estimated maximum concentrations of nitrogen dioxide can be read from the contours in the figure. It is clear that, while concentrations of nitrogen dioxide on the roadway itself and on the road reserve may exceed the EPA's 1 hour 328 µg/m^3 limit. When the likely background levels are added, the EPA's goal at private residences is not expected to be exceeded. The figure represents unfavourable dispersion conditions occurring simultaneously with peak hour morning traffic. While these conditions would not occur every morning, the meteorological data indicates that the light westerly winds depicted would occur for approximately 8% of the hours in the year, and hence probably occasionally during peak traffic conditions.

Hydrocarbons

From Table 11.9 the predicted maximum increase of total hydrocarbons is of the order of 1 mg/m^3 at ten metres from the kerb. Assuming a 5% benzene composition



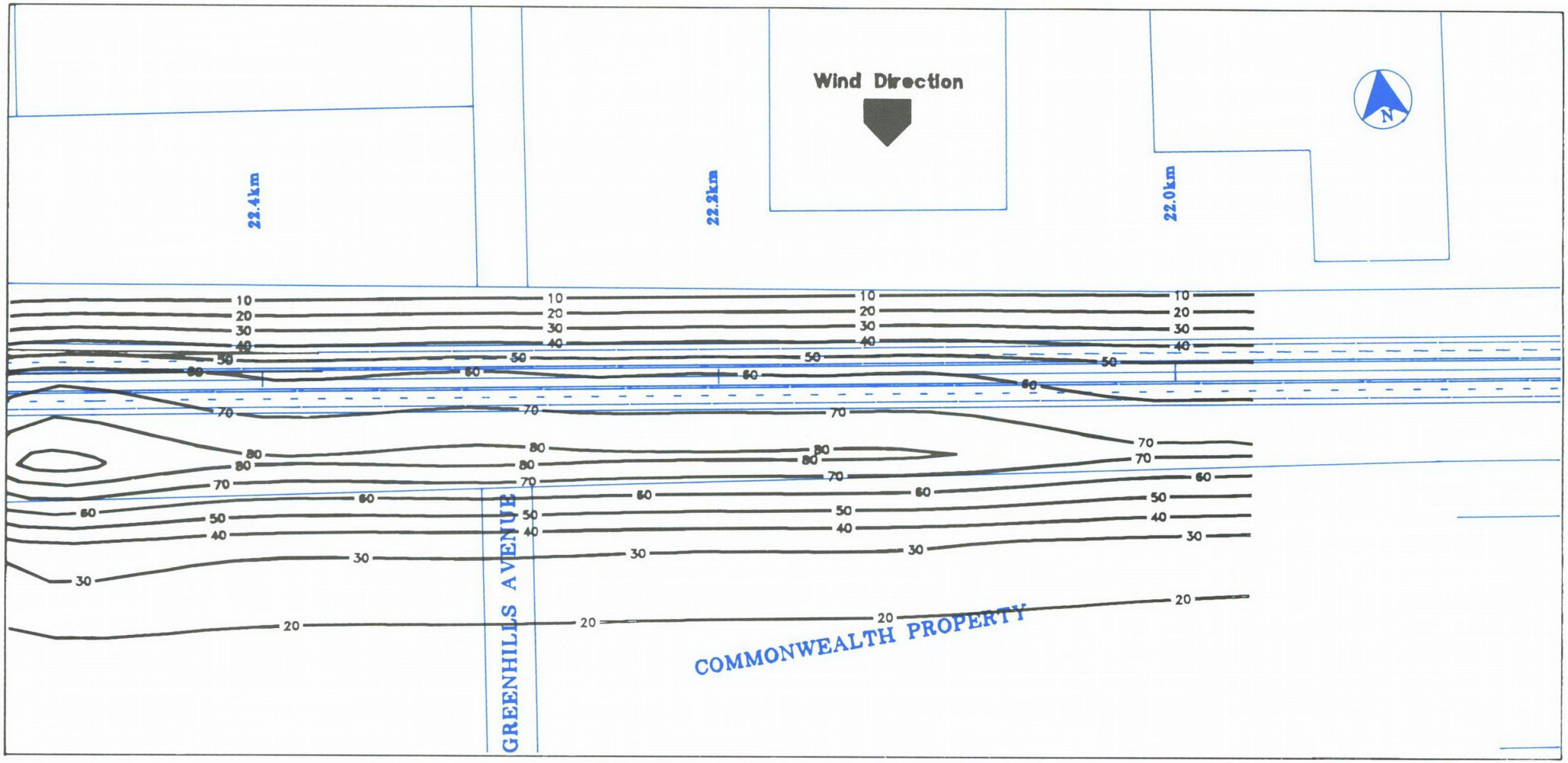
11.52

Locality Plan

0 10 20 40 60
Metres

Figure 11.6.3
PREDICTED CARBON MONOXIDE CONCENTRATION DUE TO CASULA LINK SECTION C7 - mg/m³
(Assumed conditions: 0.5m/s wind from north, stable atmospheric conditions with peak morning traffic)

Source: Nigel Holmes



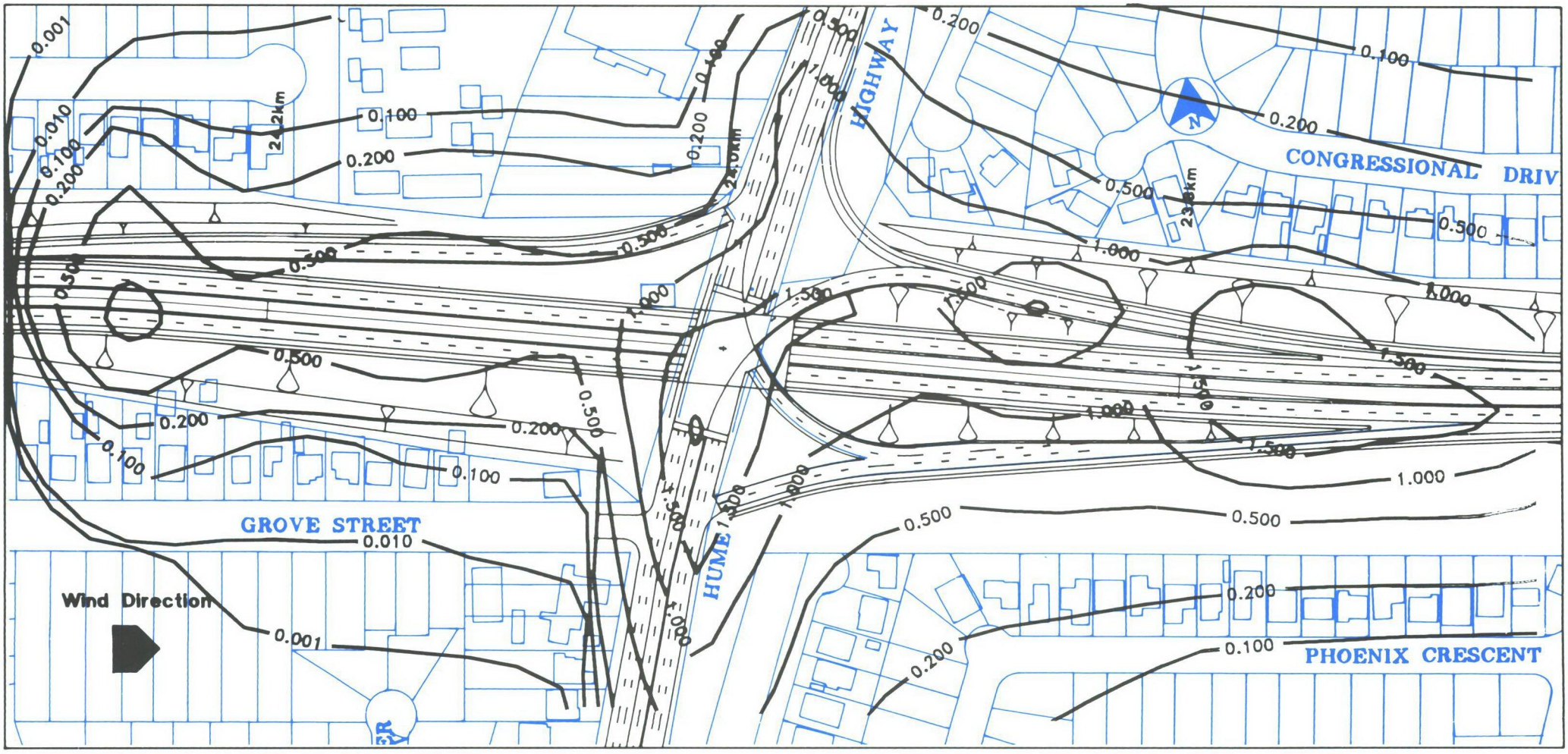
11.53

Locality Plan

0 10 20 40 60
Metres

Figure 11.6.4
PREDICTED NITROGEN DIOXIDE CONCENTRATION DUE TO CASULA LINK SECTION C7 - $\mu g/m^3$
(Assumed conditions: 0.5m/s wind from north
stable atmospheric conditions with peak morning traffic)

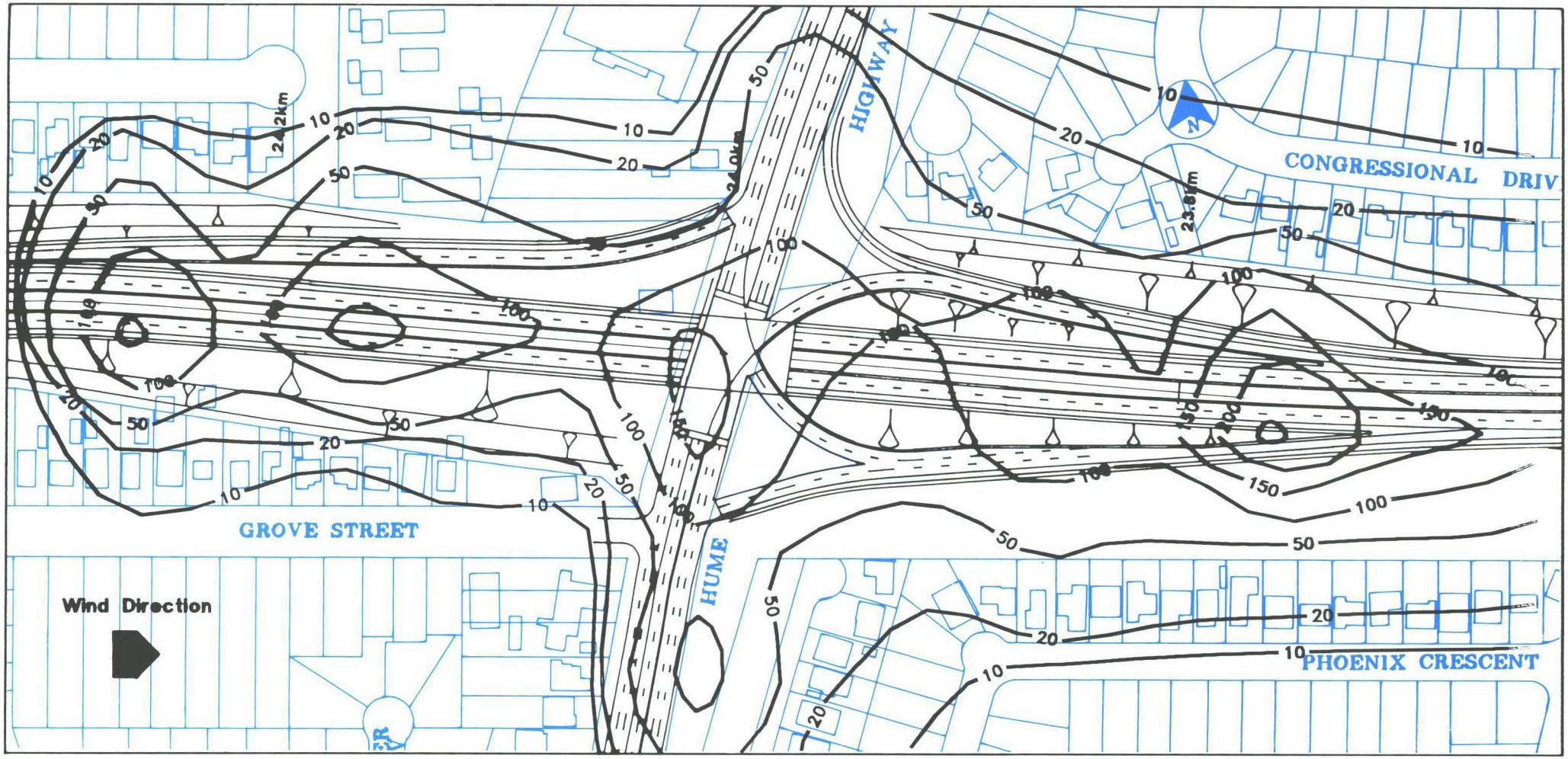
Source: Nigel Holmes



Locality Plan

0 10 20 40 60
Metres

Figure 11.6.5
PREDICTED CARBON MONOXIDE CONCENTRATION AT CASULA LINK HUME HIGHWAY OVERPASS SECTION C4 - mg/m³
(Assumed conditions: 0.5m/s wind from west, stable atmospheric conditions with peak morning traffic) *Source: Nigel Holmes*



Locality Plan

0 10 20 40 60
Metres

Figure 11.6.6
PREDICTED NITROGEN DIOXIDE CONCENTRATION AT CASULA LINK HUME HIGHWAY OVERPASS SECTION C4 - $\mu g/m^3$
(Assumed conditions: 0.5m/s wind from west, stable atmospheric conditions with peak morning traffic) *Source: Nigel Holmes*

in the exhaust, the benzene concentration at ten metres from the kerb would be 0.05 mg/m^3 (1 hour average) under unfavourable dispersion and with peak traffic flows. This is approximately half the Victorian EPA design 3 minute goal. Concentrations would of course be substantially lower at the locations of residences. It is nevertheless recognised that there may not be a safe limit for exposure to benzene *(WHO, 1987)*. Clearly motor vehicles will continue to emit benzene and motor vehicle emissions will be an exposure mechanism for urban residents to benzene, but the risks to a particular individual over a lifetime will be small.

Particulate matter

The predicted increases in particulate matter at 10m from the kerb on the Casula Link are less than 100 µg/m^3 for all road segments even under the worst-case dispersion condition combined with peak traffic flow. Concentrations over a 24 hour period would be substantially less and concentrations at sites further removed from the road would be further reduced. Even if all particles were sub-10 µm then the emissions from the road would be unlikely to cause the relevant goal of 150 µg/m^3 (24 hour average) or the 50 µg/m^3 annual average goal to be exceeded. Similarly the NH&MRC 90 µg/m^3 (annual average) goal for total particulate matter is unlikely to be exceeded.

11.6.5
Mitigative Measures

If the proposal is constructed, an ongoing monitoring programme could be undertaken to ensure pollutant levels correlate to those predicted by the air quality study. This monitoring programme could involve one or two fixed monitoring stations located within the study area. The precise location of these sites would have to be established by the relevant interested parties, the NSW Environment Protection Authority (EPA), local government and community groups.

Technological changes

This study has been based on the premise that average individual vehicle emissions will significantly decrease while overall vehicle numbers increase to the year 2011. Thus the total mass emission rate would not increase in direct proportion to the increase in vehicle numbers as this would be offset by a decrease in individual vehicle emissions.

Based on current predictions of vehicle numbers and mix in 2011, this factor has been incorporated into the modelling component of this study to a degree. By the year 2011, almost all light vehicles will be fuelled by unleaded petrol, further reducing lead emission levels, and most vehicles would have three way catalysts as a design feature which will significantly reduce NO_x emissions. These reductions are almost certain and have been incorporated into this study according to current trends. Additional emission reductions, which would further reduce overall vehicle emissions and consequently roadside pollutant concentrations, could be possible with the development of alternative fuel sources such as dual fuel bases (e.g. diesel/electric), ethanol, electricity, LPG, CNG or hydrogen, perhaps encouraged by stricter government emission regulations. Due to the current unpredictable progress of these developments, it was not appropriate to account for them in the predictions of this study.

11.6.6
Conclusion

The proposal would result in marginal improvements to regional carbon monoxide and hydrocarbon background concentrations and the possibility of slight increases in nitrogen oxides. In respect of direct effects on neighbouring properties the air quality studies undertaken for this EIS are summarised below:

- The present emissions controls on motor vehicles and the projected traffic conditions to the year 2011 are not expected to cause the EPA's carbon monoxide 1-hour or 8 hour goals to be exceeded for the proposed Casula Link.

- The more rapidly moving high volume traffic on the proposed Casula Link may cause the EPA's 1 hour nitrogen dioxide air quality goal to be exceeded on the roadways and within the road reserves under unfavourable dispersion conditions and with high volumes of traffic but not neighbouring residences. It is expected that in time, existing

emissions- control technology in use overseas will be applied to Australian motor vehicles to reduce nitrogen oxide emissions. A decision to implement further nitrogen oxide emission controls on motor vehicles would follow from regional studies (see discussion in Section 16).

- The benzene component of hydrocarbon emissions would fall well below recognised limits although these are under current scrutiny.

- The annual and 24 hour maximum air quality goals for particulate matter are not predicted to be exceeded by the proposal.

11.7 ABORIGINAL ARCHAEOLOGY

11.7.1 Assessment Methodology

The register of Aboriginal sites held by the National Parks and Wildlife Service (NPWS) is the main source of information about prehistoric and other Aboriginal sites in New South Wales. This and the NPWS file of archaeological reports were searched to identify recorded Aboriginal sites and reports on archaeological surveys or investigations undertaken in the area.

A description of the various corridor segments and an assessment of their site location potential, that is the likelihood of Aboriginal sites being present, is given in the Working Paper *(Haglund and Associates, 1992)*. Copies of this Working Paper were forwarded to NPWS.

Field surveys were confined to the motorway Link reservation (and major intersections along the Hume Highway). The road reserve was inspected or traversed on foot apart from some short stretches of private land. Previously identified Aboriginal sites were relocated and evaluated, and the character of the present surface and its archaeological potential was considered.

The Gandangara and Tharawal Local Aboriginal Land Councils (GLAC and TLALC) were informed of the current transport options. The sites officer of the GLALC inspected the relevant parts of the reservation. The Aboriginal heritage Working Paper has been forwarded to both Land Councils for review and comment.

11.7.2 Archaeological Context and Known Archaeological Sites

Aborigines are known to have been present in the Sydney area for at least 4,500 years. Climatic changes over time led to a gradual rise in sea level to the present height, established about 6,500 years ago. This caused major changes in topography and increased availability of food resources. The area would have been well stocked with edible animal and plant species. Evidence at the time of European arrival in the Port Jackson area illustrates the Aboriginal lifestyles established on the use of these resources *(Attenbrow, 1988)*.

Much of the study area has been modified by recent landuse; evidence of such modification was noted and implications in relation to underlying or adjoining surfaces considered.

Four Aboriginal archaeological sites have been identified as adjoining and a fifth as situated within the survey corridor *(Smith 1989a)*. The four sites are located south of the intersection with Camden Valley Way and a little west of the existing road. They are within the Tharawal Local Aboriginal Land Council (TLALC) area, and would not be affected by the proposed development (Figure 11.7).

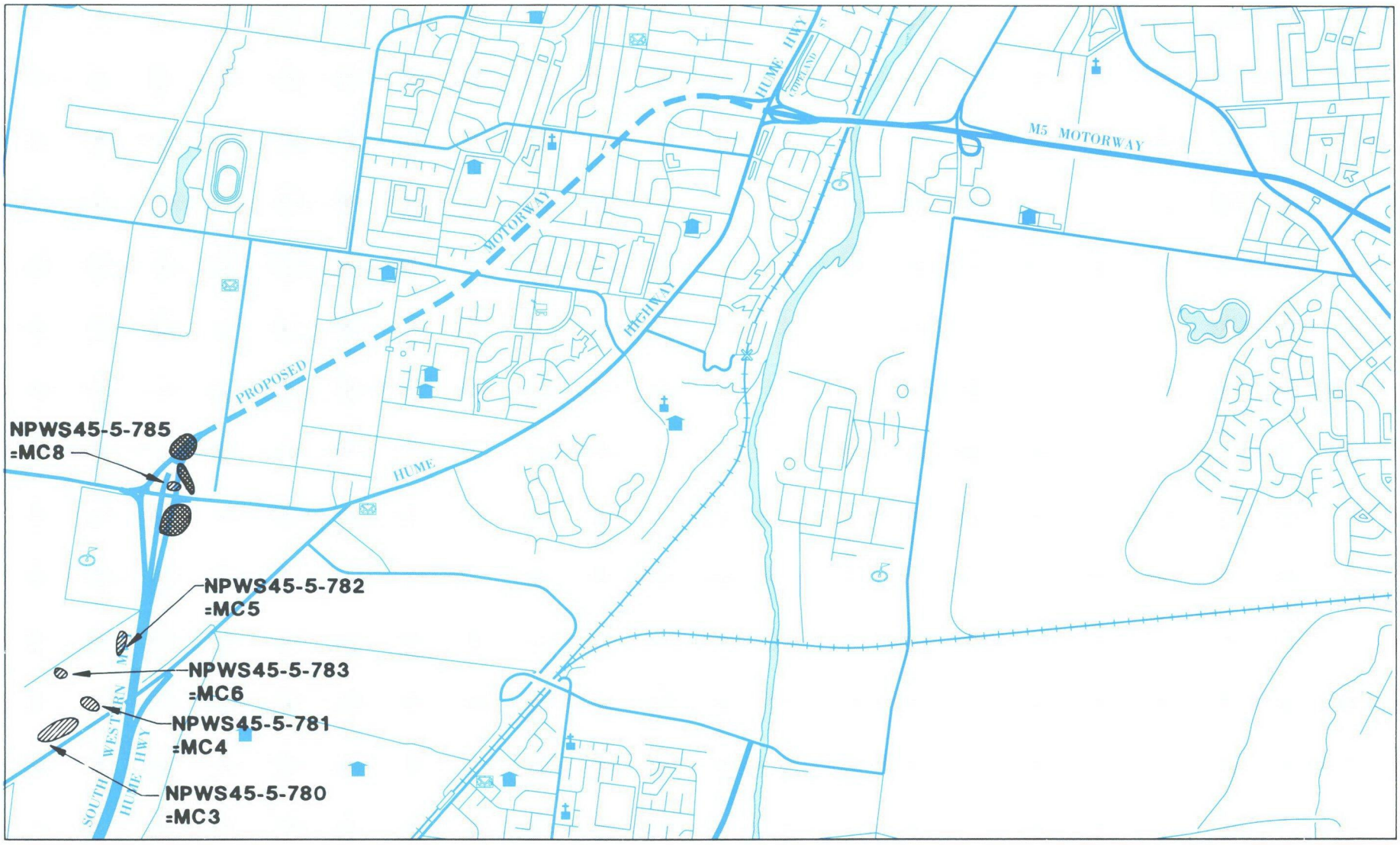
The fifth site is located north of the intersection, within the Gandangara Local Aboriginal Land Council (GLALC) area. It lies within the survey corridor and could probably not be avoided. It is very poor in content and extremely disturbed.

No sites were found within the much modified area further north.

Two locations, one just south and one somewhat north of Camden Valley Way, may contain archaeological material within or below their vegetated and apparently disturbed surfaces.

Sites south of Camden Valley Way

NPWS 45-5-780, less than 100m north of Campbelltown Road and c.150m west of the South Western Motorway, on a slight rise within a Melaleuca swamp on Maxwells Creek, some 20m from a shallow creek



NPWS45-5-785 Area Requiring Subsurface Testing

NPWS45-5-780 Known Sites

0 0.5 1.0
Kilometres

FIGURE 11.7

KNOWN ARCHAEOLOGICAL SITES

Source: Hadlund and Associates 1992

N

channel, was recorded as a sparse scatter of stone artefacts which may continue outside the track. It is severely disturbed.

NPWS 45-5-781, about 150m north of Campbelltown Road and some 100m west of the South Western Motorway, was recorded as six artefacts in a very disturbed condition (bulldozed) about 3m east of Maxwells Creek. They were not relocated although the precise area was identified.

NPWS 45-5-783, about 400m north of Campbelltown Road and 300m west of the South Western Motorway, on a graded track, was recorded as a very sparse artefact scatter. The location was identified but no artefacts seen here. A couple were noted on a less used track nearby. Artefacts in this area were interpreted as part of the background scatter along Maxwells Creek within a stretch of Melaleuca swamps.

NPWS 45-5-782, beside a graded track where this runs within the 330kV transmission line clearing 150m south of Tree Valley Golf Course, c. 50m west of the South Western Motorway, appears better preserved and somewhat richer in contents. As artefacts are partly embedded in the surface, areas nearby may contain sub surface archaeological deposit.

Sites north of Camden Valley Way

NPWS 45-5-785, c. 150m north of the intersection with the South Western Motorway and some 10m south of Maxwells Creek, is poor in content and extremely disturbed. Seven artefacts were originally recorded within 80m by 40m, on surfaces much disturbed by bulldozing, erosion and rubbish. Five fragments were noted during the recent survey.

Note, however, that the eastern bank is less disturbed and fairly well vegetated. The archaeological site is likely to extend across the creek, here quite narrow and shallow, and there could be less disturbed sub surface archaeological deposit on the eastern bank and creek flats.

Locations identified as having potential to contain sub-surface archaeological material

1. Low-lying land south of Camden Valley Way, and west of Maxwells Creek, ie. between this and the South Western Motorway.

2. Creek banks and flats north and east of Maxwells Creek near the western end of Wattle Road.

11.7.3
Effects of the Proposal

No new sites were identified but a number of previously identified sites were relocated and assessed during the course of the study. The location of these sites is shown on Figure 11.7.

Only one known Aboriginal site appears directly threatened by the proposed motorway, and none by an upgrading of the Hume Highway.

The threatened site, NPWS 45-5-785 = MC8, has been almost obliterated by past road construction activities and appears to have no scientific potential, unless sub-surface material from the site occurs also east of Maxwells Creek in a less disturbed area on the fringe of the corridor.

There is no archaeological reason against issuing consent to destroy NPWS 45-5-785 nor any need for salvage investigation of the surface west of Maxwells Creek. However, construction of a motorway could affect one stretch of creek flat which is deemed to have archaeological potential, that is creek banks and flats north and east of Maxwells Creek near the eastern end of Wattle Road.

11.7.4
Mitigative Measures

Evidence of past Aboriginal presence is more likely to be identified during the construction phase of a road. Areas identified which could require further investigation are shown in Figure 11.7.

Requirements for sub surface testing and subsequent salvage excavation, if archaeological deposits are identified, should relate to the creek bank east of site NPWS 45-5-785 if this would be affected by the road construction and associated works.

The GLALC will provide their own assessment of significance for site NPWS 45-5-785. Advice in the field indicated that it would agree with the proposal for sub surface testing and salvage but would wish the artefacts visible on the surface west of the

creek to be collected as part of the proposed salvage.

With regard to the areas considered to have some potential to contain sub surface deposits, it was concluded that such deposits, if present, would comprise very sparse scatters of stone artefacts with occasional concentrations of artefacts in focal points denoting, e.g. activity areas or single events.

Several locations on creek banks and flats north and east of Maxwells Creek, near the western end of Wattle Road, would require initial shovel testing, followed by consultation with the NPWS and the GLALC (and possibly salvage excavation), if archaeological deposits are present. Such investigations should be completed prior to any clearing and construction work.

Monitoring or sub surface testing would be required to determine whether there is an archaeological deposit at the proposed location for box drains south of Camden Valley Way.

Requirements with regard to test excavation and applications for consent to destroy site NPWS 45-5-785 (and other sites, if identified through such testing), would be determined in consultation with the NPWS of NSW, the GLALC and the TLALC.

With regard to the four open sites just outside the corridor, contractors and RTA staff should be told of the presence of Aboriginal sites west of the existing motorway and the need to keep machinery and staff away from these areas.

If any archaeological material not covered by NPWS permits or consents is identified during clearing and construction work, such work must stop in that location. NPWS and the relevant Land Council must be notified so that appropriate assessment and consultation can commence.

The RTA or the organisation undertaking the development would engage an archaeologist to arrange consultation, design a program of investigation and to monitor clearing and road works as needed during construction, and where necessary, the management of the identified Aboriginal heritage resource. Areas identified which require further survey are shown in the specialist Working Paper *(Haglund & Associates, 1992)*.

11.7.5 Conclusion

Only a small portion of the available ground surface in the road corridor and along the Hume Highway, was sufficiently bare of vegetation or constructions such as houses, green houses, etc. to allow inspection with some confidence that archaeological material would be visible, if present on the surface.

However, the physical condition of these surfaces and consideration of the range of activities which have been modifying agents in recent years, indicated that the results of the survey were in fact representative.

Only one known Aboriginal site appears directly threatened by the proposed motorway, and none by an upgrading of the Hume Highway.

The threatened site has been almost obliterated by past road construction activities and appears to have no scientific potential, unless sub surface material for the site occurs east of Maxwells Creek in a less disturbed area on the fringe of the corridor. The surfaces with artefact fragments do not merit archaeological investigation.

11.8 EUROPEAN HERITAGE

11.8.1 Assessment Methodology

The heritage study documents all buildings, landscapes, townscapes and sites of significant European Heritage value within the study boundary, as collated from various agencies and bodies. The study assesses the significance of properties affected by the proposed motorway link, including the proposed motorway alignment and variations of lanes, ramps and intersections. The study comments on the alternative option of upgrading the Hume Highway.

The study was carried out in June-August 1992. Historical research on documented material pertaining to the study area was undertaken and relevant authorities and bodies were contacted to provide background information for the study and inventory lists of items of significant

European Heritage value located within the study boundary.

A thorough field investigation of properties affected by the proposed motorway alignment was carried out and a detailed photographic inventory prepared. This visual assessment of the exterior of properties affected by the scope of works was without any interior inspection and/or examination of historical documentation pertaining to individual un-listed buildings. This field survey also included assessment of listed heritage items found in the near vicinity of the scope of works, and a limited assessment of the Hume Highway route.

Following the research on the physical and documentary evidence, a complete inventory list of significant European heritage was compiled, and the architectural significance of the properties affected by the proposed motorway alignment was assessed. Other than the items listed by the relevant agencies and bodies, it was beyond the scope of this study to consider significance other than architectural.

All properties along the proposed alignment were examined visually. Properties directly affected by the scope of works have been individually documented. Where properties that were adjacent to and otherwise unaffected by the proposal were considered to have a uniform architectural character and/or appearance, representative examples were documented and included.

The following agencies and bodies were consulted during the study:

The National Trust of Australia (NSW) (Mail); The Department of Planning (Heritage Council of NSW) (Mail and visit); Australian Heritage Commission (ACT) (Mail); Liverpool City Council (Mail and visit); The City of Liverpool and Districts Historical Society (Mail); The Liverpool Bicentennial Museum (Visit); The Macarthur County Information Centre (Visit); Liverpool City Library (Visit).

11.8.2 History of the Area

The Georges River provided the first known European access to the Liverpool area, that of George Bass and Matthew Flinders in 1795, and the earliest provision for human occupation through its use as a navigational transport aid and its supply of water from human and agricultural use. Remnants of its early use and social importance is found in the sandstone weir, 1836-9, located near the Liverpool Town Centre, and in the river frontages of such early homesteads as Glenfield Farm, Casula.

The formal founding of the Town of Liverpool, by Governor Macquarie in November 1810 saw building activity proceed apace around the towns functional and religious roles. Serving free and ex-convict settlers the formal buildings assumed a colonial Georgian character typified in the street layout itself and in the architecture of the original hospital, now the Liverpool TAFE, St. Luke's Church and the former courthouse, now the Liverpool Community Aid and Resource Centre.

As early explorers and surveyors opened up the area to the west for settlement and agricultural use, homesteads such as Collingwood and Horningsea Park were built. These homesteads provide an extant example of the early architectural character of the colony, including the important characteristics of siting on early land grants, the origins and modifications of a simple structure (vernacular) through the progress of families and subsequent owners, the incorporation into sites, various outbuildings and landscaping themes, and the development of a colonial Georgian architectural character.

From the 1860's onwards, speculative land subdivision provided smaller farming lots and small service centres for local farming communities, such as near Bernera, resulting in population growth in these centres by the 1880's. Roads developed reflecting increased lot subdivision and the rural character of centres eroded into spreading suburban-type development, no longer agriculturally based.

Early surveyors laid out street grids around village centres, such as the Church of Holy Innocents, Rossmore, from the 1880's and development of these centres with schools and general stores and the surrounding suburban use continued well into the 20th century.

The surveyor James Meehan's presence

in the Liverpool town centre is found in his layout of the original town, with its ordered grid of wide streets abutting the west bank of the river. The original architectural character of these streets included open low scaled and sparsely developed blocks with colonial Georgian buildings interspersed with more humble domestic buildings.

This original town plan has been eroded over time with streets being resumed, for the High School in 1954 and at the Hospital in 1956, for example, and through such road works as the halving of Bigge Square by Moore Street and the more recent closure of Macquarie Street. Furthermore the large individual allotments have been amalgamated in new configurations for residential flats and large scale commercial development. In this century the town centre itself has been bypassed (e.g. Copeland Avenue) as Macquarie Street the main through route became too congested.

Well into the 20th century specific areas for land settlement were established, often on marginal value agricultural land at low costs creating settlements with clear function and social, physical and architectural demarcation. In more recent years trends for consolidation and 'suburbanisation' have resulted in less distinct boundary definitions and greater homogeneity of character. These special settlement areas included the soldier settlements and the later 1910's and the depression relict settlements of the late 1920's.

With growing industrialisation at the turn of the century, increased subdivision and building activity saw residential suburbs established with industrial areas nearby. By the end of the century, streets such as Macquarie Street were linked with 2-3 storey brick shop buildings with timber framed verandahs over the footpaths. Individual expression was made through decorative detailing, signage and colour schemes along these uniform 'street walls'. Existing examples of Victorian commercial buildings are found at 277 Macquarie Street and 14 Scott Street, Liverpool. Industrialisation and the resultant improved transportation saw international influences on the architecture. The Commercial Hotel, erected 1896 features simplified Italianate detailing on a typically Victorian building. Industrialisation including the great mills on the Georges River above the weir demanded nearby dormitory suburbs such as Casula and Prestons.

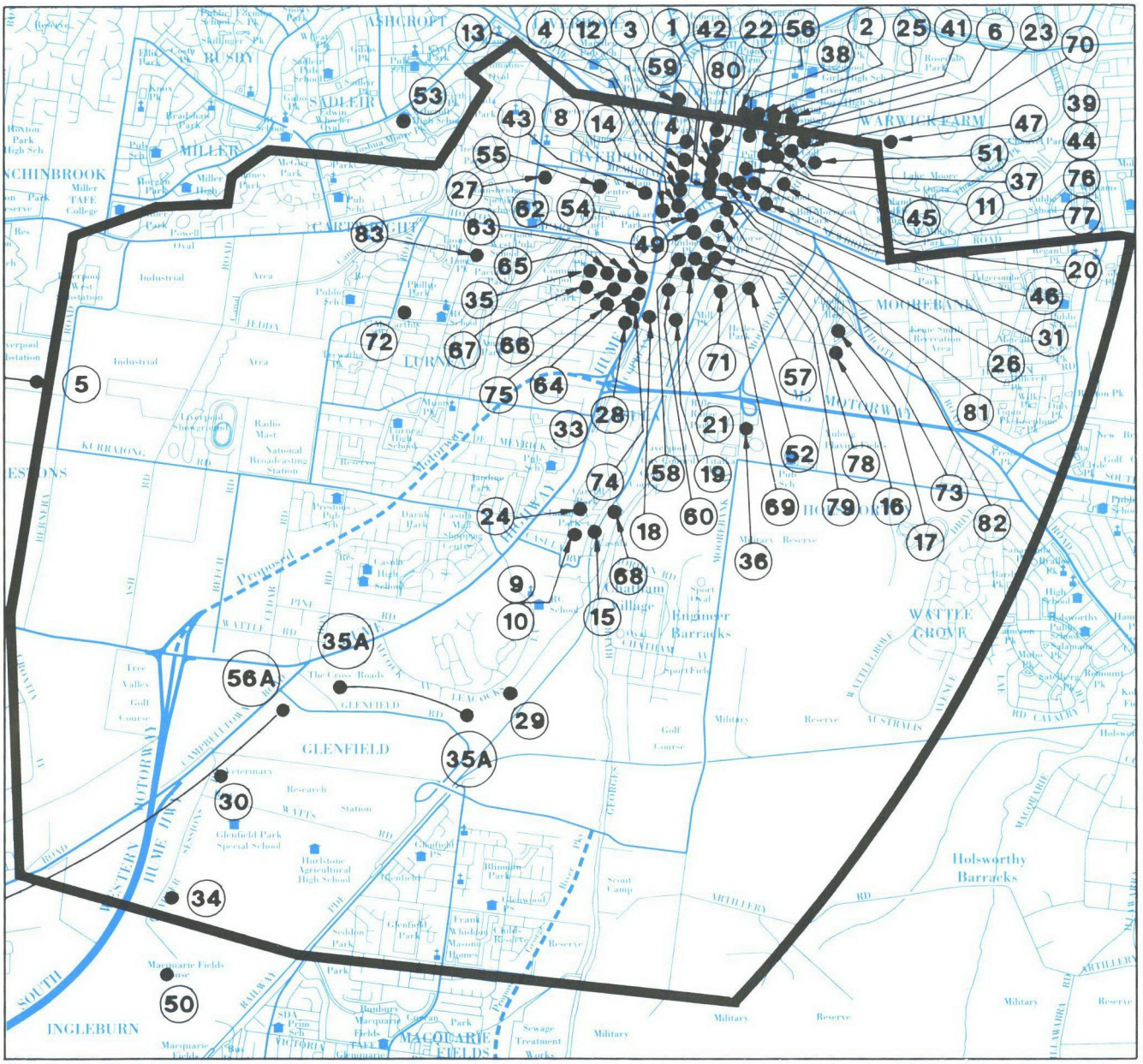
Few smaller cottages of the turn of the century period around Liverpool remain. Uniformly, these houses were single storey weatherboard or brick with a timber framed verandah. The start of the new century saw little change in this residential architecture, with some refinements made in joinery and decorative motifs. The Passefield Road, Rose and Speed Street buildings are examples of these building types.

By the 1920's town centres saw he emergence of the 'Californian Bungalow' style, having emerged out of the 'Federation Bungalow' buildings typified in larger rural houses. The Great Depression of the 1930's curtailed the building of all but the simplest structures, and weatherboard cottages with skillion or shallow hip roofs and projecting windows appeared in abundance and may still remain. The premier example of Federation Bungalow within the City of Liverpool was the premises now known as Kitchener House erected expressly for a visit by Lord Kitchener in 1912.

Amongst public buildings, in this inter-war period, Colonial and Mediterranean Revival flavours appeared in such buildings as the Memorial School of Arts, 1924, and the Liverpool Hotel included Art Deco influences. Other 'styles' that appeared in this period include Classical Revival and 'Inter-War Functionalisation', as found in Alexanders Bar and Bistro.

The post World-War II period saw prolific residential development with the soldier settlement schemes, the influx of immigration, and the development of the NSW Housing Commission to supplement low income households. The resultant architecture emphasised quantity over quality and uniformity and simplicity was repeated in double-fronted fibro houses with tiled hipped roofs and exposed face brick chimneys.

Throughout this period of 175 years of development the Hume Highway has remained the principal thoroughfare for all points south. Along its route at irregular intervals



Significant Heritage Sites

46

0 0.5 1.0
Kilometres

FIGURE 11.8

SITES OF SIGNIFICANT EUROPEAN HERITAGE

Source: Conybeare Morrison 1992

N

there remain the original carved sandstone (painted black and white) milestones. Since the 1950's commercial premises have replaced industrial and residential uses fronting it.

The 1950's continued the modest character of domestic architecture. Most houses were characterised by austere rendered brick walls, steel windows and the reduction of the front porch to a small protruding roof. Ever rarer in the district are examples of flat roofed "International style" houses.

The most prolific post-war development was the three-storeyed home unit block with bland face red brick walls, small steel or timber framed windows and flat pitched multi-hued tile hip roofs. In the late 60's and 70's, single storey red brick veneer houses with tiled hip and gable roofs spread prolifically. In the 1970's timber linings appeared above the windows of rare houses with gable and skillion roofs and deep set verandahs, in response to such architectural 'trends' as Sydney's Nuts and Berries School. By the late 70's and 80's, large 2 and 3 storey project homes dominated the suburban spread with well detailed, simply planned double brick houses with tile hip and gable roofs. In the late 1980's increasing affluence allowed the redevelopment of sites and the erection of substantial large private estates (e.g. Inghams). In select pockets remnant market garden and rural uses remain interspersed with conventional lot subdivision.

11.8.3 Existing European Heritage Items

Within the study area there are 86 buildings, landscapes, townscapes, or sites listed by the relevant heritage reports and/or agencies and bodies.

The bulk of the listed buildings are located beyond an approximate perimeter of 375-500m around the proposed motorway alignment (listed in the specialist working paper) as shown in Figure 11.8.

11.8.4 Effects of the Proposal

None of the listed items are located within the proposed corridor.

European heritage items located near the scope of the works and unaffected include: House 'No. 443 Hume Highway', located approximately 65m south of the intersection of the proposed corridor (the existing South Western Motorway) and the Hume Highway, and; Kitchener House, listed by the Macarthur Regional Environmental Study and the Liverpool Heritage Study, located approximately 75m south of the proposed circular on/off ramps of the M5 at the current intersection of the South Western Motorway and Moorebank Avenue, Moorebank (see Table 11.10). The house, built in 1912 for the visiting Lord Kitchener, is considered to be historically and architecturally significant and is acknowledged to be of local and regional significance by the Liverpool Heritage Study and Macarthur Regional Environmental Study respectively.

The next nearest buildings are the 'Frank Ollis Printing Factory', No. 3 Reilly Street and the 'Collingwood Group' off Birkdale Crescent, both located approximately 250m north of the corridor's intersection with the Hume Highway.

11.8.5 Mitigative Measures and Conclusion

Apart from those items listed by the relevant authorities and recorded in the inventory, no other buildings, landscapes, townscapes or sites of significant European heritage value have been located that are affected by the proposed corridor alignment or the proposed on/off ramps.

11.10 ITEMS OF ARCHITECTURAL SIGNIFICANCE IDENTIFIED BY OTHERS

Item	Address	Listing
"Kitchener House"	208 (52) Moorebank Avenue, Moorebank	- Macarthur Regional Environmental Study - Liverpool Heritage Study
Post World War II Residential House	443 Hume Highway Liverpool (Casula)	- Liverpool Heritage Study (Draft)

Source: Conybeare Morrisson, 1992

11.11 LOCATION OF WATER SUPPLY MAINS

Location	Pipe Size (mm)
Camden Valley Way	150 dia
Wattle Road	100 dia 750 dia
Beech Road	100 dia
Cedar Road	100 dia
Box Road	East side - 500 dia West side - 375 dia 100 dia
Kurrajong Road	South side - 375 dia North side - 150 dia
De Meyrick Avenue	100 dia
Chrysanthemum Avenue	100 dia
Verbena Avenue	100 dia
Carnation Avenue	100 dia
Graham Avenue	100 dia
Hume Highway	West side - 150 dia
Moorebank Avenue	West - 200 dia

Source: Maunsell Pty Ltd, 1992

Within the proposed corridor alignment 12 properties would be demolished. Amongst these is a shed beside the house at 140 Beech Road, Prestons which is relatively rare and unusual and should be documented before demolition. There are approximately 29 properties with front and/or rear land affected by the proposed corridor. There are approximately 24 properties affected by the proposed on/off ramps, including 4 buildings to be demolished, located at the circular on/off ramp at Moorebank Avenue, Moorebank. None of these properties was found to be architecturally significant.

The M5 West Casula Link motorway alignment does not directly affect any building, landscape, townscape or site of significant European Heritage value within the study boundary and scope of works as nominated by Maunsell Pty Ltd at the date of completion of this study.

None of the properties affected by the scope of works are listed within the included inventory of heritage items and none are considered to be architecturally significant.

Mitigative measures are not required.

11.9 UTILITIES, SERVICES AND LIGHTING

11.9.1 The Existing Situation

The corridor is serviced by utilities including telecommunication cables, electricity, water supply, natural gas pipelines and sewerage lines. The following description focuses on the major services in areas most likely to be affected by transport proposals in the corridor. Relocation of any of these services due to construction would require liaison with the relevant authorities, the cost to be met as part of the transport project.

Telecommunications cables within the corridor are extensive.

Locations along the reservation where significant cables cross include Kurrajong Road, Graham Avenue, Moorebank Avenue and the east side of the Hume Highway. In addition, the Sydney-Melbourne coaxial cable crosses at the west side of the Hume Highway.

A number of 11KV and 33KV overhead electricity transmission lines occur within the corridor. These lines cross at Beech Road, Cedar Road, Box Road, Kurrajong Road, Graham Avenue and Hume Highway. There are also underground 11KV transmission lines at the Hume Highway and Moorebank Avenue.

South of Camden Valley Way two 132kv overhead transmission lines cross the motorway alignment.

A number of water supply mains are likely to require relocation in the event of new roadworks. Table 11.11 summarises the location of water mains 100mm diameter or greater.

The largest natural gas pipeline in the corridor is a 550mm diameter primary main which crosses at Camden Valley Way. There is also a proposal to construct a new 550mm diameter primary main along the reservation from Cedar Road to Georges River. An easement for extension of this gas main exists along the southern side of the reservation east of Georges River.

There are also a number of secondary gas mains of 150mm diameter which cross at Box Road, Kurrajong Road, Graham Avenue, Hume Highway and Moorebank Avenue.

A number of **sewer mains** exist or are proposed within the corridor. They are listed in Table 11.12.

11.9.2 Effects of the Proposal

The construction of the Casula Link would require relocation and treatment of a number of services and utilities.

All telecommunications cables crossing the corridor occur at the proposed bridge locations. Therefore these cables would be built into the bridge structures across the motorway.

Kurrajong Road would be an exception as the construction sequence would require relocation of all existing services to a service easement along the north side of the existing Kurrajong Road reservation.

Other services such as water supply mains, gas pipelines and sewer mains would need to be relocated under the motorway in areas where there is no bridge overpass. Similarly overhead and underground electrical cables would require treatment to ensure clearances are maintained from the proposed Link.

11.9.3 Mitigative Measures

Few, if any mitigative measures are required apart from relocation of services affected by the proposed motorway. Care would be required in relocating existing utilities that services are maintained to consumers and access to relocated utilities must be considered for future maintenance.

11.9.4 Conclusion

Water, sewerage, gas, electricity and telecommunications utilities exist both within and adjacent to the proposed motorway reservation. Relocation of those utilities affected by the motorway construction would be undertaken by the relevant authorities prior to earthworks for the road construction commencing.

Such work is likely to be funded by the RTA, or through a funding arrangement as described in Section 13.5.

11.12 LOCATION OF SEWER MAINS

Location	Pipe Size (mm)
Camden Valley Way (proposed)	300 dia
Wattle Road (proposed)	450 dia
Cedar Road (proposed)	300 dia
De Meyrick Avenue	450 dia
Verbena Avenue	100 dia
Grove Street to Cullens Avenue	600 dia + 300 dia
Moorebank Avenue (west)	750 dia

Source: Maunsell Pty Ltd, 1992

12
EFFECTS ON THE BIOPHYSICAL ENVIRONMENT

12.1
GEOLOGY AND SOILS

12.1.1
Geology

Reference to the Penrith 1:100,000 Geological Series Sheet 9030 indicates that almost all of the road reserve occurs within the Middle Triassic Wianamatta Group (refer Table 12.1). The Wianamatta Group forms a broad westerly plunging syncline, known as the Fairfield Basin with an axis approximately 6km to 10km north of the road reserve. Sediments were transported down the basin to be deposited on a coastal alluvial plane (Bringelly Shale) and as pro-delta and delta front deposits (Ashfield Shale). Ashfield and Bringelly shales are the dominant rock types in the area and have given rise to a landscape consisting of fertile soils and low, undulating topography. The uppermost geological unit anticipated over the majority of the route is the Bringelly shale and it overlies the Ashfield shale unit. The Ashfield Shale (Rwa), the lowest rock unit consists of a dark grey to black siltstone-shale sequence of which four members have been defined: Rouse Hill Siltstone, Kellyville Laminate, Regentville Siltstone and Mulgoa Laminate. The Bringelly Shale (Rwb), the uppermost unit of the Wianamatta Group, is a dark sequence of shale, siltstone, carbonaceous claystone, fine to medium-grained lithic sandstone and rare coal. An extract of the geological series Map Penrith 9030 with the anticipated route alignment superimposed is reproduced as Figure 12.1.1.

The elevation of the road reserve gradually rises from Reduced Level (RL) +8m at Moorebank Avenue to RL +52m at Campbelltown Road.

Based on the nature of the proposed works which are expected to comprise shallow cuttings, and low fills, the engineering properties of the Bringelly shale sequence are expected to be most critical.

The Georges River and tributary water course has dissected these shales in more recent times leading to the deposition of various alluvial sequences on adjacent lowlands (refer Figure 12.1 and Table 12.1).

Refuse dump material appears immediately west of the proposed Georges River crossing. A thickness of up to 10m was encountered and extended up to 130m along the route. Further detailed investigation is highly necessary.

12.1.2
Soils

Four major soil types occur throughout the corridor as illustrated in Figure 12.1.2. Most of the corridor is dominated by the Cumberland soil series while the areas adjacent to the Georges River comprise the Elderslie series and the Hammondville series lie to the east of Moorebank Avenue.

Soil landscape units, as defined by the Soil Conservation Service of NSW (now CALM), are derived from the Wianamatta shales. Figure 12.1.2 shows where these units are found. The characteristics of the two relevant soil landscape units are listed below:

- The South Creek unit covering an area from Campbelltown Road to just north of Camden Valley Way:

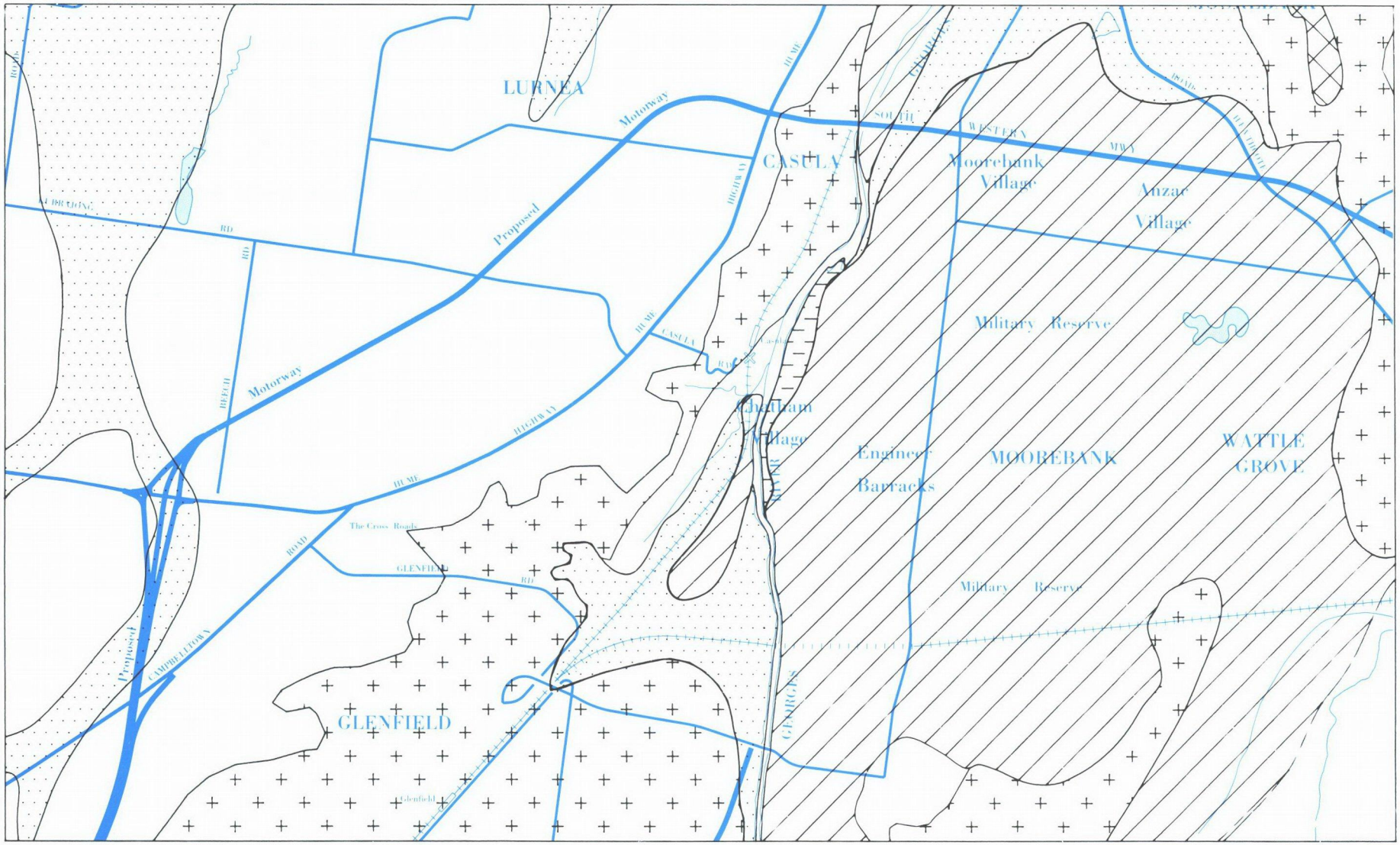
  - Found along all main streams but in none of the minor tributaries.

  - Soils are of an alluvial nature derived from erosion of surrounding Wianamatta shale slopes.

TABLE 12.1 CHARACTERISTICS OF SOIL HORIZONS

Horizon	Characteristics
A	Thick and medium clay about 10-20cm thick; soils not highly dispersive or erodible.
B	Often ironstone layer separating B horizon from A horizon; high soluble salt content; highly dispersive and susceptible to erosion.
C	High soluble salt content; highly dispersive and susceptible to erosion.

Source: Kinhill Engineers Pty Limited, 1992



Qpn:Medium-grained sand,clay,silt

Qha:Quartz sand,silty sand, silt & clay

Ta:Clayey quartzose sand, and clay

Ts:Laterized sand and clay with ferricrete bands: includes silcrete

Rwa:Dark-grey to black claystone-siltstone and fine sandstone-siltstone laminate

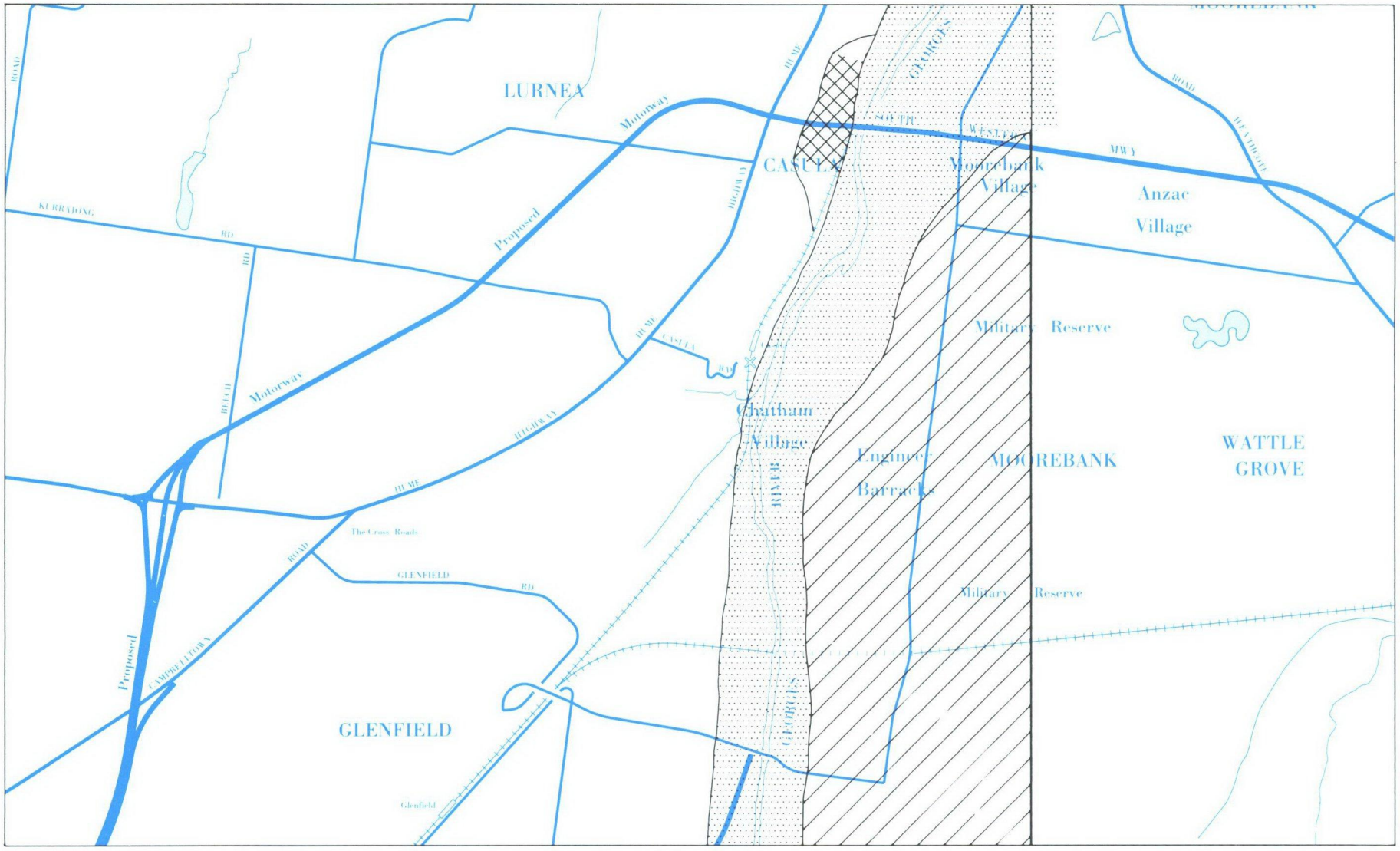
Rwm:Fine to medium grained quartz-lithic sandstone

0 0.5 1.0
Kilometres

FIGURE 12.1.1
GEOLOGY

Source: NSW Dept of Mines 1992

N



Man-Made Fill
Elderslie
Hammondville
Cumberland

0 0.5 1.0
Kilometres

FIGURE 12.1.2
SOILS

Source: NSW Dept of Mines 1992

N

- Has flooding characteristics.

- Water tables would be closest to the surface in this unit.

- Groundwater flow to the streams or baseflow would be apparent.

• Blacktown soil landscape unit north of Camden Valley Way to the Hume Highway.

- Comprises areas of rolling hills with gradients typically less than 5% on the lower slopes of the catchment.

- Has high erosion potential only if B horizon is breached. Gentle slopes can reduce the severity of the B horizon erosion rates during urban development. With steeper slopes the erosion rates may range from fifty to 100 tonnes per hectare per annum.

- The clay nature of the B horizon reduces infiltration and perched water tables are not uncommon and consequently soils may be waterlogged.

12.1.3
Effects of the Proposal

Parker and Chartres *(1983)* have indicated that soils derived from Wianamatta shales become less stable under pasture than if they remain under natural vegetation. Under pasture, bulk densities are generally increased which reduces infiltration of water. The reduced organic matter content reduces the soil strength and makes it more friable. This degradation of the soil is likely to be apparent within the corridor area, as much of the rural area has been grazed. This would lead to most of the area being susceptible to erosion, particularly if the A horizon is breached.

In addition it is probable that shallow cuttings and low fills may be effected by the upper waterlogged soils which would impact on construction difficulty.

Deeper cuttings would intersect less weathered and stronger shales, where increasing difficulty of excavation with depth is anticipated, and large excavation equipment would be required. These shales have been shown to weather rapidly on exposure to atmospheric conditions, and hence steep cutting faces should not be generally adopted.

The fine material produced during excavation of soils and underlying rock strata can produce airborne dust.

12.1.4
Mitigative Measures

Sediment control should be implemented by the measures detailed in Section 14.1 of this document.

Airborne dust and control measures are described in Section 14.3.

Erosion of cutting and fill embankment faces should be mitigated by grass stabilization during construction. The face of slopes which are compatible with hydroseed grass planting should be grassed as early as practicable.

Where water flow, in the form of surface run off and shallow groundwater is cut off from drainage lines on the downhill side of road fill embankments, then designed drainage blankets could be installed to maintain natural drainage patterns.

12.1.5
Conclusion

Earthworks and excavation of the soils and rocks likely to be encountered along the route could impact on the environment and construction processes in the form of:

• Increased erosion and sedimentation.

• Instability of cuttings due to rapid erosion.

• Airborne dust content.

• Size of excavation and placement equipment and corresponding noise and vibration levels.

These potential impacts may be addressed by the mitigative measures listed in Section 12.1.4 and the monitoring programs detailed in Section 16 of this document.

12.2
EFFECTS ON HYDROLOGY AND WATER QUALITY

12.2.1
Creeks in the Study Area

The M5 Casula Link lies within the catchment of Cabramatta Creek

which forms part of the Georges River Basin. Two main drainage lines exist within the study area: Maxwell's Creek which crosses the motorway south of Camden Valley Way, passes under Camden Valley Way via a set of 8 box culverts then recrosses the motorway reservation north of Camden Valley Way before heading north west towards Liverpool showground and Brickmakers Creek which has its headwaters in the vicinity of Pine Road and Box Road.

Several other smaller drainage courses cross the motorway reserve between Camden Valley Way and the Hume Highway and drain to either Maxwell's or Brickmakers Creek. A minor creek crosses the existing motorway reservation east of the Hume Highway and drains to the George River.

Figure 12.2 shows the existing drainage lines within the study area and the catchment areas which drain across the motorway.

Land uses in the existing catchments vary. The southern catchments are rural to semi-rural with open grassed areas predominating. The more northerly catchments are heavily urbanised with mainly residential allotments. Drainage methods vary, with the southern catchments being drained via existing creeks or open channels and with little formalised drainage. The northern urbanised catchments have more formalised drainage networks consisting of piped drains and some open channels. Control of stormwater runoff from those downstream catchments with formal drainage systems would become more difficult as the runoff generated from any new land uses in the upstream catchment area and from the paved surfaces of the motorway must be passed into the existing downstream drainage system.

Any effects due to the motorway would be addressed by the mitigative measures proposed in Section 12.2.2.

12.2.2 Effects of the Proposal and Mitigative Measures

Construction of the preferred M5 Casula Link would interrupt the drainage paths for all of the creeks draining across the motorway. For the southern catchments which are draining into undeveloped creeks it is proposed to provide culvets under the motorway to pass the 1 in 100 year event without restriction. For the northern catchments the existing drainage systems have not been designed to cope with the 1 in 100 year storms so some form of stormwater detention or drainage enhancement is required if flooding is not to occur at these locations.

Retardation basins and smaller wet detention basins are therefore proposed at catchments A and C as shown on Figure 12.3. At the outlet of the catchment, a pipe system with capacity to pass the 1 in 5 year storm exists. As the design criteria adopted for the study was to assess the effects of the 1 in 100 year storm, a small detention basin is proposed to limit the outflow to the 1 in 5 year storm. The excess inflow from the 1 in 100 year storm would therefore be temporarily stored and later released through the 1 in 5 year capacity culvet. Because of the small size of the catchment, the retardation/detention basin would require a storage of only 720 cubic metres and this can be accommodated within the motorway reserve.

Catchment C is the second largest catchment with an area of 160 hectares. An existing box culvet downstream of the motorway has (an estimated) capacity to pass the 1 in 20 year storm. To prevent flooding by storms up to and including the 1 in 100 year storm a detention basin is proposed. The storage volume required would necessitate use of the northern and southern sides of the motorway reserve.

The responsibility to maintain and clean out the retardation/detention basins lies with the RTA, where the basins are located within the road reservation, and local councils elsewhere.

Other catchments affected by the motorway are downstream and have stormwater systems capable of passing the 1 in 100 year storm. No other detention basin is proposed as part of the motorway proposal.

Flood prone land to the south of the motorway reserve would require formalisation of drainage channel to cope with the 1 in 100 year flows expected. This formalisation would need to be undertaken by Liverpool Council in conjunction with the motorway construction.

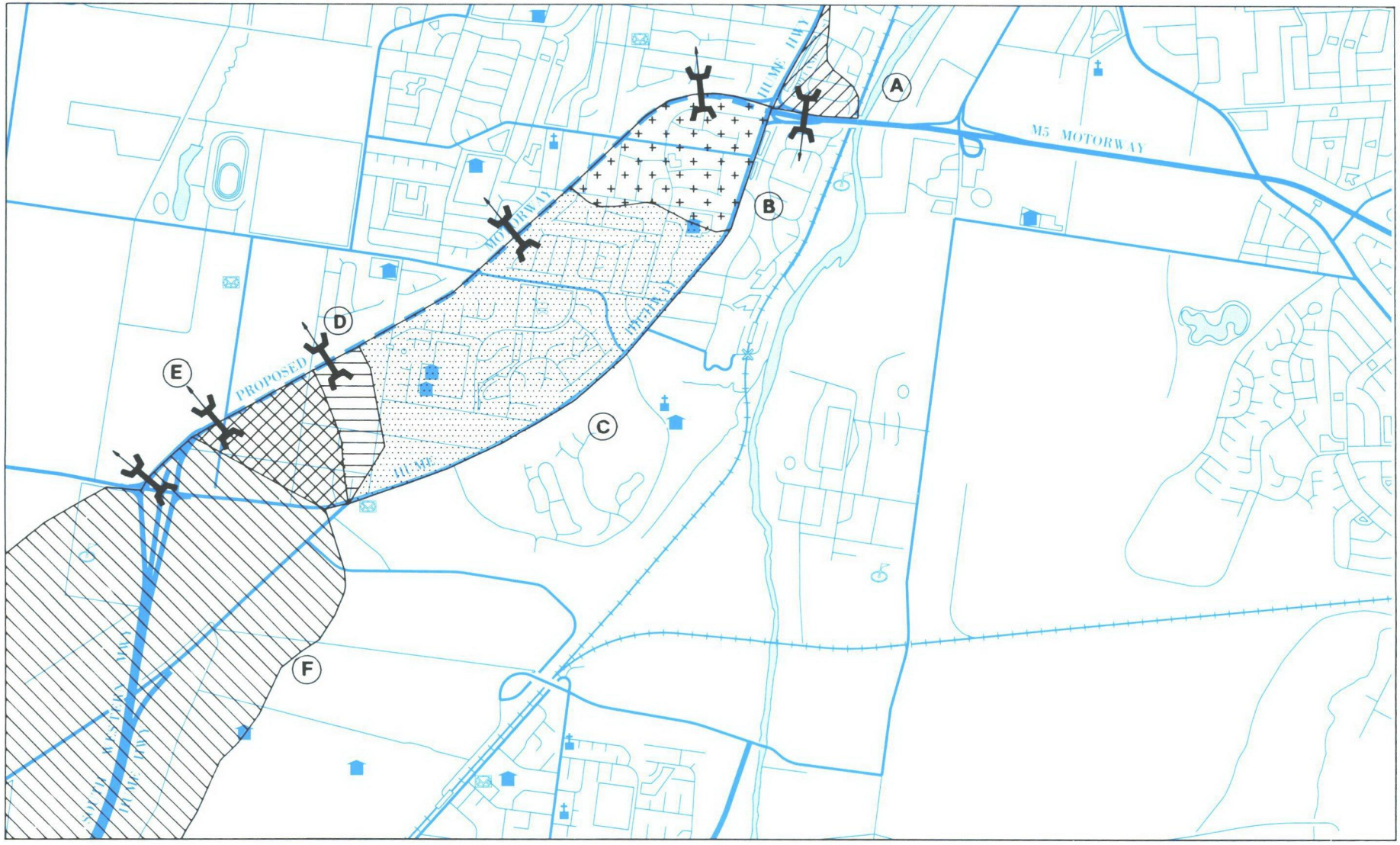
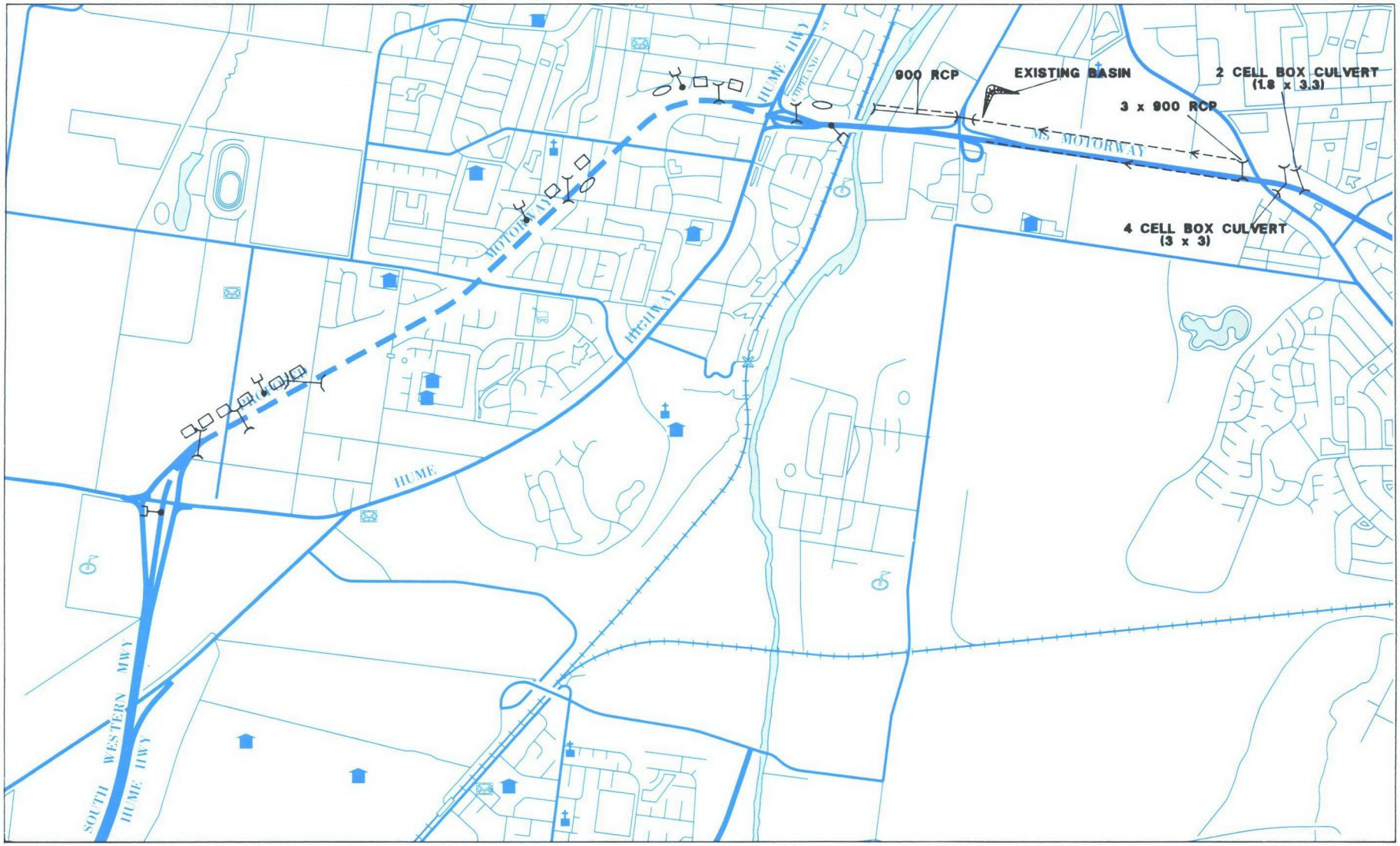


FIGURE 12.2

DRAINAGE LINES AND CATCHMENTS

Source: Maunsell Pty Ltd 1992



Sedimentation Basin
Gross Pollutant Trap
Detention Basin
Surface Channel/Drainage
RCP/Box Culvert

0 0.2 0.4 0.6 0.8 1.0
Kilometres

FIGURE 12.3
PROPOSED DETENTION BASINS
Source: Maunsell Pty Ltd 1992

N

Surface water runoff from the motorway surfaces would be directed via a system of catch drains, open channels and kerbs or into the longitudinal drainage system of the motorway. Motorway drainage would be discharged into water courses or piped drainage systems associated with the above catchments.

Water quality would be controlled by installing permanent sedimentation basins within the motorway reserves as shown in Figure 12.3. These basins would trap silt, sand and other settleable particles washed off the motorway surface and carried through the drainage system. Trash racks over major culvet inlets would also prevent large pollutants from being carried downstream. These measures would improve water quality downstream but would increase maintenance requirements.

Construction of the Link would be beneficial to water quality to the extent that there would be a reduction in the number of accidents, including those involving vehicles carrying hazardous goods. The potential for spillage of hazardous goods into local water courses is therefore reduced.

12.2.3 Conclusion

Drainage works associated with the motorway proposal would improve the local network by relieving some of the existing local flooding problems such as at De Meyrick Avenue where there is a transition from open channel flow to closed pipe flow. Construction of permanent detention basins would provide for 1 in 100 year storm flows without creating flooding within the catchments. Water quality controls in the form of sedimentation basin would be provided where motorway drainage discharge into existing watercourses or drainage systems.

12.3 FLORA AND FAUNA

12.3.1 Description of Existing Flora and Fauna

The field survey identified two plant communities as occurring along the proposed route. These are described below. *(Mt. King Ecological Surveys, 1992).*

Western Sydney woodland

Dominant Species: Forest Red Gum *(Eucalyptus tereticornis)* and Coastal Grey Box *(E. moluccana).*

Only one area of western Sydney Woodland remains along the proposed route. Covering an area of approximately 3.4 hectares, the Woodland occurs to the west of Cedar Road (Figure 12.4). The dominant tree species are Forest Red Gum and Coastal Grey Box. Associated tree species include Broad-leaved Ironbark *(E. fibrosa)* and along the drainage line to the south, Swamp Oak *(Casuarina glauca).* Tree height averages 15 metres. Few mature trees are present, most of the trees being regrowth no older than 40 years.

The understorey reflects a high level of prior disturbance with exotic species and a dense cover of Blackthorn *(Bursaria spinosa).*

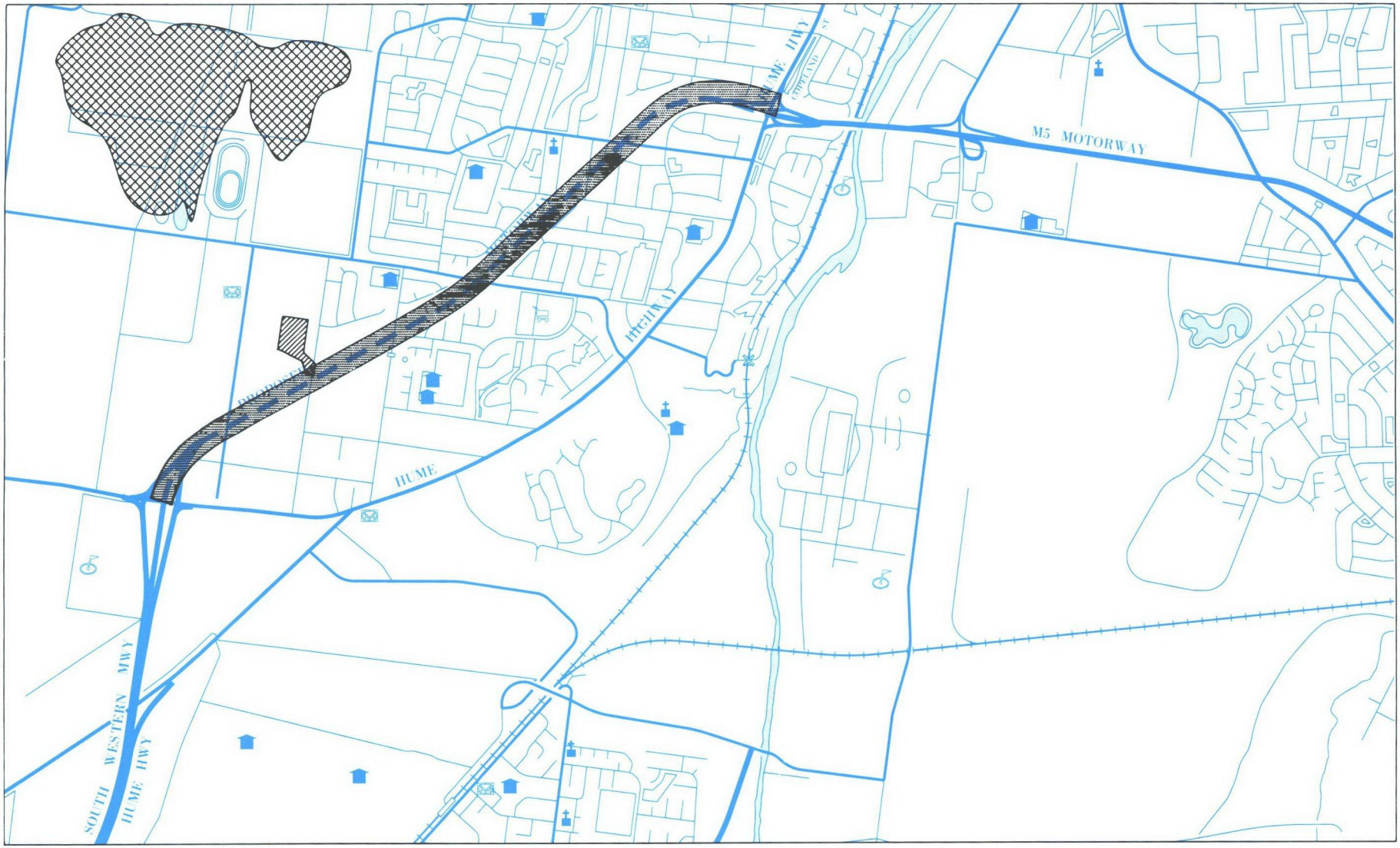
There is generally a dense shrub layer which includes Blackthorn, African Olive *(Olea africana)*, Cotoneaster *(Cotoneaster glaucophylla)* and Native Cherry *(Exocarpos cupressiformis).* The introduced vine, Bridal Creeper *(Asparagus asparagoides)*, is commonly found climbing over shrub species in the area. Moth Vine *(Araujia hortorum)* is also present.

There are patches without shrubs which support a ground layer of medium to high density. Elsewhere the ground layer flora is of low to medium density due to the dense layer of shrubs and vines. The ground layer comprises a mixture of native and exotic species. Common species include *Eragrostis leptostachya*, *Microlaena stipoides*, Kangaroo Grass *(Themeda australis)*, Kidney Weed *(Dichondra repens)*, Mother of Millions *(Kalanchoe tubiflora)*, Slender Pigeon Grass *(Setaria geniculata)* and Cobbler's Peg *(Bidens pilosa).*

Cleared land

The majority of the proposed route traverses land which has been cleared of natural vegetation. These areas tend to support exotic grass and herb species with scattered remnant indigenous trees. Small areas dominated by native grasses including Kangaroo Grass also remain.

Tree species present include Grey Box, Forest Red Gum, Broad-leaved



Western Sydney Woodland
Hoxton Park Ironbark Woodland

Fauna Survey Area

0 0.2 0.5 1.0
Kilometres

FIGURE 12.4

VEGETATION COMMUNITIES AND FAUNA SURVEY SECTIONS

Source: Mt King Ecological Surveys 1992

N

Ironbark and Thin-leaved Stringybark *(E. eugenoides)*. The tall shrub, *Melalcuca decora*, is also present in areas of impeded drainage.

A list of plant species observed along the route is included within the Working Paper (*Mt. King Ecological Surveys, 1992)*.

Rare or threatened plant species

No plant species currently listed as rare or threatened were observed along the route of the proposed road and none are known from previous surveys to occur along the corridor.

Consultation

As part of the flora survey people and organisations with knowledge of the vegetation of the Liverpool area were contacted regarding plant communities and populations of rare or threatened plant species. No specific records of rare or threatened plant species within the route corridor were known to any of those consulted.

Those consulted were:

- Jonathon Sanders of the Central Region office of the National Parks and Wildlife Service (NPWS).

- Jocelyn Howell and Doug Benson of the Royal Botanic Gardens, Sydney.

- John Trebilcock, a local resident.

Wildlife habitats

The survey of fauna of the proposed route revealed three main fauna habitats for the proposed route. These were grassland, forest and aquatic habitats, all of these habitats have been affected to a significant degree by human disturbance.

The most common habitat present is grassland. This habitat supports only a limited range of fauna species due to the high level of disturbance. The occurrence of grassland habitat results from previous clearing for agricultural and urban development. Some of the fauna species present are introduced. Areas with a higher proportion of remnant trees may support a greater range of bird species such as Australian Magpie and Black-faced Cuckoo Shrike. The location of scattered trees are described in separate sections.

The Cedar Road bushland is the only area of forest habitat which remains along the proposed route. The value of this habitat is enhanced to a degree by its proximity to dams and a creekline. Trees present in this bushland are young trees regenerating from previous disturbance. Few tree hollows suitable for fauna species were observed to be present. The disturbed nature of the understorey would also limit the range of fauna species present in the bushland.

The scattered dams and parts of the creekline represent the aquatic habitat. The dams are an artificial habitat which support a small range of animal species closely associated with water. Although the creekline is intermittent it does not contain several small pools of water after rain. These are exploited by vagrant waterbirds. There is little to no littoral vegetation associated with the aquatic habitat, particularly associated with the dams.

Fauna species

The proposed route supports a low number of native fauna species. During the survey along the route a total of nine mammals, 27 bird, five reptile and two amphibian species were located. Introduced species were found to be a common component of the fauna located.

Native mammals have largely been displaced from the area as a result of previous disturbances. Only the Brush-tailed Possum and Water Rat are likely to still be present in the area, although there was no sign of the Water Rat during the survey. Common Ringtail Possums were previously present in the Cedar Road bushland but have not been sighted in the area for over twenty years. Introduced fauna species present include Black Rat, Rabbit, Cat, Dog, Fox, Horses, Sheep and Cattle.

A range of bird species exists in the study area. The species present are common native species associated with grassland habitats and species associated with forested areas which move into grasslands for feeding. Groups of waterbirds including the Dusky Moorhen, Australasian Little Grebe and Pacific Black Duck, are

found in the dams near the Cedar Road bushland.

The main species located within the grassland habitat were the Masked Lapwing, Galah and introduced species such as the Common Starling. Other bird species which are associated with timbered habitat were also found in the scattered trees in the grassland habitat (Laughing Kookaburra, Willie Wagtail, Australian Magpie). Species utilising all habitats, including the grassland, include the Welcome Swallow, and species which exploit disturbed habitats (Australian Raven).

The forest patch at Cedar Road supported the greatest range of bird species. These were all species associated with timber habitat and included the Galah, Eastern Rosella, Black-faced Cuckoo-shrike, Superb Blue-wren, Striated Thornbill, Noisy Miner and the Laughing Kookaburra. Because of the relatively small size of the bushland patch it was possible for several introduced species to exist in this habitat (Spotted Turtle-dove, Common Mynah).

All of the species observed are considered to be abundant or common in New South Wales and the County of Cumberland.

Few amphibians and reptiles were observed or are expected in the study area, due to the high level of disturbance. The conduct of the survey during the colder months would also have limited observations.

However the following were located during the survey; Red-bellied Red Snake, Eastern Grass Skink, Weasel Skink, Eastern Blue-tongued Skink, Bearded Dragon, Common Eastern Toadlet and Spotted Grass Frog.

12.3.2 Assessment Methodology

Field surveys of the flora of the proposed route were undertaken in August 1992. Flora was surveyed by foot transect along the proposed route. Plant community descriptions follow the classification of Specht (1970).

The fauna survey was carried out over two separate days during July and August, 1992, by Dr Martin Denny of Mt. King Ecological Surveys. The entire route was traversed on foot and by vehicle. At several points along the route, observations were undertaken of animals inhabiting the survey area. Location of fauna was by direct observation, recognition of characteristic calls, scratchings, nests, scats and tracks. Some spotlighting was undertaken of the trees in the Cedar Road bushland and within the scattered trees in the surrounding paddocks.

In addition, information was obtained from previous surveys undertaken in the region e.g. the 1990 feasibility studies for the proposed Very Fast Train, from observations by Roger Lembit and from discussions with residents.

Definition of urban bushland is based on the definition in State Environmental Planning Policy No.19 (Urban Bushland) and associated circulars by the Department of Planning.

The bushland west of Cedar Road falls within the definition of bushland under State Environmental Planning Policy No.19. This Policy aims to protect urban bushland, particularly those areas within land zoned for Open Space.

The Cedar Road bushland meets the SEPP No.19 definition because indigenous native plant species comprise the canopy, the understorey strata include indigenous native species which could be re-established with appropriate management, and the vegetation structure indicates that the tree regrowth is approaching a natural structure.

12.3.3 Conservation Significance of Vegetation Communities

The remnant trees within cleared land have minimal conservation significance.

Western Sydney Woodland is a plant community which has been severely affected in the Sydney Region by previous agricultural and urban development. Remnants are under increasing threat due to urban expansion. The community is considered to be endangered in New South Wales *(Benson, 1989)*.

Nevertheless, the small size of the remnant west of Cedar Road, the high levels of past disturbance and weed invasion significantly reduce the

conservation significance of the bushland.

The Cedar Road bushland is of low conservation significance but has some value as a habitat for plant and animal species and as urban bushland. Relocation of the road to avoid this bushland is considered unnecessary. There are bushland areas of far greater significance nearby which should be protected in preference to the Cedar Road bushland. These include the area of Hoxton Park Ironbark Woodland in the vicinity of Liverpool Showground which supports the largest known population of the endangered species, *Acacia pubescens*.

12.3.4 Significance of Identified Animal Species and Wildlife Habitats

The wildlife habitats present are of low conservation value due to the high level of disturbance present, the small size and disturbed nature of the only forest habitat remnant present and the high numbers of introduced fauna species present in the study area.

All of the native fauna species observed or expected in the study area are considered to be abundant or common.

The overall value of the area for fauna conservation is considered to be low.

12.3.5 Effects of the Proposal

The proposed road would result in the clearance of an area of bushland of approximately 3.4 hectares. This bushland suffers from past disturbance and a high level of weed invasion and is considered to be of low conservation significance. Individual remnant trees and grassland patches would also be affected by road construction.

Indirect impacts on road construction may include an increase in soil erosion and reduction in water quality in catchment affected by construction. There may also be a change in hydrology due to the replacement of the natural ground surface with a hard surface impermeable to water. Hydrology changes may include an increase in the intensity of local flooding due to greater run-off during storms. This can damage stream banks further down the catchment.

The proposed road traverses the catchment of Maxwell's Creek which flows through the highly significant Hoxton Park Ironbark Woodland near Liverpool Showground. There is some limited potential for detrimental impact on this woodland, including perhaps loss of habitat if say streambank erosion is exacerbated by the road.

There is potential for the disruption of movement by fauna between areas of preferred habitat. Birds flying across the Link may have an increased risk of collision with vehicles and ground fauna may be prevented from moving by the barrier effects of the roadway.

Because there are few species which would move across the Link route the barrier created by the roadway should not affect the native fauna.

Recent amendments to the EPA Act require consideration of whether a Fauna Impact Statement (FIS) needs to be prepared. Mt. King Ecological Surveys, as the study team's flora and fauna specialists, were required to advise on this aspect of the EIS. Dr Martin Denny and Roger Lembit of Mt. King Ecological Surveys have advised that a FIS need not be prepared as there is already a high level of introduced species in the study area (*Mt. King Ecological Surveys, 1992*). This recommendation was formally accepted by the RTA in a letter of 9 November 1992.

12.3.6 Mitigative Measures

The proposal to provide a new landscape structure establishing endemic species along the fringes of the road would help to overcome the loss of trees and bushland due to road construction. Replanting of local tree and shrub species would also help to replace fauna habitat lost as a result of construction and shrub planting beside the roadway would tend to divert any birds flying across the route. The prevention of movement of some ground fauna can be mitigated by the use of culverts and underpasses as corridors for movement. Provision of shelter trees and shrubs near existing dams and waterways would help to enhance the value of these areas.

Potential indirect impacts on flora within the catchment area can be

avoided by implementation of erosion control measures and by use of hydraulic structures (such as those outlined in Section 12.2) which seek to reduce the velocity and reduce the peak flow of water flowing from the roadway into local creek systems during storm events.

12.3.7 Conclusion

The proposed M5 Casula Link passes through land which has been largely cleared of natural vegetation. The only area of bushland affected is a small area of low conservation value west of Cedar Road.

No rare or endangered species of flora or fauna would be affected by the proposed Link. The Link would have a negligible impact on wildlife movements in the area.

Construction of the roadway has the potential to affect significant bushland to the north of Liverpool Showground. However the adoption of the upstream erosion and flood control measures (proposed in Section 12.2) should avoid such impact.

13
ECONOMIC EFFECTS

13.1
REGIONAL ECONOMIC DEVELOPMENT BENEFITS

Transport by road is vital to both the national and state economies. Any road network must aim at integrating transport, land use and urban development.

Australia's long term population growth of 1.5% per annum is one of the highest in the developed world. A large part of this growth comes from immigration and while this may vary with economic developments, Australia's international responsibilities and local political events, the history of post war immigration suggests that it is likely to continue at significant levels.

Despite the current downturn, the sustained economic growth of the past decade has resulted in large increases in the demand for all forms of transport, air, rail and road.

Journeys by road in NSW have grown by about 25% since 1982. While the current economic recession will limit growth in the short term, the longer term increase in activity is forecast to be more than 50% over the next 25 years.

The transport sector accounts for about 9% of GDP in Australia. It continues to grow at a faster rate than GDP and this growth tends to facilitate economic growth.

In urban areas, reduced congestion not only saves time but reduces the variability of commercial journey lengths and times, both of which increase reliability and thus the efficiences of production.

Investment in transportation infrastructure is fixed and long term, while vehicle investment is variable both in commitment and timing. Houses and factories are also largely fixed investments while cars and trucks can be used everywhere.

It follows that it is usually more convenient and thus less costly to make alternate transport plans than to contemplate changes in place of residence or factory location.

These considerations are reflected in evaluating the costs and benefits of the M5 Casula Link in Section 13.4. In the approach followed the benefits identified come largely from travel time savings and savings from reduced accidents. The costs of adding the M5 Casula Link to the existing (and future) urban infrastructure is the long term investment directed towards more efficient, convenient and productive travel.

13.2
EFFECTS ON LOCAL BUSINESS

Businesses on that section of the Hume Highway that would be bypassed by the Casula Link would be affected by the initial fall in traffic volumes and by changes in the mix of traffic. However, loss of trade from through traffic may be offset by greater local business as the difficulties experienced by shoppers in dealing with high speed traffic diminish.

The most likely businesses to feel a negative impact would be those with a highway orientation, notably service stations, vehicle parts suppliers and motels, with lesser effects likely on fruit and vegetable markets and convenience retailing.

Closing of De Meyrick Avenue to cars could effect the current trading environment for the local shops and the group of shops fronting the Hume Highway at De Meyrick Avenue.

Maintenance of traffic on Kurrajong Road would preserve the current trading environment for Casula Mall, and this centre would continue to enjoy a growing trading catchment as urbanisation occurs in Prestons.

Other local retailing businesses would be unaffected.

The effect of the Casula Link on commercial businesses in Liverpool and Campbelltown is likely to be minor. Those retail businesses fronting the Hume Highway are likely to experience similar effects with the Casula Link to those on the bypassed section, but traffic on this route would remain substantial. Better access and more convenient travel may provide both Liverpool and Campbelltown with promotional opportunities that could be beneficial for business although these opportunities would require local entrepreneurial and planning initiatives.

13.3 LAND ACQUISITION EFFECTS

13.3.1 Land Acquisition Policy

The RTA Land Acquisition Policy (see Appendix F) outlines the procedures and guidelines for the transfer of land between the RTA and affected landowners. The Policy sets out the procedures for total acquisition and the special conditions that apply to:

- Partial acquisition.
- Compulsory acquisition.
- Hardship acquisition (owner initiated).

On release of the EIS for the proposed motorway the RTA will immediately inform all affected landowners (and adjacent) of land that is required and when occupation of the land is likely to be required if a Determination is made to proceed with the M5 Casula Link. On determination a second letter will inform the landowner that a valuer (on behalf of the RTA or one engaged by the landowner) will value the land at RTA cost. The land value takes into account the market value of the property as if it were unaffected by the proposed motorway.

Consideration is also given to special value, severance, disturbance, solatium, and changed values to land, adjoining or severed by the proposal.

Partial acquisition

When only part of a property is required the RTA is responsible for the reconstruction of fencing, driveways and landscaping to a standard similar to that existing, and the relocation of water and gas meters. Compensation for any improvements lost as a result of the partial acquisition is added to the value of the land taken. A "before and after" valuation is usually applied.

Where all major improvements are situated outside the road corridor the RTA will generally purchase only the part of the property required for roadworks.

Compulsory acquisition

Compulsory acquisition is a statutory process available to the RTA to acquire land. It also provides the means for resolving disputes about the amount of compensation payable.

Hardship acquisition

If a property is affected by a road proposal and an immediate purchase is required by the owner then the RTA will consider acquisition under "hardship" provisions. Hardship has to be demonstrated to the satisfaction of the RTA. If successful, the owner may then negotiate the acquisition or may require the RTA to compulsorily acquire the land.

An owner who has purchased in knowledge of the proposal would not normally be able to demonstrate hardship.

13.3.2 Effects of the Proposal

The proposed motorway alignment is largely located within the road reservation. Figure 11.3 illustrates that the ratio of private and public ownership of the reservation is approximately 12% to 88% respectively (by area).

Table 13.1 and Appendix G summarise the location and number of properties to be acquired to allow the motorway to be developed.

TABLE 13.1 PROPERTY REQUIREMENTS FOR THE PROPOSED CASULA LINK

Full property acquisition	
- residential	11
- vacant lots	0
Partial property acquisition	
- residential	32
- vacant lots	4

Source: Maunsell Pty Ltd, 1992

13.3.3 Mitigative Measures

During the development and refinement of the motorway preliminary design, a considerable effort has been devoted to minimising the number and area of properties to be acquired. This has applied

particularly to the location and width of on and off ramps, the provision of vehicular and pedestrian overpasses and the better use of existing structures.

13.3.4 Conclusion

The M5 Casula Link proposal would require only a small number of land aquisitions. Well established RTA land aquisition procedures would smooth the process.

13.4 COST-BENEFIT ANALYSIS

13.4.1 Methodology

The purpose of cost-benefit analysis, or economic evaluation, is to measure the economic worth of a project from the community view point. It is a useful guide to ensure that there is efficient allocation of resources. For convenience, benefits and costs are measured in monetary units so that these can be readily compared. As present goods and services are preferred to future ones by most people, future costs and benefits are discounted to the year of evaluation and thereby given less weight.

In practice, it is usually not possible to quantify and value all benefits and costs. For this analysis, the factors that have not been quantified have been clearly distinguished as indicated in Table 13.2.

The following assumptions have been made in the economic evaluation:

- A discount rate of 7% has been used, with sensitivity tests at 4% and 10%.

- The costs and benefits as specified in Table 13.2 have been compared between the proposed Casula Link and the Hume Highway upgrade to determine net costs and benefits for each major alternative.

- All costs and benefits have been discounted back to 1992 dollars.

- All costs have been examined from 1992 onwards and benefits have been assessed for 30 years of operational life of the project. A construction period of two years for the Casula Link proposal and three years for the Hume Highway upgrade alternative (including serious traffic disruption and traffic control costs) have been assumed.

- No tolls have been included in the analysis.

- Road user benefits are primarily based on traffic modelling and the outputs such as total travel time savings and total vehicle kilometre savings.

The benefits are determined by ascribing monetary values to time and distance savings and the reduced accident potential.

The results were interpolated between years 1996 and 2011 and a lower growth rate was used beyond year 2011. Monetary values for vehicle operating costs and accident costs as prescribed by RTA have been used in the evaluation.

- An annualisation factor of 1300 has been used to convert peak period modelled output to annual levels.

- The analysis is based on resource costs, which means that indirect taxes have been removed from all capital and operating costs.

- The important economic parameters of Net Present Value ((NPV), Benefit-Cost Ratio (BCR) and Internal Rate of Return

TABLE 13.2 TREATMENT OF BENEFITS AND COSTS

Benefits and Costs Quantified	Benefits and Costs not Quantified
Travel time and distance	Through traffic in residential areas
Freight efficiency	Risk from transport of materials and construction
Road accidents	Community severance
Relocation and disturbance	Visual quality
Landscaping	Impacts on Aboriginal and European heritage
Erosion and sedimentation	Air quality
Energy	Noise
Utilities and services disturbance	
Construction costs	
Land acquistition	

Source: Denis Johnston and Associates, 1992

(IRR) for the Casula Link proposal and the Hume Highway upgrade have been used to examine both project's viability.

Noise is an important environmental impact, especially in this study and noise mitigative measures account for approximately 7% of the project construction cost for the Casula Link proposal.

For this corridor where the complete achievement of noise criteria has been sought, it is considered that no noise exposure exceeds the threshold of acceptability above which a "disbenefit" cost would be ascribed. The economic costs of noise for the proposal are contained within the construction cost allowances for mitigative measures. Thus, the "disbenefit" cost is the cost of the recommended noise barriers.

13.4.2 Results of Evaluation

The salient results of the cost-benefit analysis for the proposed Casula Link and the Hume Highway upgrade alternative are shown in Table 13.3.

13.4.3 Conclusions and Sensitivity Testing

The NPV and the Present Value of Benefits shown in Table 13.3 for the Casula Link are substantial and are more than double those of the Hume Highway alternative. They show that the Casula Link would generate greater benefits. However, the BCR for the Casula Link is lower than the Hume Highway upgrade, which is due in large measure to the lower capital costs for the Hume Highway. The most significant category of benefit is travel time savings, accounting for almost 90% of the total benefits. The study corridor would be highly congested in the base case in the future and so the travel time benefits with the proposed Casula Link are considerably more than the Hume Highway alternative. The benefits from the Link would also be enjoyed over a much longer period, in contrast to the upgrade alternative which is at best a short term measure.

The major beneficiaries would be residents in the Liverpool, Campbelltown and Camden LGA's.

TABLE 13.3 ECONOMIC PARAMETERS

Economic Parameter	Casula Link proposal	Hume Highway alternative
Present Value of Benefit (M$)	583	280
Present Value of Cost (M$)	85	38
Net Present Value (M$)	498	242
Benefit Cost Ratio	6.8	7.4
Internal Rate of Return	21%	20%

Source: Denis Johnston and Assoiciates, 1992

Note: All costs and benefits have been discounted to 1992 levels at 7%

For the proposed Casula Link, the BCR is 6.8 which is far greater than the minimum value of 1 (as prescribed by the NSW Treasury) and shows that the project is viable. Further, the IRR is 20.9%, which is also far greater than the Treasury minimum value of 7%.

Sensitivity Testing

In order to check on the robustness of the proposal and its sensitivity to changes in the key economic parameters, sensitivity testing was undertaken by: -

- Increasing the construction and operating costs by 20%.
- Decreasing the expected benefits by 20%.

The results still revealed a robust project fully justified on economic ground as the NPV was $364m, the BCR 4.5 and the IRR 15%.

For the Hume Highway upgrade the corresponding figures were: - NPV $178m, BCR 4.9 and IRR 15%.

If it were further assumed that the appropriate discount rate was 10% rather than 7% the Casula Link values (NPV $207m, BCR 3.1, IRR 11%), still satisfy the NSW Treasury requirements.

Alternatively, if the discount rate were reduced to 4% the Casula Link NPV increased to $653m, the BCR goes to 7.1 and the IRR to 18% for this decreased benefits and increased cost case. Under the

assumptions, the Hume Highway upgrade NPV is $329m, the BCR 7.9 and the IRR 17%.

The conclusion from all the sensitivity testing is that the Casula Link project is not sensitive to changes in the economic parameters.

13.5 COSTS AND FUNDING

13.5.1 Preamble

The future development and functioning of Sydney is reliant on an efficient transport infrastructure. Planning and construction for roads has been the responsibility of the RTA. However due to limited resources, the state cannot afford to provide for all the city's transport needs. So in recent times, the RTA, and other government agencies have joined forces with the private sector to cover the large up-front capital costs. The M4 Motorway is one example. Opened in 1992 as a privately managed tollway, this road will revert to the ownership and control of the state after 17 years.

The M5 Motorway between King Georges Road and Moorebank Avenue has been constructed as a public-private development arrangement. Here it is between the RTA and a private consortium (Interlink Roads). The proposal to extend this Motorway from Moorebank Avenue to Campbelltown Road qualifies as a serious contender for funds from the three likely sources of funding; Commonwealth, State and private.

13.5.2 Federal Funding

Concerning the provision of finance for the M5 Casula Link, the RTA have recently advised that in February 1992 the Authority wrote to the Federal Government requesting that funds be approved to carry out the M5 Casula Link, and the Liverpool By-pass. If built, the projects would reduce unemployment and ease traffic congestion in Sydney's south western region. Regrettably no funds were allocated to these projects in the announcement of the Federal Government's 1992 One Nation Statement.

Subsequently, the Federal Government has indicated its proposal to link the current points of termination of National Highways under the post 1993 road program for Sydney. This means the linking of the M5 Motorway and the Sydney-Newcastle Motorway at Hornsby, but neither the extent to which Federal funds might become available nor the final route are as yet clear.

13.5.3 State Funding

The RTA is unable to assure the full requirement of funds for the M5 Casula Link within five (5) years, because of current commitments and limited funds.

However the RTA's funds, although limited may become available. They are, at the time of preparation of this EIS, the principal source from which funds are likely to be drawn for the proposed Link.

13.5.4 Private Funding

Indications are that the M5 Casula Link would enhance the commercial viability of the current M5 Tollroad project through increased traffic patronage and so Interlink Roads (the operator of the tollway) may be prepared to contribute to the earlier construction of the missing link.

Commercial arrangements might therefore be concluded with Interlink Roads for Interlink Roads to contribute to the construction, operation or maintenance of the proposed Casula Link.

13.5.5 Conclusion

None of the other funding options or contributions has yet matured to the point where it could be considered as a clear funding proposal.

In the event that the Determination is made to build the M5 Casula Link, the RTA would continue to negotiate with the Federal Government, review current road funding and progress discussions with Interlink Roads to achieve a successful funding arrangement.

The outcome of these negotiations would be addressed in the Determination process as would the social and environmental impact of any private funding of the Casula Link.

However it should be noted that any decision to build the Casula Link would be subject to the availability of funds.

14 CONSTRUCTION EFFECTS

The RTA has responsibility to ensure conformity with controls on any emissions of noise, air contaminants, and wastes during construction. The RTA would be required to satisfy the EPA that the proposed controls are adequate for the protection of the public and the environment. The EPA would then issue statutory approval to construct the works.

An environmental management plan is proposed for the construction period. The plan addresses those environmental effects that could occur if appropriate measures are not undertaken. The factors addressed are:

- Water management.
- Construction noise.
- Air quality.
- Urban bushland and landscape.
- Community disturbance.

The remainder of this section discusses ameliorative measures which would be included in the management plan for the construction works.

The designs and proposals for environmental control would be submitted for comment by Council, EPA, the National Parks and Wildlife Service and the Water Board, and opportunity would be provided for those groups to inspect the works. Results of RTA monitoring would also be provided to those Authorities.

It should be noted that the duration of the construction period is entirely dependent on the availability of the required funds. The various funding scenarios are discussed in Section 13.5.

Should all the required funds be readily available then it is estimated that the proposed Link could be constructed in about 18 months to 2 years. Should funds be provided over a longer period, say up to five years, then the construction would be staged according to the availability of funds. Such staging is likely to be decided by the contractor in association with the detailed designers. However a possible staging scenario, over five years, might be;

Years 1, 2 and 3 - Construct or enlarge overpasses and underpasses (Moorebank Avenue, widening of Georges River Bridge, Hume Highway, De Meyrick Avenue, Kurrajong Road, Camden Valley Way)

Year 4 - Undertake bulk earthworks activities including noise mounds and ramps.

Year 5 - Installation of noise barriers, placing of motorway pavement, installation of landscaping.

14.1 WATER MANAGEMENT

Water Management on construction sites is now an accepted and important part of all civil engineering contracts and has been part of evolving RTA construction procedures. During the construction of the works, sedimentation basins, gross pollutant traps and wet detention basins would be used to limit the removal of sediment from the site.

Responsibility for maintaining and cleaning out the sedimentation basins rests with the contractor during the construction period. Once construction is complete responsibility would be as described in Section 12.2.2.

These sediment control works are all typically described and defined as follows.

14.1.1 Sedimentation Basins

Measures to control erosion and sedimentation, such as drains, sediment traps and basins and hydraulic structures (such as energy dissipaters) would need to be installed during construction. Sediment basins are "dry" storages that fill during storms and provide pondage time to allow coarse particles to settle.

14.1.2 Gross Pollutant Traps

Gross pollutant traps are basically concrete tanks which improve water quality by:

- Settling and depositing sediments and heavy particulate material.
- Trapping litter in trash racks.

- Separating, trapping and removing oil at oil booms.

They are easily dewatered and designed for easy access to remove litter and sediment, and are cleaned out three to five times per year, typically after larger storms, by the responsible Authority (refer 12.2.2).

14.1.3 Wet Detention Basins

Wet detention basins are permanent bodies of water, such as small ponds or wet lands. They have been found to be the single most effective means of improving the quality of urban runoff, and the best means of removing heavy metals. Their effectiveness is mainly due to their capacity to detain runoff for long periods. This enables sedimentation of particulate matter and biological treatment by macrophytes within the shallow areas of the ponds.

These major works would be used to limit sediment movement and would be used during construction in conjunction with:-

- Hay bale diversion banks.
- Hay bale filters.
- Energy dissipators.
- Stabilisation of batters.

Usually, the construction stage water management plan is called for from the contractor by the tender documents and would rely for any detailed plan, on the construction sequence and method to be used by the contractor.

While it is not usual to prescribe elements of the plan, as an indication of the likely extent of works, it is proposed that:-

- Prior to and during construction, sedimentation basins would be installed at catchments A, B, C, D & E.

Progressively during construction, and as part of the completed works:-

- Gross pollutant traps would be located to treat longitudinal drainage at catchments A, C, D & E.
- Wet detention basins would be installed at catchments A and C.

This possible pattern of works recognises that:-

- Large detention basins to help manage stormwater flows would be located at A & C on Figure 12.3 and the wet basins would be part of those systems.
- With likely future accident "black spots" (or in this motorway case, really "grey spots") being at the Hume Highway interchange and the Camden Valley Way interchange, all drainage structures in these locations would be provided with gross pollutant traps in order to trap any contaminated run-off from the roadway following an accident.

The issue of the quality of releases from sedimentation basins is of real concern to the RTA. Almost certainly, the 50 mg/l NFR limit would be unachievable in practice.

The best way of achieving this water quality is by gypsum additions to the sedimentation basins. This can be a labour intensive and expensive operation (often requiring mixing tanks, boats, pumps and testing equipment) and while acknowledging its importance the method would need to be resolved by the successful contractor for the construction stage and by the RTA for the operational stage.

Of the listed construction stage sedimentation basins, it is thought that the basins at catchments B, D and E would be maintained for operational purposes but all of these judgments would be tested during detailed design and during construction stage planning.

The associated water quality monitoring program would be based on the above pattern of works. Regular monthly samples would be collected at a minimum of six locations and tested for biochemical oxygen demand (BOD), non filtrable residue (NFR), total phosphorus and total nitrogen levels. The testing of creek water qualities would start ahead of construction to provide baseline data. On-going testing is taken up in Section 16.

14.2 CONSTRUCTION NOISE

Guidelines for construction noise levels are specified by the NSW EPA (SPCC) in Section 17.1 of the EPA's (SPCC's) Environmental Noise Control Manual.

For construction periods greater than 4 weeks and not exceeding 26 weeks the L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10dB(A).

However, the experience of the EIS noise consultant is that it is not feasible to conform to such guidelines unless new technology and related construction techniques are developed which are both economically viable and practical.

The magnitude of the problem is directly related to the number and type of equipment used, and its spatial separation from those adjacent residential properties. Experience of previous projects indicate that the lowest (consistent) peak noise levels at the nearest residential properties to a routine construction zone, would be approximately 35dB(A) above background (referenced to an existing day time background sound level of 40dB(A). This data is based on the anticipation that the nearest houses are likely to be located within a distance of 20-40m from the edge of the construction zone.

Lower noise levels would be achievable at more distant houses ie. where spatial separations from the construction zone exceed 50m or more, and where it is possible to install the future roadside barriers relatively early during the construction program. Noise levels would rise and fall during the construction period and hence the high levels will only apply for limited periods of time.

To avoid the potential of a worst-case scenario it would be necessary for the RTA and its sub-contractors to endeavour to obtain the latest and quietest equipment but appropriate to the economic viability of the construction phase. The contractor would also be required by the RTA to adopt techniques that lower construction noise levels, such as by:

- Erecting traffic noise control barriers prior to construction in some areas and/or the use of temporary barriers.

- The use of techniques other than blasting such as heavy ripping where rock is required to be removed.

- Fitting of noise control kits on noisy mobile equipment.

- Shorter working hours for noisy activities.

- Notification of local residents of any unusual working hours involving noisy activities.

In addition the contract would specify the adoption of a construction cycle in which planned roadside barriers are constructed as early as possible as a means of minimising external noise emission. These measures are seen as practical and achievable and aim to meet the spirit of the EPA's noise level guidelines.

These engineering and operational controls required to achieve the target noise level of 35 dBA above background would be included in the specification for contractors.

The controls outlined in terms of equipment, practices and working hours and the predicted noise levels would be agreed with the EPA. Breaches of that agreement would not be allowed and would be actionable.

14.3 AIR QUALITY

Construction activities generate exhaust emissions (mostly diesel) and dust from earthworks and the movement of heavy vehicles. Diesel exhaust emissions are unlikely to cause any significant impact. Major construction activities that would generate dust are road excavation and excavation for drainage works. The most likely period for impacts to occur would be during the first phase of heavy excavation, where substantial earthworks occur. Impact would vary according to the construction period for each location.

There are two relevant criteria for assessing likely impacts of dust emission on nearby residents or property. These are the US EPA 24 hour primary and secondary goals, which are 260 and 150 $\mu g/m^3$ respectively.

The dust generated under assumed conditions can be estimated *(US EPA 1982, NERDDC, 1988)*. The following dust generation scenarios are based on expected plant usage

and possible construction rates for the proposal.

During the first phase of heavy excavation, where substantial earthworks occur at the relatively slow rate of 50 lineal metres per day, the highest rates of dust generation would occur. Thus the source and dust generation rates over an eight hour day during this period of greater effect would be:

- Dozers (two at the rate of 2.75 kg/h) - 43 kg/day

- Scrapers (three with water controls) - 360 kg/day

- Graders (one at 0.5kg/km travelled) - 5 kg assuming 10 km per day

- Wind erosion from 2.5 ha exposed area (0.4 kg/ha/hr) - 24 kg/day

Thus the total dust emissions under normal conditions with intensive watering would be approximately 430 kg/per day. Dust would be suppressed to the maximum possible extent using water carts. It is possible that on occasions when three scrapers are working in the construction area and meteorological conditions favour the generation of dust (dry, windy conditions), effects would be experienced at residences depending on their distance from the construction area. However these effects would be temporary in nature. On a hot dry windy day the amount of dust from wind erosion could be higher, but should still be able to be controlled using sprays from large water tankers.

In addition, the specifications will require that heavy earth moving not be undertaken during conditions of high wind velocity and adverse wind direction.

14.4 URBAN BUSHLAND AND LANDSCAPE

Construction impacts can have a lasting or permanent impact on the natural and visual environment. To ameliorate these potential effects the Environment Management Plan has adopted the following guidelines:

- Re-establishment of local tree species as proposed by the landscape consultants and detailed in Section 11.4.3 will assist in restoring flora and fauna habitat.

- Collection of seed for propagation prior to construction and stockpiling of felled trees for use as mulch in landscaping will help in retaining local genetic stock. At least 12 months lead time would be required to obtain suitable seed and container grown plant stocks of endemic species. The Consultative Committee has expressed interest in seed collection and when the construction program is better defined, it may be appropriate to raise the issue with the Committee.

- Grass species used for soil stabilisation should preferably be short-lived non-invasive species. The landscape plan (see Section 11.4.3) proposes use of appropriate grass species such as Ryecorn and Japanese Millet.

- Construction of acoustic barriers at cut batter locations would need to take place prior to such landscaping, to reduce the probability of damage to the planting by subsequent wall construction activities. The landscape master plan (to be prepared during the detailed design phase) would present planting details for these locations.

Prior to commencement of any construction activities, the contract shall prepare - and have approved - Quality Assurance Plan and Inspection Test Plan for the landscape construction and management activities. A condition of the contract shall be the ongoing management and maintenance of the landscape to ensure a timely progress and development. The management plan shall include the provision for the quarterly inspection of all plants and the recording of the presence of any dead, missing or damaged plants. All such plants shall be replaced with identical species prior to the next quarterly inspection.

Ongoing nursery contracts shall be maintained by the management authority to ensure continuous access to replacement plant stocks. The constructing authority would need to allocate funding and other resources to achieve these works.

14.5 COMMUNITY DISTURBANCE

Disturbance to the local community would occur during construction with particular neighbouring points being affected from construction activities progressing along the route. Impacts on the community would be felt from:

- Construction traffic.
- Interference to local traffic movements.
- Temporary loss of recreational/ open space facilities/activities.
- Vibrations due to construction equipment.
- Construction noise disturbance (discussed in Section 14.2).

The following briefly describes the likely impact and recommends guidelines to mitigate against these effects.

14.5.1 Construction traffic

A large proportion of construction traffic would consist of tip-trucks delivering aggregates and gravels. A large number of semi-trailers would deliver materials such as steel reinforcement, drainage pipes and precast concrete units.

Sources of aggregates and gravels for the project would probably be quarries at Penrith, Prospect and the South Coast.

Traffic delivering miscellaneous items such as drainage pipes and steel reinforcement to the site would have a wide variety of origins, with the arterial roads close to the site being most affected by this traffic.

Wherever practicable, minor roads in the vicinity of the site would not be used by construction traffic as access points onto the site would generally be from the existing major roads such as the Hume Highway and Camden Valley Way.

14.5.2 Interference to Local Traffic

Conditions in any construction contract would require that routes be maintained for traffic or access to properties and that disruption be minimised. Most disturbance will be to residents along the route when their access is interrupted, and to local traffic during intersection upgrading or widening works, when detours may be in force.

14.5.3 Recreational Activities

During construction there would be some added alienation of areas needed for site activities which, following construction, would be reinstated and returned for community use.

14.5.4 Vibration due to Construction Equipment

Heavy construction equipment, particularly large vibratory rollers, would induce ground vibrations which may be felt in nearby residential dwellings. This equipment and roller vibration amplitude would be limited to the minimum required to undertake the construction works economically. Dwellings which may be subject to vibrations, would be monitored for acceptable levels of ground vibrations and for vibration induced damage both before and during construction activities.

14.5.5 Construction Contract

The above discussion highlights a number of actions and conditions that would be required of the contractor during construction of the proposal.

Those matters relevant to the environmental management of this linear construction site would also be of interest to the local community, environmental groups, and authorities responsible for monitoring and auditing this EIS (These requirements are set out in Table 16.6).

15 SUMMARY OF EFFECTS

The Environmental Planning and Assessment Act, 1979 requires consideration of the cumulative impact of a proposed project. The following presents the assessment of the cumulative impact of:

i) All factors evaluated in this EIS.

ii) The proposed motorway with other transportation projects.

15.1 CUMULATIVE EFFECT OF ALL FACTORS

The cumulative effect of all factors addressed in the evaluation of the proposed motorway is shown in the Summary of Effects as given in Table 15.1.

The assessment of the population and employment growth and its distribution, and the transportation demand analysis were undertaken for a region greater than the study area. Transportation and safety effects, including travel time savings, vehicle operating cost savings and accident cost savings were therefore assessed for the a broader transport region. This region covered the Sydney metropolitan area south of the harbour and Parramatta River to Camden, from Leichhardt to Badgerys Creek.

Similarly, the assessment of the metropolitan population and employment growth and distribution was based on transportation improvements for the south west region of Sydney. Hence the environmental assessment of the proposed project has been considered within the Sydney metropolitan context. The benefits and costs of the proposal are presented in this EIS in terms of cumulative regional effects for land use and transportation planning issues (see Section 5).

15.2 CUMULATIVE IMPACT WITH OTHER TRANSPORTATION PROJECTS

The transportation study (Denis Johnston and Associates, 1992) included the effect of other transportation projects in the study region. In the traffic modelling, other road projects likely to occur in 1996 and 2011 were included in the base case. The transportation and economic evaluations therefore did not overstate the case for additional road space. In addition, the impact assessments (particularly for noise and air quality) were based on the cumulative traffic flows resulting from the existing traffic, and traffic from other road projects and the proposed M5 Casula Link.

TABLE 15.1 SUMMARY OF EFFECTS OF PROPOSAL

Evaluation Criteria	M5 Casula Link Motorway
TRANSPORT EFFICIENCY	
Capacity of transport system	. Increased capacity due to four completely new lanes of full grade separation for through traffic
Public transport	. Buses would use the facility on the basis of shared lanes due to the current local nature of trips by buses
Travel time	. Travel time savings of 4% during 2011 two hour a.m. peak
Fuel consumption	. Fuel savings of 2% during 2011 two hour a.m. peak
Network flexibility	. Substantial flexibility through the addition of the new link to the network and retention of the existing Hume Highway
ROAD SAFETY	
Road accidents	. Relative to the base case accident savings of 1.5% with proposed development in the south west region.
Risk from transport of hazardous materials	. Considerably lower risk exposure for adjacent/local population and built environment
ENERGY USE	. Fuel savings post construction of 11,500 litres per day during 2011 two hour a.m. peak
HUMAN ENVIRONMENT	
Noise	. The RTA's September 1992 Interim Noise Policy goals can be met. More stringent goals based on R zones will be applied where practicable . Barriers extend continuously from the Hume Highway to Box Road. From Box Road to Camden Valley Way barriers only provided at affected residences. Maximum proposed barrier height is 6.0m . A number of mitigative measures for construction noise are proposed as detailed in Section 14.2
Air Quality	. Would have minimal adverse local air quality impact as there would be two main routes to disperse the traffic and hence the air pollution . With improved traffic flow, total emissions of carbon monoxide and hydrocarbons could be lower
Traffic on local streets	. Reduced traffic intrusion as trip preference would favour the motorway over the alternative rat-run through local residential streets. However traffic on Kurrajong Road is expected to increase

TABLE 15.1 CONT'D SUMMARY OF EFFECTS OF PROPOSAL

Evaluation Criteria	M5 Casula Link Motorway
HUMAN ENVIRONMENT	
Community severence and amenity	. Minimal community severance due to provision of a vehicular and pedestrian connection at Kurrajong Road, and pedestrian connections at De Meyrick Avenue and Box Road . Reduction in open space due to the resumption of land for the motorway . Residential amenity would be maintained using extensive landscaping and noise barriers
Land use	. The Casula Link would result in the loss of 11 residential properties and partial acquisition of 32 residential properties (refer Table 9.2 and Appendix G)
Aboriginal Heritage	. Only one known Aboriginal site appears directly threatened by the proposal. This site has been almost obliterated by previous road construction activities and therefore could be destroyed after mapping. One stretch of creek flat (Maxwells Creek near Wattle Road) has archaeological potential and would be monitored during construction
European Heritage	. No listed items of European Heritage are located within the proposed corridor.
BIOPHYSICAL	
Visual impact	. A continuous woodland corridor would be created on each side of the motorway to screen it from adjacent properties
Erosion, sedimentation and water quality	. Drainage works would relieve some problem areas such as at De Meyrick Avenue. Permanent detention basins would eliminate flooding due to 1 in 100 year storms. Sedimentation basins and Gross Pollutant Traps would provide water quality controls
Flora and fauna impacts	. Minimal impact on flora and fauna since the majority of the proposed route is through cleared land. No rare or threatened plant species are known in the corridor
ECONOMIC	
Benefit cost ratio (7%)	7.22
Net present value (7%)	$531M

monitoring and auditing

MONITORING AND AUDITING

Section 16 describes the requirements for future monitoring and auditing if the motorway is constructed for compliance with this Environmental Impact Statement.

16 MONITORING AND AUDITING

16.1 BACKGROUND

This section of the EIS sets out the requirements of the study team for future monitoring and auditing should the Casula Link be built. The monitoring program is aimed at checking compliance with the provisions of this Environmental Impact Statement during both the construction and operation of the proposed motorway project.

16.2 APPROACH TO ENVIRONMENTAL AUDITING AND MONITORING

There are increasing pressures to ensure that Environmental Impact Statement provisions are auditable. The benefit of an environmental audit is that it can be applied at some future time to assess the actual impact of the project, test the accuracy of the predictions in the EIS, and provide means by which techniques can be improved in future EISs.

In developing an environmentally auditable EIS, the following aspects require attention; baseline data collection, impact predictions, and ongoing monitoring.

In the preparation of the EIS, the specialist consultants have collated baseline data, evaluated the proposal and, where relevant, recommended on-going monitoring requirements. Where possible the EIS consultants have undertaken their studies and evaluations according to the following definitions:

Baseline studies on present conditions should be presented in the EIS in a way that provides the basis for an ongoing monitoring program. This ongoing monitoring may subsequently take place during construction and operation.

It is necessary that impact predictions be quantified so that during project construction and operation they can be tested for accuracy against the actual impacts that do occur. This process allows for verification and for improvements in the techniques used in future EISs.

Monitoring requires an ongoing commitment and maintenance of records, both during construction and operation. Both those impacts that require audit and the key indicators of these impacts should be identified. A key indicator can be described as one that serves as both an indicator of impact, and which may be indicative of the effectiveness of mitigative measures *(Mt King Ecological Surveys, 1992).*

16.3 AUDIT PROCEDURES

The following procedures should be followed:

- Identify predicted impacts and key indicators.
- Collect baseline data on present conditions before the project is implemented.
- Through monitoring, obtain data on actual conditions as they change during the implementation of the project and once it is operational.
- Compare the actual impacts with the predicted impacts to identify any difference.
- Determine the cause of the difference.

16.4 APPLICATION OF AUDIT PRINCIPLES

Monitoring procedures would apply if the proposed project proceeds, with several government agencies having responsibilities for the design and implementation of these programs.

The recommended monitoring and auditing programs are outlined below. The actions are identified under broad headings to indicate their relevance to the transport objectives of the project, (see Section 7) and the evaluation of effects detailed in Sections 11 and 12.

16.4.1 Transport and Safety Effects

The main aspect of traffic performance monitoring on the proposed motorway Link and in the corridor which should be monitored on an ongoing basis is the incidence of traffic accidents.

The RTA routinely collects such information on a metropolitan-wide basis and any necessary monitoring can be incorporated into this existing process.

Table 16.1 outlines the monitoring requirements for safety.

16.4.2 Community Effects

The monitoring and auditing issues relevant here relate to the metropolitan, regional and local community. They are also closely connected to those issues identified in Section 16.2, and have only been separated here for ease of discussion.

16.4.3 Human Environment Effects

Traffic noise

The EPA has the primary role in enforcing noise standards while the RTA has a limited charter in this area, however it will take appropriate action to support EPA enforcement programs which aim to reduce noise at the vehicle source.

- The RTA will inspect heavy vehicles for noise level compliance under the annual Heavy Vehicle Inspection Scheme.

- The RTA, in co-operation with AUSTROADS and the industry, will investigate controlling the use of heavy vehicle engine compression brakes in built-up areas of NSW.

- The RTA will continue research into the causes of, and measures to reduce, vehicle noise.

- The RTA will support the Advisory Committee on Vehicle Emissions and Noise (ACVEN) in promoting new Australian Design Rules in relation to noise control for new vehicles.

As part of its Interim Traffic Noise Policy the RTA is also committed to its policy of loudspot treatment.

Loudspots are lengths of road where traffic noise levels are high and considered to be inappropriate for the adjacent land use. To address road traffic noise at loudspots, the RTA is investigating developing a priority listing of loudspots for roads under its control and criteria and funding for any remedial measures.

The RTA has advised that it intends to implement an on-going monitoring program through which the community noise impact from all current and future motorways and/or tollways will be progressively assessed. Such programs will utilise unattended long term monitoring systems which will assess noise and meteorological factors, and where relevant, ground vibration should this be suspected as being a problem.

The data to be collected by such systems will involve assessments of at least 8 statistical A-weighted sound

TABLE 16.1 ASSESSMENT OF SAFETY EFFECTS

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Safety . Accident performance	. Existing accident rates projected to future traffic volumes. Accident savings of $3.49m predicted for year 2011. See Table 15.1	. Ongoing monitoring of number and severity of accidents. See Table 15.1	. Test at 1, 10 and 15 years.	. RTA
. Hazardous goods transportation	. Accident rates for NSW. Mitigative measures also outlined.	. Use as basis for ongoing monitoring. Check to see if measures have been implemented and if they are effective.	. During and after construction and following accidents.	. RTA

TABLE 16.2 ASSESSMENT OF COMMUNITY EFFECTS AND URBAN DESIGN

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Community Severence	. Current land uses and road/pedestrian network mapped. Predicted that the proposed over and underpasses would not constrain facility usage.	. Community views on adequacy of access and any barrier effects of the motorway. . Confirmation of provision of over/under passes.	. 1 year and 5 years after opening. . At construction approval.	. RTA
Community Composition Urban Design	. Profile of age, sex, household size, income etc for the environs of the motorway and Hume Highway.	. Relative stability in status and composition at census periods.	. At the two censuses following opening.	. RTA
. Hume Highway	. Precincts with specific built form and character identified. Opportunities identified for planned upgrading and coordination of land uses as traffic pressure is reduced.	. Council and/or community initiatives to improve or manage the highway frontage uses, parking and/or landscaping.	. Annually for 5 years from opening.	. RTA
. Reservation south of Kurrajong Road	. Existing rural residential development identified. Potential built form and urban design to contain noise effects identified.	. Provisions for noise control in Development Control Plans for future urban releases in this area.	. As DCPs are exhibited.	. RTA Liverpool City Council

level parameters, wind velocity and direction, temperature and pressure, all of which will be presented with a uniform format suitable for rapid visual assessment.

Where groundborne vibration is to be collected, its measurements shall involve pre-filtering in accordance with the requirements of AS2670 Parts 2 and 3 - 1990, suitable for assessing the 'Z' axis vertical vibration as well as the other related vector components.

Such measurements are planned for a maximum cycle of five years, utilising monitoring points which are representative of the original locations at which the EIS studies were undertaken.

Air quality

It is recognised that the conclusion drawn in the EIS on the likely effects of the proposal on air quality, rely to a large extent on the predictions of models which have been used both to estimate emissions and assess dispersion. Models have limitations as to accuracy and thus the conclusions presented above are conditional on model predictions being essentially correct. To manage these uncertainties it is recommended that the RTA implement a program of air quality monitoring to confirm that modelling predictions are correct.

The RTA has already commenced such monitoring activities as part of related road development projects.

These include monitoring of nitrogen dioxide and carbon monoxide on the M4 Motorway.

The Metropolitan Air Quality Study (MAQS), is shortly to be commissioned by the EPA. MAQS is a major air quality study that will greatly expand the EPA's meteorological and air quality monitoring data base in Sydney, Lower Hunter and Illawarra Regions of NSW. The studies will quantify emissions of major pollutants in the study regions and develop software for predicting day by day air pollution levels and for developing management plans for air pollution control. The RTA will participate in MAQS. Monitoring programs will determine the requirements for future emissions controls on NSW (Australian) motor vehicles.

Landscape/visual quality

The construction of the landscape must be carried out in accordance with the detailed plans and specifications which should be prepared by a qualified and experienced landscape architect to accord with the requirements of this EIS.

Prior to commencement of any construction activities, the contractor should prepare - and have approved - a Quality Assurance Plan and Inspection Test Plan for the landscape construction and management activities. A condition of the contract should be the ongoing management and maintenance of the landscape to ensure timely progress and development. The management plan should include the provision for the quarterly inspection of all plants and the recording of the presence of any dead, missing or damaged plants. All such plants should be replaced with identical species prior to the next quarterly inspection.

Monitoring would be the responsibility of the management authority who would also maintain ongoing nursery contracts to ensure continuous access to replacement plant stocks. Co-operative involvement by local Councils and representatives of relevant environmental/bushland management groups should be initiated.

Archaeology and heritage

Figure 11.9 illustrates the location of three potential sites where further testing would be required and other deposits or sites may be found during future investigation and construction activities. If Aboriginal archaeological material were to be located, monitoring during clearing of surface material would be required. For surfaces likely to be subjected to additional wear or erosion, for example where archaeological material may become exposed, a monitoring program would be implemented. Monitoring of the Aboriginal sites and the potential sites identified in the corridor would be required both during and after-construction.

Prior to commencement of construction the RTA or the organisation undertaking the development would engage an archaeologist to arrange consultation with NPWS, TLALC and GLALC, to design a program of investigation and to monitor clearing and road works as needed during construction.

Since no heritage item would be affected by the proposed motorway, monitoring measures are not considered necessary.

16.4.4 Biophysical Environment Effects

Geology and Soils

An on-going monitoring program would be essential during both the construction and post-construction stages to evaluate the effectiveness of erosion and sediment control measures and to test the water quality impact against the predictions. To enable a quantitative assessment to be made of any soil erosion or sedimentation impact, the following baseline survey would be undertaken prior to construction of the motorway:

- Ground survey and placement of pegs on transects along bushland watercourses.

- Sampling and testing of water in creeks following several rainfall events to assess content of total phosphorus and total nitrogen.

- Sampling and testing of water in creeks following several rainfall events to assess turbidity levels.

Specific mitigative measures proposed for the construction phase are

TABLE 16.3 ASSESSMENT OF HUMAN ENVIRONMENT EFFECTS

Criteria	Baseline data provided in EIS/prediction made	Data required from future Monitoring	Time Scale of Monitoring	Action / Authority
Traffic Noise	. The EIS has offered detailed night time noise level predictions for the year 2011. The predictions assume the construction of the recommended noise barriers and the development of the expected traffic volumes, particularly heavy vehicles. . Existing noise levels provided for 12 representative sites in study area (Leq 6 hr which is the most critical parameter). . Noise predictions made for the year 2011. . Transport may affect residences.	. Confirmation that the recommended noise barriers are constructed. . The RTA to monitor noise from heavy vehicles . RTA to continue to investigate noise reduction measures . RTA to promote the work of ACVEN . RTA to implement an ongoing noise and ground vibration program . Monitor noise and vibration levels (as appropriate) at same sites (24 hr A-weighted stat analysis plus meteorological data) . Noise monitoring would be required, vibration monitoring only in the event of impact. . Compare forecast data with future statistical noise measurements to assess prediction accuracy.	. During construction, one month after opening of Link and at 5 year maximum intervals thereafter.	. RTA . Consultants
Air Quality	. For the selected motorway locations, and under nominated atmospheric conditions, air quality predictions for nitrogen oxide, carbon monoxide. . Minimal CO, NOx . CO, PM10, HC will remain below existing Ambient Air Quality Standard (AAQS) (1992) . NO (as NO2) will be equal to or marginally in excess of existing (1992) AAQS in the year 2011.	. RTA to participate in MAQS . RTA to monitor nitrogen dioxide and carbon monoxide . Ambient and kerbside NOx and NO2 at selected location sites to be agreed with EPA. . Optional to monitor HC and PM10.	. At each agreed sample location continuous for 1 month per season to determine seasonal and diurnal variations to year 2011.	. EPA . RTA

TABLE 16.3 CONT'D ASSESSMENT OF HUMAN ENVIRONMENT EFFECTS

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time Scale of Monitoring	Action / Authority
Visual Quality	. Visual Assessment Plan and Report (Working Paper).	. On site visual inspection and report, to confirm "as built" relationships.	. At time of construction completion . 5 years after construction. . 10 years after construction.	. RTA . Community Consultative Committee . Adjust planting plans to ameliorate any new problem areas.
Impacts on utilities, services and lighting	. Relocations costed in EIS economic analysis.	. Records of relocations to be provided as part of construction.	. Records to be maintained by relevant authority as they require.	. Utility Authority . Prospect County Council, Waterboard, Telecom, Natural Gas Co., Liverpool City Council
Aboriginal archaeology	. Areas requiring further investigation are identified. . The need to inform contractors and RTA staff of the presence of four known aboriginal sites just outside the corridor.	. Sub surface testing to determine presence of archaeological deposits. . Confirm that machinery and staff are kept away from these areas.	. 12 months minimum prior to construction commencement. . Fortnightly intervals during construction.	. RTA . NPWS . GLALC . TLALC
European heritage	. No heritage item affected	. Site inspection to confirm assessment	. Prior to construction and during bulk earthworks phase	. RTA
Landscape	. EIS provides details of proposed landscape development along the route, and the methods of construction and maintenance.	. Confirm collection and storage of seeds, including grasses. . Confirm preparation of quality assurance plans for design, construction and maintenance activities. . Confirm preparation of plan of management for long term use and management of roadside reserves. . Post construction inspection, report, remedial action.	. Predesign stage. . Prior to construction commencement. . Prior to construction completion. . Quarterly for 3 years, annually thereafter	. RTA . Community Consultative Committee . Approvals required from RTA or contractor's Quality Assurance Manager, prior to progression to next phase.

discussed in Section 14.2. These would be monitored for their effectiveness in preventing or minimising erosion, sedimentation and water quality during construction.

At any stage during or following construction of the motorway, further surveys could be undertaken and the results compared to the baseline figures to determine the effectiveness of the mitigation measures. It is recommended that they be continued for at least five years after completion of roadworks.

The efficiency of sediment control measures could be approximately assessed by measuring the sediment retained in sediment basins and comparing that figure with an accumulation of fresh sediment along the transects in the watercourses below the basin.

On completion of the project a maintenance program should be prepared and implemented. All erosion and sediment control measures should be regularly monitored and maintained until erosion has been controlled. All such monitoring and maintenance activities would be planned and implemented with relevant State and local government authorities, such as the Department of Conservation and Land Management and the EPA.

Hydrology and water quality

Monitoring of the effectiveness of erosion and flood mitigation measures should be undertaken to ensure that downstream effects of the road are limited.

TABLE 16.4 ASSESSMENT OF THE EFFECTS ON THE BIOPHYSICAL ENVIRONMENT

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Geology and soils	. Regional geology described and implications for construction assessed. . Major soil types described and their use for construction assessed. . Concept design for motorway promotes the use of straw bales, sediment basins, gross pollutant traps (GPTs) contour drains, revegetation, energy decipators and wet basins both during construction and operation.	. Confirmation that detailed design and construction techniques recognise the properties of the major soil and rock types. . Confirmation that the proposed erosion control measures are implemented through the contractor's environmental management plan. . Monitoring of sedimentation rates in basins and traps.	. During design and construction. . Annual inspection of permanent sedimentation basins and GPTs.	. RTA
Hydrology and water quality	. Existing water quality broadly assessed. . RTA committed to limit NFR of any releases from sediment basins to 50mg/l. Discharge licence to be sought from EPA.	. Water quality baseline to be established before construction. . Quality of any releases to be checked during construction and if possible, during storms.	. 12 months prior to construction. . On a monthly basis and during storm occurence.	. RTA . RTA

TABLE 16.4 CONT'D ASSESSMENT OF THE EFFECTS ON THE BIOPHYSICAL ENVIRONMENT

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Flora	. The only area of bushland within the corridor will be cleared to construct the motorway. No rare or threatened plant species identified.	. Monitoring considered unnecessary due to low conservation value of flora.	-	-
	. There is potential for detrimental impacts on Hoxton Park Woodland at Liverpool Showground supporting endangered species Acacia pubescens. These threats include erosion, reduced water quality and increased intensity of local flooding.	. Baseline to be established before construction. . Downstream effects for effectiveness of erosion and flood mitigation measures.	. 12 months prior to construction. . On a monthly basis and during storm occurence	. NPWS Dept. of CALM Liverpool City Council
Fauna	. The motorway should not affect the native fauna because there are few species which would move across the Link route. The loss of habitat is not considered significant.	. Determine whether native fauna are being disrupted by moving between areas of preferred habitat. . Monitor use of culverts and underpasses.	. Survey prior to and during construction and then every second year for 10 years after construction.	. NPWS

Flora

An intensive program of monitoring the effects of construction of this proposal on flora of the area is considered unnecessary due to the low conservation value of flora along the route. It would be better to direct funding for such monitoring to road construction projects with impact on larger areas of bushland with a high conservation significance.

Fauna

The area cannot be considered as having conservation significance except on a very local basis.

Monitoring of the effects upon native fauna from the construction and operation of the proposed Casula Link could be undertaken by setting up survey sites along the route and undertaking fauna surveys before and during construction, and periodically after the proposed Link is in operation. The results of the surveys would assist in assessing the impacts from the Link as well as from any mitigation measures proposed.

It is recommended that the proposed Link route be surveyed prior to and during construction and then every second year for 10 years after construction. The main survey site should be located within the bushland area at Cedar Road and another site within the open grassland to the north. The surveys should be undertaken during the warmer months to ensure the widest sample of fauna is achieved. All groups of terrestrial fauna should be sampled.

16.4.5 Economic Effects

The benefit evaluation for the motorway proposal relies heavily upon the assessment of travel time savings and the value of accident number reduction. The monitoring requirements for accident statistics

are set out in Table 16.1 while those for travel time savings are set out in Table 16.5.

The other important economic factor of construction cost should also be monitored by checking actual tender values on award and at the completion of construction. These requirements are also set out in Table 16.5.

16.4.6
Construction Effects

Section 14 of the EIS has assessed the environmental effects during construction under the headings of:-

- Water management.
- Noise.
- Air quality.
- Urban bushland.
- Community disturbance.

The importance of these assessments is not repeated here but a summary of the construction stage monitoring and auditing requirements is presented in the following Table 16.6.

TABLE 16.5 ASSESSMENT OF ECONOMIC EFFECTS

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Regional economic development benefits	. Construction cost estimate prepared in late 1992.	. Actual tenders should be checked during and at the end of construction.	. During construction.	. RTA
	. Value of time savings assessed in late 1992.	. Literature should be reviewed for changes in the value of time savings.	. As required approximately every 3 years.	. RTA
	. Growth in traffic predicted in late 1992.	. Traffic numbers should be carefully monitored.	. On an on-going and thorough basis. Time periods should cover, hourly and monthly volumes by vehicle types.	. RTA
Land acquisition effects	. Acquisition costs estimated in late 1992.	. Monitoring ceases when acquisition is complete.	. Prior to construction.	. RTA

TABLE 16.6 ASSESSMENT OF CONSTRUCTION EFFECTS

Criteria	Baseline data provided in EIS/prediction made	Data required from future monitoring	Time scale of monitoring	Action / Authority
Water Management	. Anticipated soil and rock strata. . Qualitative assessment of weathering patterns and erosion potential. . Section 14 identifies location of GPTs, sedimentation basins, wet basins and advocates use of hay bale banks, reseeding and restoration	. Detail soil and rock data along route. . Erosion/dispersion testing of materials. . Confirmation that the contractor has prepared and is following a Waste Management Plan including water quality testing.	. Site investigation in initial few months of contract. Then regular monitoring during contract for erosion and sedimentation patterns. . All ponds and visible flows to be sampled monthly.	. RTA and Consultant . RTA and Contractor . RTA EPA and Contractor
Construction noise	. Section 14.2 sets out the NSW EPA's requirements for control of construction noise.	.Confirmation that the contractor is using the quietest equipment, is erecting noise barriers when necessary, and is limiting working hours for noisy activities. . 10 hr A-weighted statistical analysis plus vibration data at nearest houses.	. Initial assessment then monitor throughout contract at each significant stage of construction programme.	. RTA and Contractor
Air quality	. Production of dust during construction procedures.	. Confirmation that the contractor is using effective water sprays and is avoiding heavy excavation during windy weather. . Airborne dust volume, wind speed and direction.	. During bulk excavation phase.	. RTA Consultant and Contractor
Community disturbance . Vibrations	. Section 14.5 sets out the likely causes of community disturbance and suggests measures to help control truck deliveries, parking of heavy equipment, loss of neighbourhood open space and interference with local traffic. . Vibrations due to heavy construction equipment particularly vibratory rollers.	. Ground vibration monitoring. Inspection of affected residences both before and after construction.	. During bulk earthworks phase.	. RTA Consultant and Contractor

conclusion

FINDINGS

Section 17 gives the findings and conclusions of this Environmental Impact Statement.

17
FINDINGS

This final section of the EIS summarises the findings of the study in terms of:

- Project formulation.
- Assessment of alternatives.
- Understanding transport effects.
- Understanding and mitigating human environmental effects.
- Mitigating biophysical effects.
- The needs for on-going monitoring.
- project justification

The summary uses dot-point format. The detailed arguments have been presented in earlier sections.

17.1 PROJECT FORMULATION FINDINGS

- Opening of the M5 Tollroad has emphasised the "missing link" between Moorebank Avenue and Campbelltown Road.
- The "missing link" improvements could mean better access to the south western region and a better local network.
- In particular, the missing link has the capability of reducing delays and in relieving traffic congestion on the Hume Highway.
- The improvements are needed to match continuing population, employment and traffic growth in the region.

17.2 FINDINGS ON ALTERNATIVES

- The study reviewed the alternative projects of:
  - Proceeding with the M5 Casula Link
  - Upgrading and widening the Hume Highway
  - Shared use of the motorway by public and private transport
  - Doing nothing
- Of this short list, only the first two were seriously canvassed.
- Of the two main options, the M5 Casula Link was favoured on the grounds of:
  - Reduced accidents
  - Improved transport efficiency
  - Improved urban structure (particularly after the provision of vehicular and pedestrian overpasses)
  - Realisation of the community's investment in creating the road reserve
  - Better management of the human, biophysical and social effects.

17.3 FINDINGS - TRANSPORT EFFECTS

- The M5 Casula Link would, in the year 2011, reduce total travel time across the network by about 4% with consequent savings in fuel.
- These savings would be just as important in the years leading up to the year 2011.
- The Link would attract traffic from the Hume Highway and would allow increased levels of service to adjacent land uses.
- Accidents would be reduced and hazardous goods would be handled more safely.

17.4 FINDINGS - HUMAN ENVIRONMENT EFFECTS

- The M5 Casula Link and its associated vehicular and pedestrian overpasses would minimise any severance effects. Of the overpasses, those in Kurrajong Road and De Meyrick Avenue are the most important.
- The project would cater adequately for existing local traffic movements.
- The construction of the Link would also create urban design opportunities for the Hume Highway route.
- The provision of noise barriers would allow the RTA's Noise Policy Guidelines to be met. The study's demanding night-time criteria would also be met where practicable.

17.5 FINDINGS - BIOPHYSICAL EFFECTS

• Adoption of the study's landscape master plan would in the longer term establish an indigenous woodland throughout the road reservation.

• This new woodland would replace largely disturbed grassland.

• Only one known Aboriginal site appears directly threatened by the M5 Casula Link project and this site has been almost obliterated by past road construction.

• No building, landscape, townscape or site of significant European heritage value has been located in the road reservation or near the proposed on and off ramps.

• The Cedar Road bushland is of low conservation value. There are far more important areas of bushland away from the proposed Casula Link.

17.6 FINDINGS - ON GOING MONITORING

• The EIS advocates major new monitoring programs for the motorway proposal (including landscape and planting) as well as supporting the continuation of the current programs for traffic flows, accidents, noise and air monitoring.

• The EIS also recommends the establishment of biophysical environmental baseline conditions prior to the start of construction and that programs be set up to check on noise, dust, water quality, and local area disruption during the building phase.

17.7 PROJECT JUSTIFICATION FINDINGS

• The M5 Casula Link would provide travel time savings, reduced accidents and increased levels of service to adjacent land uses.

• The benefits of the above items when assessed in a traditional benefit-cost analysis show the M5 Casula Link motorway proposal to have a very high benefit cost ratio (7.2) and a very high internal rate of return (22%).

• When compared to the major alternative of upgrading the Hume Highway, the net present worth of the motorway proposal is double the Hume Highway figure.

• The motorway proposal can be implemented without significant environmental or social impact.

• The M5 Casula Link Motorway would enhance urban structure and facilitate urban development in south west Sydney.

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appendices

DEPARTMENT OF PLANNING DIRECTOR'S REQUIREMENT

RTA EIS BRIEF TO MAUNSELL

STUDY TEAM

RTA INTERIM TRAFFIC POLICY, 1992

PUBLIC CONSULTATION

E1 Community consultation submissions and key issues raised

E2 Authorities and representative groups consulted and responses

RTA ACQUISITION POLICY

PROPERTIES AFFECTED BY PROPOSAL

Department of Planning

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
DX . 15 Sydney

Telephone : (02) 391 2000 Ext: 2083
Fax No : (02) 391 2111

Mr R Morris
Regional Director
Roads and Traffic Authority
PO Box 558
BLACKTOWN NSW 2148

ROADS & TRAFFIC AUTHORITY
RECEIVED
22 JUN 1992
ACK.
RFP

Contact : M. Beveridge

Our reference : P92/00747

Your reference : ES 180501

Dear Mr Morris

RE: F5 FREEWAY BETWEEN PRESTONS AND CASULA

Thank you for your letter of 18 May, 1992 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

2. An EIS is required to be prepared where the proposal is an activity referred to in Section 112(1) of the Environmental Planning and Assessment Act, 1979. The EIS shall be prepared in accordance with clause 57 of the Environmental Planning and Assessment Regulation, 1980 and shall bear a certificate required by clause 59 of the Regulation (see Attachment No 1).

3. In addition, pursuant to clause 58 of the Regulation, the Director requires that the following matters be specifically addressed in the EIS:

- justification for the proposal;
- identification of proposed route of freeway, including clear identification of all properties to be affected, and (if necessary) proposals for acquisition of properties;
- impact on existing local road system, including impact on local traffic movements;
- impact on existing residential areas, including noise, air pollution and access impacts during the construction and operational stages. Proposed mitigation measures;
- impact on access to the Prestons industrial area;
- impact on lands proposed for future urban release;

../2

- visual impact, and proposed mitigation measures;
- construction impact, including noise, traffic movements, and measures to control erosion and runoff;
- flood related issues;
- impact on vegetation, including impacts on any Cumberland Plain remnant vegetation;
- discussion of the community consultation process, and a review of its findings;
- results of consultation with:

  Liverpool Council
  Campbelltown Council
  Environment Protection Authority
  Department of Conservation and Land Management
  National Parks and Wildlife Service

4. Attachment No 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

5. When an adequate EIS has been prepared for the subject proposal, as determining authority, you should then proceed with the matter in accordance with Sections 112 and 113 of the Act, and place the document on public exhibition. The procedures for public display that are to be followed by the proponent and/or determining authority are as in clauses 60 to 64 of the Environmental Planning and Assessment Regulation, 1980.

6. When the EIS is completed, four (4) copies should be forwarded to the Secretary, Attention: Manager, Assessment Branch pursuant to Section 112(2) of the Act, as well as details of the exhibition period and public display locations.

7. The determining authority should also note that section 113 of the Environmental Planning and Assessments Act, 1979, and clause 61 of the associated Regulation, requires that the EIS be made available for inspection at the same time in the offices of the determining authority and the Department as well as any other agencies nominated by them. To ensure that simultaneous exhibition occurs, the Roads and Traffic Authority should forward the necessary documents to the Department prior to the commencement of the public display period. This will enable concurrent exhibition in the Department's head office and the relevant regional office where appropriate.

../3

8. Should any submissions be made during the period of public exhibition, it is advised that such submissions should be forwarded to the Secretary in accordance with Section 113(3) of the Act.

9. If the determining authority has not received a reply within 21 days of sending submissions to the Secretary, it should proceed to determine the matter. The Department will only contact the determining authority after the receipt of submissions if an issue of major significance is involved.

10. If there is no objection to the proposed development as a result of the exhibition, the determining authority may determine the matter at any time after the last day upon which submissions are accepted.

11. It would be appreciated if a copy of the determination could be forwarded to the Department for our information.

12. Should you require any further information regarding this matter please do not hesitate to contact us again.

Yours faithfully

B Adams 16/6/92

B. Adams
Manager
Assessments and Major Hazards Branch
As Delegate for the Director

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS.

In accordance with Part V of the Environmental Planning and Assessment Act, 1979, an environmental impact statement (EIS) must meet the following requirements.

Pursuant to clause 57 of the Environmental Planning and Assessment Regulation, 1980, as amended:

(1) An environmental impact statement referred to in section 112 (1) of the Act shall be prepared in written form and shall be signed by the person who has prepared it.

(2) The contents on an environmental impact statement referred to in subclause (1) shall include the following matters:-

(a) a full description of the proposed activity;

(b) statement of the objectives of the proposed activity;

(c) a full description of the existing environment likely to be affected by the proposed activity, if carried out;

(d) identification and analysis of the likely environmental interactions between the proposed activity and the environment;

(e) analysis of the likely environmental impacts or consequences of carrying out the proposed activity (including implications for use and conservation of energy);

(f) justification of the proposed activity in terms of environmental, economic and social considerations;

(g) measures to be taken in conjunction with the proposed activity to protect the environment and an assessment of the likely effectiveness of those measures;

(g1) details of energy requirements of the proposed development and measures to be taken to conserve energy;

(h) any feasible alternatives to the carrying out of the proposed activity and the reasons for choosing the latter;

(i) consequences of not carrying out the proposed activity.

The EIS must also take into account any matters required by the Director of Planning pursuant to clause 58 of the Regulation, which may be included in the attached letter.

The EIS must bear a certificate as required by clause 59 of the Regulation.

DEPARTMENT OF PLANNING
ATTACHMENT NO 2

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR A MAJOR ROAD DEVELOPMENT IN AN URBAN/SUBURBAN ENVIRONMENT

Pursuant to S112 of the Environmental Planning and Assessment Act, 1979, where a proposal is a prescribed activity or where a proposal is likely to significantly affect the environment, a determining authority must, before deciding whether to proceed with the proposal, consider an EIS prepared in respect of the proposal.

It is the responsibility of the determining authority to decide whether an EIS is required (unless the proposal is a prescribed activity). While the site characteristics largely determine the need for an EIS to be prepared, in general major road developments in an urban/suburban environments have the potential to create problems for local residents and landholders due to land resumption/demolition, loss of access, noise generation, lighting problems, impacts during construction, local and regional traffic flows, and local commercial interests.

The purpose of this paper is to outline various issues relevant to the preparation and consideration of an EIS for such major road developments. It is the applicant's responsibility to identify and address, as fully as possible, the matters relevant to the specific development proposal in complying with the statutory requirements for EIS preparation (see Attachment No 1).

The matters nominated in this paper are not intended as a comprehensive identification of all issues which may arise in respect of such a major road development. Some of the issues nominated may not be relevant to a specific proposal. On the other hand, there may be other issues, not included, that are appropriate for consideration in the EIS.

Information provided should be clear, succinct and objective and, where appropriate, be supported by maps, plans, diagrams or other descriptive detail. The purpose of the EIS is to enable members of the public, the determining authority and the Department of Planning to properly understand the environmental consequences of the proposed development.

2/...

1. Description of the proposal.

The description of the proposal should provide general background information on the location of the proposed road works, particularly their relation to, and compatibility with, the arterial and local road network and any traffic management schemes in force or proposed and including the criteria used for route selection. It should provide an indication of adjacent developments, and land use activities, as well as details of the site, land tenure, zonings and relevant forward planning proposals, and any other land use constraints including natural and built environmental features sensitive to the impact of the proposal.

It may also be appropriate for the EIS to describe statutory procedures for implementing the proposal.

This section should provide specific information on the nature, intent and form of the development. Particular details that may generally be relevant include:

- The form and physical dimensions of the proposed roadworks, including locations and dimensions of bridge and elevated or subsurface structures and associated facilities including proposals for drainage and ventilation.
- Earthworks involved including details of cut and fill and balancing of volumes proposed.
- Presence of median strips, barriers to pedestrians, and grade separation proposals at intersecting roads.
- Alterations to access to adjoining properties.
- Resumptions and or demolitions required of existing development to accommodate the proposed road.
- Construction problems envisaged including staging of works; source, transport and assembly of plant and materials; employment details; access arrangements; alternative routes and traffic management proposals for local and through traffic; and hours of operation for demolition/construction works etc.
- Provision of facilities for under/over passes for pedestrians, cyclists etc.
- Flood prevention measures.
- Safeguards to control erosion and siltation.
- Rehabilitation proposals on completion including any relevant landscape plans.

2. Description of the Environment.

This should provide details of the environment in the vicinity of the development area and also of aspects of the environment likely to be affected by any facet of the proposal. In this regard, physical, natural, social and economic aspects of the environment should be described to the extent necessary for assessment of the environmental impact of the proposed development. In particular:

3/...

- Geography, topography, geology and geotechnical data, meteorology, hydrology etc.
- Noise and air quality where appropriate for impact consideration.
- Aesthetics.
- Flora and fauna including open space and urban bushland etc.
- Utilities and communications.
- Buildings having architectural/heritage significance.
- Existing traffic levels and traffic flow patterns.
- Socio economic aspects including local commercial activities.

3. Assessment of Alternative Routes.

The EIS should include a proper assessment of the alternative routes considered in the feasibility study for the proposal including the key physical and engineering constraints as well as the environmental and economic factors pertinent to same including clear reasons for rejecting such alternatives in favour of the recommended proposal. Reference should be made herein to any existing road reservations and background decisions relating to their location.

4. Analysis of Environmental Impacts.

Environmental impacts usually associated with a major road development in an urban/suburban environment and related activities listed below. Where relevant to the specific proposal, these should be addressed in the EIS, taking into account the adequacy of safeguards proposed to minimise them both during construction and when in use after completion:

- Likely noise disturbance caused by the construction of the road, and by traffic operating on the completed roadway, on any nearby residential and commercial buildings. A map depicting anticipated noise contour levels in relation to residences and inhabitants involved may be necessary. Consideration should be given to both existing and proposed residential developments for such an analysis.
- Emission of air pollutants from vehicular traffic affected by the proposal, and their impact on the local and regional environment.
- Stormwater runoff and erosion and siltation potential.
- Impact on natural vegetation and faunal movement,, flood plains, drainage patterns, (particularly sedimentation from construction activity).
- Subsidence potential.
- Visual impact, particularly on residential developments by both day and night taking into account the following effects of the proposed road:

4/...

  - Scale in relation to the natural landscape and adjacent residential and commercial development.
  - Appearance from nearby and afar.
  - Lighting effects on existing and proposed residential/commercial buildings.
- Carriage of hazardous goods on vehicles, spillage potential and provisions for emergency clean up.
- Changes in traffic patterns and improvements to limit accident potential.
- Impacts of traffic at entry/exit points.
- Impact on historic buildings and matters of heritage/archaeological interest.
- Effect on commercial operations and changes in community characteristics caused by severence.

In addition, any potential for hazard or risks to public safety and any proposal to monitor and reduce environmental impacts should be included.

5. Contact with relevant Government Authorities.

In preparing the EIS, it is suggested that authorities, such as those listed below, should be consulted and their comments taken into account in the EIS.

- The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements.
- The Traffic Authority with regard to traffic and road development aspects and the Urban Transport Authority with regard to public transport aspects.
- Any servicing authorities which may be required to supply water, power, etc.
- The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance for the State.
- Local Councils through whose areas the road passes.

It is the responsibility of the person preparing the EIS to determine those Departments relevant to the proposed development.

5. Supporting information.

The EIS should refer by suitable appendices to all relevant studies/investigations that have been carried out in support of the proposals. This supporting documentation should be made available during the period of public display of the EIS.

F5 SOUTH WESTERN FREEWAY CORRIDOR

PREPARATION OF ENVIRONMENTAL IMPACT STUDY

SUBMISSION BRIEF

"You are invited to submit an offer to manage the preparation of the Environmental Impact Statement for the development of a major road corridor from the end of the F5 South Western Freeway at the Hume Highway, Casula to the recommencement of the F5 at The Crossroads, Prestons.

This project has been sought by the Sydney South Western Region's Community for many years. It would link two sections of the existing F5 and separate the north/south and east/west traffic at The Crossroads intersection. With the Tollroad Section of the F5 between Moorebank Avenue and King Georges Road programmed to be opened at the end of this year, a solution to the ever growing problem of traffic congestion on the Hume Highway between The Crossroads at Prestons to the Hume Highway is needed.

The project will require attention to at least the following components:

1. The planning justification.

2. The project alternatives including consideration of public transport.

3. The costs of those options.

4. The land requirements and the options for commercial release of publicly owned lands.

5. The travel demands along the corridor, both present and future.

6. The economic evaluation of various options.

7. The noise impact including treatment options and costs.

8. Air pollution impacts.

9. Water and soil quality considerations.

10. Flora and fauna impacts.

11. Archaeological impacts.

12. Legal implications.

13. Social implications.

14. Visual impacts.

15. Financial implications.

Comprehensive public consultation and liaison with Local Government and relevant Government Authorities is required.

The time frame is to have the EIS ready for display within six months. Each and every element needs to have professional authority. Each of the elements of the EIS requires support by separate reports by a professionally qualified consultant. A sketch plan is attached.

Legal considerations are most important. The Authority will engage Solicitors, Freehill Hollingdale and Page to be part of the management process. The EIS must be robust in its own right under the EP & A Act and other relevant State and Federal Legislation including the Endangered Fauna (Interim Protection) Act 1991. It must also address in detail the concerns expressed by residents during the consultation process.

The **financial implications** will be important. The extent to which the project can be funded through State, Federal funds or in part from private sources will be outlined by the RTA as the project develops. Separate tolls for the section are not envisaged but the aspect should be addressed.

The RTA will provide a technical officer to service the project. However, there is a possibility that this role may be delegated to the Project Manager of Leightons Interlink Pty Ltd building the F5 Tollroad. There will be assistance available on a more casual basis from various experts throughout the Authority including the Environmental Planning Section.

Standard RTA conditions for the engagement of consultants are to apply.

Your offer should indicate details of those who would comprise your management team as well as the skills and experience of your organisation. There should be a schedule of activities and the expected times for the achievement of milestones. You should indicate the basis for charging for each section of the report and

indicate the expected cost for each section and for the total of the report.

Your offer should include the preparation of all documentation including concept design plans."

MAUNSELL PTY LTD

D N Odgers	Project Director
G M Legoe	Project Manager
D C McLean	Quality Assurance Director
B J Spry	Design Engineer
M P Forwood	Design Engineer
D J Macleod	Environmental Coordinator
E K Madew	Environmental Engineer
S D Porman	Environmental Engineer
G M Smart	Environmental Scientist
J Rowley	Design Draftsman
B G Jacobs	Design Draftsman
T Poy	Design Draftsman
J Van den Dungen	Moss Designer
S Peake	Librarian

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Aboriginal Heritage Archaeology HAGLUND AND ASSOCIATES	L Haglund
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Economic Evaluation MAUNSELL PTY LTD DENIS JOHNSTON & ASSOCIATES	
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AMPERSAND	V Gillmer
LEE CALLISTER DESIGN	L Callister
Landscape and Visual Impact	G Gallagher
TRACT CONSULTANTS	M Siu
Social Impact Assessment	
Metropolitan Strategy Assessment	
Community Consultation Program	S Young
MSJ KEYS YOUNG PLANNERS PTY LTD	K Houghton
Noise Assessment	
CHALLIS & ASSOCIATES PTY LTD	L Challis
Transportation and Traffic	D Johnston
DENIS JOHNSTON & ASSOCIATES PTY LTD	J Piper
	T Scholes
	V Gupte
	R Parrish
Valuation	
RTA (SYDNEY REGION)	B Willoughby
Water Catchment and Soil Management	
MAUNSELL PTY LTD	

THE ROADS AND TRAFFIC AUTHORITY OF NSW (RTA) LIAISON

RTA (Sydney Western Region)	R Morris
	E Sancbergs
	A Ross
	C Ford
	P Tweedie

LEGAL ADVISORS

Freehill Hollingdale & Page	J Taberner

INTERIM TRAFFIC NOISE POLICY

Policies and actions relating to road traffic noise

SEPTEMBER 1992

RTA
Roads and Traffic Authority
New South Wales

FOREWORD

The New South Wales roads and traffic system is a vital part of the State's transport network and is fundamental to the efficient functioning of the economy. However, the operation of this system has its costs, one of which is road traffic noise.

This document sets out the issues and the interim policies which have been developed by the RTA to address the problem of traffic noise while exercising its statutory functions.

The RTA's commitment to addressing road traffic noise is reflected in the environmental goal in its Corporate Plan:

> ***To ensure that the roads and traffic system is developed and managed in harmony with the natural and social environment while meeting community needs for the movement of people and goods.***

The major first step in directing the activities of the RTA towards achieving this goal was the public release of its *Environmental Vision*. The *Vision* contains five main environmental strategies which have guided the development of the policies and actions in this document. These strategies are to:

- Reduce the environmental impacts of the roads and traffic system.
- Incorporate environmental considerations into all RTA activities.
- Communicate and coordinate with the public, industry and other authorities on environmental impacts and issues.
- Increase environmental expertise and awareness within the RTA.
- Conduct and support environmental research.

Due to the range of factors involved in road traffic noise, no single policy or action in isolation is likely to be able to address all road traffic noise problems. Rather, a combination of actions is needed to generate the best result. Addressing noise problems will also require a co-operative effort between government agencies, at all levels, the community and industry.

Road traffic noise can be addressed in four main ways:

- Assessing and managing noise impacts of road related projects.
- Reducing noise at the vehicle source.
- Land use planning, site design and building layout.
- Managing traffic.

Although the RTA can play a role in most of these areas, its greatest opportunity to address the noise problem independently and directly is by assessing and managing noise impacts of its new road projects. Accordingly, it is in this area that policies have been developed.

However, as the RTA wishes to address road traffic noise as comprehensively as possible, actions to address noise problems on existing roads are also presented, as are actions to address problems by controlling noise at the vehicle source, by land use planning, site design and building layout and by managing traffic.

The policies and actions in this document will be monitored and revised in light of their effectiveness, government initiatives, community feedback, further research findings, overseas developments and technological changes.



Bernard Fisk
Chief Executive, Roads & Traffic Authority

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1 ASSESSING AND MANAGING NOISE IMPACTS OF RTA ROAD RELATED PROJECTS

ISSUES ▼ POLICIES ▼

1.1 New RTA road and bridge projects

The RTA has a direct role in addressing the noise impacts of its new road and bridge projects. Road traffic noise associated with these projects is addressed by setting – and attempting to meet – Noise Level Objectives for designated assessment sites (such as hospitals). Noise Level Objectives are based on predicted traffic conditions which generally reflect the ultimate predicted traffic flow 10 years after the opening of a project. These Noise Level Objectives are shown in **Table 1.**

Policy 1.1
Noise level reduction will be considered at all stages during the development of new RTA road and bridge projects.

The RTA will endeavour to meet the Noise Level Objectives in Table 1, for new RTA road and bridge projects subject to the practicality and cost-effectiveness of the measures taken.

1.2 Major RTA road upgrading and traffic management projects

Major road upgrading projects are those works involving the construction of additional traffic lanes. Major traffic management projects are those which significantly affect regional traffic flows but do not involve building new roads or upgrading existing roads. To reduce traffic noise impacts from these projects, noise reduction measures will be implemented when it is cost-effective and practical.

However, in some locations, roadscape characteristics (such as topography and proximity of buildings to the roadway) can make it difficult to reduce the impacts of road traffic noise, particularly noise from traffic management projects. In these cases, there are few techniques available to minimise traffic noise impacts. Nevertheless, those which are available will be considered and, if appropriate, implemented.

Where the noise levels resulting from a project exceed the appropriate Noise Level Objective in **Table 1,** and there has been an appreciable increase in noise, the following policy applies.

Policy 1.2
Appropriate measures will be implemented to reduce noise levels caused by major RTA road upgrading and traffic management projects when:

- *The appropriate Noise Level Objective in Table 1 has been exceeded and,*
- *There is an appreciable noise increase (i.e. greater than 3 dBA) and,*
- *It can be demonstrated that such measures to reduce traffic noise are cost-effective and practical.*

1.3 Noise barriers

There are various techniques to minimise the impact of road traffic noise. Noise barriers are one of the more common techniques. With respect to new roads and bridges, provision for barriers will be considered during all stages of the project's development. The following policy applies, subject to Section 3 of this document.

Consultation will aim to reach an acceptable balance between noise reduction, visual impact and community aspirations.

Policy 1.3
During the design phase of proposed new road or bridge projects, if noise barriers are considered appropriate, the height and location of these will be established after consultation with tenants or owners of adjoining properties.

1.4 Road pavement maintenance

This involves repairing, resurfacing or reconstructing road pavements. The policy relates to the noise from traffic on the treated road and not the noise generated during the maintenance activity itself.

Road maintenance programs will use appropriate road pavement surfaces and markings to ensure there will be no appreciable increase (that is, greater than 3 dBA) in tyre/road surface noise.

Policy 1.4
In residential areas, the RTA will aim to limit to no greater than 3 dBA noise level increases due to road pavement conditions at the completion of a maintenance program.

Table 1: Traffic Noise Level Objectives [1] for new road and bridge projects
(for uses conforming to zoning)

Column 1	Column 2	Column 3	Column 4	Column 5
Assessment site category [2]	**Descriptor**	**Base Objective**	**Lower noise areas**	**Higher noise areas**
Buildings of a residential nature including residences, hospitals, motels, and caravan parks	"Daytime" (24 hour) Leq (24 hour)	60	Ambient [3] +12 dBA	Ambient+3 dBA
	Night-time (10 pm-6 am) Leq (8 hour)	55	Ambient+12 dBA	Ambient+3 dBA
Classrooms in educational institutions	8.30 am-3.30 pm Leq (1hour) internal	45 [4]	45	Ambient+3 dBA
Community facilities, eg places of worship passive urban parks and noise sensitive facilities (eg libraries)	Consideration will be given to ambient noise conditions, extent and type of use to determine whether noise reduction strategies are needed.			

How to use Table 1

To select an appropriate Noise Level Objective for any site:

- Select the appropriate site category in Column 1.
- Refer to the Base Objective in Column 3.
- Refer to Column 4 for the appropriate Noise Level Objective in lower noise areas, that is, where the ambient noise level is 12 dBA or more below the Base Objective.
- Refer to Column 5 for the appropriate Noise Level Objective in higher noise areas, that is, where the ambient noise level is greater than the Base Objective (in Column 3) less 3 dBA.

Notes

(1) The Noise Level Objective is the noise level which the RTA aims to achieve. It generally reflects the noise from the ultimate predicted traffic flow.

(2) An assessment site is a location being investigated to determine possible noise impacts. The noise level at the site is determined at the 'Assessment Point'. For all assessment sites other than classrooms in educational institutions, the assessment point is outside a building at 1.2 metres above ground or floor level (whichever is appropriate), and one metre from the ground floor window or door which is most exposed to traffic noise.

(3) The ambient noise level is the total noise at the assessment site excluding extraneous noises, such as cicadas, before the road project commences.

(4) This is the Noise Level Objective used by the Public Works Department for inside classrooms. The RTA will endeavour to meet this objective in those cases where a classroom has been located, designed and constructed to meet 45 dBA.

2 MONITORING AND RECTIFICATION

ISSUES ▼ POLICIES ▼

2.1 Major projects assessed in environmental impact statements (EIS)

In the case of a major new or upgraded RTA road or bridge where an EIS is undertaken, noise levels will be assessed from the opening of the road or bridge and up to 10 years afterwards.

Policy 2.1 applies up to one year after the opening of a new or upgraded road or bridge.

If any assessment after one year from the opening of a new or upgraded road or bridge indicates the need for remedial measures, these will be undertaken as part of the Loudspot treatment program (see Section 4).

Policy 2.1
When an EIS has been carried out for a new or upgraded road or bridge, remedial measures will be undertaken if, within one year after the opening, the actual noise levels exceed those predicted in the EIS for the end of the 10th year after opening, and also exceed the appropriate Noise Level Objective stated in Table 1. Remedial measures will be undertaken when they are cost-effective and practical.

2.2 Other major new or upgraded road projects

Action 2.2
In response to complaints about excessive noise levels resulting from major new or upgraded RTA road projects other than those assessed in an EIS, measures will be taken to either reduce the noise when it is cost-effective and practical or have a site treated as a Loudspot.

3 APPLICATION OF THE POLICIES OF SECTIONS 1 AND 2

ISSUES ▼ POLICIES ▼

3.1 New road projects

It is assumed that property owners will take appropriate action to minimise the impact of road traffic noise. As inferred by Policy 3.1, property owners should consider that the RTA may not be able to meet the Noise Level Objectives shown in **Table 1** if they make building, land use or zoning changes which are inappropriate for land adjacent to a zoned road.

Policy 3.1
The RTA will endeavour to apply the policies in Sections 1 and 2 if, after an arterial road zoning has been included in a planning instrument or a determination to proceed has been made and advertised or approval to construct a new road has been publicised:

- *A building which is primarily affected by traffic noise is constructed and positioned to minimise the potential effect of this noise, and/or*
- *A land use or zoning change occurs which makes the site suitable for being in close proximity to major RTA road related projects.*

3.2 Upgraded road or traffic management projects

The issue statement in Section 3.1 also applies to Policy 3.2.

Policy 3.2
The RTA will endeavour to apply the policies of Sections 1 and 2 if, after public notification of a traffic management project or an upgraded road project:

- *A building which is primarily affected by traffic noise is constructed and positioned to minimise the potential effect of this noise, and/or*
- *A land use or zoning change occurs which makes the site suitable for being in close proximity to major RTA road related projects.*

3.3 Noise reduction treatments

Policy 3.3
The RTA will consult affected property owners before adopting a noise treatment for an RTA road related project. Once a preferred noise reduction treatment has been selected it will be documented.

The RTA will not normally extend or undertake another treatment after the preferred treatment has commenced, unless Section 2 is applicable.

This policy extends to subsequent property owners.

3.4 Multi-storey buildings

The policies of Section 1 will be applied to the upper levels of multi-storey buildings when it can be demonstrated that it is cost-effective and practical.

Policy 3.4
Noise reduction for the upper levels of multi-storey buildings will be considered when it is cost-effective or practical.

3.5 Classrooms in educational institutions

Policy 3.5
Noise reduction for classrooms in educational institutions will be considered in accordance with the Noise Level Objectives stated in Table 1.

Consideration will be given to ambient noise conditions, the building location, type of building construction, and the cost of noise reduction measures other than conventional treatments in determining the most cost-effective and practical noise treatment.

4 LOUDSPOT TREATMENT

ISSUES

Loudspots are lengths of road where traffic noise levels are high and considered to be inappropriate for the adjacent land use. To address road traffic noise at loudspots, the RTA will take the following action.

ACTIONS

Action 4
The RTA will investigate developing a priority listing of Loudspots for roads under its control. The practicality, criteria and funding for any remedial measures for Loudspots will also be investigated.

5 CONSULTATION AND INFORMATION SHARING

ISSUES

The RTA is committed to consultation and information sharing and is liaising with other government departments, industry associations, and community groups to develop initiatives to address traffic noise impacts. Accordingly, the RTA will take the following actions.

ACTIONS

Action 5.1
The RTA will continue working with other State government departments, local councils, industry associations, and the community to develop initiatives to address traffic noise impacts.

Action 5.2
The RTA will use the Quiet House at Pennant Hills, to illustrate to the public potential ways people can act to protect their homes from traffic noise.

Action 5.3
The RTA will continue to produce publications dealing with issues relating to traffic noise.

Action 5.4
The RTA will continue to provide current information to the public on the status of all major RTA road proposals.

6 RESEARCH AND DEVELOPMENT

ISSUES

There is a need for continued research on noise issues, including such broad issues as the best way to describe traffic noise and the nature of the human response to it. Research continues overseas and in Australia to increase our understanding of these matters. The commitment of the RTA to research and development is reflected in the following action.

The results of such research will provide a basis to guide future policies and actions.

ACTIONS

Action 6
The RTA will continue to research a wide variety of traffic noise issues and encourage research into fundamental noise issues via organisations such as AUSTROADS.

7 REDUCING NOISE AT THE VEHICLE SOURCE

ISSUES

The Actions in this section relate to reducing noise by changing the vehicle design or the way it is driven. Treating noise at the vehicle source is a cost-effective way to reduce traffic noise.

The Federal Department of Transport and Communications (under the Motor Vehicle Standards Act) is responsible for the Australian Design Rules which set motor vehicle emission and other standards, while the NSW Environment Protection Authority (EPA) has the primary role in enforcing noise standards. Although the RTA has a limited charter in this area, it will take appropriate action to support EPA enforcement programs.

Heavy vehicles are a major source of traffic noise and, accordingly, they are the subject of specific actions. For example, the Minister for Roads and the Minister for Environment have agreed to introduce noise testing for heavy vehicles under the Heavy Vehicle Inspection Scheme.

The RTA will work towards reducing noise at the vehicle source by the following actions.

ACTIONS

Action 7.1
The RTA will inspect heavy vehicles for noise level compliance under the annual Heavy Vehicle Inspection Scheme.

Action 7.2
The RTA, in co-operation with AUSTROADS and the industry, will investigate controlling the use of heavy vehicle engine compression brakes in built-up areas of NSW.

Action 7.3
The RTA will investigate potential incentives to encourage the use of low-noise emission vehicles.

Action 7.4
The RTA will continue research into the causes of, and measures to reduce, vehicle noise.

Action 7.5
The RTA will co-operate with the NSW EPA to investigate vehicle noise regulation.

Action 7.6
The RTA will produce educational material for drivers of heavy vehicles which encourages the operation of these vehicles in a manner which minimises noise impact.

Action 7.7
The RTA will consider noise level emissions when evaluating potential RTA plant and truck equipment to purchase or hire.

Action 7.8
The RTA will support the Advisory Committee on Vehicle Emissions and Noise (ACVEN) in promoting new Australian Design Rules in relation to noise control for new vehicles.

Action 7.9 The RTA will inform the community of ways to reduce noise from their own vehicles.

8 SEPARATING PEOPLE AND NOISE

LAND USE PLANNING, SITE DESIGN AND BUILDING LAYOUT

ISSUES

The type of activity being undertaken at a site influences people's responses to nearby road noise. For example, workers at an industrial site are likely to be more tolerant of noise than people at an educational institution. It is therefore important to ensure that those land uses which are most sensitive to noise are located away from busy roads. This can be done through land use planning. Further noise reduction can be achieved by suitable site design and building layout, so that a site or building's most noise-sensitive areas are located as far as possible from busy roads.

Land use planning is the responsibility of the Department of Planning and local councils. In general, site design and building layout are the responsibility of individuals, although standards for these (primarily based on health and safety criteria) are prescribed by local councils. At a State level, the Department of Housing is responsible for site design and building layout of activities under its control.

The RTA has no direct responsibility for land use planning, site design or building layout. However, given the importance of these in ameliorating road traffic noise, the RTA will take the following actions.

ACTIONS

Action 8.1
The RTA will continue to support the planning actions of the Department of Planning and local councils to reduce traffic noise impacts.

Action 8.2
The RTA will request local councils to use planning instruments and development approvals to ensure that proposed developments next to main roads are not 'sensitive' to traffic noise.

Action 8.3
The RTA will encourage planning authorities to consider road traffic noise when classifying land into various land use classes.

Action 8.4
The RTA will continue research into the use of planning strategies to reduce noise impacts on land adjacent to main roads.

9 TRAFFIC MANAGEMENT TO REDUCE NOISE

ISSUES

Traffic related factors which affect noise levels are the location of designated truck routes, time of day, the number and type of vehicles, traffic speed and driving behaviour. A co-operative effort is needed in order to manage all of these factors. This involves agencies such as the Department of Planning and the RTA, local councils and individual drivers. The RTA will take the following actions.

ACTIONS

Action 9.1
The RTA will investigate, in consultation with Department of Planning, the designation of truck routes in urban areas with a view to reducing the number of trucks and, therefore, noise on local residential streets.

Action 9.2
The RTA will co-operate with local councils and the industry to investigate the practicality of appropriate night-time truck controls for local residential streets.

Action 9.3
The RTA will investigate traffic management techniques which achieve more uniform traffic flows.

Action 9.4
The RTA will consider noise impacts at the design stage when planning to install major traffic control facilities.

10 REVIEW PROCESS

ISSUES

The RTA will monitor the effectiveness of the interim policies and actions in this document. Findings of this monitoring will be important in shaping the final Noise Policy document.

ACTIONS

Action 10
The RTA will review the Interim Traffic Noise Policy in view of its implementation, the final recommendations of the NSW State Traffic Noise Task Force, overseas findings, research results and comments from the community.

DEFINITIONS

Australian Design Rules	Construction and performance rules for motor vehicles that have been formulated through various advisory committees and as recommended through the Australian Transport Advisory Committee. These rules are implemented by the Australian Motor Vehicle Certification Board.
AUSTROADS	Association of Australian State Road Authorities.
Approval to construct	The decision by the RTA to proceed with construction of roadworks.
Assessment point	A point at which noise measurements are taken or estimated.
Cost-effective	In this document, when the cost of noise treatment is less than the economic benefit.
dB	The abbreviation for "decibel" which is the unit for measuring Sound Pressure Level, or noise.
dBA	Decibels using the "A" weighting, which approximates the response of the human ear to sound.
Leq	The equivalent continuous noise level. In this document some periods of 1 hour and 24 hours are used, together with the period specifically defined.
Leq(1 hr)	The equivalent continuous noise level during any one hour period between 8.30 am - 3.30 pm.
Leq(8hr)	The equivalent continuous noise level over the eight hour period between 10 pm and 6 am.
Leq(24 hr)	The equivalent continuous noise level during any 24-hour period
Loudspot	A length of road where traffic noise levels are high and considered to be inappropriate to the adjacent land use.
Noise Level Objective	The noise level which the RTA aims to achieve.
Planning instrument	An environmental planning instrument as defined in the Environmental Planning & Assessment Act 1979.
Roadscape	The full view from or to the roadway.

COMMUNITY CONTACT

F5 CASULA LINK EIS

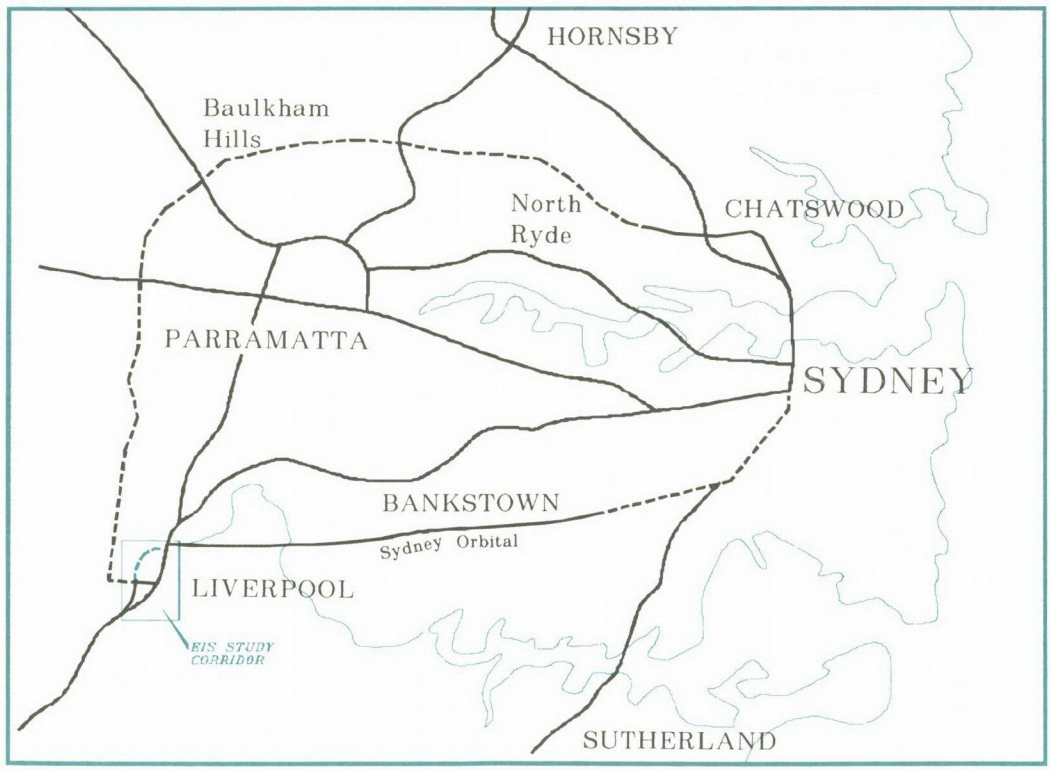
Issue No.1

July 1992

WHAT TRANSPORT ALTERNATIVES WILL BE EVALUATED?

Residents of Sydney's South Western Region and local councils have called for an easing of traffic congestion on the Hume Highway. The RTA has responded by commissioning Maunsell to prepare an Environmental Impact Statement (EIS) for a proposed expressway link, known as the F5 Casula Link. This link would, if built, provide for a continuous expressway from Campbelltown to King Georges Road, Bexley. The proposed link would utilise the existing freeway reservation through the local areas of Prestons, Casula and Lurnea.

The proposed link is likely to be a four-lane road with interchanges at Campbelltown Road, Camden Valley Way and the Hume Highway. Maunsell is also to investigate the interchange at Moorebank Avenue on the existing section of the expressway. Vehicle access across the proposed expressway link extension would occur in at least at one location (as well as the interchanges mentioned). This is likely to be at Kurrajong Road. Pedestrian access across the expressway could occur at De Meyrick Ave or Graham Ave, depending upon the results of the EIS.



Thus, in the course of the EIS study, the Maunsell team and the community will examine the location and feasibility of:

- Pedestrian under or overpasses;
- Local cross roads to be overpassed or closed;
- On and off ramps at Campbelltown Road, Camden Valley Way, Hume Highway and Moorebank Avenue.

An alternative to the construction of the F5 Casula link is the upgrading and widening of the Hume Highway. The feasibility of this alternative is currently being analysed by Maunsell's engineers and environmental planners.

The first of an occasional newsletter issued by Maunsell Pty Ltd to provide information and feedback about the proposed F5 Casula Link. MAUNSELL PTY LTD 7th Floor, 80 Alfred Street, MILSONS POINT NSW 2061

EIS STUDY CORRIDOR



FITTING INTO THE BIG PICTURE

The effectiveness of transportation - both public and private - has a big impact on how land is used both in the region under review and nearby.

Therefore the transport proposal will be tested against several development futures for Sydney for the next 25-30 years to assess how well it might serve the community needs: eg. the ease of getting to and from work and leisure activities; moving the goods needed to supply shops and industries.

Convenience and accessibility must be balanced against the environmental impact, for example noise, air pollution and changes to the landscape.

It will be necessary to consider the impact on both individual residents and business owners who might be particularly affected and on whole suburbs.

To estimate the impacts, the Maunsell team will consider where people are travelling to and from at present, and their likely travel patterns in the future when Sydney will have grown.

Projections made in the Department of Planning's 1988 Metropolitan Strategy for Sydney, "Sydney into it's Third Century" indicated a preference for urban consolidation: that is, increasing the population in existing built up areas and also in newly developing areas. But the Strategy still found that:

- The Sydney population is likely to rise to 4.5 million by 2011.
- The biggest growth will be in the south-west, west and north-west sectors of the Sydney region, and in the Gosford/Wyong area.
- That the majority of Sydney's population will live in these outer areas (over 70% by 2011).
- That this growth will occur despite government effort to encourage urban consolidation.

Transport links between and within growth areas are vital for their functioning and for the convenience of the people living there.

Local requirements must fit into broader road and transport plans for moving people and goods around the growing city. A successful transport solution for the south-west corridor must also mesh with the network of ring roads designed to distribute traffic around Sydney rather than through the city centre.

The study will assess the utility and viability of making provision for public transport. For example, the maximum and minimum levels of patronage which could be expected on the public transport system will be estimated.

WHAT IS AN ENVIRONMENTAL IMPACT STATEMENT?

In NSW, any group or agency proposing a development (the "proponent") is responsible for preparing an Environmental Impact Statement (EIS) in accordance with the EP & A Act 1979. The purpose of an EIS is to demonstrate that the likely environmental impacts of the proposed development have been evaluated and are of an acceptable level. Design and cost aspects of the proposal are detailed in the EIS. As well, alternatives are examined and assessed.

When professional environmental consultants prepare the EIS for the proponent, as in this case, one of their roles is to develop a design that minimises any negative impacts. Changes to minimise such impacts are called mitigation measures.

The EIS for the F5 Casula Link proposal will be written in clear English, and will be sufficiently specific to inform the lay and informed reader of the consequences of carrying out (or not carrying out) the project.

The EIS process, as illustrated in Figure 1, provides for a period of review by the community, other government agencies and interested groups. In this case, input will be sought from agencies and the community during the preparation of the EIS, in order to minimise the negative impacts and maximise the benefits of the proposal. When completed, the EIS will be placed on public exhibition for six weeks, at which time, the public can make submissions about aspects of the proposal or the adequacy of the EIS.

On receipt of all submissions, the proponent (in this case, the RTA) will evaluate the EIS and the public responses to the exhibition, and prepare an assessment report to the Chief Executive who will then make a determination to:

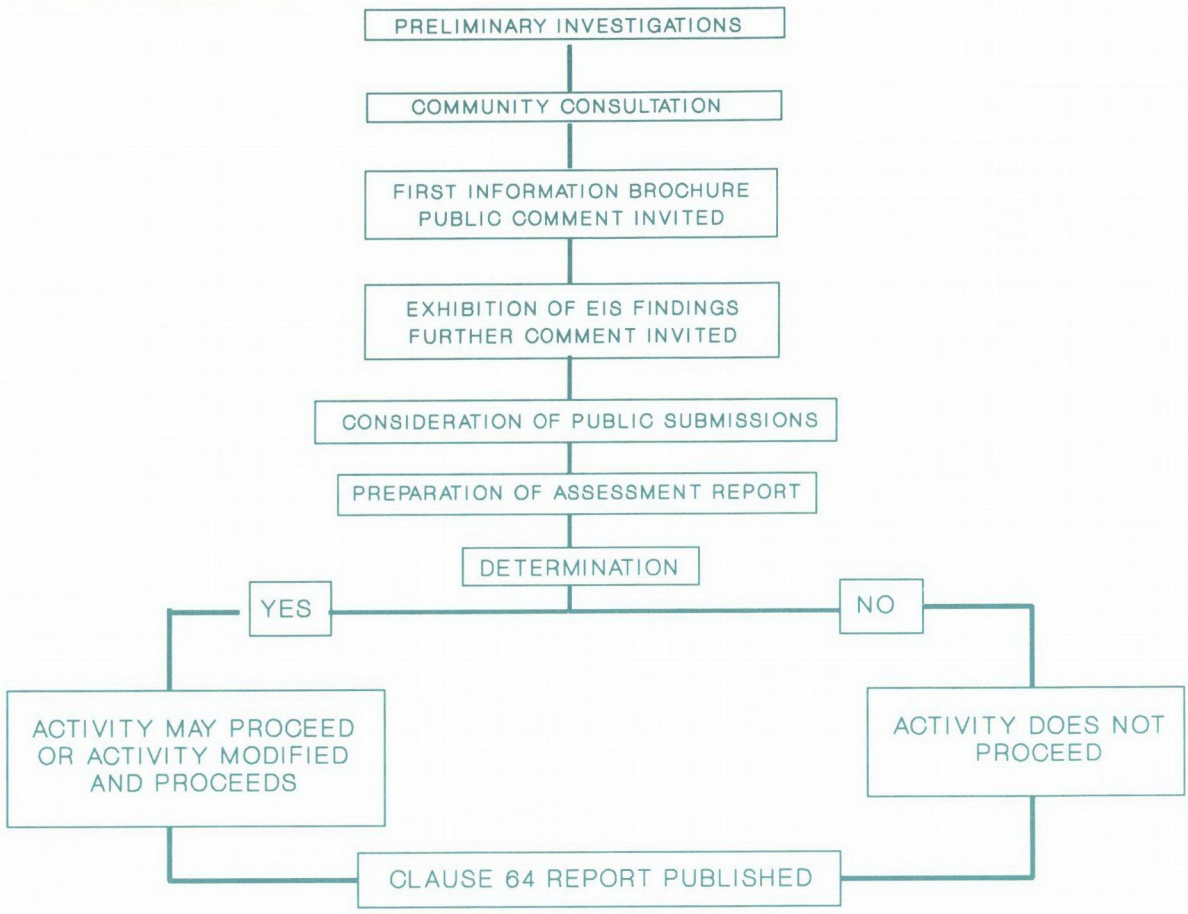
proceed; or

proceed with modification to the proposal; or

not proceed.

There are provisions in the Act under which the EIS is prepared to ensure that the proponent acts responsibly in making that decision.

EIS PLANNING PROCESS



WHAT ARE THE MAJOR ISSUES LIKELY TO BE?

Specialists will investigate the issues vital to the F5 Casula Link Environmental Impact Statement.

They include the main subjects of debate arising from other transport or expressway proposals and environmental issues particularly relevant to South Western Sydney.

These include:

- Traffic noise
- Air quality
- Traffic, transportation and road safety
- Social impact - severance, accessibility, property acquisition
- Financial and economic considerations
- Landscape and visual
- Flora and fauna
- Engineering design
- Planning implications
- European and Aboriginal heritage
- Water quality

As well as these issues, an extensive community consultation process is to be established, so that the local community has the opportunity to identify other issues that should be examined in the study.

For each of the above area of potential impact, measures will be recommended to minimise any adverse impacts that the proposal may cause.

Examples of this might include:

- Noise barriers
- Landscape treatment of finished works
- Erosion and sedimentation controls during construction

Some of the more important issues are discussed below.

NOISE - A PRIME TARGET!

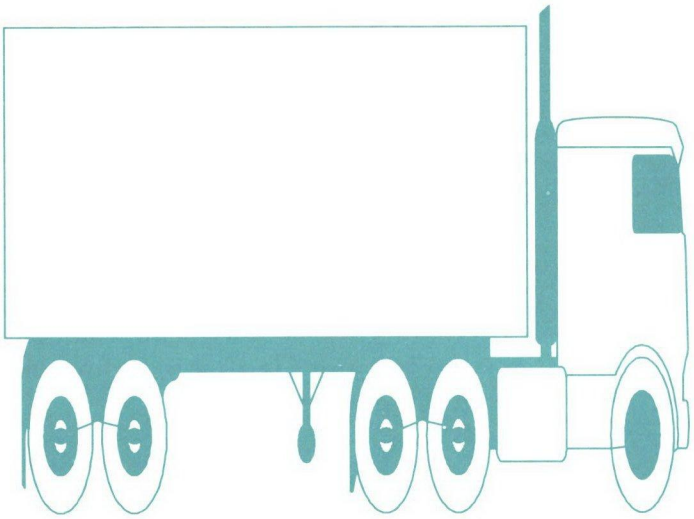
Noise is one of the most important issues that needs consideration with many people fearing their peaceful surroundings are under threat.

Noise consultants must ascertain the existing noise levels, predict the levels of noise and indicate what levels are considered to be acceptable.

This, of course, varies between night and day and according to the traditional use of the area. Those who sleep lightly will know that the sound of a motor bike seems much louder when they are trying to sleep.

The study will use computerised sound recording systems to simultaneously record environmental noise levels and meteorological data.

The latest noise standards will be used and comparisons will be made with similar highway developments in Australia and overseas.



WHAT ABOUT AIR POLLUTION?

Air quality will be assessed in accordance with standards set by the new NSW Environment Protection Authority. Other internationally recognised standards on carbon monoxide and nitrogen oxides will be used also.

The existing levels of pollutants must be measured, and predictions made for motor vehicle emissions for the expressway proposal and for the Hume Highway alternative. To do this, the study will consider vehicle emission controls, the age of vehicles, expected vehicle speeds and traffic density.

Where possible the contribution to greenhouse gas emissions will be investigated.

SITTING ON AN ARCHAEOLOGICAL SITE?

Any areas or items in the local area that are of historical significance - be they of Aboriginal or European origin - will be assessed. You can help here if your know of any site on or near the proposed route which you believe is of archaeological or historic importance.

You can do this by ringing Maunsell Pty Ltd or by filling in the feedback form.

WHAT WILL BE THE SOCIAL IMPACT ON LOCAL RESIDENTS?

The study will examine how the proposal and the design alternatives would impact on the lives of people in areas such as Casula, Lurnea and Prestons.

Shops, schools, community facilities, and recreational areas will all come under examination as well as how people get to various local places - whether by car or by foot.

The 'landscape quality' for the proposal will be established. This will take into account people's expectation for maintaining pockets of open space. The study will investigate how the proposal might affect wildlife, flora and access to recreation. Landscape planting recommendations will be designed to make any construction as visually pleasing as possible.

The risks and hazards of the proposal must also be assessed. This includes such things as fire, explosions and the accidental release of toxic substances from passing trucks and the danger of long-term contamination of groundwater, creeks or other waterways.



HOW DO I GET INVOLVED? HOW DO I STAY INFORMED?

There are several ways of getting more information, asking questions and voicing your opinion.

Consultative Committee: A committee of local residents and interest groups has been established to work with the study team for the length of the project. These are people who responded to public advertisements asking for representatives for the committee.

Newsletters: Additional newsletters will be issued as more information and the environmental assessment develops. The next issue is planned for August and will be distributed to all householders in the study area and to people on the mailing list.

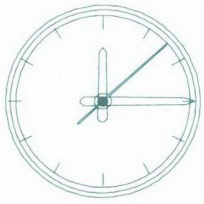
Meetings: Maunsell's representatives will be meeting with as many groups as possible.

Display: When the EIS is on public exhibition, displays showing the alternatives under review will be located in Council offices and shopping centres for your information and comments.

Feedback Form: Fill in the feedback form enclosed in this newsletter and return it to us. This will also ensure that you are then on our mailing list.

If you have any questions about how you can make your views known or if your want details about things like who is on the consultative committee, you can ring our community consultation person Susan Young on (02) 361 4301 or Maunsell's project manager Georgina Legoe on (02) 959 3422.

WHAT IS THE TIMING OF THE EIS?



June - July

Maunsell's consultants in the field undertaking specialist research and assessment.

Comment sought on the consideration of the alternatives to the expressway link proposal now under review and to provide suggestions and ideas.

July - August

Consultants to provide preliminary results to Maunsell.

Environmental assessment by the EIS study team of the transport proposal.

Next newsletter from Maunsell to the community.

Maunsell evaluates all information including feedback from the Community.

Sept - October

Maunsell develops EIS report to be submitted to Roads and Traffic Authority (RTA) for subsequent exhibition and seeking of public submissions in response to the EIS's recommendations.

Carrying out an EIS study is not a cut and dried process and there are many uncertainties involved.

The dates we have nominated are targets that we think are achievable. But public input and the need to carry out proper environmental investigations will determine the actual timing.

WHO IS ON THE EIS STUDY TEAM?

Major environmental issues will be addressed by a team of specialist consultants. The following team has been chosen to prepare the EIS.

Maunsell Pty Ltd

Engineering design.
Evaluation of environmental impacts.
Preparation of the EIS.
Community consultation.
Soil and water quality.

Denis Johnston & Associates

Transport and traffic investigation.
Economic evaluation.

Stephenson & Associates

Air quality.

Mt King Ecological Surveys

Bushland, flora and fauna.

Conybeare Morrison & Partners
Haglund & Associates

European and Aboriginal Heritage

Tract Consultancy

Landscape and visual quality.

Challis & Associates

Noise assessment.

MSJ Keys Young

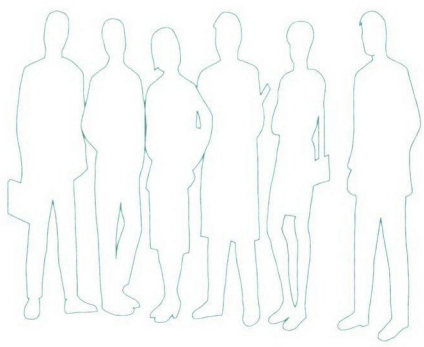
Social impact.
Community consultation
Urban design.
Metropolitan planning.

WHO CAN GET INVOLVED?

Pro, anti, uncertain, confused or brimming with ideas - everyone is included. We want to hear from you.

And that means any group or individual interested in the transport proposal, or having proposals of their own.

Our transport problems won't go away.



So we need to find the answer that best suits the needs of:

People living in the area;
People travelling through the area, to and from work or to and from social and leisure activities;
Heavy transport.

It must also:

Best anticipate future land use demand;
Consider other environmental and social needs.

There are many factors to consider. But it's important that all views are expressed so a balanced assessment can be made.

So don't sit back, we would like to hear from you.

FEEDBACK FORM

1. Thinking about the alternatives that are now under review what is your view about.....

   - Proceeding with the F5 Casula Link expressway as proposed.

   .....

   .....

   .....

   - Upgrading and widening the Hume Highway as an alternative.

   .....

   .....

   .....

   - The shared use of the expressway by public and private transport.

   .....

   .....

   .....

   - Doing nothing.

   .....

   .....

   .....

2. If the western link of the F5 expressway is built, what is your view about these design alternatives.....

   - Provision of off-ramps at the Hume Highway.

   .....

   .....

   - Provision of on-ramps at the Hume Highway.

   .....

   .....

   - Closure of roads that cross the expressway.

   .....

   .....

   - Provision of pedestrian crossings of the expressway.

   .....

   .....

3. What issues are of particular concern to you (please tick)?

   ☐ Noise ☐ Air pollution/quality ☐ Road safety/accidents ☐ Risk/hazard (spillage)
   ☐ Retention of open space/landscape/visual
   ☐ Heritage/archaeological ☐ Property acquisition ☐ Safe access to local facilities
   ☐ Congestion of roads ☐ Better public transport
   ☐ Access to employment ☐ Access to recreation facilities ☐ Other (please specify)

   .....

   .....

   .....

4. What other alternatives do you think should be assessed?

   .....

   .....

5. Are there specific questions or issues that you would like the consultants to address?

   .....

   .....

6. Are there issues you would like more information about?

   .....

   .....

7. Would you like to be placed on our mailing list for further information and updates?
   If so, please fill in the following:

Your name .....

Address .....

.....Postcode .....

Telephone ..... (W) ..... (H)

Are you connected with any community group that may be interested in this EIS study?

Name of group.....

Address .....

.....Postcode .....

Do you have any additional information/research or submissions that you can provide to us?

.....

.....

ANY OTHER COMMENT

.....

.....

.....

.....

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.....

Please send your feedback form to:
Ms Georgina Legoe
Maunsell Pty Ltd
7th Floor
80 Alfred Street
MILSONS POINT NSW 2061
Fax: 957-6536

Thank you for your assistance.

COMMUNITY CONTACT

F5 CASULA LINK EIS

Issue No. 2

Sept 1992

Transport alternatives evaluated

A need has been demonstrated for an easing of traffic congestion on the Hume Highway south of Liverpool. The RTA has responded by commissioning Maunsell to prepare an Environmental Impact Statement (EIS) for a proposed expressway link, known as the F5 Casula Link.

This link would, if built, provide for a continuous expressway from Campbelltown to King Georges Road, Bexley. The proposed link would utilise the existing freeway reservation through the local areas of Prestons, Casula and Lurnea. This is the preferred proposal.

An alternative to the construction of the F5 Casula Link is the upgrading and widening of the Hume Highway from six to eight lanes.

However, if the F5 Casula Link is built traffic on the Highway would decrease. This would provide a number of opportunities for beneficial redevelopment of the Hume.

The EIS study team has been examining all major social and environmental issues associated with the proposals. When Maunsell has evaluated all the information, including feedback from the community, it will prepare the EIS for public exhibition.

At that time the public will have a further opportunity to respond to the recommendations in the EIS. The RTA will consider all submissions received and make the final determination of whether to proceed or not with any proposal.

Traffic conditions in the area

The Casula Link lies at the junction of a number of major roads carrying traffic north to Hornsby and east to Sydney Airport and the industrial areas of inner Sydney.

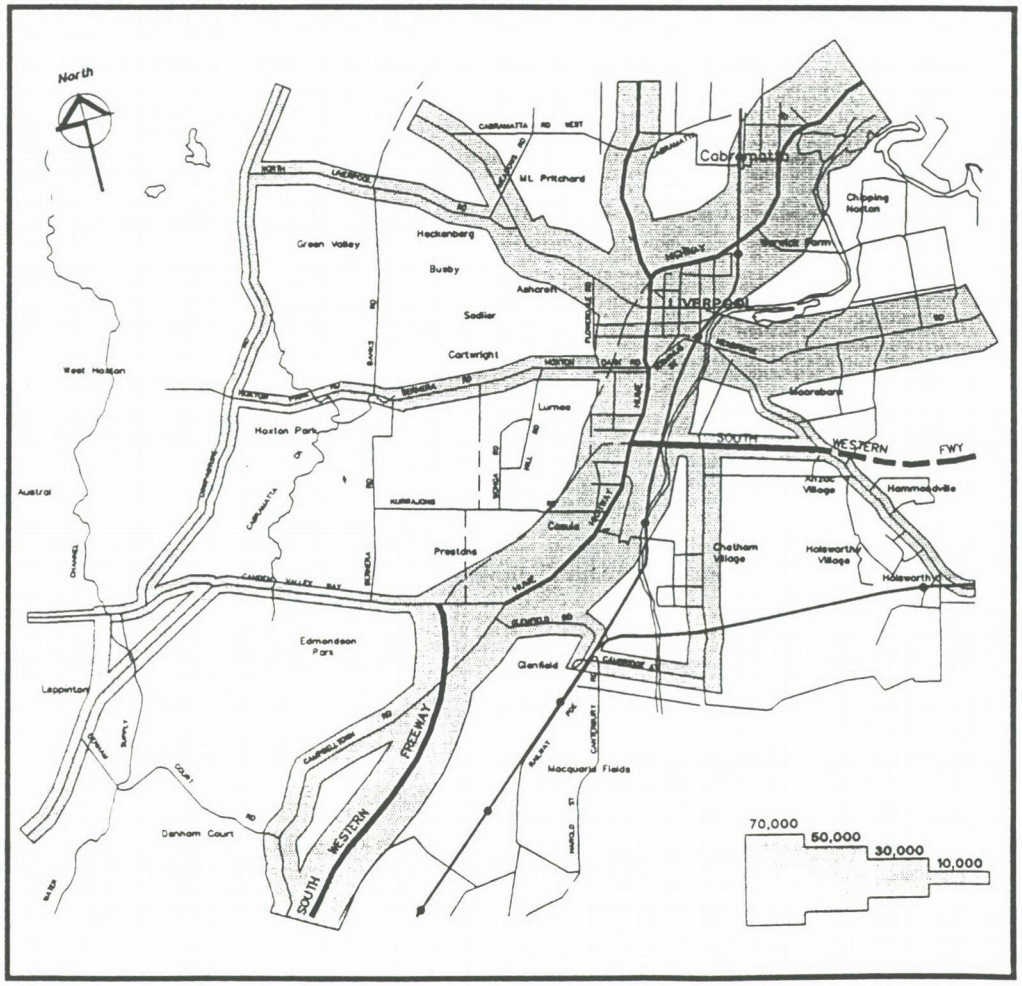
The Hume Highway currently carries 73,000 vehicles per day, the Cumberland Highway 32,000, while 50,000 travel Newbridge Road each day.

Traffic movements will inevitably increase as the city grows, and the road network must be developed to cope with that growth.

The section of the M5 that opened recently is one such improvement: it takes some of the load off Newbridge Road and increases the capacity of the eastern arm of the arterial network.

The Casula Link would ease traffic congestion on the Hume Highway which

continued page 2



Average Annual Daily Traffic shown in thousands of vehicles per day (July 92).

Traffic conditions in the area

from page 1

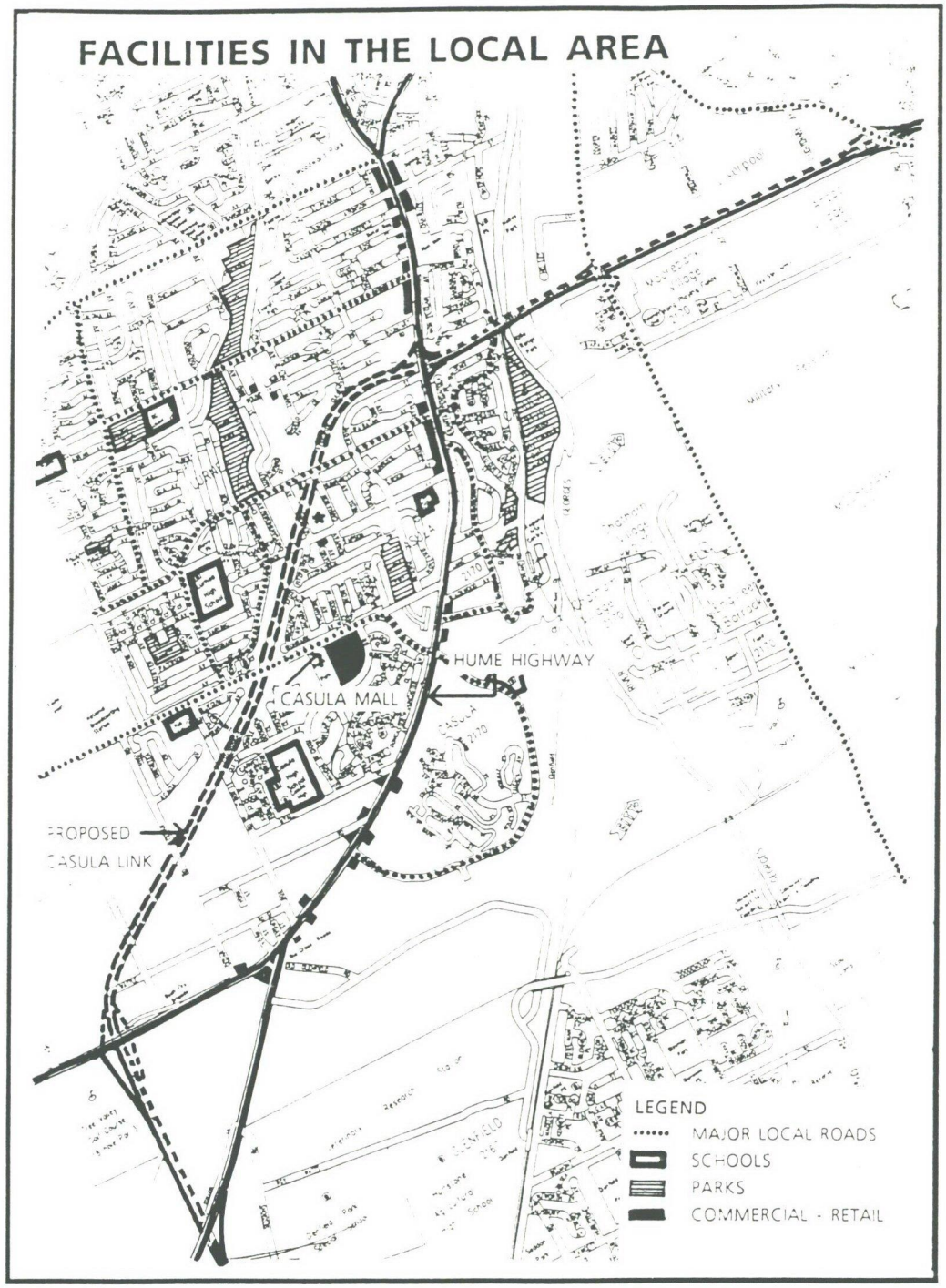
is currently operating close to its limits.

The Casula Link would have the added benefit of providing continuous motorway conditions from inner Sydney to Campbelltown, Camden and southern parts of NSW.

It would be possible to widen the Hume Highway from six to eight lanes by acquiring some property, but the extra capacity gained from this widening would not satisfy medium to long term demand.

Facilities in the local area

The map (on right) shows the study area and the major facilities. The proposed intersections of the F5 Casula Link with the major arterial roads are also indicated.



The community consultation process

A Consultative Committee of local residents and interest groups has been established to work with the study team for the length of the project and has met regularly to discuss the design of the Casula Link.

The majority of the Committee is sympathetic to the need to move traffic through the area more effectively and is working with the study team to develop a satisfactory transport solution while minimising the impact on the local area, residents and businesses.

In addition, community members have had an opportunity to express their views through a feedback form provided in the first newsletter.

This current newsletter describes some of the issues that have arisen and the efforts being taken to minimise or mitigate any adverse impacts.

ABOUT THIS NEWSLETTER

The second of an occasional newsletter issued by Maunsell Pty Ltd to provide information and feedback about the proposed F5 Casula Link.

MAUNSELL PTY LTD
7th Floor, 80 Alfred Street,
MILSONS POINT NSW 2061
Telephone: (02) 959 3422
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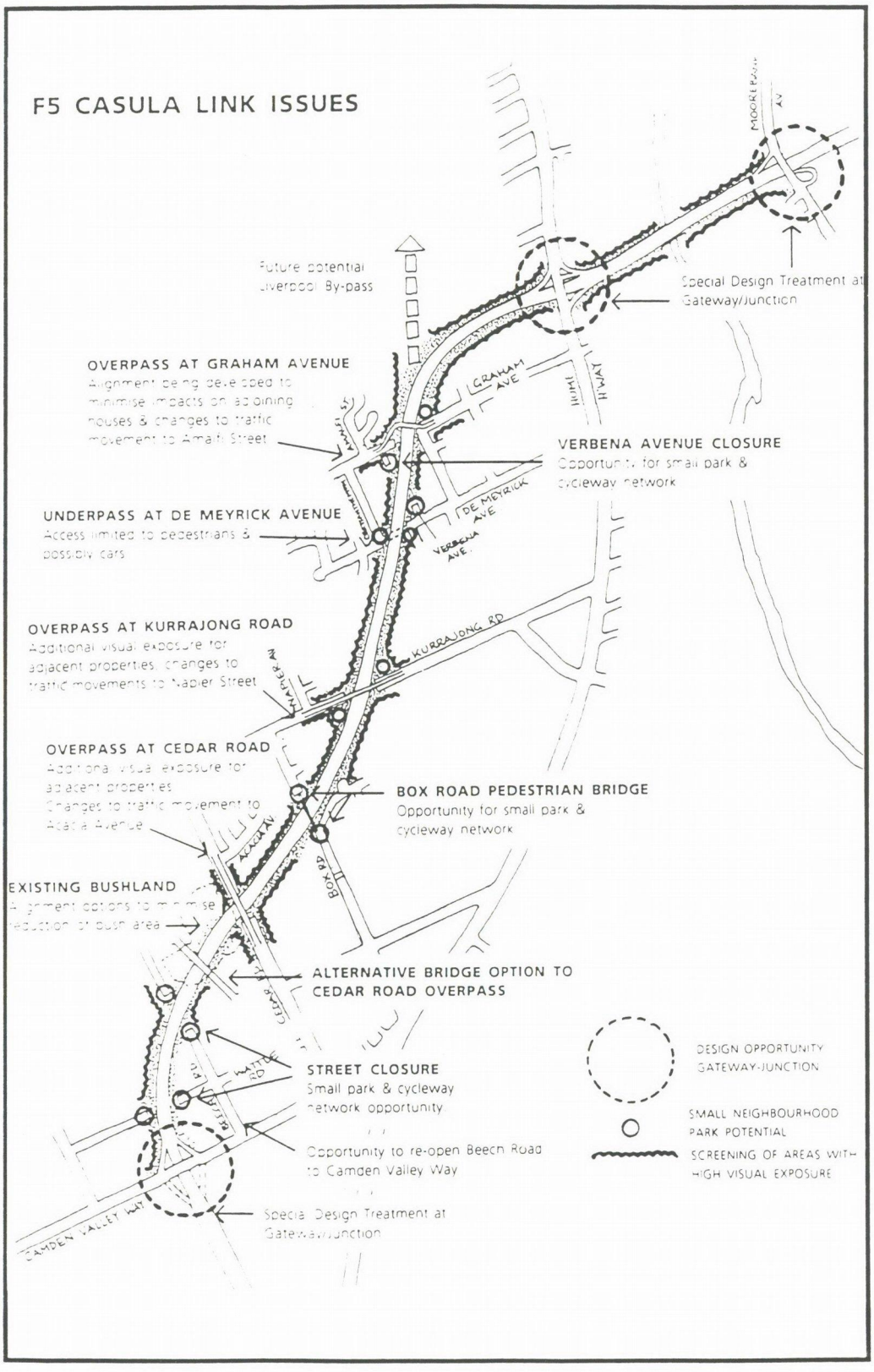
Issues and mitigating measures: the F5 Casula Link



Changes to Local Pedestrian and Car Traffic

• To ensure that the F5 would not become a barrier, a number of links across it are being investigated, including road and pedestrian overpasses at Graham Avenue, Kurrajong Road, Cedar Road or south west of Cedar Road, and an underpass with limited access at De Meyrick Avenue. A footbridge would be provided where Box Road is interrupted.

• Access to roads and houses next to the overpasses would be ensured by changes in local road and traffic arrangements; the way of achieving this would differ depending on the final function and alignment of each overpass.

Visual and Noise Exposure

• Landscaping, noise barriers and mounding along the wide easement between the roadway and adjacent properties would be used to reduce traffic noise and screen buildings from headlight glare and visual exposure.

• The height and alignment of roads that pass over the expressway would be designed to minimise the visual intrusion on adjacent homes; the overpasses would also be landscaped.

Loss of Natural Setting and Open Space

• The corridor is sufficiently wide to allow extensive replanting along the edge of the roadways. The new landscape could build on the existing planting and any retained trees, to produce an apparently natural corridor of trees, shrubs and grasses.

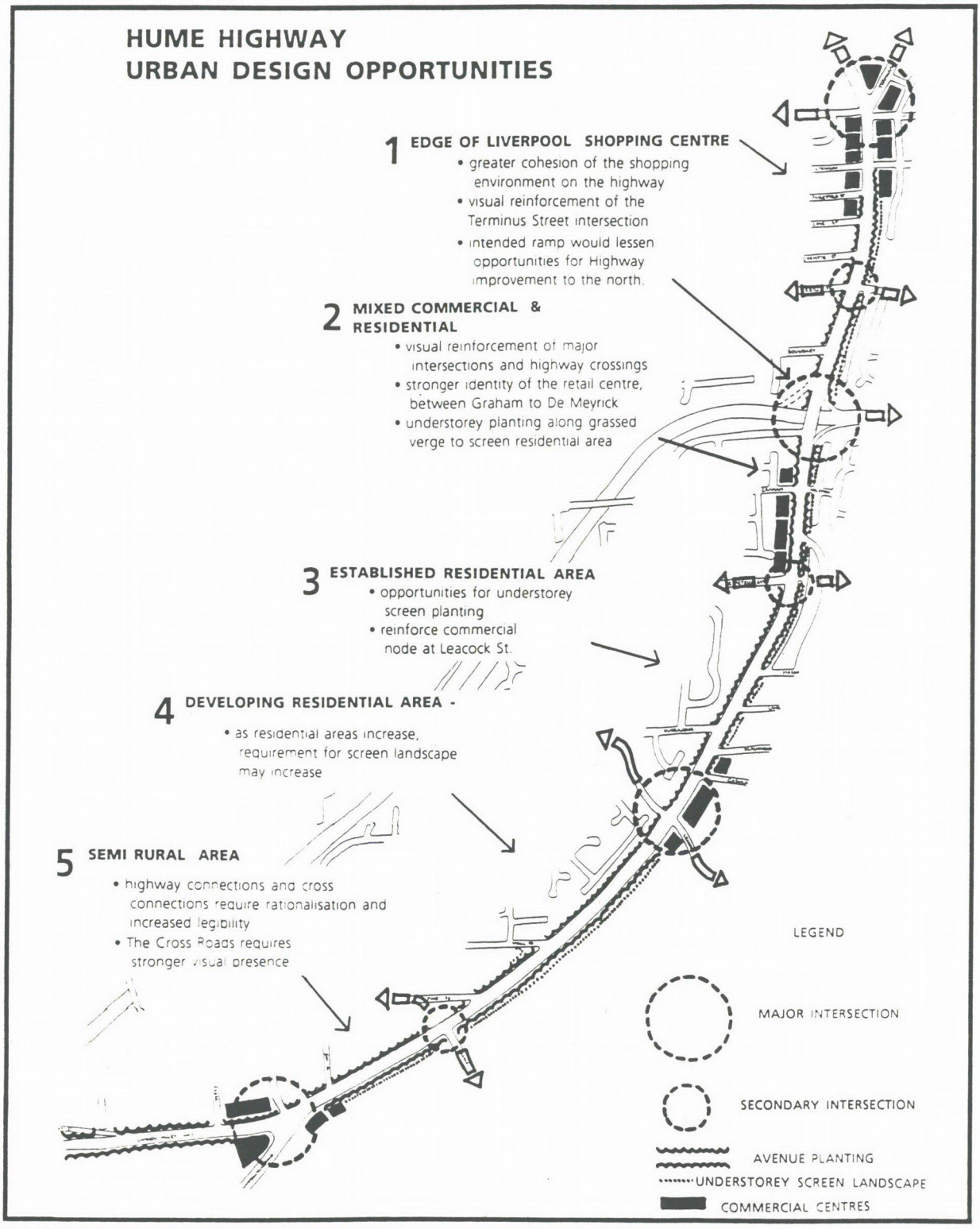
• Opportunities to provide new neighbourhood open spaces would be developed at a number of locations along the corridor, notably:

- at pedestrian crossings over the corridor, and
- where some existing local roads would be closed at the corridor.

Design opportunities for the Hume Highway if the F5 Casula Link is built

If the F5 Casula Link is to be built, lessened traffic on the Hume Highway would provide a number of private opportunities for beneficial redevelopment. The RTA itself would not be involved in any such redevelopment of the Highway. These opportunities might include:

- Creation of a series of strongly marked intersections providing easily identified access to the residential areas, schools and shopping centres on either side of the road.
- Strengthening the identity of groups of shops along the Highway and providing more parking for them.
- Improvements for local residents with regard to noise and privacy. This could be done through the provision of trees, shrubs and mounding in selected areas where there are wide roadside verges such as between Reilly and Marsh Streets, and along the outer edge of the road curvature where visual exposure is high.
- Linking the various developments along the Highway through new landscaping to reduce the present haphazard appearance of the entrance to Liverpool and metropolitan Sydney.



SUMMARY OF REPLIES FROM ORGANISATIONS

In July 1992, letters were sent to over 110 relevant public and private sector organisations seeking comments regarding the corridor proposal for the Casula Link. The responses received are summarised below.

COMMONWEALTH GOVERNMENT DEPARTMENTS AND AUTHORITIES

The following comments were received from Commonwealth Government Departments and Authorities.

Australia Post

The Casula Link is preferred by Australia Post as it would have greater benefits for its interstate and regional operations. As well as journey time advantages there would be improved fuel consumption and reduced emissions. The proposed route poses no inconvenience to the existing local delivery operations.

Australian Defence Force

Defence's concern relates to the impact the M5 Casula Link would have on civilian usage of Moorebank Avenue and Anzac Road.

Both these roads are Army owned and maintained, with no contribution from either Campbelltown or Liverpool Council or the RTA, despite the fact that eighty percent of road users are non Defence people and are from these two council areas.

Army's operations in the area have long been seriously affected by the heavy flow of traffic and the situation will continue to grow worse over the next five years as Defence develops the largest stores distribution centres in Australia on Moorebank Avenue. Defence will have a considerably greater number of large vehicles using Moorebank Avenue for access to this centre.

Defence's aim in the longer term is to close Moorebank Avenue and Anzac Road to civilian traffic as soon as the RTA constructs an alternate route. Therefore Defence would oppose any proposal which results in additional traffic being forced or encouraged to transit the area from/to Cambridge Avenue.

Conversely Defence would be supportive of any proposal which reduces civilian traffic flow on these two Army roads.

Defence vehicles have no particular need to access either the exiting M5 or the proposal Casula Link at any particular point. The need is for continuing, guaranteed access to Moorebank Avenue across the M5. Defence does not support a four lane overpass as this would increase the civilian vehicles flow, on an already choked system, to an unworkable level. This would not suit Defence or civilian users. A two lane overpass would have little effect on current traffic flow an would allow access to both Defence and civilian vehicles in the shorter term.

Department of Transport and Communications

It is proposed that the National Highway be extended to include the Liverpool to Hornsby link from 1994. The exact route is yet to be determined but is likely to involve the Hume Highway from the Crossroads and then the Cumberland Highway to Pennant Hills Road.

Possible options for the ultimate development of the Liverpool-Hornsby link include the M5 Casula Link and an extension to the Cumberland Highway (i.e. from the Crossroads to Graham Avenue on the Casula Link and then from Graham Avenue to the Cumberland Highway at the Hume Highway intersection on the Cumberland Highway extension).

An alternative long-term option is to develop the north-south section of the Sydney orbital route via the Prospect Arterial, the Seven Hills Road extension and the Castlereagh Freeway to Pennant Hills Road (known also as the North West Transport Link / F2).

Both options terminate in the general area covered by the EIS for the M5 Casula Link and therefore would be a design consideration in the EIS for this link.

STATE GOVERNMENT DEPARTMENTS AND AUTHORITIES

A summary of comments from State Government departments and authorities is shown below.

Australian Museum

No comments. EIS advice can only be provided through their Consulting Program i.e. through commercial engagement.

CityRail

CityRail is currently investigating a number of route options to service the South Creek Valley urban release area and the proposed second Sydney Airport at Badgery's Creek. The proposed Casula Link does not conflict with the current preferred rail route.

Department of Agriculture and Fisheries

Water quality and fish habitats should be protected from either direct or indirect adverse impacts through sedimentation and other forms of pollution during construction and operation of the freeway. The EIS should take into account NSW Fisheries Freshwater Habitat Management Guidelines.

Department of Conservation and Land Management

Access roads to any freeway Link through the existing Liverpool Showgrounds may affect rare plant species which need to be considered for retention.

Soil conservation must be addressed and may be presented in the form of an Erosion and Sediment Control Plan (ESCP). CALM is advocating the NSW Government's concept of Total Catchment Management (TCM) and a Council for the Georges River is in its formative stages.

Department of Housing

The Department is not directly affected by the proposed Casula Link. However, the Department is continuing with significant development in the South West and would be likely to support better access to these areas through the Casula Link rather than the upgrading of the Hume Highway.

Department of Industrial Relations, Employment, Training and Further Education

Referred the issue to the Workcover Authority of NSW.

Department of Local Government and Co-operatives

Not affected by the proposed Casula Link.

Department of Mineral Resources

There are no known mineral or extractive resources in the study area.

Department of Planning

Advice was provided to heritage sub-consultants, Conybeare and Morrison. The EIS should consider any possible impact of the proposal on properties within the City of Liverpool which are listed under the Heritage Act, 1977. The Department draws attention to correct procedures regarding the discovery of relics or proposed disturbance of a site suspected to contain relics. The proposal should also be referred to the National Trust of NSW, the Australian Heritage Commission and local historical societies.

Department of School Education

Pedestrian access is required across the proposed extension to enable students to access the four schools in the area. Proposed pedestrian access at De Meyrick Avenue or Graham Avenue is acceptable. However a footbridge overpass is required at Box Road.

Department of Transport

The proposed Casula Link would require rationalisation of existing bus services to Liverpool from suburbs in the study area.

Department of Water Resources

No special comments. The Department's guideline documents should be addressed by the EIS.

Environment Protection Authority, NSW

The EIS should cover prediction, criteria and remedial actions for the following:

- noise and vibration pollution
- air pollution

- water pollution including rainwater, waste & washings and spillages.

The proposed construction of the M5 Casula Link would require a pollution control approval under section 17K of the Pollution Control Act 1970.

Ethnic Affairs Commission of NSW

Community consultation committee arrangements should allow for participation of people of non-English speaking backgrounds which would represent the population mix of the areas affected. Any publicity seeking submissions or comments should be done in a manner to effectively target people of non-English speaking backgrounds.

NSW National Parks and Wildlife Service

- An archaeological survey of the area should be undertaken and the potential for disturbing unrecorded relics should be identified.

- A detailed description by suitably qualified specialists of the flora and fauna in the study area should be undertaken. Particular attention should be given to rare or threatened plants and vegetation communities, regionally uncommon associations and endangered fauna habitats.

- Landscaping works should use endemic plants to provide habitat for native fauna.

Pacific Power (Electricity Commission of NSW)

Existing electrical installations satisfy statutory clearances from present road levels. Any modifications to the road which affect these clearances must be approved by Pacific Power.

Premiers Department NSW

Acknowledged receipt of letter.

State Transit Authority of NSW

Referred the matter to the Department of Transport.

State Development

Fully supports the Casula Link proposal on the basis of providing essential economic infrastructure and assisting State and regional economic growth.

South Western Sydney Area Health Service

There are no Health Department requirements which would affect the EIS.

Sydney South West Emergency Management Zone

Acknowledged receipt of letter.

Property Services Group

Will comment at the exhibition stage.

RTA Bicycle Advisory Council

(The matter was referred to the RTA's Regional Local Network Unit who made the following comments.)

The RTA is currently identifying a network of mainly State roads which will link the regional centres of Sydney. These roads will progressively be upgraded to a bicycle safe standard and will be known as the Regional Bicycle Network. This network is largely yet to be determined but freeways are considered to be an ideal type of road for such usage. It is therefore essential that the M5 Casula Link be designed to a standard to enable the safe use by cyclists.

All local road crossing points of the motorway, including the pedestrian overpass at Box Road, are considered worthy of inclusion in the local bike plan. Therefore they need to be constructed to a standard suitable for safe use by cyclists.

The Treasury, NSW

Treasury is concerned with the efficient allocation and use of resources. The EIS process provides a mechanism for assessing the costs and benefits to the community. The proposal must be consistent with the strategic planning of the region for both land use and transport considerations. All feasible options should be considered including the "no-spend option".

Parliament of NSW, Legislative Assembly, Member for Liverpool

Acknowledged receipt of letter.

University of Western Sydney, Macarthur

UWS, Macarthur has a vested interest concerning improved motor vehicle access between the campuses at Campbelltown and Milperra.

Waste Recycling and Processing Service of NSW

Acknowledged receipt of letter.

Water Board

The Water Board has a number of concerns regarding the proposed development. Specific comments will be made during the exhibition period of the EIS but preliminary comments are:

- Waterways in the EIS study area are classified as Class "C" Controlled Waters and any discharge into these waters must satisfy the relevant requirements and restrictions.

- The M5 Casula Link has the potential to increase water quality problems within the Georges River catchment including the Georges River, Bunbarry Curran Creek and Glenfield Creek. The EIS should include details of proposed mitigation measures.

- An overall Runoff Control Plan should be implemented prior to any works commencing. As a minimum this should include trash racks, sedimentation basins and booms. Stormwater mitigation techniques should be trailed to determine their effectiveness under local conditions.

Both funding and maintenance responsibilities should be included in the EIS as well as a maintenance program.

- During construction erosion control measures such as hay bales and geotextiles should be used. The use of locally indigenous plant species is strongly recommended for rehabilitation work. A program should be initiated for the ongoing monitoring and control of weeds.

Workcover Authority

Declined participation in the EIS.

LOCAL COUNCILS

A summary of the comments received from local government authorities now follows.

Campbelltown City Council

Council fully supports the early construction of the M5 Casula Link. Provision must be made for a left hand turn from the M5 onto the Hume Highway at its northern end. It is noted that this is being provided. To ensure the accessibility of residents of Campbelltown into the city it is imperative that this link be constructed as soon as possible.

Council of the Municipality of Camden

Acknowledged receipt of letter and noted the M5 Task force technical representatives would meet with Maunsell to discuss the study. A copy of the South Creek Valley Sector Transport Study Report should be obtained as reference material for the EIS. Council's Municipal Engineer should be contacted in relation to technical aspects in the preparation of the EIS.

Fairfield City Council

Council acknowledged receipt of the letter and advised that there would be no direct effect on the Fairfield Local Government Area. However, it requested that it be kept informed during the EIS process.

Liverpool City Council

(While there has not been a formal response from Liverpool Council, there have been a number of important meetings with Council staff and elected representatives discussing the needs of local traffic, the provision of crossings for vehicles and pedestrians, the location of services, the impact of construction facilities and the EIS process.

The output of these discussions has been reflected in EIS sections dealing with those topics mentioned above.)

STATUTORY AUTHORITIES

Comments from statutory authorities were limited to those from Prospect Electricity.

Two comments were received. One was received direct from Prospect Electricity and the other was from their consultants EDAW.

Prospect Electricity

1. Existing overhead electrical assets would have to be either relocated or undergrounded for either the Hume Highway upgrade or the Casula Link. The cost of these works would have to be met by the RTA.

2. EDAW have been retained by Prospect Electricity to study electricity supply improvements to Casula West - environmental assessment and route selection.

Prospect Electricity proposes to construct a new zone substation at Casula West, south of Liverpool. Two 33 kV transmission lines would feed the substation, one directly connected to the existing West Liverpool substation and the other from an existing 33 kV line on Kurrajong Road. At least one and possibly both transmission lines would cross the existing freeway reservation. In addition, some line routes may be located along part of the reservation, if it is possible to do so.

REPRESENTATIVE GROUPS

Comments from representative groups were limited to those from the Friends of Wolli Creek.

Friends of Wolli Creek

Friends of Wolli Creek oppose the proposal to construct the M5 Casula Link. This road would encourage much heavy vehicle traffic onto the M5 route to Beverly Hills, placing pressure on the local road system east of Beverly Hills. This would renew pressure for a Beverly Hills-St Peters truck road in the Wolli Creek Valley.

An upgrade of the existing Hume Highway north and east of Casula would be appropriate to overcome "localised" traffic problems.

If the Casula Link is built there should be both on/off ramps to the Hume Highway and all existing roads crossing the proposed link should be maintained.

Other alternatives to the Casula Link are:

- construction of the proposed Sydney CBD - Airport rail link;
- quadruplication of the East Hills Rail Line;
- extension of two tracks of the East Hills rail line to South Creek, Badgerys Creek, Eastern Creek, Blacktown, Baulkham Hills and Beecroft with an extended Carlingford Line joining Baulkham Hills and Beecroft. This rail link would tie together virtually all radial rail links.

The issues to be addressed by the EIS should be:

- Noise, especially from heavy vehicles
- Air pollution/quality
- Road safety/accidents noting that good public transport would reduce the number of road accidents due to a reduction in the number of road vehicles
- Retention of open space
- Better public transport

Specific issues to be addressed by the EIS should be:

- a study such as the Botany-West Transport Study should be carried out in conjunction with the EIS.
- An origins/destinations study of private and commercial traffic should be conducted.
- Any positive or negative effects of proposals P and R of the Botany-West Transport Study should be investigated and reported.
- Any positive or negative effects on the M5 Tollway should be investigated and reported.

Particularly the toll plaza area and traffic entering or leaving the M5 especially at King Georges Road, Beverly Hills.

The process, reports and results of the Botany-West Transport Study must be referred to in the EIS for the Casula Link.

PRIVATE SECTOR ORGANISATIONS

A summary of comments from private organisations is shown below.

Nippon Credit Australia

Nippon Credit Australia is the mortgagee of the property at the crossroads bounded by Camden Valley Way, Campbelltown Road and the M5 Freeway. It is proposed that a transport terminal be constructed on this site and therefore the design and location of access and egress points from both north and southbound traffic would be of particular interest.

The preferred access to the site for traffic from the south would be via a ramp off the M5 Freeway to a right turn on to Campbelltown Road with a slip lane to a left turn into the site approximately opposite Quarter Sessions Road.

Traffic from the north could obtain access to the site off Camden Valley Road approximately opposite Beech Road.

Exit from the site for both north and south bound traffic would be preferred at the same point as the access point on Camden Valley Road.

Westfield Developments

Wishes to view expected usage, origin/destination information and proposed on/off ramp linkages.

FOI
FREEDOM OF INFORMATION
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Land Acquisitions

RTA

Roads and Traffic Authority
New South Wales

Policy Statement

Land Acquisitions

Owners of property required by the Authority in connection with roadworks are generally aware of the proposals either through enquiries made when purchasing the property or from the proposal being shown on a Local Planning Scheme. New proposals are made public as soon as possible after a final decision has been reached.

A proposal may require public consultation and the preparation of an Environmental Impact Study which enables owners of affected land, to lodge submissions.

Procedures (Authority Initiated Acquisitions)

The Authority endeavours to purchase the land by negotiation in much the same way as a private property transaction. The offer of compensation is assessed in accordance with the Land Acquisition (Just Terms Compensation) Act 1991 hereafter referred to as "The Act". When roadworks are programmed the Authority advises the owner that the land is required and when occupation of the land is required. (Occupation of the land is usually required for adjustment to public utilities prior to actual road construction).

The letter will advise the owner that a Valuer representing the Authority will make arrangements to inspect the property and discuss the acquisition for the purpose of submitting a formal offer for the owner's consideration. The letter will also state that if an owner engages a Registered Valuer and a Solicitor the Authority will reimburse reasonable fees. Valuation fees are reimbursed in accordance with the Authority's schedule included with the letter and Legal fees in accordance with Schedule 1 of the General Order of the Conveyancing Act. Every effort will then be made to negotiate an agreement.

Compensation is to be assessed by having regard to the market value of the property as if it were unaffected by the road proposals. In addition to the market value regard is also taken to special value, severance, disturbance, solatium and any increase or decrease in the value of any other land adjoining or severed by the carrying out of the work. Division 4 of The Act defines the owner's entitlement to compensation.

An advance payment (usually only for the purpose of paying a deposit on a replacement property) will be considered if requested.

If agreement cannot be reached to ensure the Authority's timely entry onto the required land for roadworks the Minister may approve the issue of a written Proposed Acquisition Notice to compulsorily acquire the land. See "Compulsory Acquisition" below.

Partial Acquisition

When only part of a property is required the Authority is responsible for the reconstruction of fencing, driveways and landscaping to a standard similar to that existing and relocation of water and gas meters. Compensation for any improvements lost as a result of the partial acquisition is added to the value of the land taken. A "Before and After" valuation will reflect most compensable items. The Authority will generally make an allowance to an owner who wishes to arrange for his/her own property adjustments.

Where all major improvements are situated outside the road corridor the Authority will generally purchase only the part of the property required for roadworks.

Compulsory Acquisition

Compulsory Acquisition is a statutory process available to the Authority to acquire land. It also provides the means for resolving disputes about the amount of compensation payable.

Compulsory acquisitions are carried out under the provisions of The Act.

The Process

- The Authority seeks the Minister's approval to compulsorily acquire land.

- If the Minister approves, the Authority issues a Proposed Acquisition Notice to each party with a known legal or equitable interest in the land, (eg a registered proprietor, mortgagee, lessee, trustee, occupant, beneficiary of an easement). The Notice advises of the Authority's intention to acquire the land after 90 days. However, a shorter period can be agreed by the owner and Authority, or can be approved by the Minister. A Proposed Acquisition Notice is accompanied by a Compensation Claim Form.

- The issue of a Proposed Acquisition Notice is recorded on the relevant Title registers at the Land Titles Office.

- During the 90 day period after the issue of the Proposed Acquisition Notice, negotiations may continue in an effort to purchase the land.

- If contracts for purchase have not been exchanged within the 90 days the Minister recommends to the Governor that the compulsory acquisition proceed.

- If the Governor approves, an Acquisition Notice is published in the Government Gazette within 120 days of the issue of the Proposed Acquisition Notice unless a longer period is agreed by the owner and the Authority. An extract of the Acquisition Notice is also published in a local newspaper.

- The Authority owns the land from the date of publication of the Acquisition Notice in the Gazette. The legal and equitable interests of each party are converted to an entitlement to compensation.

Advance Payment

Immediately following the publication of the Acquisition Notice the Authority advises affected owners of the acquisition and generally offers to pay 90% of the Authority's purchase offer, in return for vacant possession of the land.

Terms of Continued Occupation

- If possession is not given, the Authority is entitled to charge rent for the land from the date of notification in the Gazette until possession is obtained. The terms of

rental are at the discretion of the Authority. Unpaid rent may be deducted from compensation payable.

Compensation

- Each recipient of a Proposed Acquisition Notice is entitled to lodge a claim for compensation with the Authority. Also, anyone else who considers that they are entitled to compensation but did not receive a Proposed Acquisition Notice may lodge a claim. Claims must be on the prescribed form. Compensation is not paid until a properly completed claim has been lodged. If agreed, compensation may comprise land or works in whole or part settlement of a claim.

- The Valuer General determines the amount of compensation (including legal and valuation costs) to be offered by the Authority in a Compensation Notice.

- A Compensation Notice is issued within 30 days after notification of the compulsory acquisition in the Gazette. This Notice is issued whether or not a claim for compensation has been lodged. However, the Minister may approve delay in the issue of a Compensation Notice by up to an extra 60 days. However in the case of competing claims the Authority does not issue a Compensation Notice until entitlement is resolved.

- If the amount of compensation is accepted, and the necessary settlement papers and claim form are returned to the Authority properly completed, the Authority will pay the compensation within 28 days of receipt of those papers. Interest is paid on the compensation from the date of acquisition to the date of payment.

- If the amount of compensation is not accepted, the claimant may lodge an objection with the Land and Environment Court. The objection should be lodged within 90 days of the Compensation Notice issuing. This ensures that the Court will hear the objection and determine the amount of compensation to be paid. Within 28 days after lodgement of the objection, the Authority will pay the claimant 90% of the compensation offered in the Compensation Notice as an advance on account of compensation if that is acceptable to the claimant. Interest is also paid on the advance. If it is not accepted, the advance and interest will be deposited into a trust account pending the Court decision.

- If, within 90 days of a Compensation Notice issuing, the amount offered in that Notice has not been accepted and an objection has not been lodged with the Land and Environment Court the offer is deemed to have been accepted. The Authority then deposits the amount offered plus interest into the trust account where it is held until it is accepted or until an objection is lodged with the Court. Money earned by the trust account deposit becomes part of the compensation.

- If, the compensation has been in the Trust Account for six years and a claim has not been received, the compensation is paid to the State Treasurer and held in the Treasury until paid to an entitled claimant. Interest is not paid on the compensation for the time that it is held in the Treasury.

Occupation

- People in lawful occupation of land compulsorily acquired and to whom compensation is payable are entitled to remain in occupation as tenants of the Authority until:

  (a) the compensation is paid; or

  (b) an advance payment of not less than 90% of the amount offered in the Compensation Notice is paid; or

  (c) not less than 90% of the amount offered in the Compensation Notice is deposited into the trust account due to a deemed acceptance, Court action, or competing claims;

  whichever occurs first.

- Furthermore, people lawfully occupying their principal place of residence or place of business are entitled to remain in occupation as tenants of the Authority for three months after it is compulsorily acquired, regardless of whether any of the abovementioned payments have been made. However, the Minister may shorten that period.

- Once the Authority is entitled to vacant possession, it may request the Sheriff to deliver possession of the land to the Authority. The Sheriff's costs may be recovered as a debt or deducted from any compensation payable.

Hardship Acquisition

(Owner Initiated Acquisitions)

If a property is affected by a road proposal the Authority will consider acquisition under the "Hardship" provisions of the Act and acquisition clauses in Local Environmental Plans. Hardship has to be demonstrated to the satisfaction of the Authority in accordance with Division 3 of the Act. When hardship has been established to the satisfaction of the Authority the owner may negotiate the acquisition or may require the Authority to compulsorily acquire the land.

An owner who has purchased in knowledge of the Authority's proposal can usually sell on the same basis on which it was purchased and would not normally be able to demonstrate hardship.

The Authority is not obliged to acquire more land than is required for the public purpose.

The valuation will be the market value unaffected by the Authority's proposal. Disturbance items, injurious affection, severance, solatium, and the payment of legal and valuation fees need not (under the provisions of the Act) be taken into account in the assessment of compensation under the Hardship provisions.

Notes

- Solatium means compensation to a person for non-financial disadvantage resulting from the necessity of the person to relocate his or her principal place of residence as a result of the acquisition. The amount of compensation is to be assessed depending on the degree that the person is disadvantaged to a maximum of $15,000 or such increased figure as notified by the Minister in the Gazette.

- The Act does not apply to the acquisition of land by agreement where the land is available for public sale.

CAT No. 45064042

GS 664-059

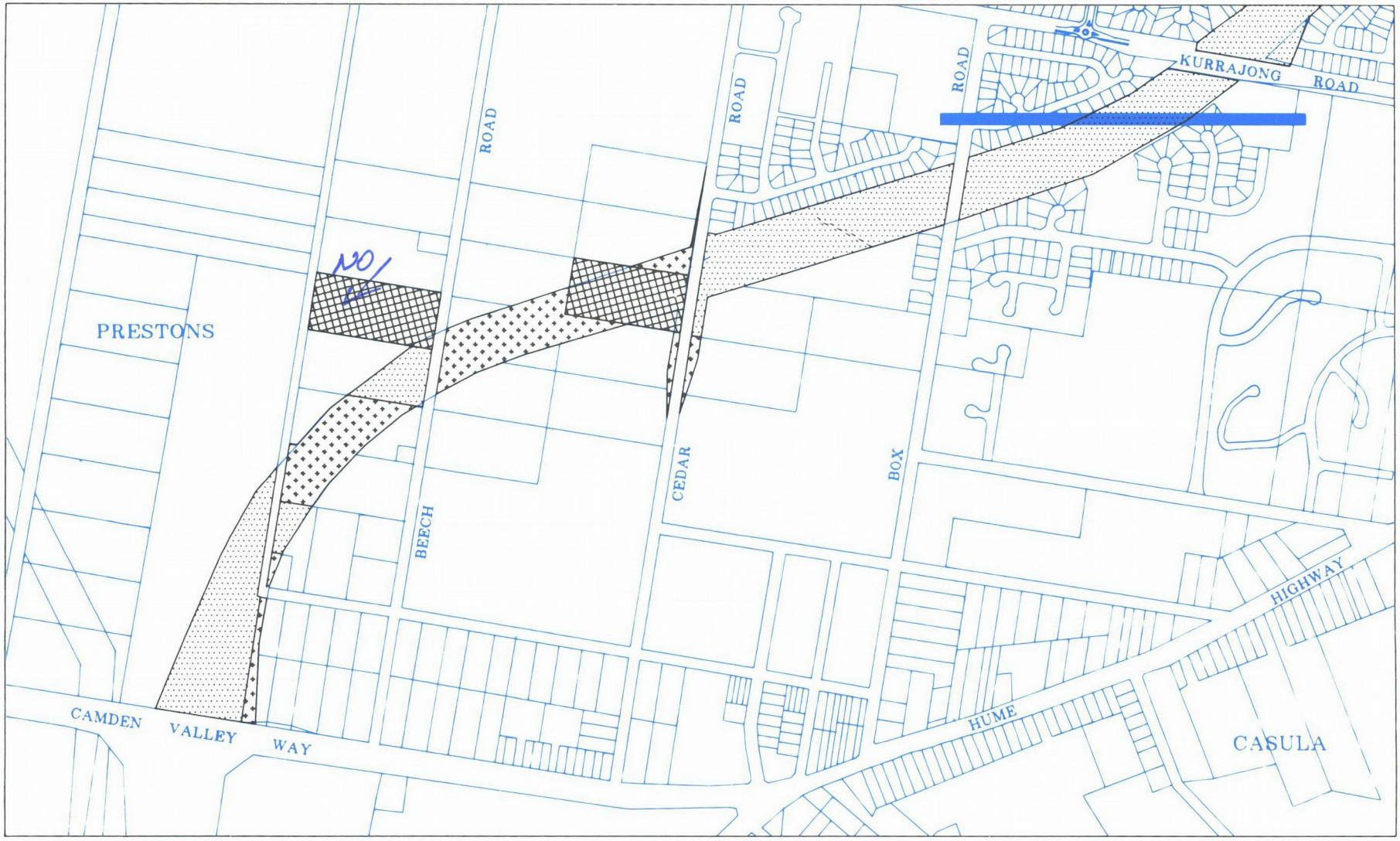
RTA GRAPHIC SERVICES

SUMMARY OF RESIDENTIAL PROPERTIES AFFECTED BY M5 CASULA LINK

Location/Street Name	Number of Residential Properties Affected	
	Requiring Full Property Acquistion	Requring Partial Acquisition
. Camden Valley Way to Beech Road	1	4 (+2 vacant lots privately owned)
. Beech Road to Cedar Road	2	5
. Cedar Road to Box Road	0	0 (+1 vacant lot privately owned)
. Box Road to Kurranjong Road	0	0
. Kurrajong Road to De Mayrick Road	0	0
. De Meyrick Avenue to Graham Avenue	4	12 (+1 vacant lot privately owned)
. Graham Avenue to Hume Highway	4	11
TOTAL	**11**	**32 (+4 vacant lots privately owned)**

Source: Maunsell Pty Ltd, 1992

In the assessment of property impacts for the Casula Link, a residential lot was deemed to be fully acquired if construction required at least some part of the main structure to be removed. Lots requiring partial acquisition were those not falling into the first category, but still requiring some land for construction. These numbers include properties already purchased by government authorities.



Full Property Acquisition Required

Partial Property Acquisition Required

Other Land previously identified and previously acquired for this project

0 0.1 0.2 0.3

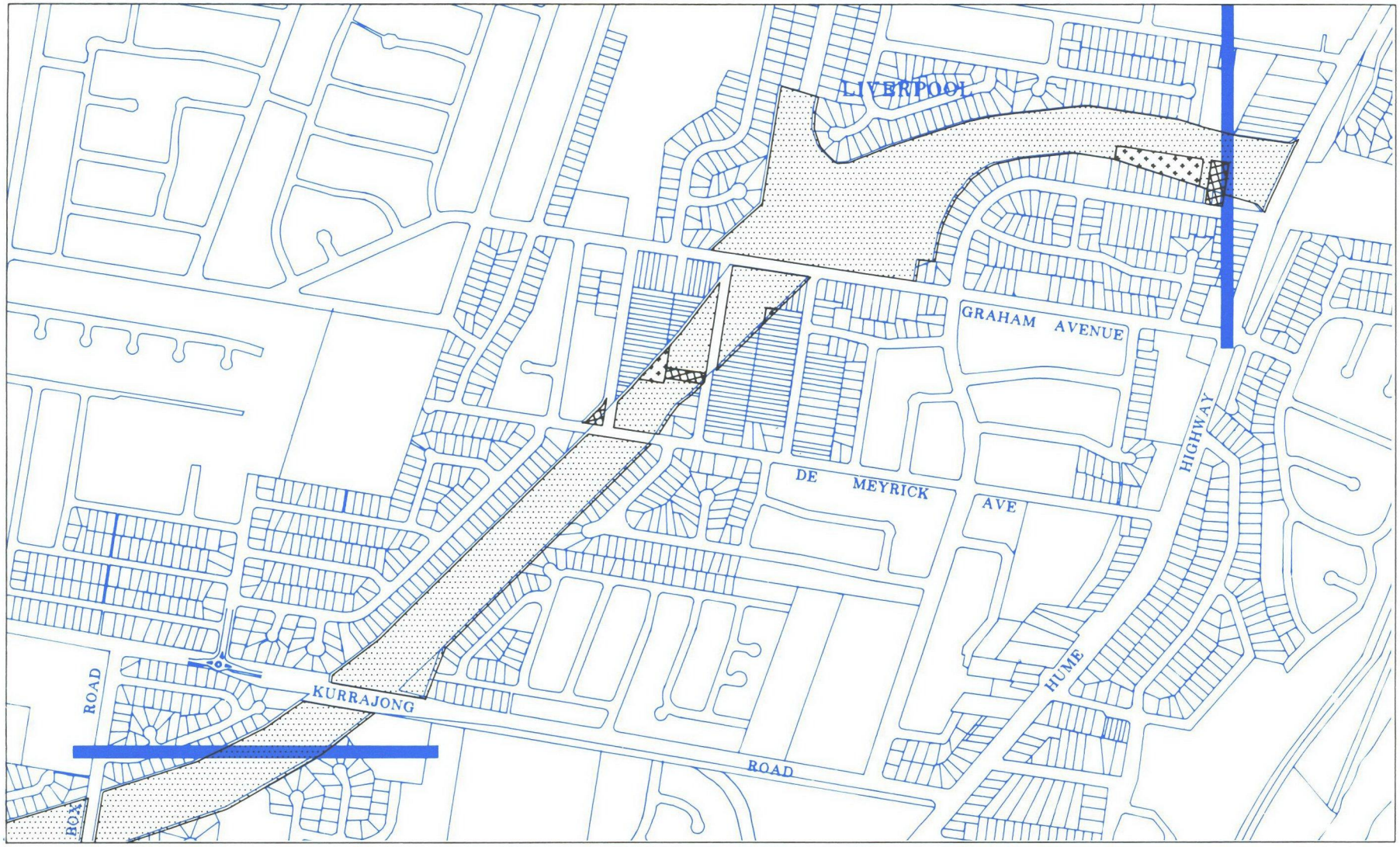
Kilometres

FIGURE G 11

LAND REQUIREMENTS: MOTORWAY (SHEET 1 OF 3)

Source: Maunsell Pty Ltd 1992

N



Full Property Acquisition Required

Partial Property Acquisition Required

Other Land previously identified and previously acquired for this project

0 0.1 0.2 0.3

Kilometres

FIGURE G.12

LAND REQUIREMENTS: MOTORWAY (SHEET 2 OF 3)

Source: Maunsell Pty Ltd 1992

N



Full Property Acquisition Required

Partial Property Acquisition Required

Other Land previously identified and previously acquired for this project

0 0.1 0.2 0.3

Kilometres

FIGURE G.1.3.

LAND REQUIREMENTS: MOTORWAY (SHEET 3 OF 3)

Source: Maunsell Pty Ltd 1992

N



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