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Ridgeland Residents Incorporated Submission to Mach Energy Mt Pleasant Mine Modification 3

Ridgeland Residents Incorporated recognises Mach Energy Australia, Mt Pleasant Operation for the maintenance of Conditions 7.2 being the construction of the Mt Pleasant Northern Link Road on proceeding to planned closure of Castlerock Road East and the Mt Pleasant Western Link Road (on proceeding with planned closure of Wybong Road East).

The Mt Pleasant Western and Northern Link Roads are essential to inter and intra Shire residential traffic movements and trade and commerce access from Sydney, the Central West, Bylong Valley, Sandy Hollow, Scone and Upper Hunter and is essential without diversion of tens of kilometres via Muswellbrook South and the congested Muswellbrook CBD.

The Mt Pleasant Western and Northern Link Roads, in conjunction with RMS, provide the basis of a Western Aberdeen Muswellbrook Bypass of positive net value and lower cost to the State as compared with the proposal for a 7km Eastern Bypass of Muswellbrook-only, costed at \$350 million and rising, providing a net negative value to the State and Shire and NO resolution of the congested Muswellbrook CBD and western mine bound traffic movement gridlock.

Ridgeland Residents Incorporated acknowledge the commitment given by Mach Energy Mt Pleasant Operation to maintain Wybong Community road links direct to Scone and the Central West and participation in frank consultations with the directly affected Wybong community that is expendable to Muswellbrook Shire Council other than for MSC misappropriation of Wybong Community tied Mining Consent funds.

Ridgeland Residents Incorporated also acknowledges that Mt Pleasant Modification 3 negates the deletion of the Mt Pleasant Western Link Road as Mach Energy Mt Pleasant Operation Modification 3 proposes to emplace piped fines slurry west of the Mt Pleasant Western Link Road and excludes the haulage of overburden envisaged by Rio Tinto to the west of the Mt Pleasant Western Link Road as reason given for Rio Tinto engaged Cardno to impose a 2015 Mine Affected Road Network Plan and therein gain a greater than \$46 million benefit from the Muswellbrook Ratepayer and RMS by deletion of the Mt Pleasant Western Link Road to assist sale by Rio Tinto of the Mt Pleasant Operation to Mach Energy.

Ridgeland Residents Incorporated anticipates that fines will be emplaced by Mach Energy Mt Pleasant Operation so as to exclude the possibility or actuality of fine overflows such as caused by a Centennial Coal operation in the Blue Mountains and overflows to Wybong Creek caused by Glencore Mangoola Coal.

Sincerely,

John Shewan

Convenor

Ridgeland Residents Inc.

20/07/2017

Ridgeland Residents Incorporated acknowledges the Primacy of Traditional Peoples and Elders past, present and future, Owners of the Land.

Appendix A Mt Pleasant Consent Conditions "Road Transport"

7.2 Road Transport

1. The Applicant shall, as required by Council and/or the RTA:
 - (b) prior to the closure of Castlerock Road, construct at its own expense, the Mount Pleasant Northern Link Road to Dorset Road;
 - (c) prior to the closure of Wybong Road, construct at its own expense, the Mount Pleasant Western Link Road, from the intersection of the Bengalla Link Road to the intersection of the Mount Pleasant Northern Link Road, generally in accordance with Council's Western Roads Strategy;
 - (e) should the following intersections be required, undertake construction works at:
 - (i) the intersection of the Western Link Road and access to the mine site,
 - (ii) the intersection of the Bengalla Link Road and the Western Link Road,
 - (iii) the intersection of Castlerock/Mount Pleasant Northern Link Road and the Western Link Road,
 - (iv) the intersection of the Mount Pleasant Northern Link Road and Kayuga Road.
2. The Applicant shall contribute an amount, determined by Council to the maintenance costs of the Wybong Road between the mine access and Kayuga Road (including the Rosebrook Bridge) for the period from commencement of construction and concluding with the commencement of the use of the Bengalla Link Road by the Applicant.
7. Should a construction road be proposed, the Applicant shall provide either an overpass or underpass across Wybong Road, or other means of crossing Wybong Road, to Council's satisfaction.

Appendix B MSC Western Roads Strategy

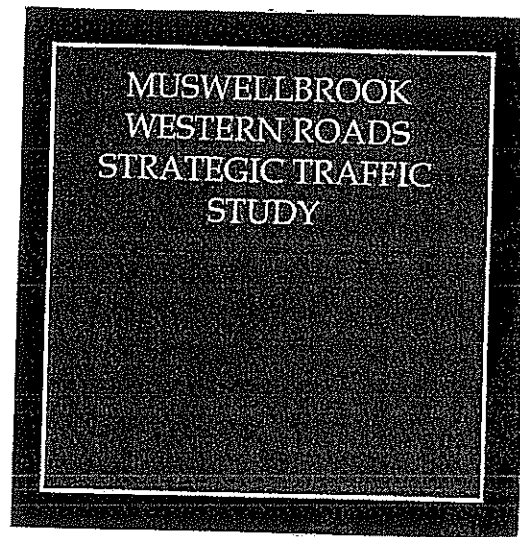
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PLANNING

ENVIRONMENTAL

& ENGINEERING

CONSULTANTS



 MITCHELL
ERM McCOTTER

MUSWELLBROOK
WESTERN ROADS
STRATEGIC TRAFFIC
STUDY

For:
MUSWELLBROOK SHIRE COUNCIL

April 1997
96204

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Report No. 96204

This report has been prepared in accordance with the scope of services described in the contract or agreement between ERM Mitchell McCotter Pty Ltd (ERMMM) and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and ERMMM accepts no responsibility for its use by other parties.

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Position: Project Director
Signed: Bob McCotter
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Date: 14 April 1997

ERM Mitchell McCotter Quality System

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EXECUTIVE SUMMARY

Several new coal mines are proposed west of the township of Muswellbrook in the Hunter Valley of New South Wales. Apart from generating more traffic, some of these mines will seek to extract coal from beneath existing roads. Muswellbrook Shire Council therefore commissioned this study to examine future road network options to serve the community west of Muswellbrook.

The study adopted a relatively long term time frame (a minimum of 30 years from 1998 to 2028) because the coalmines in the area will have an extensive future life; in some cases, future reserves are estimated to be available for up to 60 year's operations.

The study identified a preferred future road network strategy for the area to the west of Muswellbrook. It was carried out in five stages which are summarised below.

Traffic Volumes and Distributions (Stage 1)

The TMODEL2 Traffic Network Model was used to accurately represent existing and future traffic conditions over a significant area of the Muswellbrook Shire, extending as far west as Denman and Sandy Hollow. Traffic flows in this area were represented in the model by four types of traffic, namely.

- Muswellbrook urban traffic, generated by residential properties in Muswellbrook;
- Muswellbrook rural traffic, generated by rural properties in Muswellbrook Shire;
- New England Highway traffic, which includes through traffic and traffic travelling to and from Muswellbrook CBD and other commercial areas; and
- Mine traffic generated by existing and future coal mines in the Muswellbrook area.

Each traffic type was independently considered because of the different distributions of traffic origins and destinations and in most cases different future traffic growth rates.

Future Road Network Options (Stage 2)

Following a Planning Focus meeting for the proposed Mt Pleasant Mine in December 1996, it was determined by the mining company (Coal and Allied Operations Pty Ltd) that future mine infrastructure would be located on Wybong Road, near the south western corner of the mine site.

This decision meant that three road network options were initially assessed in the study, together with an extension of the Dartbrook Link Road. A fourth pair of options (Options 4A/4D) were included in the study in March 1997 to further examine the optimal alignment for the western section of the Bengalla Mine Link Road if Wybong Road is closed between the Mount Pleasant and Bengalla Mines. The study options are detailed below, while plans are given in Chapter 3.

Option 1A

This option makes fewest changes to the present road network and is essentially, the base case option. The Mt Pleasant infrastructure would be located at the south western corner of the Mt Pleasant Authorisation, with Wybong Road remaining open and Castlerock Road being diverted onto Dorset Road (The Mt Pleasant Northern Link Road) and the western end of Dorset Road being diverted onto Dartbrook Road (The Kayuga Northern Link Road).

This option would provide reasonable access for Castlerock Road residents without too much additional distance (approx. 1.6 km) for journeys to and from the south. The Bengalla Link Road would be as proposed in the Bengalla EIS, with minor adjustments to accommodate the proposed Mt Pleasant Rail Loop.

Option 2A

This is the same as Option 1A with the addition of a link road across the western side of Mt Pleasant Mine. This western link would primarily benefit Wybong Road users and mine traffic which travel to the north via the Dartbrook Link Road (if a public road) or Blairmore Lane. It is expected that few Castlerock Road residents would travel to and from the south via this link.

Option 3A

This option considers the impact on the road network proposed in Option 2A if Wybong Road were closed adjacent to the Mount Pleasant and Bengalla Mines.

Option 4A

This further option was examined to investigate the relative benefits to rural traffic from Wybong Road to the west if the western section of the Bengalla Mine Link Road is diverted to the west to connect more directly into Wybong Road, near the Roxburgh Road Junction.

Dartbrook Link Road Extension Options

Each of the above four options was also evaluated with an opening to public traffic and an extension to the western end of the Dartbrook Link Road, resulting in a further four alternatives defined as Options 1D, 2D, 3D and 4D.

Each future option involves the construction or completion of a number of link roads, namely:

- ❑ Mt Pleasant Northern Link Road;
- ❑ Mt Pleasant Western Link Road;
- ❑ Kayuga Northern Link Road;
- ❑ Completion of Bengalla Link Road;
- ❑ Diversion of Bengalla Link Road; and
- ❑ Dartbrook Link Road Extension.

The study identified likely constraints to these roads such as land ownership, terrain and environmental effects. A preferred alignment is presented, together with a summary of likely capital cost, and overall feasibility for each of these link roads.

Develop Traffic Model (Stage 3)

The current (year 1996) traffic distributions for the four types of traffic were represented by a "trip table" which defines the total daily traffic movements between 31 zones as follows:

- ❑ nine zones for Muswellbrook urban traffic;
- ❑ 15 zones for Muswellbrook rural traffic;
- ❑ three zones for New England Highway traffic (North, South and Aberdeen); and
- ❑ four zones for mine traffic.

The 1996 "trip table" was increased by appropriate future growth factors for each of the four types of traffic to produce future trip tables for the years 1998, 2013 and 2028.

The existing traffic network model included all significant road links and intersections in the study area. Certain links such as the Kayuga Bridge and the Brook Street railway crossing were assigned a lower capacity than normal links to reflect the additional traffic delays at these locations.

Travel speeds for each link were determined from current speed limits or typical travel speeds where road conditions are affected by reduced seal width or an unsealed road.

The existing model was calibrated to 1996 traffic conditions to an overall calibration accuracy of better than 10 per cent on those road links where traffic count data were available.

Modified future road network models were then developed for each option to calculate traffic distributions for the years 1998, 2013 and 2028. The year 2013 and 2028 road networks all included a New England Highway bypass to the east of Muswellbrook, generally following the alignment identified by the Roads and Traffic Authority in a recent study (RTA, 1993).

Travel Time Benefits (Stage 4)

The economic benefits of each option were calculated, based on travel time, travel distance and accident savings. Total benefits were calculated for all traffic and the relative benefits for different types of traffic were also identified.

The travel benefits were generally only gained by the rural traffic and mine traffic, because the road improvements were located away from the main urban areas of Muswellbrook and the New England Highway.

Overall Assessment (Stage 5)

The most appropriate future road network strategy was developed from an overall assessment of the options in relation to the following six objectives:

1. To maintain reasonable access for rural residents.
2. To provide reasonable access for the mines.
3. To maximise coal recovery.
4. To reduce mine traffic through Muswellbrook CBD.
5. To consider environmental/engineering constraints.
6. To consider overall economic benefits.

Summary and Recommendations (Stage 6)

The following conclusions and recommendations were determined from the overall assessment in relation to the base case and additional road network options.

□ Option 1A, The Base Case Option

These improvements are essential to give reasonable future access for rural residents, although the cost of this option is significant (approximately \$13.8 M) excluding the Muswellbrook Bypass.

The overall assessment results generally showed that the other options, which provided more roads, performed better than the base case option. The following three options were found to perform best in the assessment:

□ Option 3D, Close Wybong Road with Mount Pleasant Western Link Road and Dartbrook Link Road Extension

This option performed best in the overall assessment and the comparatively high potential value of the coal makes it a highly economically feasible option.

□ Option 4D, Close Wybong Road with Bengalla Link Road Diversion, Mt Pleasant Western Link Road and Dartbrook Link Road Extension

This option also performed very well but has higher construction costs than Option 3D resulting in a lower overall economic performance. However, the local traffic detour costs for rural residents are effectively minimised with this option.

□ Option 2D, Mt Pleasant Western Link Road with Dartbrook Link Road Extension

This option performed very well in the overall assessment of options but in practice the low economic benefit: cost ratio would make construction of it difficult to justify.

INTRODUCTION

1.1 COAL MINING DEVELOPMENT

This traffic study has been undertaken for Muswellbrook Shire Council to identify the most appropriate future road network requirements for the area to the west of Muswellbrook which will be affected by future coal mines. The study area is illustrated in *Figure 1.1* and identifies the three mining areas as follows

□ Dartbrook/Kayuga

Underground now operating (177 employees)
Future Kayuga Open Cut to commence late 1998,
Future maximum 280 employees (3 shifts)

□ Bengalla

Future Open Cut to commence late 1998,
Future maximum 258 employees (3 shifts)

□ Mt Pleasant

Future Open Cut to commence by year 1998/1999,
Future maximum 380 employees (3 shifts)

An existing open cut coal mine is already operating in the Muswellbrook area to the east of Muswellbrook. It is operated by the Muswellbrook Coal Company and employs 209 persons.

Other existing coal mines in Muswellbrook Shire at Drayton and Bayswater and the potential future mine at Mt Arthur North are located further south away from the area of immediate concern to this study. The study area is primarily the town of Muswellbrook and the area west of the Hunter River, where access is generally restricted by bridge crossings of the Hunter River.

The future timing of the Mt Arthur North mine is also not reliably known at present and its future traffic requirements and traffic implications cannot be specifically considered in this study.



Figure 1.1 STUDY AREA

1.2 RURAL ROAD NETWORK

The combined future area of the open cut coal mines at Bengalla, Mt Pleasant and Kayuga, *Figure 1.1*, will extend over an area of approximately 11 kilometres from north to south and up to 5 kilometres from east to west. There are three major rural access roads which are potentially affected by the future coal mines in the area, namely:

- Wybong Road (also known as Roxburgh Road);
- Castlerock Road (also known as Coal Creek Road); and
- Dorset Road.

Wybong Road was until recently a classified main road (MR 208). It connects rural communities (Mangoola, Wybong and Sandy Hollow) in a significant area west of the Shire to the town of Muswellbrook. The road continues west from Sandy Hollow to Merriwa and Mudgee, although comparatively little through traffic comes from these directions from outside Muswellbrook Shire.

Castlerock Road is a minor rural road located approximately five kilometres further north from Wybong Road. It connects into Kayuga Road at the eastern end and loops around to join Wybong Road at the western end. An unsealed three kilometre section in the mid part of this road means it carries very little through traffic. The eastern part of Castlerock Road which will be severed by the proposed Mt Pleasant mine currently serves approximately 38 rural properties.

Dorset Road is an additional local road located between one and two kilometres further north from Castlerock Road. It currently provides access to some 15 rural properties, the majority of which will be acquired for the construction of the Mt Pleasant and Kayuga Mines. The eastern end of Dorset Road is nevertheless proposed to be retained in the future as a local access road to carry traffic diverted from Castlerock Road.

1.3 TRAFFIC OBJECTIVES

A range of local traffic objectives were defined for this study by the Muswellbrook Council Steering Committee which included representatives from the three mines and residents from Castlerock Road.

The study used a computer-based network traffic model (TMODEL2) to investigate future road network options and quantify the benefits to traffic flow and local access for each of these options. These results have been used to recommend a preferred strategy for the future rural road network based on the following six objectives:

1. Reasonable Access for Rural Residents

This objective considered traffic benefits to rural residents or additional travel distances for typical journeys if these would be greater than the base case option.

2. Reasonable Access for Mines

This criterion considered the traffic benefits for the new coal mines (Bengalla, Kayuga and Mt Pleasant) of each road option, based on the additional travel costs for typical journeys. The future accessibility of the mines to employees based in Muswellbrook is a significant traffic issue.

3. Maximise Coal Recovery

This objective considered the value of coal resources which could be recovered if certain roads were closed (ie Wybong Road for up to four kilometres west of the existing Bengalla Road intersection). This would enable coal beneath and alongside the road to be mined. The potential future closure of Dorset Road to mine coal along the boundary between Mt Pleasant and Kayuga Mines was not specifically considered as an option in this study.

4. Reduce Mine Traffic Through Muswellbrook CBD

The ability of each option to bypass future mine traffic and some rural traffic around the Muswellbrook CBD when travelling to destinations either north or south from Muswellbrook was reviewed. This would primarily be achieved by the Dartbrook Link Road and the Bengalla Link Road which connects to the Thomas Mitchell Drive route to the south from Muswellbrook.

5. Environmental/Engineering Constraints

Potential environmental and engineering constraints evaluated for each route generally included land use, terrain, traffic noise, visual and drainage impacts.

6. Overall Economic Benefits

Costs and benefits were assessed in nett present value terms over the next 30 years with discount rates of either 4%, 7% or 10% per annum. This criterion included the major identifiable costs and benefits to the community of the road network options, namely:

- ☐ construction costs;
- ☐ future road maintenance costs;
- ☐ future travel time and distance savings;
- ☐ future road accident savings; and
- ☐ future value of coal reserves able to be mined.

TRAFFIC VOLUMES AND DISTRIBUTIONS

2.1 PREVIOUS INVESTIGATIONS

A number of reference sources for traffic distributions and land use data were used to model traffic volumes and distributions. The following sources are acknowledged:

- Traffic Origin and Destination surveys undertaken by the RTA in March 1992 at the following locations (RTA, 1993):
 - New England Highway South of Rutherford Street;
 - New England Highway North of Aberdeen Street;
 - New England Highway Muswellbrook CBD;
 - MR208 Wybong Road at Kayuga Bridge; and
 - MR209 Denman Road West of Wollombi Road.
- In recent years Muswellbrook Council and the RTA have undertaken daily traffic volume counts on a number of major and minor roads. These traffic counts have been utilised to develop and calibrate road network traffic models;
- an aerial photo of Muswellbrook was used to identify approximately 3,174 existing residential dwellings in urban zones;
- a map of the future urban growth areas in Muswellbrook (PWD, 1995);
- Previous traffic modelling data (GHD, 1982) gave the typical distribution of traffic destinations within Muswellbrook;
- Council's rural property database recorded approximately 1,322 existing properties in rural zones;
- future mine employee residential locations were determined from three operating mines: Muswellbrook, Drayton and Dartbrook Underground

- typical urban and rural traffic generation rates of 8.0 and 6.0 vehicle trips per day respectively were used based on current and historic RTA standards (RTA, 1984); and
- a rural traffic distribution factor was based on 1986 census data for the proportion of the workforce in rural employment. This determined the proportion of rural traffic remaining within rural zones.

The following sections of this chapter summarise typical traffic volumes and distributions for the four main types of traffic in the Muswellbrook area.

2.2 MUSWELLBROOK URBAN TRAFFIC

This traffic is generally not affected by proposed road improvements on the western side of the Hunter River. It must still be included in the network traffic model to accurately simulate traffic congestion and delays on the New England Highway and other major roads in the township.

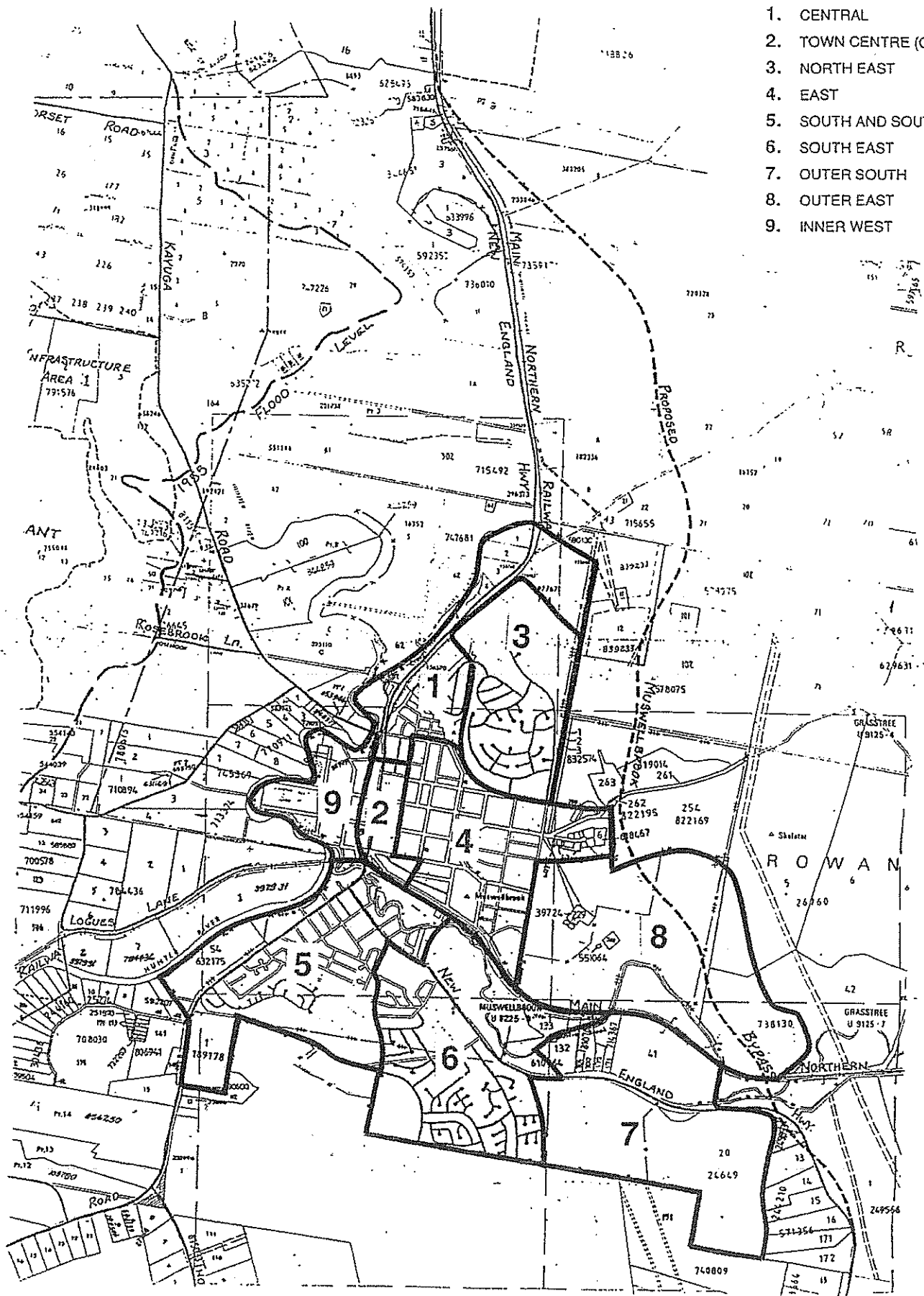
A recent aerial photo showed 3,174 dwellings in the Muswellbrook urban area. These are estimated to generate 25,392 daily vehicle movements travelling to and from zones within Muswellbrook, as shown in Table 2.1.

Table 2.1 MUSWELLBROOK URBAN TRAFFIC GENERATION

	Zone Location (refer Figure 2.1)	Number of Dwellings	Traffic Generation Rate	Traffic Movements per day
1	North Central	242	8.0	1,936
2	Town Centre (CBD)	38	8.0	304
3	North East	426	8.0	3,408
4	East	638	8.0	5,104
5	South and South West	766	8.0	6,128
6	South East	926	8.0	7,408
7	Outer South	0	8.0	0
8	Outer East	0	8.0	0
9	Inner West	138	8.0	1,104
	TOTAL *	3,174		25,392

Typical distributions for urban traffic were determined from the Muswellbrook Traffic and Road Development Study (GHD, 1982) and are summarised in Table 2.2.

1. CENTRAL
2. TOWN CENTRE (CBD)
3. NORTH EAST
4. EAST
5. SOUTH AND SOUTH WEST
6. SOUTH EAST
7. OUTER SOUTH
8. OUTER EAST
9. INNER WEST



Not to Scale

Figure 2.1

URBAN ZONES

Table 2.2 MUSWELLBROOK URBAN TRAFFIC DISTRIBUTION

Basic Distribution	Detailed Distribution
19% Town Centre	19% CBD
60% Other Muswellbrook Urban Areas	9% North
	5% North East
	17% East
	12% South and South West
	12% South
	4% Outer South East
	1% Outer East
13% New England Highway	7% Highway South
	3% Highway North (Aberdeen)
	3% Highway North (Scone and Beyond)
8% Rural West	5% Denman
	3% Denman Road

2.3 MUSWELLBROOK RURAL TRAFFIC

A recently compiled rural property database identified the number of properties so typical daily traffic could be estimated. Overall 1,322 rural properties generate about 7,932 vehicle movements each day, as indicated in Table 2.3.

Table 2.3 RURAL TRAFFIC GENERATION

Zone	Locality (refer Figure 2.2)	Number of Rural Properties	Traffic Generation Rate	Traffic Movements Per Day	Rural Traffic Direction
10	Wybong	117	6.0	702	Wybong Road
11	Castlerock	58	6.0	348	Wybong Road
12	Sandy Hollow	148	6.0	888	Wybong Road
13	Denman	323	6.0	1,938	Denman Road
14	Mangoola/Roxburgh	61	6.0	366	Wybong Road
15	Dorset Road	15	6.0	90	Wybong Road
16	Muswellbrook Rural West	127	6.0	762	Wybong Road
17	Castlerock Road	38	6.0	228	Wybong Road
18	Kayuga	43	6.0	258	Wybong Road
19	Jerry's Plains	35	6.0	210	Denman Road
20	Muswellbrook Rural South	171	6.0	1,026	Denman Road
21	Muswellbrook Rural East	14	6.0	84	East
22	Muscle Creek	58	6.0	348	East
23	McCully's Gap	98	6.0	588	East
24	Aberdeen South	16	6.0	96	East
		1,322		7,932	

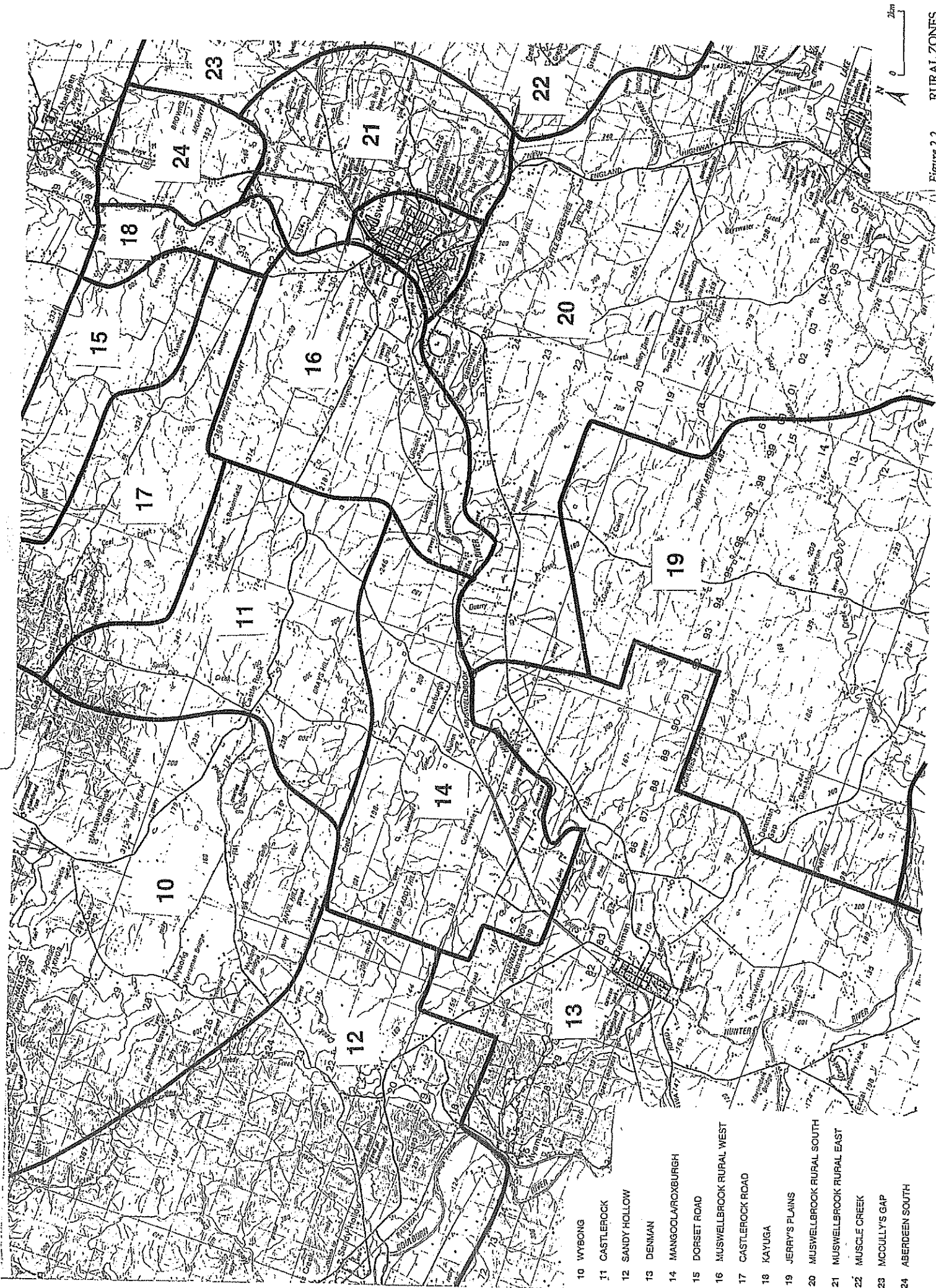


Figure 2.2 RURAL ZONES

Typical distributions for rural traffic were based on RTA origin and destination surveys (RTA, 1993) which included traffic approaching Muswellbrook on Wybong Road (The Kayuga Bridge) and Denman Road. However, the survey results were adjusted to account for the proportion of rural traffic which remains in rural areas.

These traffic distributions are summarised in Table 2.4. They vary significantly depending on how traffic approaches Muswellbrook.

Table 2.4 RURAL TRAFFIC DISTRIBUTION

Traffic Approach Direction	Basic Traffic Distribution	Detailed Traffic Distribution
Traffic Approaching Muswellbrook from Wybong Road via Kayuga Bridge	Rural Factor (Typically 39%) Remains within Rural Areas	20% Remains within zone 19% Other rural zones
	New England Highway North and South (23%)	10% Highway South 6% Highway N (Aberdeen) 7% Highway N (Scone)
	Muswellbrook Town (34%)	9% CBD 25% Other Areas
	Through Muswellbrook to Denman Road (4%)	4% Rural zones on Denman Road
Traffic Approaching Muswellbrook from Denman Road (at Wollombi Road)	Rural Factor (Typically 50%) Remains within rural areas	26% Remains within zone 25% Other rural zones
	New England Highway North and South (18%)	8% Highway South 4% Highway N (Aberdeen) 6% Highway N (Scone)
	Muswellbrook Town (28%)	7% CBD 21% Other Areas
	Through Muswellbrook to Wybong Road (4%)	4% Rural zones west of the Hunter River
Traffic Approaching Muswellbrook from the East (Muscle Creek Road, Common Road, McCully's Gap Road)	Rural Factor (Typically 30%) Remains within rural areas	15% Remains within zone 15% Other rural zones
	New England Highway North and South (9%)	5% Highway South 2% Highway N (Aberdeen) 2% Highway N (Scone)
	Muswellbrook Town (55%)	13% CBD 42% Other Areas
	Through Muswellbrook to Denman Road (6%)	4% Denman 2% Denman Road

Note * The Rural Traffic factor is the percentage of the workforce which has rural employment in agriculture, some retail, some community services and some recreation/personal services.

2.4 HIGHWAY TRAFFIC

RTA traffic counts record traffic daily volumes on the northern and southern outskirts of Muswellbrook (Table 2.5). These volumes correspond to approximately 9,000 actual movements per day because of the high percentage of heavy vehicles (15% approximately).

Table 2.5 NEW ENGLAND HIGHWAY DAILY TRAFFIC VOLUMES

Location RTA (reference)	Year 1984 AADT	Year 1988 AADT	Year 1992 AADT	Year 1995 AADT (Actual Vehicles)
South of Muswellbrook (05.244)	9,060	8,633	11,548	10,255 (8,917)
North of Muswellbrook (05.063)	8,030	8,284	10,979	10,445 (9,083)
East of Denman Road (05.245)	12,480	13,554	19,068	15,957 (13,876)
Muswellbrook CBD (05.247)	14,540	14,265	20,707	17,605 (15,309)
Railway Underpass (05.246)	18,250	18,187	22,465	19,565* (17,013)

Notes: * Estimated from trends at the other four locations.

Daily traffic on the New England Highway within Muswellbrook is significantly higher than outside, being approximately 16,000-20,000 AADT (14,000-17,000 actual vehicles per day). The highest traffic volumes occur at the Railway Underpass.

A large proportion of the traffic on the New England Highway is locally generated by urban and rural properties in the Shire.

However the traffic counts on the New England Highway outside Muswellbrook include some vehicles travelling to and from the township which are not accounted for in the figures presented in Sections 2.2 and 2.3 of this report. These additional movements are summarised in the distributions of "Highway" traffic in Table 2.6 which were determined from the RTA Origin and Destination Surveys of Traffic (RTA, 1993).

Regional traffic from other directions outside the Shire was considered during the development of the traffic model. However this traffic, from Scone to the north via Dartbrook Road and from Merriwa and Rylstone to the west via Sandy Hollow, is much less than flows on the New England Highway. It was not included in the model because initial calibrations showed movements on Wybong Road to the west of Muswellbrook were at least as high as actual traffic volumes, without the inclusion of this traffic.

Traffic from the west also generally travels south via Denman and Singleton and effectively bypasses the study area. Similarly, any additional traffic from Scone via Dartbrook Road would not generally be affected by any of the proposed road closures and new road links.

Table 2.6 HIGHWAY TRAFFIC DISTRIBUTIONS

Location	Traffic Distribution
New England Highway South of Muswellbrook (Northbound)	41% Through traffic 27% Commercial traffic to and from Muswellbrook CBD 11% Commercial traffic to and from Muswellbrook other areas 21% urban and rural traffic already accounted for
New England Highway North of Muswellbrook (Southbound)	38% Through traffic 16% Commercial traffic to and from Muswellbrook CBD 16% Commercial traffic to and from Muswellbrook other areas 30% urban and rural traffic already accounted for

2.5 MINE TRAFFIC

Traffic from four mines was specifically included in the study, including two existing coal mines:

- Muswellbrook; and
- Dartbrook including Kayuga Expansion.

and two future coal mines:

- Bengalla; and
- Mount Pleasant.

Other coal mines at Drayton and Bayswater were not separately defined in the study because they are located at the southern fringe of the study area, away from the major areas of interest. Their traffic in the study area is already represented by Muswellbrook urban and rural traffic volumes.

The overall traffic generated by each of these mines is determined by the number of employees, plus additional movements as shown in Table 2.7. There will be a small but significant proportion of car sharing among the employees at future mines resulting in an overall car driver to employee ratio of between 80 and 85 per cent.

Table 2.7 MINE TRAFFIC MOVEMENTS

Mine	Future Total Employees	Car Driver Percentage	Daily Employee Car Trips	Other Daily Trips	Total Daily Trips
<i>Existing Mines</i>					
Dartbrook	180	82.5	296	40	336
Muswellbrook	209	82.5	345	60	405
<i>Future Mines</i>					
Bengalla	258	82.5	426	60	486
Mt Pleasant	380	82.5	627	60	687
Dartbrook/Kayuga	280	82.5	462	60	522
Muswellbrook	209	82.5	345	60	405

Future mine traffic distributions will primarily be determined by the residential locations of the workforce as most mine traffic is from employees. Estimated future traffic distributions for the Bengalla, Mt Pleasant and Dartbrook/Kayuga mines are given in Table 2.8 below.

Table 2.8 MINE TRAFFIC DISTRIBUTIONS

Residential Location	Proportion of Mine Workforce %			
	Existing Dartbrook Underground	Existing Muswellbrook Coal Co	Existing Drayton Coal Pty Ltd	Future Mines (estimate)
Muswellbrook Shire (includes some rural)	39%	63%	49%	50%
North (Aberdeen)	5%	14%	8%	9%
North (Scone and Beyond)	20%	10%	6%	12%
West (Denman)	1%	7%	5%	4%
South (Singleton and Beyond)	35%	6%	32%	25%
TOTAL	100%	100%	100%	100%

Experience with the Dartbrook mine has shown that although the mine initially attracted a significant proportion of the workforce from the Lower Hunter and Lake Macquarie Regions, with time these employees found other jobs closer to home or have relocated to the Muswellbrook Area. Consequently the proportion of the workforce travelling each day from Singleton or further south will be no more than 25 per cent for future mines after a three to four year settling in period.

Muswellbrook Mine is a well established enterprise and the traffic distribution will tend to remain the same in the future. The other three mines (Dartbrook/Kayuga, Bengalla and Mt Pleasant) will approach the "future mines" estimated distribution in Table 2.8 above after about four years.

2.6 FUTURE TRAFFIC GROWTH

For the future years considered in this study (1998, 2013 and 2028) the following future traffic growth factors have been determined for each type of traffic.

2.6.1 Urban Traffic Growth

Urban traffic growth will tend to be proportional to the number of new dwellings constructed. This is generally related to population growth but includes an allowance for decreasing household sizes (from 3.07 persons per dwelling to 2.80 persons per dwelling) between 1996 and 2028.

A recent sewerage planning strategy for Muswellbrook (PWD, 1995) estimated an overall future population growth rate of 1.25 per cent per annum. This means 53 additional dwellings each year, after adjustment for decreasing household sizes. This growth will be primarily in the south-east, outer south east and outer eastern zones shown in Figure 2.1, where there is potential capacity for up to 2,580 additional dwellings, as given in Table 2.9.

Table 2.9 FUTURE MUSWELLBROOK URBAN GROWTH

Urban Zone	Potential Additional Lots	Distribution of New Dwellings from Year 1996		
		to year 1998	to year 2013	to year 2028
6. South East	420	+17	+144	+271
7. Outer South East	1,580	+65	+550	+1,035
8. Outer East	580	+24	+207	+390
TOTAL	2,580	+106	+901	+1,696

2.6.2 Rural Traffic Growth

New dwellings in rural areas will be similar to urban growth rates, but will be uniformly distributed according to the existing population and number of dwellings in each rural zone, as shown in *Table 2.3*. However, rural traffic generated in the zones affected by mining will be significantly reduced because approximately 86 properties have been or will be acquired by mining companies, namely;

- Zone 15, Dorset Road - (12 properties);
- Zone 16, Muswellbrook West rural - (48 properties);
- Zone 17, Castlerock Road - (14 properties); and
- Zone 18, Kayuga - (12 properties).

It has been assumed that all these properties would be vacated from approximately the year 1998 onwards when Bengalla, Mount Pleasant and Kayuga Mines begin operations. However some of these properties would be occupied during the construction phase of mines which may continue beyond the year 1998.

A more detailed review of mine construction and operations during 1998 and 1999 and the corresponding impacts of potential additional traffic at Kayuga Bridge are considered in Chapter 8 of this report.

2.6.3 Highway Traffic Growth

A recent strategic planning report for the New England Highway (Travers Morgan, 1995) estimated that traffic on the New England Highway will grow between 1.3 and 1.7 per cent per annum. A mid-range value of 1.5 per cent was adopted for this study.

2.6.4 Mine Traffic Growth

The workforce at future mines will vary over time. These variations will be relatively minor, so for simplicity it was assumed that future maximum employees will be constantly maintained at each mine.

FUTURE ROAD OPTIONS

3.1 DESCRIPTION OF OPTIONS

Four future road network options are illustrated in *Figures 3.1, 3.2, 3.3 and 3.4*. These options are also combined with the opening of the Dartbrook Link Road to public traffic in Options 1D, 2D, 3D and 4D.

Option 1A, Minimal Change Option

This option has reasonable alternative access for Castlerock Road and Dorset Road residents to the west of the proposed mines. It includes the basic road network improvements suggested by the study steering committee namely:

- Close Castlerock Road for 5 kilometres west of Kayuga Road;
- Close Dorset Road between 3 and 5 kilometres west of Kayuga Road;
- Construct Mt Pleasant Northern Link Road (to Dorset Road);
- Construct Kayuga Northern Link Road (to Dartbrook Road);
- Complete Bengalla Link Road (to Wybong Road); and
- RTA to construct Muswellbrook Eastern Bypass (by year 2005/6 approximately).

Option 1D, Dartbrook Link Road Extension

This is similar to Option 1A, but includes the Dartbrook Link Road Extension which connects directly to Kayuga Road. This will enable the Dartbrook Link Road to be taken over as a public road by Muswellbrook Shire Council. This improves local access to the New England Highway and reduces potential future traffic increases on the alternative Blairmore Lane route to the north for both local and mine traffic. It also assists in reducing local traffic on Kayuga Bridge.

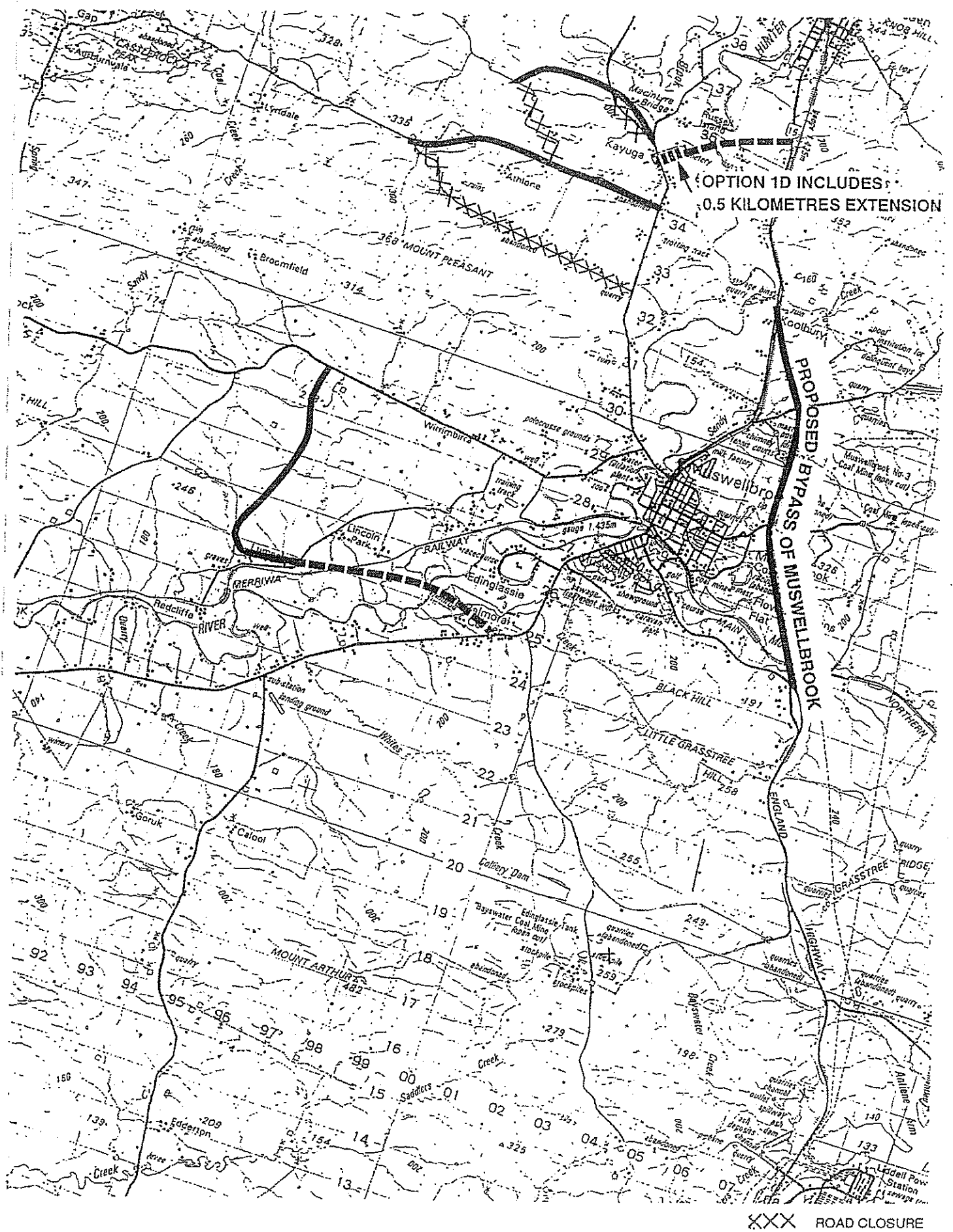


Figure 3.1 OPTION 1A/1D

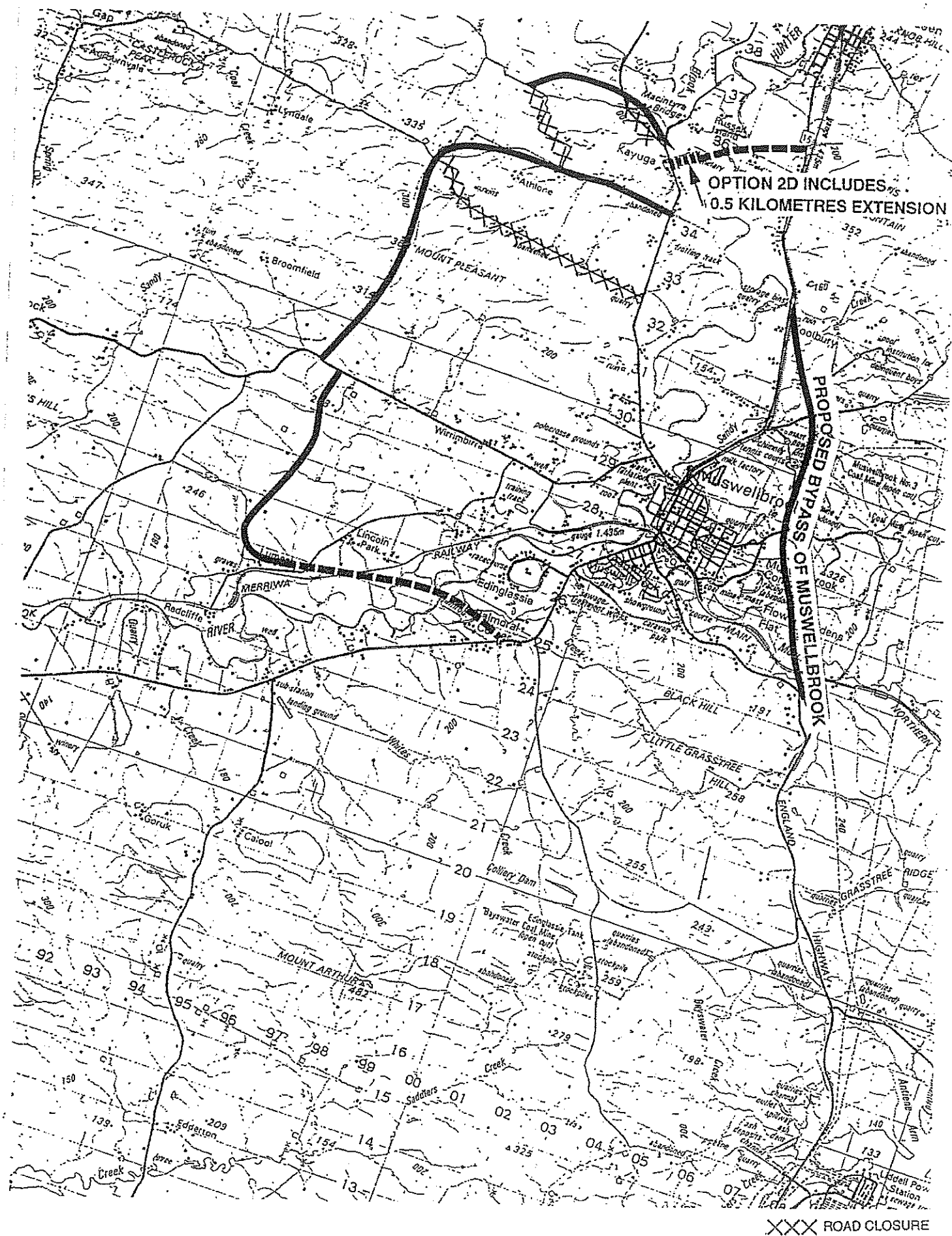


Figure 3.2

OPTION 2A/2D

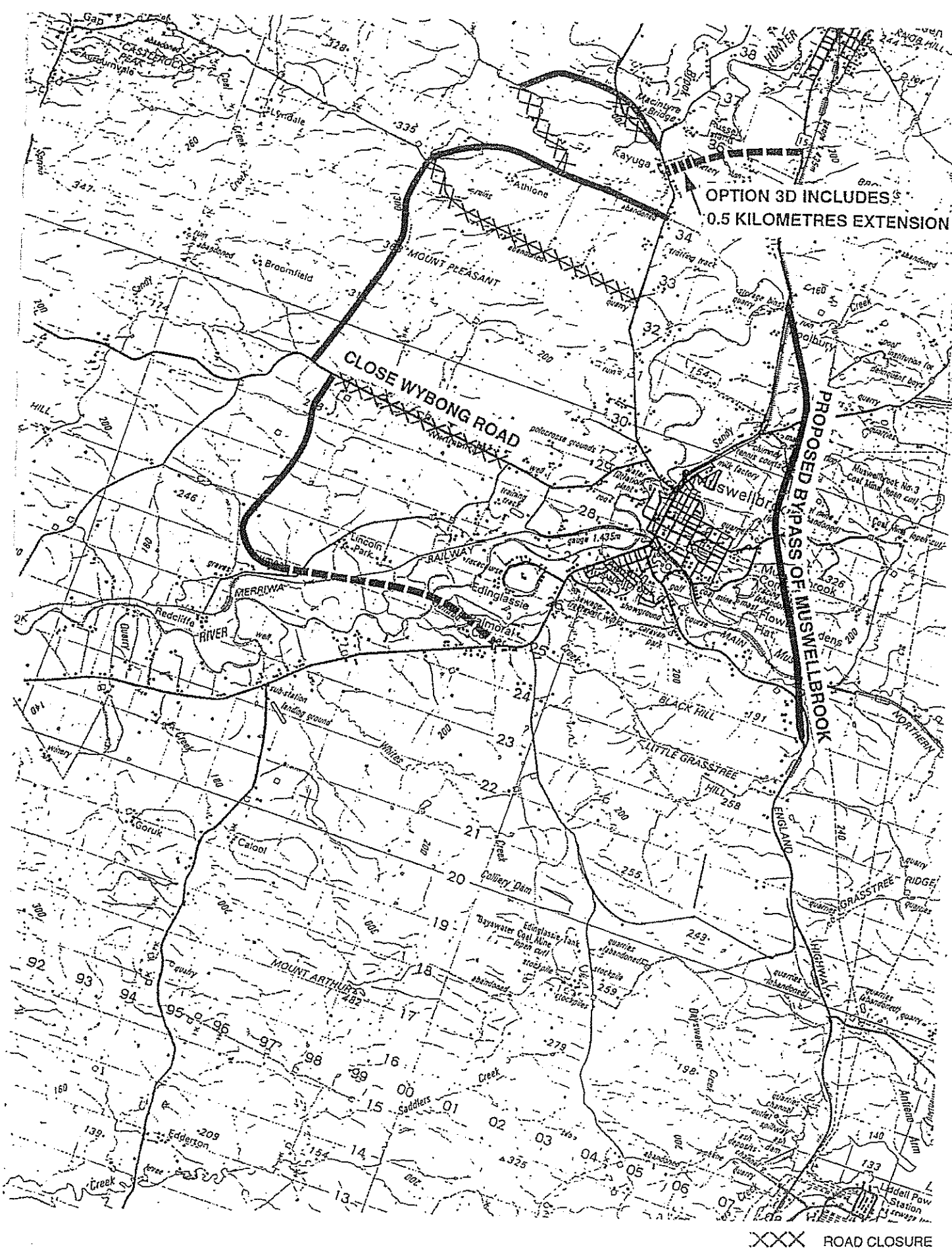


Figure 3.3

OPTION 3A/3D

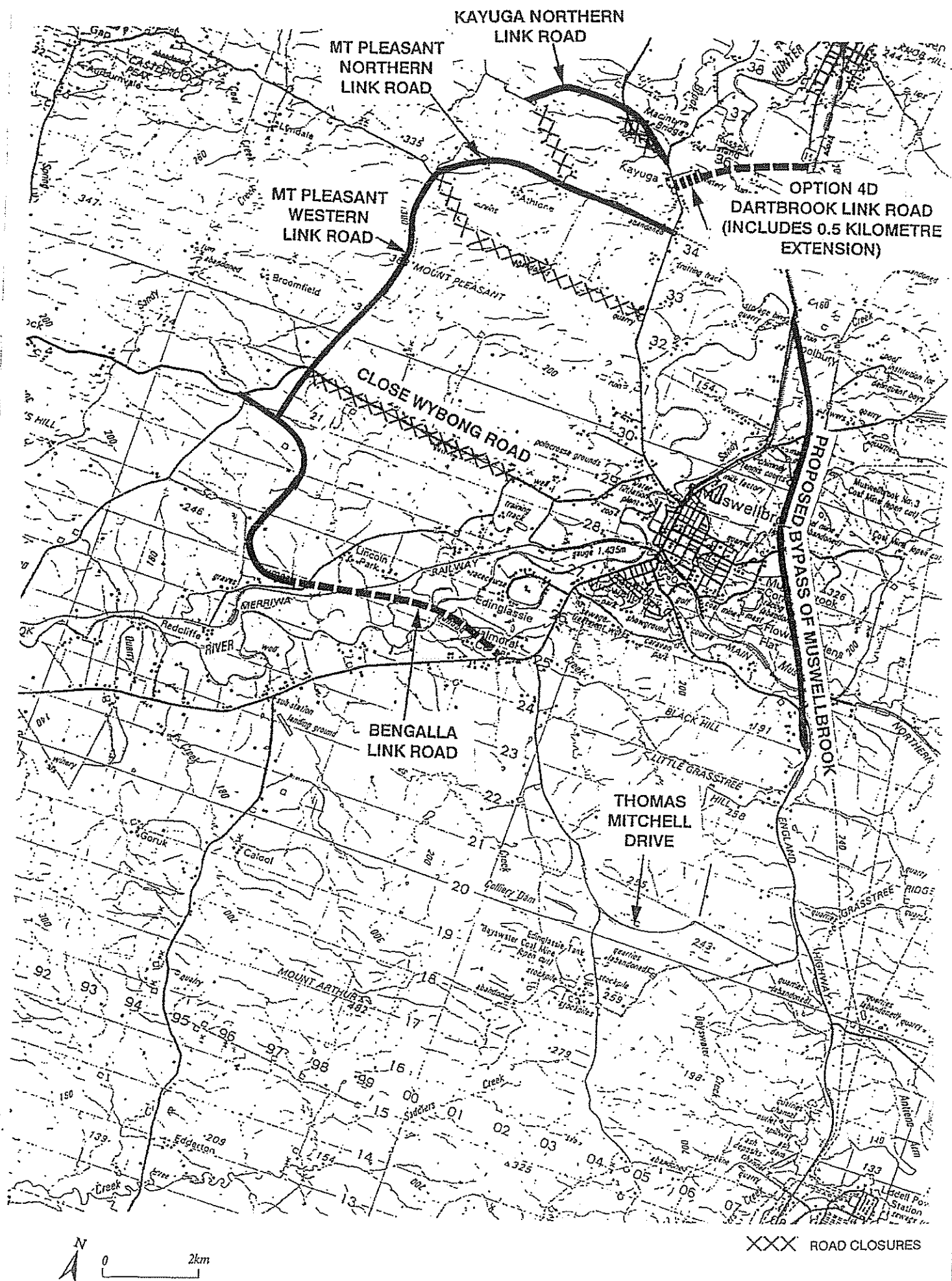


Figure 3.4 OPTION 4A/4D

Option 2A, Mt Pleasant Western Link Road Option

This includes all the road improvements and road closures in Option 1A, together with the Mt Pleasant Western Link Road. This additional link would give alternative access to the south for Castlerock Road residents but would primarily be used by Wybong Road traffic, Mt Pleasant mine traffic and Bengalla mine traffic travelling north. This option comprises the following road closures and road network improvements:

- ❑ Close Castlerock Road for 5 kilometres west of Kayuga Road;
- ❑ Close Dorset Road between 3 and 5 kilometres west of Kayuga Road;
- ❑ Construct Mt Pleasant Western Link Road (to Wybong Road);
- ❑ Construct Mt Pleasant Northern Link Road (to Dorset Road);
- ❑ Construct Kayuga Northern Link Road (to Dartbrook Road);
- ❑ Complete Bengalla Link Road (to Wybong Road); and
- ❑ RTA to construct Muswellbrook bypass (by year 2005/6 approximately).

Option 2D, Mt Pleasant Western Link Road plus Dartbrook Link Extension

This option is similar to option 2A, but includes the Dartbrook Link Road Extension.

Option 3A, Close Wybong Road Option

This option includes closing a section of Wybong Road and assumes that the Mt Pleasant Western Link Road and Bengalla Link Road would provide alternative routes to the north or south for Wybong Road traffic, Mount Pleasant mine traffic and Bengalla mine traffic. This option has the following road closures and road improvements:

- ❑ Close Wybong Road for 4 kilometres east of Bengalla Link Road;
- ❑ Close Castlerock Road for 5 kilometres west of Kayuga Road;
- ❑ Close Dorset Road between 3 and 5 kilometres west of Kayuga Road;
- ❑ Construct Mt Pleasant Western Link Road (to Wybong Road);
- ❑ Construct Mt Pleasant Northern Link Road (to Dorset Road);
- ❑ Construct Kayuga Northern Link Road (to Dartbrook Road);
- ❑ Complete Bengalla Link Road (to Wybong Road); and
- ❑ RTA to construct Muswellbrook Eastern Bypass (by year 2005/6 approximately).

Option 3D, Close Wybong Road, with Dartbrook Link Road Extension

This is similar to option 3A and includes the Dartbrook Link Road extension.

Option 4A, Close Wybong Road, with Bengalla Link Road Diversion

This is similar to Option 3A, but reduces local traffic detours for Wybong Road traffic from the west by connecting more directly to Wybong Road. An additional 1.35 kilometre link is included to the Mount Pleasant Western Link Road to the north. This option has the following road closures and road improvements:

- ☐ Close Wybong Road for 4 kilometres east of Bengalla Link Road.
- ☐ Close Castlerock Road for 5 kilometres west of Kayuga Road.
- ☐ Close Dorset Road between 3 and 5 kilometres west of Kayuga Road.
- ☐ Construct Mount Pleasant Western Link Road (to Wybong Road).
- ☐ Construct Mount Pleasant Northern Link Road (to Dorset Road).
- ☐ Construct Kayuga Northern Link Road (to Dartbrook Road).
- ☐ Complete Bengalla Mine Link Road with diversion to the west.
- ☐ RTA to construct Muswellbrook Bypass (by year 2005/6 approximately).

Option 4D, Close Wybong Road, with Bengalla Link Road Diversion and Dartbrook Link Road Extension.

This is similar to Option 4A but includes the Dartbrook Link Road extension.

3.2 CONSTRAINTS TO ROAD DEVELOPMENT

Constraints affecting the proposed alignment of the new road are identified in the following sections of this chapter, taking into account the following factors:

- ☐ Land ownership;
- ☐ Terrain;
- ☐ Environmental Factors;
- ☐ Intersections;
- ☐ Cost; and
- ☐ Overall feasibility.

None of the proposed link road options is likely to have significant ecological impacts on native flora or fauna. However, it should be noted that Aboriginal heritage items such as artefacts, camp sites and marked trees might occur along some of these proposed road alignments, particularly near water sources or the Hunter River or in areas which have not previously been extensively cleared. On this basis proposed road alignments identified in this report should be discussed with local Aboriginal groups.

3.2.1 Mt Pleasant Northern Link Road

A preliminary road alignment is illustrated on *Figure 3.5*. The proposed route is about 5.5 kilometres long and generally follows the boundary between the Mt Pleasant and Kayuga mines. It deviates slightly to the south at the eastern end to follow Dorset Road, and the western end follows the property boundaries between Portions 73 and 45 to the south and 153 and 94 on the northern side.

At the western end the route climbs approximately 80 metres in 1.2 kilometres. It could connect with either Castlerock Road to the west or the Mt Pleasant Western Link Road to the south if required. The following design constraints have been noted in selecting the most suitable alignment for this road.

i. Land Ownership

The horizontal road alignment is constrained by a minimum curve radius of 560 metres for a design speed of 100 kilometres per hour. This constraint is not significant along most of the route to the east of the "Belgrave" property. However at the western end, the corners of property boundaries require the route to pass well within the boundaries of land to be acquired by the Mt Pleasant Mine.

ii. Terrain

The proposed route follows generally level terrain east of the "Belgrave" property with only one steep section for 500 metres, about 3.5 kilometres west of Kayuga Road. The route climbs fairly steeply west of the "Belgrave" property for 800 metres at gradients of up to nine per cent. This section requires up to seven metres of cut and fill.

iii. Environmental Factors

There will be no traffic noise or air quality impacts because properties adjacent to the proposed road will generally be acquired by the Kayuga or Mt Pleasant Mines.

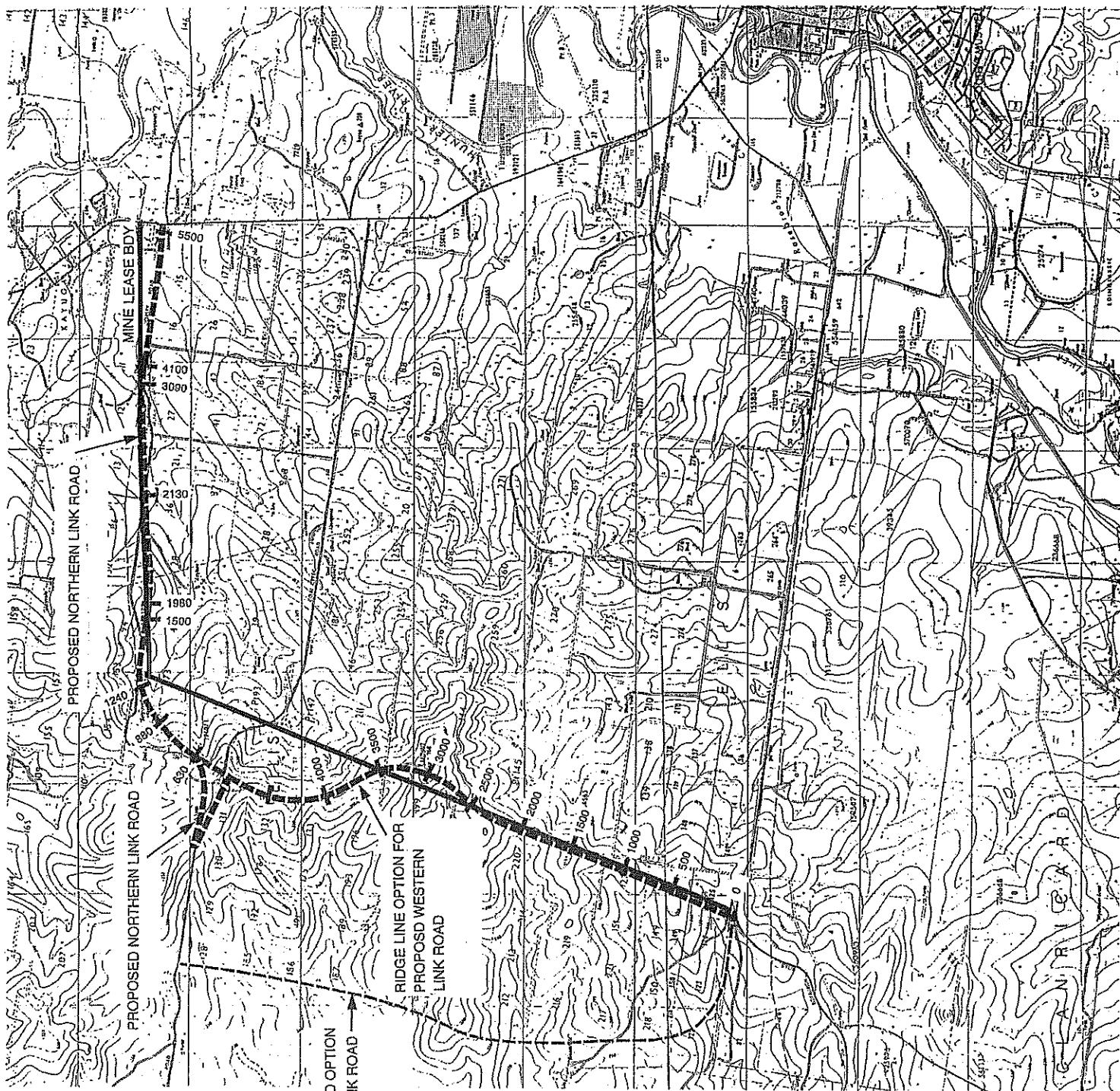


Figure 3.5

MT PLEASANT

LINK ROAD ALIGNMENTS

The elevated western section of the proposed road may have extensive views over coal mining operations which could be difficult to screen visually. Also, the existence of the road will prevent the future rehabilitation landscaping earthworks being undertaken consistently for both adjacent mines which will result in a future discontinuity of the landform to the north and south of the road.

iv. Intersections

The proposed road will have intersections at each end. All intermediate access points will be closed as a result of Kayuga and Mt Pleasant Mines.

v. Cost

The proposed road will have significant quantities of cut and fill near the western end and only minor earthworks at the eastern end. The overall average depth of cut or fill over the route will be between 1 and 1.5 metres, resulting in an average construction cost of \$1.1 million per kilometre (Appendix A). The estimated cost would be \$6.2 million including a new intersection at the eastern end.

vi. Overall Feasibility

Construction of the proposed route to 100km/hr design standard is feasible. Relatively steep gradients (8 to 9 per cent) on parts of the road are unavoidable because of the landform between the "Belgrave" property and Castlerock Road.

A major concern with this road however, is the possible sterilisation of valuable coal resources. The gross revenue to be gained from this "barrier coal" would be less than for the equivalent deposits beneath Wybong Road, (estimated as \$912 million in Section 7.3 of this report) but would still be highly significant, \$600 to \$700 million approximately.

In the next 30 years, some minor road realignments may be required to accommodate adjacent mining and rehabilitation operations.

3.2.2 Mt Pleasant Western Link Road

A preliminary alignment for this road following the western boundary of the Mt Pleasant Mine is illustrated on Figure 3.5. The 4.9 kilometre long route passes close to the top of Mount Pleasant and generally follows existing ridge lines to the north and south. An alternative alignment passing through the Broomfield property one to two kilometres further west was also considered initially but was found to require significantly greater quantities of cut and fill to provide an equivalent road alignment.

i. *Land Ownership*

The alignment is contained within two property ownerships which may need to be acquired by Mt Pleasant Mine. It follows existing tracks for most of the route, although a 100km/hr design speed horizontal alignment requires a number of minor deviations from these tracks.

The southern end of the route will run alongside a future 66 kV electricity transmission easement. A crossing would be established for mine trucks travelling west to coal reject emplacement areas.

ii. *Terrain*

The proposed route is less steep than the Mt Pleasant Northern Link Road, with maximum gradients of seven to eight per cent for 300 metres to 400 metres either side of Mt Pleasant. There is only one major cutting required near the top of Mt Pleasant which has a maximum depth of eight metres, restricting the alignment to an 80 km/hr design speed vertical curve.

iii. *Environmental Factors*

The proposed route will have minimal environmental impacts as it will follow the boundary of Mt Pleasant Mine and there will be no residential properties in the vicinity. It may be difficult to screen mining operations from elevated sections of the proposed route near the ridge line.

iv. *Intersections*

The road will have no intermediate intersections but will require a rural T-intersection at the northern end to connect with Castlerock Road and the Mt Pleasant Northern Link Road. At the southern end, at Wybong Road, there will be another T-intersection.

v. *Cost*

The proposed route will have an average depth of cut or fill of approximately 1.5 metres and a typical construction cost of \$1.2 million per kilometre (Appendix A). The estimated cost would be \$6.2 million including two intersections.

vi. *Feasibility*

The proposed alignment appears feasible although some future issues must still be resolved such as provision for mine trucks to cross the route near the southern end and the need to accommodate both road and electricity easements.

3.2.3 *Kayuga Northern Link Road*

The alignment for the Kayuga Mine Northern Link Road is illustrated in *Figure 3.6*. The western section of the proposed route is 2.1 kilometres long and is required to provide alternative access to a small number of rural properties which would remain at the western end of Dorset Road.

The eastern 0.9 kilometres of the proposed route is a deviation of Dartbrook Road which enables an increased area of land to be mined.

i. *Land Ownership*

The proposed route is on land which has been acquired by Kayuga Coal Pty Ltd for the Kayuga Coal Mine.

ii. *Terrain*

The proposed route has one relatively steep section with a gradient of just over ten per cent extending for about 400 metres, about one kilometre from the western end of the new road.

iii. *Environmental Factors*

There are no residential dwellings near the proposed route which could be affected by traffic noise or dust. Erosion control measures will be required to accommodate changed drainage patterns in the creek catchment on the northern side, downstream of the proposed road.

The western end of the proposed road will be relatively elevated and will have views over Kayuga Coal Mine, which may be difficult to screen.

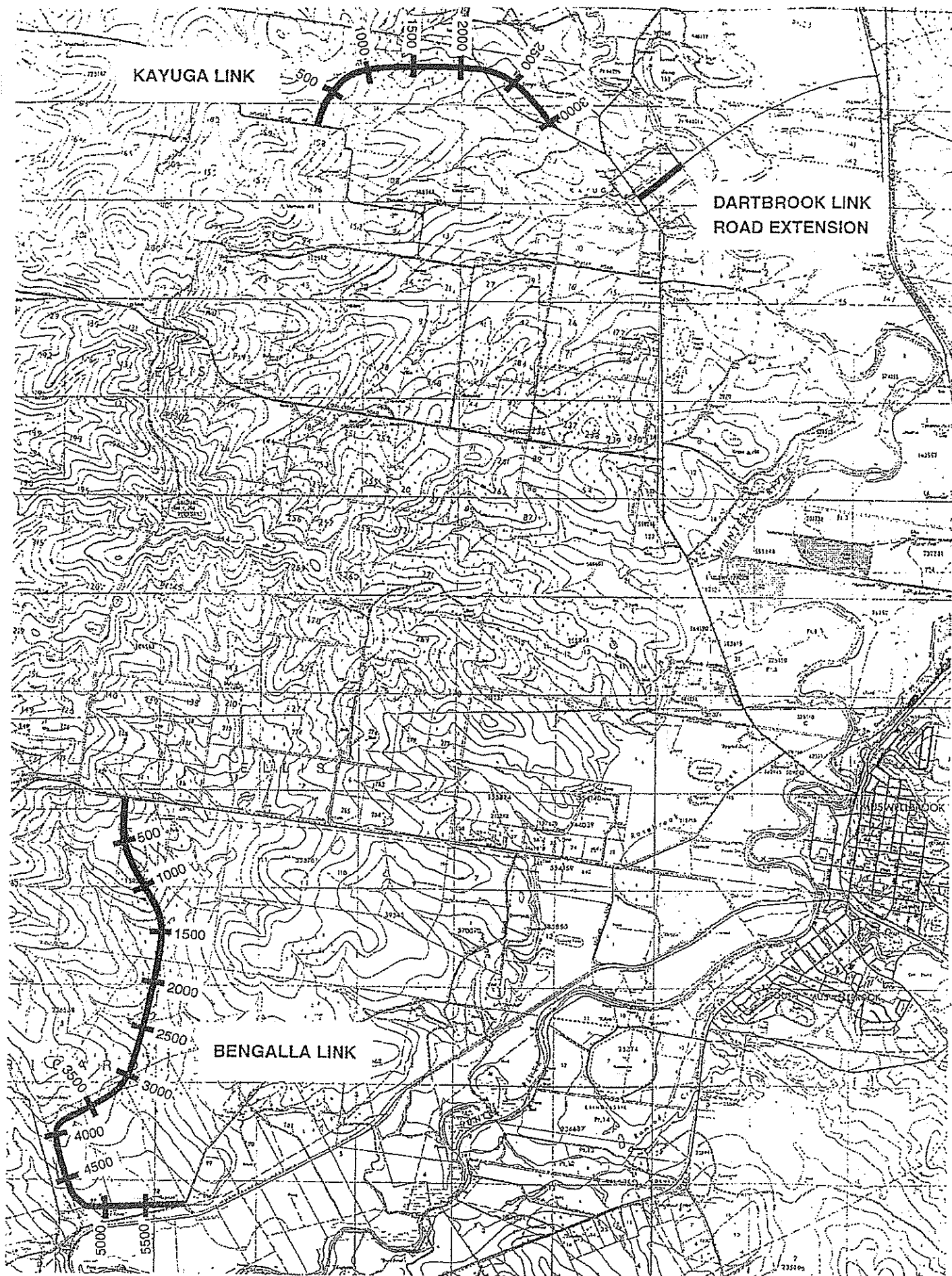


Figure 3.6 ADDITIONAL LINK ROAD ALIGNMENTS

iv. Intersections

The proposed route will connect into Dorset Road at a T-intersection at the western end. It will join the existing alignment of Dartbrook Road at the eastern end and will require a T-intersection approximately 0.9 kilometres from the eastern end to connect into Dartbrook Road to the north.

v. Costs

The proposed route will not require extensive cut or fill and could be constructed at a cost of approximately \$0.9 M per km (Appendix A). The overall estimated cost including the two intersections would be approximately \$3.0 M.

vi. Feasibility

The proposed route is feasible, with no significant constraints. The relatively steep 400 metre section with a gradient of over ten per cent is necessary because of the landform along the route and is acceptable for a minor road of this nature.

3.2.4 Completion of Bengalla Link Road

Completion of the western section of the Bengalla Link as proposed in the Bengalla Mine EIS is illustrated in Figure 3.6. The route is approximately 5.0 kilometres long from the proposed Bengalla Mine Infrastructure Area to Wybong Road and is constrained by the proposed rail loading loop for Mt Pleasant Mine.

i. Land Ownership

The proposed route follows the western edge of the Bengalla Mine Lease Boundary. At the northern end, close to Wybong Road, the route passes across a property currently owned by E.E. Maclean and others which will need to be acquired to construct the Mt Pleasant Mine Rail Loading Loop. Elsewhere the route passes through properties already acquired by the Bengalla Mining Company.

ii. Terrain

As with other road links, this road has one section with a relatively steep gradient of approximately 7 per cent for 350 metres at the northern end. Elsewhere the route generally follows ground contours at between 160 - 170 metres, alongside the Bengalla Mine Lease Boundary and the future Mt Pleasant Rail Loop.



Figure 3.7
BENGALLA MINE LINK ROAD
DIVERSION TO THE WEST

i. *Land Ownership*

A substantial section of the proposed diversion passes through privately owned property. In order for this diversion to proceed, land ownership issues would need to be resolved.

ii. *Terrain*

Road gradients with this alignment are generally flat, being a maximum of five per cent, although this gradient is maintained for a considerable distance from 0.3 kilometres to 1.5 kilometres east of Roxburgh Road.

iii. *Environmental Factors*

There are no residential dwellings in the immediate vicinity of the route which would be affected by traffic noise or dust. Potential environmental impacts would primarily be construction related, including changes to drainage patterns. There would also be a redistribution of traffic on approach routes to the town of Muswellbrook.

iv. *Intersections*

There would be an additional intersection at the western end at Wybong Road, relocation of the intersection at Roxburgh Road and an additional intersection at the junction with the 1.35 kilometre long road connection to the north.

v. *Costs*

The diversion would be approximately 0.2 kilometres shorter than the route shown in the Bengalla EIS, resulting in a small saving in construction costs of \$0.2 million. However, for the Mt Pleasant proposal to proceed, the additional costs of a bridge crossing the proposed Mount Pleasant Rail Loop (\$1.0 million) and the additional 1.35 kilometre road connection to the north (\$1.8 million approximately) would need to be considered.

vi. *Feasibility*

The diversion would marginally decrease the construction costs for the Bengalla Mine Link Road and will provide a more direct connection to Muswellbrook for Wybong Road traffic from the west. Additional environmental impacts are minor but require land acquisition from private properties. Additional consideration will be required of the costs related to the development of the Mount Pleasant Mine if this diversion is adopted.

3.2.6 Dartbrook Link Road Extension

Opening the Dartbrook Mine Link Road to the general public would require a new road approximately 500 metres long, as shown in *Figure 3.6*.

i. Land Ownership

The 500 metre extension will traverse two blocks of pastoral land owned by the Shell Company of Australia and J & NM Lonergan. Each of these blocks would be severed into two portions.

ii. Terrain

The terrain is flat, which will minimise earthworks.

iii. Environmental Factors

Extending the Dartbrook Link Road will have no direct traffic noise or air quality impacts as no dwellings adjoin the route. There may however be some amenity impacts from additional traffic using Kayuga Road in the immediate vicinity.

The road would not be built up significantly above surrounding land and would not affect flooding patterns in the Hunter River. It would however sever two portion pastoral land.

iv. Intersections

The proposed road extension will have two intersections to connect with the Dartbrook/Kayuga Mine surface facilities access road and with Kayuga Road.

v. Cost

Likely construction costs will be approximately \$0.8 million per kilometre, because of the minimal earthworks (Appendix A). The total cost would be approximately \$0.7 million including the two intersections.

vi. Feasibility

The extension would be relatively straightforward and feasible, subject to acquisition of the necessary corridor. Opening this route as a public road would make Muswellbrook Shire Council liable for future maintenance costs of the existing 2.5 kilometre section of this road.

3.2.7 Future Muswellbrook Eastern Bypass

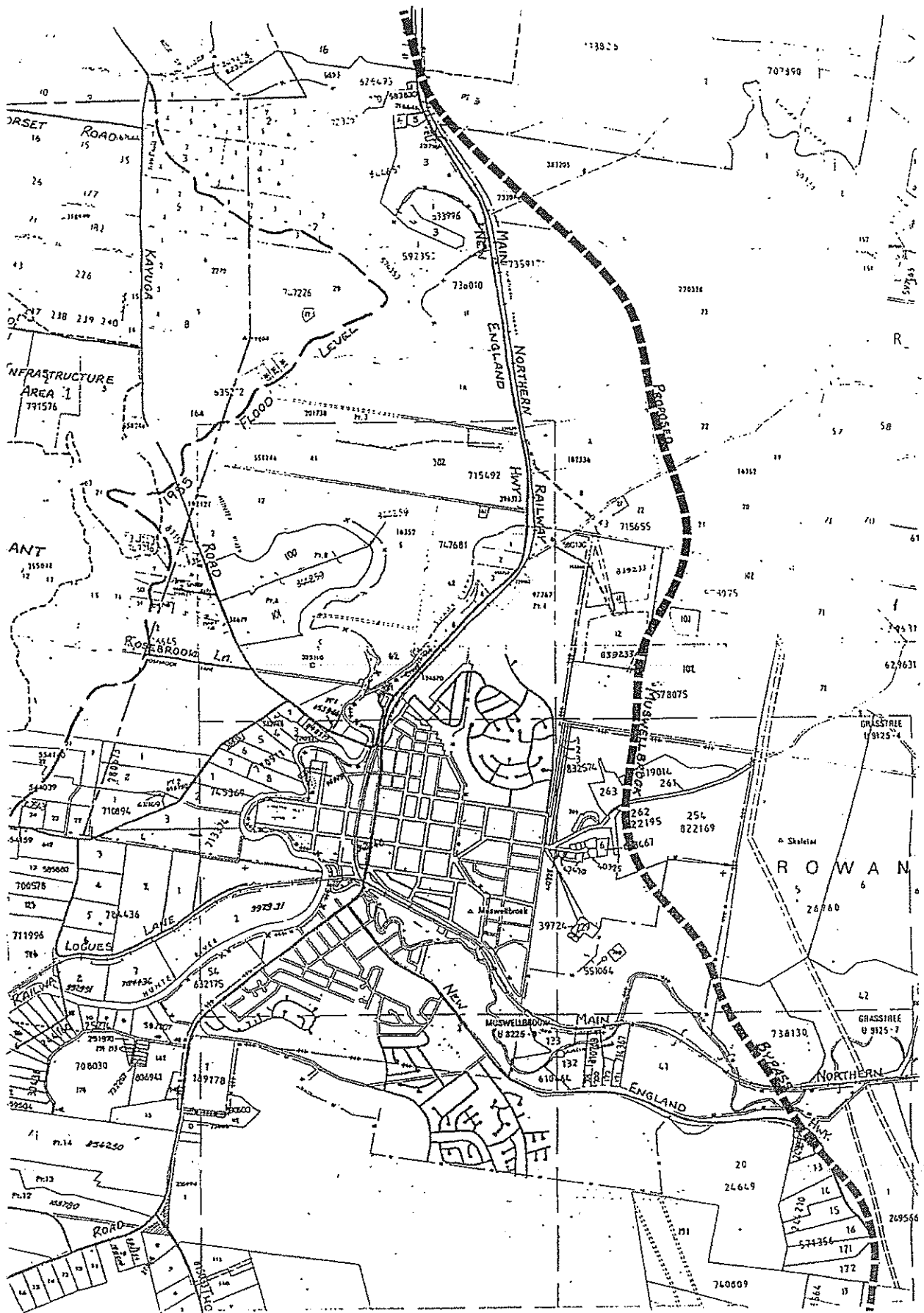
In the later years considered in this study there would be a major bypass of the New England Highway to the east of Muswellbrook.

In 1992 the RTA considered six design options and found the alignment in *Figure 3.8* had the best mix of engineering and social benefits. This route is approximately 12 kilometres long. The estimated construction cost in 1992 was between \$32 M and \$42 M.

This route was selected by the RTA after considering a wide range of controls and constraints, namely:

- future residential expansion;
- development of sporting facilities;
- disused electricity sub-station;
- electricity transmission lines;
- current and future open-cut coal mining;
- Muswellbrook waste disposal centre;
- Aboriginal land grants and claims;
- sensitive environmental areas;
- landuse - residential and rural;
- interchange site potential;
- minimisation/optimisation of structures;
- local road network planning;
- Hunter River flooding; and
- future strategy including a possible Aberdeen bypass.

An internal bypass, suggested by the Muswellbrook Chamber of Commerce was considered, but failed to satisfy the National Highway design criteria as both ends of the bypass were preceded by a 60 km/h zone, the horizontal and vertical alignments were below standard, and the route could be severely flooded by the Hunter River.



Not to Scale

Figure 3.8

FUTURE EASTERN BYPASS

THE BASE CASE OPTION

4.1 SUMMARY OF EFFECTS

4.1.1 *Traffic Detours*

Option 1A includes the minimum road improvements required to maintain reasonable access for rural residents in the future. This will lead to some traffic detours compared with the existing road network. These detours are considered to be generally acceptable as discussed below.

- i. *Dorset Road diversion to Dartbrook Road (Kayuga Northern Link Road)*
 - 2.5 kilometres less for journeys to and from the north;
 - 0.4 kilometres longer for journeys to and from Muswellbrook;
 - 0.4 kilometres longer for journeys to and from the south.

Traffic from Dorset Road currently travels equally to the north and south. These detours are generally better than the existing route and are considered to be a positive advantage.

- ii. *Castlerock Road diversion to Dorset Road (Mt Pleasant Northern Link Road)*
 - 2.0 kilometres less for journeys to/from the north;
 - 1.6 kilometres longer for journeys to/from Muswellbrook; and
 - 1.6 kilometres longer for journeys to/from the south.

Traffic from Castlerock Road currently travels primarily to Muswellbrook or the south (approximately 80%). The overall detours for traffic to the north (20%) and south (80%) will increase travel distances for Castlerock Road traffic by less than one kilometre per trip on average and the additional travel distances will be partially off set by the higher standard of road provided by the Mt Pleasant Northern Link Road.

4.1.2 Overall Community Benefits/Disbenefits

This option will provide acceptable alternative access for local rural communities located west of the proposed mines.

The following summary is presented here of the overall implications of the base case option in comparison to existing traffic arrangements.

i. Reasonable Access for Rural Residents

The proposed base case road network changes would only have potential adverse effects for Castlerock Road residents. In the worst case for residents whose travel patterns are 100 per cent to and from the south, the additional fuel costs would be approximately \$500 per property per year.

For other residents whose traffic patterns would on average include a proportion of trips to the north, the additional fuel costs would be lower, approximately \$300 per year. In future years, approximately 24 properties would be affected by these detours resulting in overall community costs of \$7,200 per year.

ii. Reasonable Access for Mine Traffic

The proposed base case road network changes would improve access for future traffic to the Mount Pleasant Mine from the south with the completion of the Bengalla Mine Link Road. The traffic for the Bengalla and Kayuga Mines would not generally be significantly affected by the proposed road network changes.

Future traffic volumes at the Kayuga Bridge would increase marginally with this network, primarily as a result of the additional Mount Pleasant Mine Traffic.

iii. Maximise Coal Recovery

There would be significant future sterilisation of the coal resource along the boundary between the Mount Pleasant and Kayuga Mines as a result of the decision to construct the Mount Pleasant Northern link road between the two mines, although this road is necessary to maintain reasonable access for Castlerock Road residents.

This coal would have a gross revenue value of approximately \$600-\$700 million and a net economic gain of some \$60-\$70 million profit from mining operations.

iv. Reduced Mine Traffic Through Muswellbrook CBD

This option would not generally provide major alternative bypass routes for mine traffic around the Muswellbrook CBD and would lead to increased total traffic usage of the New England Highway through the Muswellbrook CBD by the year 1998 of approximately 750 vehicles per day in comparison to existing year 1996 traffic volumes.

However a significant proportion of this future traffic increase would be attributable to general traffic growth with future mine traffic contributing approximately 400 vehicles per day to the increase.

v. Environmental and Engineering Constraints

The new roads would be constructed around mining areas and would have minimal environmental impacts on other areas. The land acquisition impacts for these new roads would also be relatively minor and would be wholly contained within properties to be acquired for mining.

vi. Overall Economic Benefits

The combined construction costs of the future roads required for the base case option are significant, a total of \$13.8 million. The economic justification for these roads has not specifically been assessed in this study as the roads are essential to provide reasonable access for both the rural traffic and future mine traffic in the area.

4.2 COMPARISON OF OPTION COSTS

4.2.1 Construction Costs

The following summarises the construction costs for each option, excluding the Muswellbrook Bypass which is an RTA funded project common to all network alternatives.

- Option 1A (Base Case Option) = \$13.8 M Total Cost
 - \$4.6 M complete Bengalla Mine Link Road
 - \$6.2 M Mt Pleasant Northern Link Road
 - \$3.0 M Kayuga Northern Link Road
- Option 1D (Dartbrook Link Road Extension) = \$0.7 M Additional Costs
- Option 2A (Mt Pleasant Western Link Road) = \$6.2 M Additional Costs

- Option 2D (Mt Pleasant Western Link Road and Dartbrook Link) = \$6.9 M Additional Costs
\$6.2 M Additional Cost, Mt Pleasant Western Link Road
\$0.7 M Additional Cost, Dartbrook Link Road Extension
- Option 3A (Close Wybong Road with Mt Pleasant Western Link Road) = \$6.2 M Additional Costs, as per Option 2A
- Option 3D (Close Wybong Road with Mt Pleasant Western Link Road and Dartbrook Link) = \$6.9 M Additional Costs as per Option 2D
- Option 4A (Close Wybong Road with Bengalla Link Road Diversion) = \$8.8M Additional Costs, as per Option 3A with \$2.6 M additional costs for the diversion of the Bengalla Mine Link Road
- Option 4D (Close Wybong Road with Bengalla Link Road Diversion and Dartbrook Link) = \$9.5M Additional Costs, as per Option 3D with \$2.6 M additional costs for the diversion of the Bengalla Mine Link Road.

4.2.2 Maintenance Costs

Each option will also result in additional road maintenance costs of approximately \$20,000 per kilometre per year. This is a recent RTA estimate for major rural roads which includes all roadside maintenance and periodic structural rehabilitation of the pavement. Additional annual road maintenance costs would be as follows.

- Option 1D (+ 0.5 km) = + \$10,000 per year
- Option 2A (+ 5 km) = + \$100,000 per year
- Option 2D (+ 5.5 km) = + \$110,000 per year
- Option 3A (+ 1 km) = + \$20,000 per year
- Option 3D (+ 1.5 km) = + \$30,000 per year
- Option 4A (+ 2 km) = + \$40,000 per year
- Option 4D (+ 2.5 km) = + \$50,000 per year

It should be noted that the annual maintenance costs for the existing 2.5 kilometre section of the Dartbrook Link Road would be transferred from Dartbrook Mine to Muswellbrook Shire Council if it were used as a public road. However, for the economic assessment of the road options, "transferred" costs are excluded as they are not true economic costs.

NETWORK TRAFFIC MODEL

5.1 ROAD NETWORK LINKS AND NODES

The study used the TMODEL2 traffic network modelling program which builds a road network from a series of links and nodes. It includes the following basic information for each road link and node in the study area. Further details are included in Appendix B to this report.

- Location of 31 key traffic generating zones (nodes 1 - 31)
- the geographic location of other intersection nodes;
- additional nodes to represent significant bends in road links;
- link daily traffic capacities in each direction;
- travel speeds for each link;
- type of intersection (ie. T junction, traffic signals, roundabout);
- the daily traffic capacity for each node or intersection;
- additional network operating parameters such as weighting of travel time and distance and the number of iterations performed when operating the model.

The study area traffic network model is based on daily traffic volumes because these are the most suitable for calculation of the economic benefits of future road network changes.

5.2 TRAFFIC VOLUME TRIP TABLES

The network traffic model operates by distributing traffic volumes within an area according to the shortest or quickest route between each pair of origin and destination zones based on the combined valuation of travel time (\$/minute) and travel distance (\$/km).

Traffic volumes are input to the model in the form of trip tables which contain the total number of daily traffic movements between each pair of zones.

Trip tables were prepared for the model for the years 1996 (calibration) and 1998, 2013 and 2028 (operations), according to the traffic generation and distributions defined in Chapter Two of this report. Example trip tables for each of these years are presented in Appendix C.

Additional trip tables were also calculated to identify the respective travel time and distance savings for four different types of traffic, namely:

"A" Trip Tables = (total traffic) i.e mines & rural & hwy & urban

"B" Trip Tables = (no mines) i.e. rural & hwy & urban traffic

"C" Trip Tables = hwy & urban traffic only

"D" Trip Tables = urban traffic only

5.3 TRAFFIC VOLUME CALIBRATION

Before the model was used to assess traffic changes and travel benefits for the future road network, the model calibration was checked at 36 locations where recent traffic counts had been undertaken by either Muswellbrook Shire Council or the RTA.

A summary of the traffic model calibration is presented in *Table 5.1* which indicates that the model underestimates total traffic volumes on the road network by about eight per cent.

However, the calibration accuracy is different for rural, urban and highway locations and is generally better for the rural (-3%) and highway (+3%) traffic categories than for Muswellbrook urban traffic (-12%), *Table 5.1*.

This accuracy is acceptable because the traffic model is primarily intended to assess rural and mine traffic conditions to the west of Muswellbrook. There are relatively few major calibration discrepancies in the model, namely Ridgeland Road and Mangoola Road in the rural areas and Ruth White Avenue in the urban area. These are primarily the result of high local traffic concentrations near certain nodes which represent traffic origins and destinations for relatively large rural or urban zones.

Table 5.1 MODEL CALIBRATION LOCATIONS

	Location	Actual Count	Model Count	% Difference
1	Denman Rd (at Denman)	1,957	738	-62
2	Denman Rd (Hunter Br)	2,673	2,956	+11
3	Thomas Mitchell Dr (at Denman Rd)	1,969	1,650	-16
4	Thomas Mitchell Dr (at Hwy)	242	313	+29
5	Muscle Creek Rd	833	365	-56
6	Kayuga Bridge (Wybong Road)	2,164	1,841	-15
7	McCullys Gap Rd	691	578	-16
8	Wybong Rd (West of Kayuga Rd)	1,090	1,380	+27
9	Kayuga Rd (North of Wybong Rd)	962	671	-30
10	Castlerock Rd (E)	168	172	+2
11	Castlerock Rd (W)	59	72	+22
12	Edderton Road	594	509	-14
13	Denman Road (W of Edderton Rd)	1,627	2,846	+75
14	Roxburgh Road	142	305	+115
15	Mangoola Rd (N of Roxburgh Rd)	55	297	+440
16	Mangoola Rd (S of Roxburgh Rd)	197	420	+113
17	Wybong Rd (near Reedy Ck Rd)	233	518	+122
18	Yarraman Rd (at Ridgeland Rd)	79	67	-15
19	Ridgeland Rd (at Wybong Rd)	196	641	+227
20	Merriwa Rd (at Sandy Hollow)	1,278	370	-71
21	Blairmore Lane	176	276	+57
22	Dartbrook Link Road	408	338	-17
23	Kayuga Road (at Kayuga)	547	498	-9
	TOTAL RURAL LOCATIONS	18,340	17,821	-3
1	Thompson St	2,162	3,742	+73
2	Bell St	8,660	5,457	-37
3	Bridge St	15,309	8,165	-47
4	Hunter St	1,383	902	-35
5	Ford St	2,030	1,529	-25
6	Railway U/Pass	17,013	17,508	+3
7	Denman Rd at Highway	7,816	8,691	+11
8	Glendenning St	1,302	1,772	+36
9	Brook St	3,488	2,494	-28
10	New England Hwy (E of Denman Rd)	13,875	8,817	-36
11	Ruth White Ave	712	5,810	+716
	TOTAL URBAN LOCATIONS	73,750	64,887	-12
1	Highway North	9,083	8,971	-1
2	Highway South	8,917	9,523	+7
	TOTAL HIGHWAY LOCATIONS	18,000	18,494	+3
	TOTAL ALL	110,090	101,202	-8

5.4 TRAFFIC USAGE

Future use of rural roads in the study area is presented in detail in Appendix D. Traffic in urban areas is given in Appendix E. This section summarises two situations, namely short term base network traffic changes and changes with the future network options.

5.4.1 Base Network Traffic Volume Changes

These are the short term changes which will occur in 1998 with the opening of new coal mines at Bengalla, Mount Pleasant and Kayuga after base case road network improvements are made, namely:

- complete Bengalla Mine Link Road (to Wybong Road);
- construct Mt Pleasant Northern Link Road (with closure of part of Castlerock Road); and
- construct Kayuga Northern Link Road (with closure of part of Dorset Road).

These changes are summarised in *Table 5.2*. One major change will be the new Bengalla Link Road (432 vehicles per day). This traffic is primarily mine traffic (375 vehicles per day with only a small proportion of rural traffic (57 vehicles per day).

Other notable changes in *Table 5.2* are the moderate traffic increases (+229 and +753 vehicles per day) on Denman Road and the New England Highway at the railway underpass.

Table 5.2 also shows significant increases in Wybong Road and Kayuga Bridge traffic volumes (+594 and +263 vehicles per day respectively) mainly from increased coal mining traffic.

Table 5.2 YEAR 1998 BASE NETWORK TRAFFIC CHANGES

Location	Traffic Model 1996 Calibration	Traffic Model 1998 Base (Option 1A)	Change 1996 - 1998
1. Castlerock Rd E	172	127	-45
2. Castlerock Rd W	72	67	-5
3. Dorset Rd (at Kayuga Rd)	101	127	+26
4. Kayuga Br	1,841	2,104	+263
5. Kayuga Rd (N/Wybong Rd)	671	657	-14
6. Wybong Rd (W/Kayuga Rd)	1,380	1,974	+594
7. Wybong Rd (at Reedy Creek)	518	507	-11
8. Bengalla Link Rd (at Denman Rd)	-	432	+432
9. Dartbrook Link Rd (at Hwy)	338	532	+196
10. Thomas Mitchell Dr at Denman Rd	1,650	1,865	+215
11. New England Hwy at rail underpass	17,508	18,261	+753
12. Denman Rd at New England Hwy	8,691	8,920	+229

5.4.2 Comparison of Future Network Options

These future changes are primarily summarised here for the short term traffic model for the year 1998. In the years 2013 and 2028, traffic volumes will generally increase uniformly in all areas. However in the Muswellbrook town centre the future Muswellbrook Bypass will divert significant traffic volumes away from the town centre, namely:

- 7,600 vehicles per day, year 2013;
- 9,400 vehicles per day, year 2028.

The year 1998 future traffic changes with each network option are summarised at key locations on the road network on the following Table 5.3, Table 5.4 and Table 5.5.

Table 5.3 YEAR 1998 DAILY TRAFFIC VOLUMES (TOTAL TRAFFIC)

Location	1A	1D	2A	2D	3A	3D	4A	4D
1. Castlerock Rd (E)	127	127	160	160	160	160	160	160
2. Castlerock Rd (W)	67	67	34	34	34	34	34	34
3. Mt Pleasant N Link	127	127	593	934	1,020	1,168	987	1,135
4. Kayuga Bridge	2,104	1,829	2,056	1,784	707	669	674	636
5. Kayuga Rd	657	932	258	296	492	530	459	497
6. Wybong Rd	1,974	1,974	1,617	1,383	-	-	-	-
7. Wybong Rd (W)	507	507	504	507	318	318	318	318
8. Bengalla Link Rd	432	432	448	448	1,444	1,400	1,457	1,413
9. Dartbrook Link Rd	532	841	532	945	532	945	532	945
10. Mt Pleasant W Link	-	-	531	872	958	1,106	925	1,073
11. Thomas Mitchell Dr	1,865	1,865	1,865	1,865	2,139	2,139	2,139	2,139
12. N Eng Hwy	18,261	18,261	18,114	18,013	18,250	18,102	18,283	18,135
13. Denman Rd	8,920	8,920	8,776	8,672	9,292	9,144	9,325	9,177

Table 5.4 YEAR 1998 DAILY TRAFFIC VOLUMES (EXCLUDING MINE TRAFFIC)

Location	1A	1D	2A	2D	3A	3D	4A	4D
1. Castlerock Rd (E)	125	125	151	151	151	151	151	151
2. Castlerock Rd (W)	57	57	31	31	31	31	31	31
3. Mt Pleasant N Link	125	125	449	637	777	857	689	769
4. Kayuga Bridge	1,509	1,370	1,462	1,323	679	648	591	560
5. Kayuga Rd	516	655	263	294	483	514	395	426
6. Wybong Rd	1,209	1,209	1,003	895	-	-	-	-
7. Wybong Rd (W)	470	470	470	470	287	287	287	287
8. Bengalla Link Rd	57	57	71	71	563	563	651	651
9. Dartbrook Link Rd	0	159	0	239	0	239	0	239
10. Mt Pleasant W Link	-	-	378	566	706	786	618	698
11. Thomas Mitchell Dr	1,682	1,682	1,682	1,682	1,799	1,799	1,799	1,799
12. N Eng Hwy	17,618	17,618	17,472	17,392	17,593	17,513	17,681	17,601
13. Denman Rd	8,614	8,614	8,468	8,388	8,774	8,694	8,862	8,782

Table 5.5 YEAR 1998 DAILY TRAFFIC VOLUMES (MINE TRAFFIC)

Location	1A	1D	2A	2D	3A	3D	4A	4D
1. Castlerock Rd (E)	2	2	9	9	9	9	9	9
2. Castlerock Rd (W)	10	10	3	3	3	3	3	3
3. Mt Pleasant N Link	2	2	144	297	243	311	298	366
4. Kayuga Bridge	595	459	594	461	28	21	83	76
5. Kayuga Rd	141	277	0	2	9	16	64	71
6. Wybong Rd	765	765	614	488	0	0	0	0
7. Wybong Rd (W)	37	37	34	37	31	31	31	31
8. Bengalla Link Rd	375	375	377	377	881	837	806	762
9. Dartbrook Link Rd	532	682	532	706	532	706	532	706
10. Mt Pleasant W Link	0	0	153	306	252	320	307	375
11. Thomas Mitchell Dr	183	183	183	183	340	340	340	340
12. N Eng Hwy	643	643	642	621	657	589	602	534
13. Denman Rd	306	306	308	284	518	450	463	395

The following general changes occur with each network option compared to the base case.

i. *Option 1D, Dartbrook Link Road Extension*

This option results in increased usage of the Dartbrook Link Road by rural and mine traffic (approximately +310 vehicles per day).

There is correspondingly less traffic on Kayuga Bridge, - 275 vehicles per day and more on Kayuga Road, +275 vehicles per day.

ii. *Option 2A, Mt Pleasant Western Link Option*

This option predicts reasonable traffic volumes for the Mt Pleasant Western Link Road (530 vehicles per day), which are primarily rural traffic (approximately 380 vehicles per day) with a smaller proportion of mine traffic (150 vehicles per day).

There is consequently more use of the Mt Pleasant Northern Link Road, (+470 vehicles per day).

This option reduces traffic at most other locations on the road network by approximately:

- Kayuga Road, -400 vehicles per day;
- Wybong Road, -360 vehicles per day;
- Kayuga Bridge, -50 vehicles per day;
- Denman Road, -140 vehicles per day; and
- New England Hwy (at rail underpass), -150 vehicles per day.

There is, however, no change to traffic volumes on Thomas Mitchell Drive, indicating that the proposed Mt Pleasant Western Link Road does not provide an effective alternative route to the south of Muswellbrook for rural traffic from Castlerock Road.

iii. *Option 2D, Mt Pleasant Western Link and Dartbrook Link Road Extension*

This option predicts increased traffic on the Mt Pleasant Western Link (870 vehicles per day) which is primarily rural traffic (570 vehicles per day) with a smaller proportion of mine traffic (300 vehicles per day). Traffic on the Dartbrook Link Road increases by +410 vehicles per day.

Elsewhere this option causes the following reductions in traffic usage:

- Wybong Road, -590 vehicles per day;
- Kayuga Road, -360 vehicles per day;
- Kayuga Bridge, -320 vehicles per day;
- Denman Road, -250 vehicles per day; and
- New England Highway (at rail underpass), -250 vehicles per day.

iv. *Option 3A, Close Wybong Road with Mt Pleasant Western Link Road*

This option includes the Bengalla Link Road and Mt Pleasant Western Link Roads which will provide alternative routes to and from the north for Wybong Road traffic. There are nevertheless significant reductions in Wybong Road traffic west of Castlerock with this option (-190 vehicles per day approximately).

This option significantly reduces traffic at Kayuga Bridge (-1,400 vehicles per day) with corresponding increases on Denman Road (+370 vehicles per day) and the Bengalla Mine Link Road (+1,010 vehicles per day).

Traffic which continues to use Wybong Road from the west results in increased traffic on the Mt Pleasant Western Link Road (approximately 960 vehicles per day), the Mt Pleasant Northern Link Road (1,020 vehicles per day).

v. *Option 3D, Close Wybong Road with Mt Pleasant Western Link and Dartbrook Link Road Extension*

This is generally similar to Option 3A and gives comparable reductions on Wybong Road, west of Castlerock Road (-190 vehicles per day) and at the Kayuga Bridge (-1,440 vehicles per day). There are higher volumes on the Mt Pleasant Western Link Road (1,100 vehicles per day), increasing to 1,170 vehicles per day on the Mt Pleasant Northern Link Road. There are also generally traffic increases on a number of other roads, namely:

- Bengalla Link Road, +970 vehicles per day;
- Dartbrook Link Road, +410 vehicles per day;
- Denman Road, +220 vehicles per day; and
- New England Highway (at rail underpass), -160 vehicles per day;

vi. *Option 4A, Close Wybong Road with Mount Pleasant Western Link Road and Bengalla Mine Link Road Diversion*

This option causes similar changes to Option 3A, with marginally lower usage of the Mount Pleasant Western and Northern Link Roads (-30 vehicles per day) and marginally greater volumes on the Bengalla Mine Link Road and Denman Road routes.

The reduction on Kayuga Bridge is still highly significant at -1,430 vehicles per day.

vii. *Option 4D, Close Wybong Road with Bengalla Mine Link Road Diversion, Mount Pleasant Western Link Road and Dartbrook Link Road Extension.*

This is also similar to Option 3D, again with marginally lower use of the Mount Pleasant Western Link Road and marginally greater patronage of the Bengalla Mine Link Road and Denman Road by about 30 vehicles per day.

Reductions in Kayuga Bridge traffic, -1,470 vehicles per day and greater use of the Dartbrook Mine Link Road +410 vehicles per day are still highly significant with this option.

TRAVEL BENEFITS

6.1 OVERALL TRAFFIC BENEFITS

The traffic model gives total daily travel time and daily travel distance for each road network option. These results are illustrated in *Table 6.1*. The travel benefits only occurred for mine traffic or rural traffic.

Table 6.1 TOTAL NETWORK TRAVEL SAVINGS

Option	Year	Daily Travel Distance Saving (Vehicle /Km)*	Daily Travel Time Saving (Vehicle/Hrs)*
1D	1998	133	9
	2013	86	10
	2028	128	15
2A	1998	1,025	27
	2013	1,268	27
	2028	1,446	34
2D	1998	1,697	52
	2013	1,955	54
	2028	2,280	70
3A	1998	-4,590	-28
	2013	-5,240	-39
	2028	-6,016	-43
3D	1998	-3,680	7
	2013	-4,315	-8
	2028	-4,899	-3
4A	1998	-3,941	-23
	2013	-4,276	-33
	2028	-4,667	-35
4D	1998	-3,057	9
	2013	-3,256	0
	2028	-3,471	8

Note: * Travel savings are calculated in comparison to Option 1A, the base case option

6.2 BENEFITS FOR RURAL AND MINE TRAFFIC

Current valuations of travel time and distance for mixed traffic flow (including both cars and heavy vehicles) were determined from RTA economic analysis guidelines (RTA, 1996). These are approximately \$0.20 per kilometre for travel distance and \$20 per hour for travel time.

These valuations were used in Appendix F and in the following Table 6.2 to summarise total travel benefits and the proportions which relate to mine traffic and rural traffic.

Table 6.2 BENEFITS FOR RURAL AND MINE TRAFFIC

Option	Year	Total Traffic Benefits (\$/day)	Rural Traffic Benefits (\$/day)	Mine Traffic Benefits (\$/day)	Proportion of Benefits Rural: Mines
1D	1998	207	112	95	54:46
	2013	217	151	66	70:30
	2028	326	274	52	84:16
2A	1998	745	617	128	83:17
	2013	794	743	51	94:6
	2028	969	968	1	100:0
2D	1998	1,379	1,016	363	74:26
	2013	1,471	1,158	313	79:21
	2028	1,856	1,637	219	88:12
3A	1998	(-1,478)	(-855)	(-623)	-58:-42
	2013	(-1,828)	(-1,270)	(-558)	-69:-31
	2028	(-2,063)	(-1,292)	(-771)	-63:-37
3D	1998	(-596)	(-487)	(-109)	-82:-18
	2013	(-1,023)	(-763)	(-260)	-75:-25
	2028	(-1,040)	(-550)	(-490)	-53:-47
4A	1998	(-1,248)	(-375)	(-873)	-30:-70
	2013	(-1,515)	(-653)	(-862)	-43:-57
	2028	(-1,633)	(-502)	(-1,131)	-31:-69
4D	1998	(-431)	8	(-439)	2:-102
	2013	(-651)	(-146)	(-505)	-22:-78
	2028	(-534)	21	(-555)	4:-104

i. *Option 1D, Dartbrook Link Road Extension*

This option will generate total travel benefits of \$100,000 per annum, most of which will occur for rural traffic with only relatively minor benefits for mine traffic.

ii. *Option 2A, Mt Pleasant Western Link*

This option produces travel benefits of approximately \$300,000 per annum which also benefit primarily rural traffic.

iii. *Option 2D, Mt Pleasant Western Link & Dartbrook Link Road Extension*

This option produces total travel benefits of approximately \$600,000 per annum which again primarily benefit rural traffic.

iv. *Option 3A, Close Wybong Road with Mt Pleasant Western Link Road*

This option results in additional travel costs on the road network of approximately \$700,000 per annum which mostly affect rural traffic but also affect mine traffic to a significant extent.

v. *Option 3D, Close Wybong Road with Mt Pleasant Western Link and Dartbrook Link Road Extension*

This option gives additional travel costs of over \$300,000 per annum, which primarily affect rural traffic.

vi. *Option 4A, Close Wybong Road with Bengalla Mine Link Road Diversion*

This option imposes extra travel costs of over \$500,000 per annum which mostly affect mine traffic, although rural traffic is significantly affected.

vii. *Option 4D, Close Wybong Road with Bengalla Mine Link Road diversion and Dartbrook Link Road Extension*

Additional travel costs with this option are minimised, approximately \$200,000 per annum and these costs are almost entirely borne by mine traffic with only minimal additional costs for rural traffic.

OVERALL ASSESSMENT OF OPTIONS

7.1 REASONABLE ACCESS FOR RURAL RESIDENTS

7.1.1 *Future Road Network Options*

Future road links and road closures for each network option will have the traffic detour effects discussed below.

i. Mt Pleasant Western Link Road

The Mount Pleasant Western Link Road would give an alternative route for rural traffic from the west on Wybong Road travelling north because it is approximately 2.5 kilometres shorter than the alternative via Wybong Road and Kayuga Road.

This new connection would be a longer route for Castlerock Road traffic to Muswellbrook via Kayuga Bridge. It is approximately 3.0 kilometres longer than the Mt Pleasant Northern Link Road detour via Dorset Road and Kayuga Road, which is 4.6 kilometres longer than the existing Castlerock Road route.

This route would also not be an attractive alternative for traffic from Castlerock Road travelling south via Thomas Mitchell Drive because it would be approximately 7.0 kilometres longer than the existing route via Castlerock Road and the Muswellbrook CBD and 5.4 kilometres longer than the proposed detour via Dorset Road, Kayuga Road and the Muswellbrook CBD.

ii. Dartbrook Link Road Extension

This new connection will benefit rural traffic from Kayuga village, Dorset Road or Castlerock Road travelling to Aberdeen or rural areas accessible off the New England Highway between Muswellbrook and Aberdeen. There would typically be distance savings of at least two to three kilometres.

iii. Closure of Wybong Road with Mount Pleasant Western Link Road

With options 3A and 3D, closure of a section of Wybong Road between Bengalla Road and the proposed Mount Pleasant Mine infrastructure site would extend

journeys on Wybong Road, by 5.6 kilometres in each direction when travelling to the Muswellbrook CBD.

These detours would be reduced with Options 4A and 4D which reduce the effective detour distance from Wybong Road to the Muswellbrook CBD to approximately 2.4 kilometres in each direction.

7.1.2 Rural Traffic Benefits

Average annual rural traffic benefits or detour costs have been calculated over a 30 year period, in comparison to the base case Option 1A, as follows:

□	Option 1D,	\$63,000	per year saving
□	Option 2A,	\$280,000	per year saving
□	Option 2D,	\$453,000	per year saving
□	Option 3A,	-\$428,000	per year extra costs
□	Option 3D,	-\$234,000	per year extra costs
□	Option 4A	-\$199,000	per year extra costs
□	Option 4D	-\$24,000	per year extra costs

7.2 REASONABLE ACCESS FOR MINE TRAFFIC

A similar summary of the relative benefits of the various network options for mine traffic gave the following results:

□	Option 1D,	\$25,000	per year saving
□	Option 2A,	\$21,000	per year saving
□	Option 2D,	\$110,000	per year saving
□	Option 3A,	-\$229,000	per year extra costs
□	Option 3D,	-\$102,000	per year extra costs
□	Option 4A,	-\$340,000	per year extra costs
□	Option 4D,	-\$183,000	per year extra costs

7.3 MAXIMISE COAL RECOVERY

Options 3A, 3D, 4A and 4D allow an opportunity to maximise the recovery of coal reserves by closing a four kilometre section of Wybong Road. There is about 30.3 million tonnes of "in-situ" coal beneath the road, of which 67 per cent or 20.3 million tonnes would be recoverable.

The gross revenue from the sale of this coal would be approximately \$912 million at a sale price of \$45 per tonne. For the purposes of this report the net economic gain as a result of these mining operations, is estimated from both company profit and government royalties, which would typically be approximately 10 per cent of this sum.

This is a conservative estimate which corresponds to a net annual benefit of approximately \$3.04 million each year over a thirty year period (total \$91.2 million). It is acknowledged that there would be additional flow-on economic benefits to the region from the wages from mining operations and the revenue from rail transport. These benefits are likely to be significant but are not relied upon in the analysis.

7.4 REDUCE MINE TRAFFIC THROUGH MUSWELLBROOK CBD

Model results summarised in *Table 5.3*, *Table 5.4* and *Table 5.5* illustrate that various network options would only marginally affect daily volumes of mine traffic travelling on the New England Highway through the Muswellbrook CBD, as follows:

□	Option 1D,	643 vehicles per day	(no change from Option 1A)
□	Option 2A,	642 vehicles per day	(-1 from Option 1A)
□	Option 2D,	621 vehicles per day	(-22 from Option 1A)
□	Option 3A,	657 vehicles per day	(+14 from Option 1A)
□	Option 3D,	589 vehicles per day	(+54 from Option 1A)
□	Option 4A,	602 vehicles per day	(-41 from Option 1A)
□	Option 4D,	534 vehicles per day	(-109 from Option 1A)

These diversion benefits for each option are illustrated to a greater extent by the daily traffic volume changes for all traffic travelling on the New England Highway through the Muswellbrook CBD as follows:

- Option 1D, 18,261 vehicles per day (no change from Option 1A)
- Option 2A, 18,114 vehicles per day (-147 from Option 1A)
- Option 2D, 18,013 vehicles per day (-248 from Option 1A)
- Option 3A, 18,250 vehicles per day (-11 from Option 1A)
- Option 3D, 18,102 vehicles per day (-159 from Option 1A)
- Option 4A, 18,283 vehicles per day (+22 from Option 1A)
- Option 4D, 18,135 vehicles per day (-126 from Option 1A)

7.5 ENVIRONMENTAL AND ENGINEERING CONSTRAINTS

Potential environmental impacts and engineering feasibility of the proposed route alignments are discussed in Chapter 3 and are summarised here in comparison to the base case option (Option 1A).

- Option 1D, Dartbrook Link Road Extension

This route would have relatively minor potential environmental impacts from construction and generally positive traffic redistribution effects on the road network. It is considered to be "excellent" in terms of environmental/engineering issues.

- Option 2A, Mt Pleasant Western Link Road

This route is also considered to have relatively minor potential environmental impacts and is considered to be "very good" in terms of this objective.

- Option 2D, Mt Pleasant Western Link Road with Dartbrook Link Road Extension

This route will combine the potential environmental impacts of the previous two new road connections and is also considered to be "very good" in terms of this objective.

- Option 3A, Close Wybong Road

This option will have relatively minor potential impact from the direct construction effects but will result in significant redistribution of traffic volumes at other locations on the study area road network. This option is also considered to be "good" in terms of this objective.

□ Option 3D, Close Wybong Road with Dartbrook Link Road Extension

This option will have significant potential impacts from new road construction and will result in significant redistribution of traffic volumes on the study area road network. The comparative assessment of this option is "good" in terms of this objective.

□ Option 4A, Close Wybong Road with Bengalla Link Road Diversion

This option will also have significant potential impacts from new road construction and significant traffic redistribution effects on the study area road network. This option is considered acceptable in terms of this objective.

□ Option 4D, Close Wybong Road, with Bengalla Link Road Diversion and Dartbrook Link Road Extension

This option will have the greatest potential impacts from new road construction and will also have significant traffic redistribution effects on the study area road network. This option is considered acceptable in terms of environmental constraints.

7.6 OVERALL ECONOMIC BENEFITS

Detailed economic analyses of travel time savings and other benefits for the options are presented in Appendices F and G. These summarise annual benefits and the future discounted cost and benefit streams over a thirty year period.

The overall economic performance of each option is summarised by the benefit to cost ratio. This uses an annual rate of seven per cent per year to discount future benefits.

□	Option 1D,	Benefit to Cost Ratio	1.32:1
□	Option 2A,	Benefit to Cost Ratio	0.42:1
□	Option 2D,	Benefit to Cost Ratio	0.83:1
□	Option 3A,	Benefit to Cost Ratio	5.01:1
□	Option 3D,	Benefit to Cost Ratio	4.80:1
□	Option 4A,	Benefit to Cost Ratio	3.45:1
□	Option 4D,	Benefit to Cost Ratio	3.62:1

7.7 SUMMARY AND CONCLUSIONS

This study has confirmed that the base case road network improvements are necessary as a minimum requirement, namely:

- Construct Mt Pleasant Northern Link Road (\$6.2M);
- Construct Kayuga Northern Link Road (\$3.0M);
- Complete Bengalla Mine Link Road (\$4.6M); and
- Construct Bypass to the East of Muswellbrook (by the year 2005/6 approximately).

These projects, excluding the future Muswellbrook bypass, form a significant roadworks program which will be substantially funded by the coal mines at a total cost of \$13.8 million.

The overall assessment of the other road options against six study objectives is summarised in *Table 7.1*. This indicates that most options show substantial benefits in comparison to the base case option. The three best performing options are all comparable and include the Dartbrook Mine Link Road Extension, as follows.

Option 3D, Close Wybong Road with Mount Pleasant Western Link Road and Dartbrook Link Road Extension

This option performs best in the overall assessment and the comparatively high potential value of the coal makes it a highly economically feasible option.

Option 4D, Close Wybong Road with Bengalla Link Road Diversion, Mt Pleasant Western Link Road and Dartbrook Link Road Extension.

This option also performs very well but has higher construction costs than Option 3D so economic performance is lower. Local traffic detour costs are effectively minimised with this option.

Option 2D, Mt Pleasant Western Link Road with Dartbrook Link Road Extension

This option performs very well in the overall assessment but its low benefit: cost ratio would make construction of this option difficult to justify.

Table 7.1 SUMMARY OF ASSESSMENT OF OPTIONS

Option	Access For Rural Residents	Access For Mine Traffic	Maximise Coal Recovery	Reduce Muswellbrook CBD Traffic	Environmental and Engineering Constraints	Overall Economic Benefits	Overall Assessment Score	Overall Ranking of Option
1A Base Case Option	Good 3	Good 3	Poor 1	Acceptable 2	Very Good 4	Acceptable 2	15/30	Acceptable (Equal 7th)
1D Dartbrook Link Road Extension	Good 3	Good 3	Poor 1	Acceptable 2	Excellent 5	Good 3	17/30	Good (5th)
2A Mt Pleasant Western Link Road	Very Good 4	Good 3	Poor 1	Good 3	Very Good 4	Poor 1	16/30	Good (6th)
2D Mt Pleasant Western Link Road Plus Dartbrook Link Extension	Excellent 5	Very Good 4	Poor 1	Very Good 4	Very Good 4	Poor 1	19/30	Very Good (Equal 2nd)
3A Close Wybong Road Plus Mt Pleasant Western Link Road	Poor 1	Acceptable 2	Excellent 5	Acceptable 2	Good 3	Excellent 5	18/30	Good (4th)
3D Close Wybong Road Plus Mt Pleasant Western Link Road Plus Dartbrook Link Extension	Acceptable 2	Acceptable 2	Excellent 5	Good 3	Good 3	Excellent 5	20/30	Very Good (1st)
4A Close Wybong Road with Bengalla Link Road Diversion	Acceptable 2	Poor 1	Excellent 5	Poor 1	Acceptable 2	Very Good 4	15/30	Acceptable (Equal 7th)
4D Close Wybong Road with Bengalla Link Road Diversion and Dartbrook Link Extension	Good 3	Acceptable 2	Excellent 5	Good 3	Acceptable 2	Very Good 4	19/30	Very Good (Equal 2nd)

Note Scores Range:

5 = Excellent 4 = Very Good 3 = Good 2 = Acceptable 1 = Poor

KAYUGA BRIDGE TRAFFIC IMPACTS

8.1 SEQUENCING OF EVENTS IN 1998

Model results for 1998 traffic volumes at Kayuga Bridge and other crossings of the Hunter River are summarised in *Table 8.1*.

Table 8.1 DAILY TRAFFIC VOLUMES AT HUNTER RIVER CROSSINGS

Location	1996 Model Calibration	Year 1998 Traffic Model Options							
		1A	1D	2A	2D	3A	3D	4A	4D
Kayuga Bridge	1,841*	2,104	1,829	2,056	1,784	707	669	674	636
Blairmore Lane	276	385	351	484	450	677	450	677	450
Dartbrook Link Road	338	532	841	532	945	532	945	532	945
Bengalla Mine Link Road	0	432	432	448	448	1,444	1,400	1,457	1,413

*Note: ** The model calibration at the Kayuga Bridge is approximately 200-300 vehicles per day low because the model has not included through traffic from the Scone direction on Dartbrook Road.

These results show that future traffic at Kayuga Bridge from the year 1998 onwards would be lower than existing volumes for all options except Options 1A and 2A.

However a further assessment of the actual traffic volumes during the construction period for the Mount Pleasant and Kayuga Mines, in the year 1998, has been undertaken because these will be slightly different to *Table 8.1*.

During construction of Mount Pleasant and Kayuga Mines, most rural properties within these mine lease areas will still be occupied and generating traffic. For this study it is assumed that 80 per cent of these properties will still be occupied during the construction period.

However the daily traffic generated by the mines will be lower during construction than in subsequent operations, which will tend to cancel out a proportion of the increased rural traffic volumes.

8.2 REVIEW OF KAYUGA BRIDGE IMPACTS

A summary of the short term traffic changes as a result of this sequencing of events is presented in *Table 8.2* below.

Table 8.2 CONSTRUCTION PERIOD TRAFFIC CHANGES

Total Change	Traffic Volume Change (vehicles per day)	General Traffic Distribution
Traffic increases from rural properties still occupied during construction *	+300 vehicles per day	+117, Local Rural Zones (39%) +144, via Kayuga Bridge (48%) +21, via Blairmore Lane (7%) +18, via Dartbrook Link Rd (6%) +0, via Bengalla Link Rd (0%)
Traffic reductions from lower Mount Pleasant workforce during construction (250 employees)	-200 vehicles per day	-22, Local Rural Zones (11%) -80, via Kayuga Bridge (40%) -24, via Blairmore Lane (12%) -18, via Dartbrook Link Rd (9%) -56, via Bengalla Link Rd (28%)
Traffic reductions from lower Dartbrook/Kayuga workforce during construction (260 employees)	-33 vehicles per day	-3, Local Rural Zones (7%) -0, via Kayuga Bridge (0%) -0, via Blairmore Lane (0%) -30, via Dartbrook Link Rd (93%) -0, via Bengalla Link Rd (0%)

*Note: * The total of 86 rural properties identified in Section 2.6.2 of this report are distributed as follows: 25 for the Bengalla Mine and 61 for the Mount Pleasant and Kayuga Mines. Approximately 50 of these would remain occupied during construction work for the Mount Pleasant and Kayuga mine infrastructure.*

Short term traffic changes for the construction period summarised in *Table 8.2* were used to estimate corresponding daily traffic changes at Kayuga Bridge. These are summarised in *Table 8.3*.

Table 8.3 PREDICTED KAYUGA BRIDGE TRAFFIC VOLUMES DURING CONSTRUCTION

Road Network Option	Daily Traffic Volume Adjustment		
Existing 1996 Traffic *	1,841		
1998 Option 1A	$2,104 + 144 + 18 - 80 - 18$	=	2,168
1998 Option 1D	$1,829 + 144 - 80$	=	1,893
1998 Option 2A	$2,056 + 144 + 18 - 80 - 18$	=	2,120
1998 Option 2D	$1,784 + 144 - 80$	=	1,848
1998 Option 3A	$707 + 144 + 18$	=	869
1998 Option 3D	$669 + 144$	=	813
1998 Option 4A	$674 + 144 + 18$	=	836
1998 Option 4D	$636 + 144$	=	780

Note: * The traffic model calibration at the Kayuga Bridge is approximately 200-300 vehicles per day low because the model has not included through traffic from the Scone direction on Dartbrook Road.

The volumes predicted in Table 8.3 are in most cases only marginally higher than for the mine operations scenario in Table 8.1. If options are ranked on traffic increases at Kayuga Bridge, the following results are produced:

- Options least acceptable (daily traffic increases 15-18%)
 - Option 1A
 - Option 2A
- Options marginally acceptable (daily traffic increases 0-3%)
 - Option 1D
 - Option 2D
- Options definitely acceptable (daily traffic reductions 53-58%)
 - Option 3A
 - Option 3D
 - Option 4A
 - Option 4D

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APPENDICES