

MACHEnergy

Appendix C

Road Transport Assessment



MACH Energy Australia Pty Ltd

Mount Pleasant Operation Mine Optimisation Modification Road Transport Assessment

May 2017

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1. Introduction

1.1 Background

1.1.1 Overview of the Mount Pleasant Operation

MACH Energy Australia Pty Ltd (MACH Energy) acquired the Mount Pleasant Operation from Coal and Allied Operations Pty Ltd (Coal & Allied) on 4 August 2016. The approved Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated infrastructure located approximately three kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW) (Figure 1-1). The mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Mount Pleasant Operation will operate in accordance with Development Consent DA 92/97, granted by the (then) NSW Minister for Urban Affairs and Planning on 22 December 1999. When Development Consent DA 92/97 was granted in 1999, the mine was permitted to carry out mining operations for a period of 21 years (until 22 December 2020).

Development Consent DA 92/97 was subsequently modified by Coal & Allied in 2011, at which time various Consent Conditions were updated. However, the Consented time limit on mining operations (Condition 5, Schedule 2) was not updated to reflect the fact that mining had not commenced at that time.

The Mount Pleasant Operation was also approved under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) in 2012 (EPBC 2011/5795).

In March 2017 MACH Energy also sought and obtained a minor modification to Development Consent DA 92/97 for the relocation of the South Pit haul road. At this time the Department of Planning and Environment made some minor amendments to contemporise some conditions, but did not amend the operational period provided in the Development Consent.

MACH Energy recommenced the construction of the Mount Pleasant Operation in November 2016 and will commence overburden and ROM coal mining operations in 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795.

1.1.2 Overview of the modification

The Mine Optimisation Modification (the Modification) would primarily comprise:

- An extension to the permitted period of mining operations at the Mount Pleasant Operation to provide for open cut mining to 22 December 2026.
- Extensions to the Eastern Out of Pit Emplacement to better align with the underlying topography and facilitate development of a final landform that is more consistent with the characteristics of the local topography and incorporates additional waste rock capacity.

The proposed extension to the Eastern Out of Pit Emplacement would enable MACH Energy to avoid the need to emplace waste rock material in the approved South West Out of Pit Emplacement and therefore the total development area of the Mount Pleasant Operation would be unchanged.

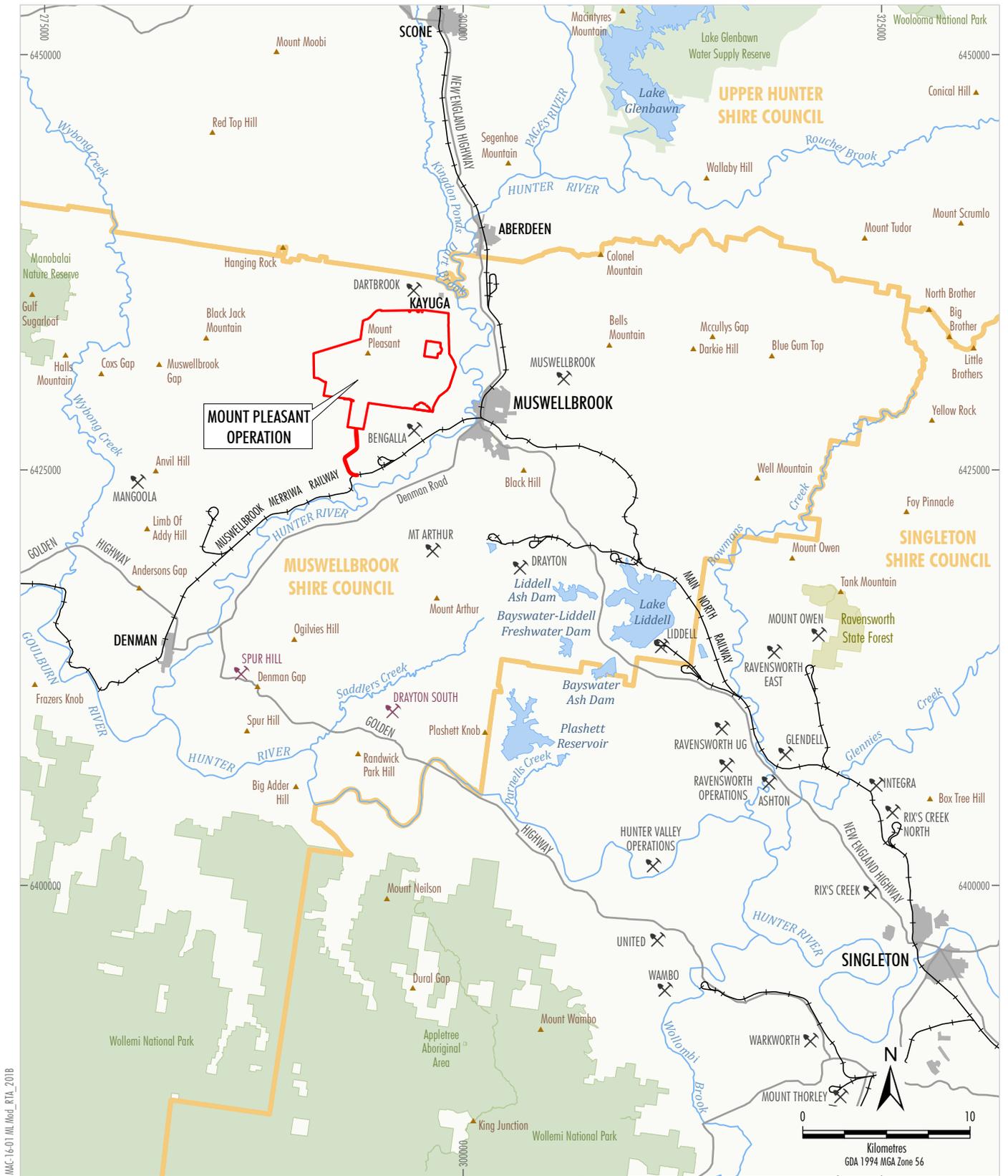
The Modification also involves some additional improvements to the final landform to be consistent with MACH Energy's intended truck and excavator mining methodology (as opposed to Coal & Allied's intended combination of truck, excavator and dragline operations) and associated minor adjustments to the development sequence of the mine.

The Modification would not increase the approved annual maximum ROM coal and waste rock production rates.

1.1.3 Assessment of the modification

This assessment has been prepared to examine the potential impact of the proposed Modification on the local road transport network. In particular, this assessment considers the potential cumulative road transport impacts of the Mount Pleasant Operation in the context of other mining developments and background traffic growth in the modified operational period to 2026.

Construction traffic was examined and has been confirmed as less than operational traffic. Therefore, this assessment has focused on the effects of operational traffic exclusively, as the impacts of the construction workforce would be lower than the peak operational (2026) impacts assessed in this report.



AMC-16-01 ML Mod_RTA_2018



- LEGEND**
- Mining Operation
 - Proposed Mining Operations (Application Lodged)
 - Mining Lease Boundary (Mount Pleasant)
 - Railway
 - Local Government Boundary
 - State Forest
 - National Parks and Wildlife Estate

Source: Geoscience Australia (2006); NSW Division of Resources & Energy (2016); Land and Property Information (2016)

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 Regional Location

Figure 1-1

1.2 Referenced materials

The following documents and reports were considered in this assessment:

- Mt Arthur Coal Consolidation Project Traffic & Transport Impact Assessment, Hansen Bailey, 21 August 2009
- Bulga Coal Optimisation Project Traffic Impact Assessment, ARC Traffic and Transport and Transport and Urban Planning, 7 December 2012
- Muswellbrook Mine Affected Roads, Stage 1 – Road Network Plan, Ver 13, Cardno, 27 August 2015
- Mangoola Coal Project – Modification 6, Traffic and Transport Impact Assessment, Hyder Consulting, 23 May 2013
- Mount Pleasant Mine Environmental Impact Statement, Section 14, ERM Mitchell McCotter, September 1997
- Wilpinjong Extension Project Road Transport Assessment, GTA Consultants, 27 October 2015
- Thomas Mitchell Drive Contributions Study, GHD, 2014

1.2.1 Traffic data

Site specific surveys were undertaken at several sites as outlined in Section 2.3. In addition, the abovementioned reports were used to derive average weekday traffic count data for key roads, specifically Thomas Mitchell Drive (2012) and Wybong Road (2013). Weekday count data for New England Highway was obtained from Roads and Maritime Services (RMS) (2017).

2. Existing conditions

2.1 Road transport network

The transport network that will carry traffic from the Mount Pleasant Operation includes several major arterial and minor roads. These roads are described in the following sections.

2.1.1 New England Highway

The New England Highway is part of the National Land Transport Network 2014, funded by the Federal Government. The Highway is managed by RMS. It connects between Newcastle and Brisbane as an inland route running parallel to the Pacific Highway. The New England Highway passes through several regional population centres including Maitland, Singleton, Muswellbrook and Tamworth. It is a key freight route of national strategic importance.

The New England Highway is typically constructed to a rural highway standard, with one lane travelling in each direction, additional turn lanes at key intersections and a posted speed limit of 100 kilometres per hour (km/h). Through population centres (such as Muswellbrook) the New England Highway is an urban arterial road with a reduced speed limit.

There is a planned future bypass for New England Highway around the eastern side of Muswellbrook. The bypass is currently in the early planning phase. Any future bypass would likely be constructed to a rural highway standard and would therefore have a higher capacity than the current urban arterial road through Muswellbrook.

2.1.2 Denman Road

Denman Road is a State Road connecting to Sydney Street at Muswellbrook and continuing west to Golden Highway at Denman. Denman Road is typically constructed to a rural highway standard, with one lane travelling in each direction and additional turn lanes at key intersections. The posted speed limit is 100 km/h, west of Bengalla Road, and 80 km/h, east of Bengalla Road (to Muswellbrook).

2.1.3 Thomas Mitchell Drive

Thomas Mitchell Drive is a local road connecting between Denman Road and New England Highway, bypassing the south of Muswellbrook. It provides access to the Muswellbrook Industrial Estate as well as the Mt Arthur Coal Mine. It also provided access to the Drayton Mine that has recently closed. Thomas Mitchell Drive is a two-lane road with a posted speed limit of 80 km/h through the industrial estate, and near Denman Road, and 100 km/h for the southern section connecting to New England Highway.

2.1.4 Wybong Road

Wybong Road is a local road connecting between Kayuga Road, at Muswellbrook, and Golden Highway at Sandy Hollow. Wybong Road connects to Bengalla Road at a give-way controlled intersection with an altered alignment where Bengalla Road – Wybong Road (west) forms the major road. East of Bengalla Road, Wybong Road does not carry significant heavy vehicle traffic as the preferred heavy vehicle route is via Bengalla Road and Denman Road. A gross load limit of 12 tonnes applies to the eastern section of Wybong Road.

Wybong Road is constructed to a rural road standard and has two lanes travelling in each direction. The approved Mount Pleasant Operation will be accessed directly off Wybong Road, east of the Bengalla Road intersection. Parts of Wybong Road will be closed in the future to permit future mining activities along the current road alignment (see Section 2.4 of this report).

In accordance with Condition 38, Schedule 3 of Development Consent DA 92/97, MACH Energy are currently undertaking minor upgrades to Wybong Road from Bengalla Road to the Mount Pleasant Operation mine access.

2.1.5 Bengalla Road

Bengalla Road (referred to as Bengalla Link Road in Development Consent DA 97/92) connects between Wybong Road and Denman Road. Along with the western portion of Wybong Road, Bengalla Road forms the preferred route for heavy vehicle traffic, including mine traffic, to the New England Highway south of Muswellbrook (via Thomas Mitchell Drive). Bengalla Road has two lanes travelling in each direction and provides direct access to the Bengalla Mine. The posted speed limit is 100 km/h.

2.1.6 Kayuga Road

Kayuga Road is a local road connecting between New England Highway (via Aberdeen Street) and the town of Kayuga, approximately 4 km north of Muswellbrook. The southern portion of Kayuga Road provides a link between Muswellbrook and the eastern end of Wybong Road.

Kayuga Road crosses the Hunter River, immediately west of the Aberdeen Street intersection, at the Kayuga Bridge, which is a single-lane, timber structure. The Mount Pleasant Operation Development Consent (DA 92/97) requires that mine related traffic from Muswellbrook travels via Bengalla Road and Denman Road rather than Wybong Road and Kayuga Road.

2.2 Key intersections

The key intersections potentially impacted by the Modification include the following:

- Wybong Road / Bengalla Road

The intersection of Wybong Road and Bengalla Road is a give-way controlled T-intersection with Wybong Road (east) forming the minor road approach. Wybong Road (west) and Bengalla Road form the major road and are the approved route for mine related traffic travelling to and from mine sites west of the Mount Pleasant Operation (e.g. the Mangoola Mine).

A channelised right turn lane (CHR) is provided for vehicles turning from Bengalla Road into Wybong Road (east) and an auxiliary left turn lane (AUL) is provided for vehicles turning from Wybong Road (west) into Wybong Road (east). A raised median island separates inbound and outbound traffic on the minor (Wybong Road) road approach. The Wybong Road upgrades (Section 2.1.4) include upgrades to the intersection of Wybong Road and Bengalla road to accommodate B-Double turning movements.

- Bengalla Road / Denman Road

The intersection of Bengalla Road and Denman Road is a give-way controlled T-intersection where Bengalla Road forms the minor road approach. A CHR is provided for vehicles turning from Bengalla Road into Wybong Road (east) and an AUL is provided for vehicles turning from Wybong Road (west) into Wybong Road (east). An eastbound acceleration lane is also provided on Denman Road downstream of the intersection. A raised median island separates inbound and outbound traffic on the minor (Bengalla Road) road approach.

- Denman Road / Thomas Mitchell Drive

The intersection of Denman Road and Thomas Mitchell Drive is a give-way controlled T-intersection where Thomas Mitchell Drive forms the minor road approach. The intersection is located approximately 850 metres east of the Denman Road / Bengalla Road intersection along Denman Road.

An auxiliary right turn treatment (AUR) is provided on Denman Road along with an AUL for vehicles turning into Thomas Mitchell Drive. Thomas Mitchell Drive has dedicated right and left turn lanes onto Denman Road.

- Kayuga Road / Wybong Road

This intersection is a give-way controlled T-intersection where Wybong Road forms the minor road approach. The intersection currently has no formal treatment.

2.3 Existing traffic volumes

2.3.1 Daily traffic volumes

Total weekday traffic volumes on a number of key roads have been obtained from the 2015 Cardno report, “Muswellbrook Mine Affected Roads, Stage 1 – Road Network Plan” Prepared for Muswellbrook Shire Council. The counts are based on a range of traffic surveys undertaken in November, 2013. An extract from Table 3-1 of the Cardno report is presented in Table 2-1.

Table 2-1 Existing weekday traffic volumes (2013)

Road Section	Total Traffic Volumes			
	Totals (vpd)	Total x Vehicle Types ¹ (vpd)		% HV of total vpd
Kayuga Road North 2013 (Shire Boundary to Wybong Road)	578	LV's	550	4.8%
		HVs & MCV's	28	
Kayuga Road East 2013 (Wybong Road to Kayuga Bridge)	1,718	LV's	1,625	5.4%
		HVs & MCV's	93	
Wybong Road West 2013 (Sandy Hollow to Mangoola Mine)	804	LV's	749	6.8%
		HVs & MCV's	55	
Wybong Road 2013 (Mangoola Mine to Bengalla Road)	1,288	LV's	1,198	6.9%
		HVs & MCV's	89	
Wybong Road East 2013 (Bengalla Road to Kayuga Road)	589	LV's	547	7.1%
		HVs & MCV's	42	
Bengalla Road North 2013 (Wybong Road to Bengalla Mine)	1,056	LV's	965	8.6%
		HVs & MCV's	91	
	2,030	LV's	1,813	10.7%

¹ HVs: Heavy vehicles, LVs: Light Vehicles, VPD = vehicles per day
MCV's: Multi-combination vehicles (B-Doubles and above)

Road Section	Total Traffic Volumes		
	Totals (vpd)	Total x Vehicle Types ¹ (vpd)	% HV of total vpd
Bengalla Road South 2013 (Bengalla Mine to Denman Road)		HVs & MCV's 218	
Thomas Mitchell Drive North 2013 (Denman Road to the Industrial Estate)	8,801	LV's 8,223	6.5%
		HVs & MCV's 577	
Thomas Mitchell Drive South 2013 (Near New England Highway)	4,146	LV's 3,579	13.6%
		HVs & MCV's 567	

Source: Cardno, 2015 (Table 3-1). Note there may be small discrepancies in totals due to rounding.

Existing daily traffic volumes have been sourced for other roads as summarised in Table 2-2. Additionally, GHD commissioned Northern Transport Planning and Engineering to undertake mid-block traffic surveys at Thomas Mitchell Drive and Kayuga Road in November 2016.

Table 2-2 Existing weekday traffic volumes (2012-2017)

Road Section	Total Traffic Volumes	
	Totals (vpd)	% HV of total vpd
New England Highway 2017 (south of Muswellbrook) <i>Source: RMS 2017</i>	9,353	20.0%
Denman Road 2012 (west of Bengalla Road) <i>Source: Hyder Consulting 2013</i>	2,993	-
Denman Road 2012 (east of Thomas Mitchell Drive) <i>Source: Hyder Consulting 2013</i>	9,392	-
Thomas Mitchell Drive North 2016 (near Denman Road)	5,006	-
Kayuga Road North 2016 (west of Wybong Road)	920	-

Of particular note is a significant reduction in the level of traffic using Thomas Mitchell Drive with daily traffic volumes in 2016 reducing by over 40% compared to those in 2013. This is primarily considered to be a result of recent mine closures and personnel reductions at a number of mines in the Hunter Valley.

From examination of morning and evening period turning movement counts (Section 2.3.2), traffic reductions were also identified on Denman Road, west of Bengalla Road, by approximately 7% and on Denman Road, east of Thomas Mitchell Drive, by approximately 27%. These have been applied to the 2013 counts as follows:

- Denman Road (west of Bengalla Road) 2016 (adjusted)
 - 2,777 vehicles per day with 9.9% HVs
- Denman Road (east of Bengalla Road) 2016 (adjusted)
 - 6,842 vehicles per day with 7.3% HVs

2.3.2 Turning movement surveys

GHD commissioned Northern Transport Planning and Engineering to undertake turning movement surveys in November 2016 at key intersections of relevance to the Modification. The surveys covered a 4-hour period in the morning (5:00 am to 9:00 am) and a 4-hour period in the afternoon (3:00 pm to 7:00 pm). Vehicle counts were separated into light vehicle and heavy vehicle movements and recorded in 15 minute increments. The results are presented in Figure 2-1 to Figure 2-4. The surveys indicate that there are relatively low traffic volumes within the road network. Denman Road and Thomas Mitchell Drive attract the highest volume of traffic, with volumes peaking between 200-300 vehicles per hour (veh/hr). Wybong Road, Bengalla Link Road and Kayuga Road carry significantly lower volumes of traffic, generally less than 100 veh/hr, with Bengalla Link Road exceeding 100 veh/hr only in the PM peak period.

While overall traffic volumes are low, the proportions of heavy vehicles are relatively large on the major haul roads. Heavy vehicle percentages range from 10% to 20% on Bengalla Link Road, Denman Road and Thomas Mitchell Drive. Wybong Road (east) and Kayuga Road have very low traffic volumes, with a maximum of 1 heavy vehicle movement recorded per hour.

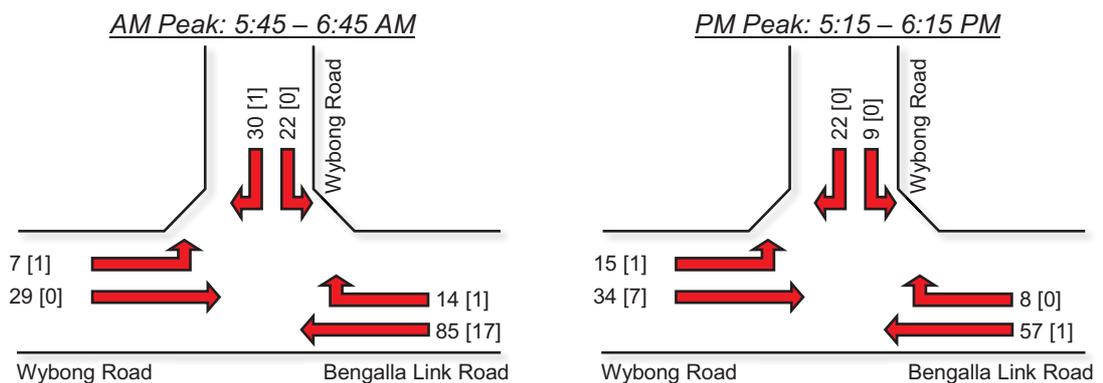


Figure 2-1 Wybong Road / Bengalla Road (all vehicles [HV])

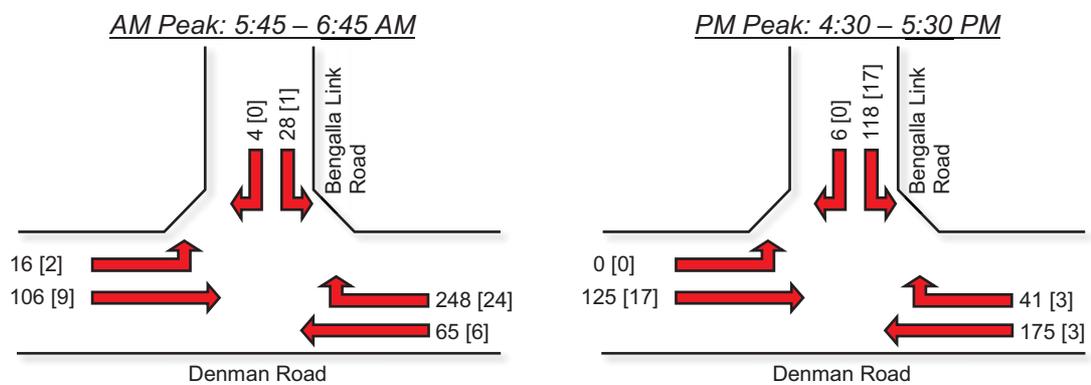


Figure 2-2 Bengalla Road / Denman Road (all vehicles [HV])

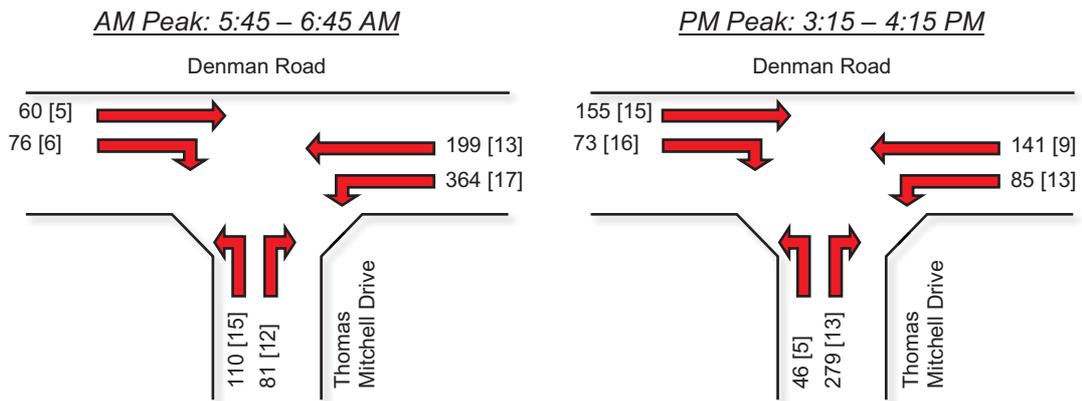


Figure 2-3 Thomas Mitchell Drive / Denman Road (all vehicles [HV])

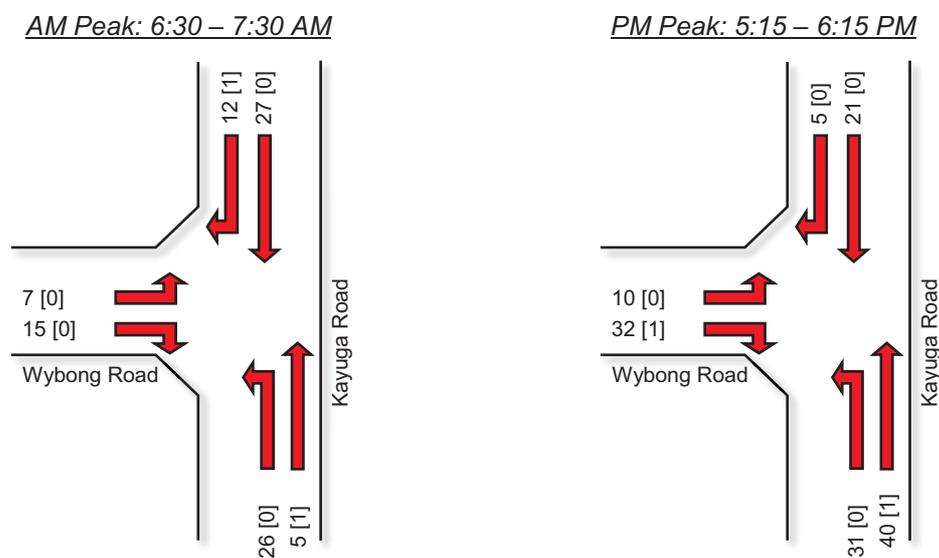


Figure 2-4 Wybong Road / Kayuga Road (all vehicles [HV])

2.4 Potential future road network changes

The *Muswellbrook Mine Affected Roads Stage 1 – Road Network Plan* report (Cardno 2015) was endorsed by Muswellbrook Shire Council at their 12 October 2015 meeting. The report identifies several key road network changes which are likely to be implemented in the short, medium and long-term. The majority of these road network changes are thought unlikely to occur during the life of the Modification (to December 2026) and have therefore not been incorporated to this study. For completeness, the subject roads are listed in Sections 2.4.1 to 2.4.4 below.

It is further noted that there were a number of road improvements listed in the 1997 consent which are required to be undertaken as the Mount Pleasant Operation progresses. These include:

- Mount Pleasant Western Link Road (including intersections) – this road is not anticipated to be constructed during the life of the Modification because the advance of the open cut is not anticipated to require the closure of Wybong Road during this time, instead access will be via Bengalla Road and Wybong Road.

- Mount Pleasant Northern Link Road (including intersections) – this road will be constructed when Castlerock Road is closed (planned to occur in approximately 2020). Mine related-traffic from the north of the Mount Pleasant Operation (e.g. Scone and Dartbrook) are not anticipated to access the site via the Northern Link Road during the life of the Modification. Instead, northern traffic will continue to access the site via Kayuga Road and Wybong Road until Wybong Road is closed and the Western Link Road is constructed.
- Contribution to intersection improvements at Denman Road / Thomas Mitchell Drive – the level of traffic using this intersection has decreased significantly in recent times such that the traffic generated by the approved Mount Pleasant Operation will not adversely impact the current intersection.

2.4.1 Closure of Wybong Road and new connection to Bengalla Road

It is proposed to close a 5.4 km section of Wybong Road, east of the Mount Pleasant Operation access, to permit mining along the current road alignment. This is not planned to occur during the life of the Modification. The Muswellbrook Mine Affected Roads Strategy (Cardno, 2015) identified an option to connect Bengalla Road to the eastern section of Wybong Road (as shown in Figure 2-5) to maintain connectivity.

2.4.2 Replace Kayuga Bridge and upgrade Aberdeen Street

It is likely that the existing Kayuga Bridge will require replacement in order to cope with increasing traffic volumes on the Kayuga Road corridor in the future. The connection from Kayuga Road to New England Highway via Aberdeen Street was also identified in the Cardno report as a priority upgrade. Any update to the Kayuga Bridge is not anticipated to affect the Mount Pleasant Operation as mine-related traffic from Muswellbrook is required to travel via Bengalla Road and Wybong Road.

2.4.3 Upgrade Wybong Road

Upgrade of Wybong Road, between the Mount Pleasant Operation Access and the Bengalla Road intersection to facilitate the approved Mount Pleasant Operation.

2.4.4 Bengalla Road diversion (long term)

In the longer term it is likely that the alignment of Bengalla Road will be modified to allow the western expansion of the Bengalla Mine (including the current road alignment) and to facilitate an improved connection to Wybong Road to the west.

The potential road network changes listed above are shown in Figure 2-5.

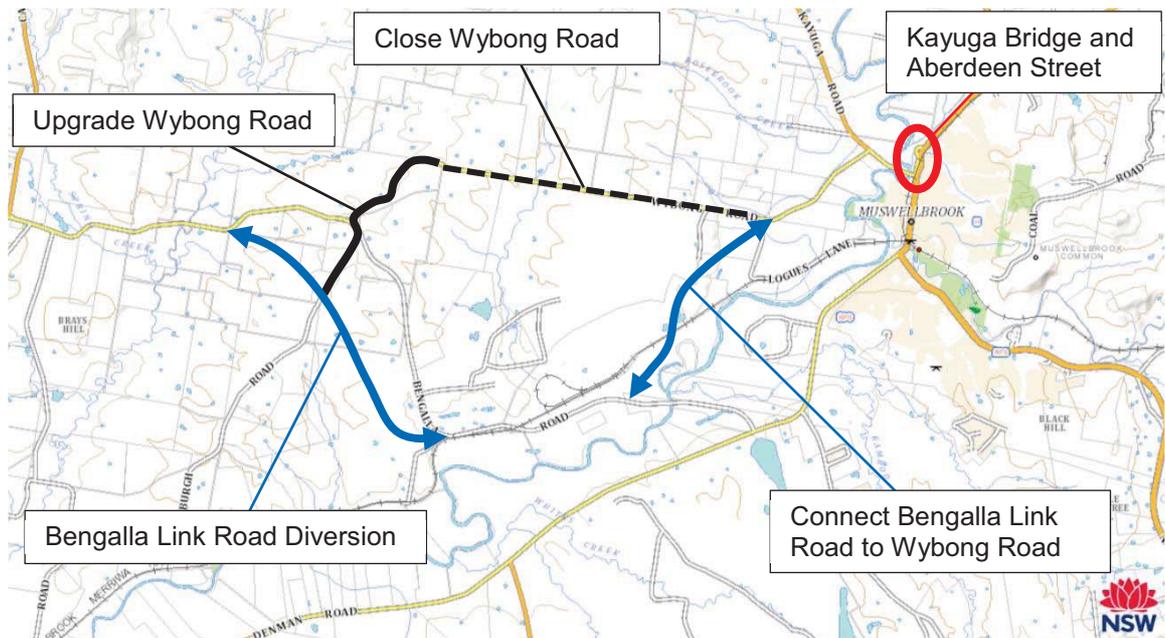


Figure 2-5 Potential future road network changes

2.5 Crash history

Crash data was obtained for the 5-year time period from 2011 to 2015 inclusive for the Muswellbrook Shire Local Government Area (LGA). A total of 418 crashes were recorded across the entire LGA including 11 fatal crashes and 223 crashes resulting in other injury. A significant proportion of total crashes occurred on the New England Highway through Muswellbrook, which is not unexpected due to it carrying significantly higher traffic volumes than other roads in the area.

The crash history on key roads potentially affected by this Modification is detailed in Table 2-3.

Table 2-3 Crash history (2011-2015)

Location	Number of Crashes		Dominant Crash Type(s) and Number of Crashes
	Total	Casualty	
Mid-block Locations			
Denman Road (Thomas Mitchell Drive to Bengalla Road)	1	0	Animal (1)
Denman Road (Bengalla Road to Edderton Road)	5	4	Run off road (3)
Thomas Mitchell Drive (Carramere Road to Mt Arthur Coal Mine Access)	4	2 (1 Fatal)	Not Applicable
Bengalla Road	2	1	Manoeuvring (2)
Wybong Road (Bengalla Road to Mangoola Road)	5	3	Run off road (5)
Wybong Road (Bengalla Road to Kayuga Road)	5	4	Run off road (4), Animal (1)

Location	Number of Crashes		Dominant Crash Type(s) and Number of Crashes
	Total	Casualty	
Kayuga Road (North of Wybong Road)	4	3	Overtaking / Side swipe (3)
<i>Intersection Locations</i>			
Denman Road / Thomas Mitchell Drive	2	1	Right turning (1), Animal (1)
Denman Road / Bengalla Road	1	1	Run off road (1)
Denman Road / Edderton Road	2	2	Run off road (1), Animal (1)
Thomas Mitchell Drive / Enterprise Crescent	1	1	Rear end (1)
Thomas Mitchell Drive / Carramere Road)	2	2	Right turning (1), Rear end (1)
Thomas Mitchell Drive / Mt Arthur Coal Mine Access	2	1	Emerging (1), Rear end (1)
Bengalla Road / Roxburgh Road	1	1	Side swipe (1)
Bengalla Road / Wybong Road	2	1	Right turning (1), Run off road (1)
Wybong Road / Kayuga Road	1	0	Right turning (1)
<i>Total</i>	40	27	

The crash history detailed in Table 2-3 does not suggest any specific road safety deficiencies in the existing road network which might be exacerbated by continued traffic generation from the Mount Pleasant Operation. It is noted that crashes were typically higher than average in severity, with over 65% of crashes resulting in casualty, which is considered reflective of the rural, high speed nature of these roads.

A single fatal occurred in 2012 on Thomas Mitchell Drive, south of the industrial estate, and involved a head on collision between two vehicles (Table 2-3).

A map showing crash locations is presented in Figure 2-6. It is noted that no crashes were recorded on Wybong Road in the vicinity of the Mount Pleasant Mine Access.

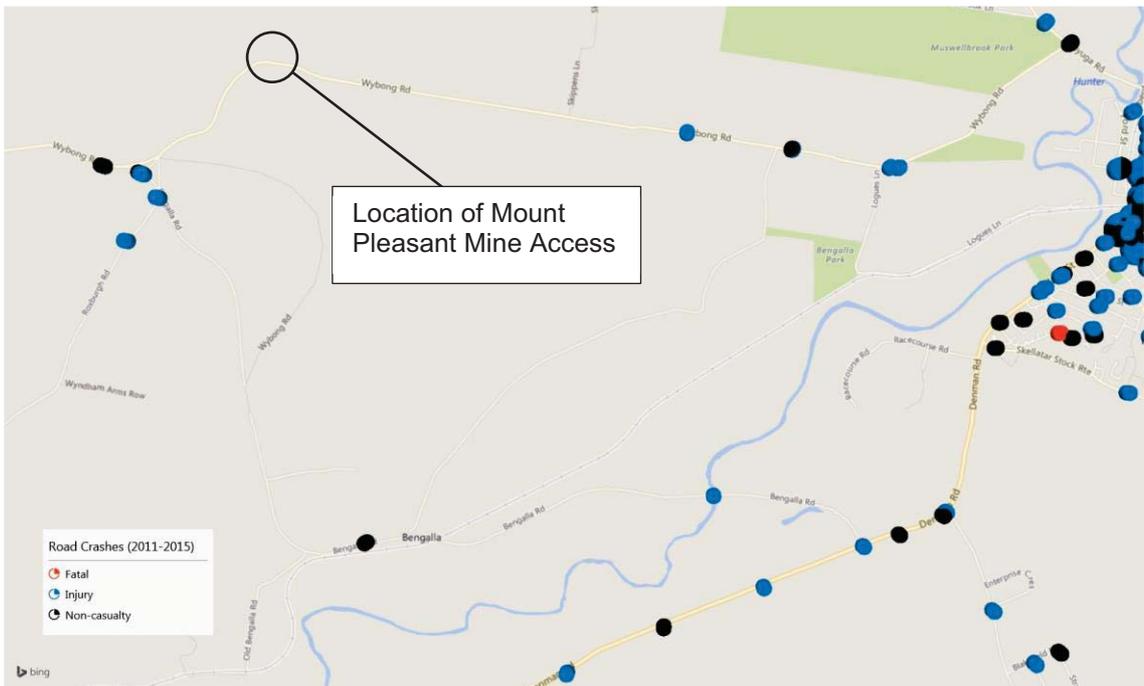


Figure 2-6 Crash history

Base image source: Bing Maps

3. Proposed development

3.1 Mount Pleasant Operation

The Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated infrastructure. The Mount Pleasant Operation is located approximately 4 km north-west of Muswellbrook in the Upper Hunter Valley of NSW.

This report considers a modification to Development Consent DA92/97 comprising the following key changes to the approved Mount Pleasant Operation:

- An extension to the time limit on mining operations to 22 December 2026 (i.e. modify Condition 5, Schedule 2 of DA 92/97).
- Minor revisions to the mining sequence and final landform to be consistent with MACH Energy's intended truck and excavator mining methodology.

3.2 Traffic generation

The traffic generation for the Mount Pleasant Operation was determined based on the proposed mine operations and personnel, and benchmarked against neighbouring mines within the surrounding area, as described in the following sections.

3.2.1 Traffic generation estimation

Operation

The approved Mount Pleasant Operation is expected to employ up to a total of 380 full time equivalent (FTE) staff during operation, including contractors. The total number of FTE staff would remain unchanged for the Modification, but their employment would be extended until December 2026. Accounting for leave entitlements and other absences, it is assumed that around 85% of FTE staff will be on-site on a particular day. An average car occupancy of 1.18 (85% solo occupant vehicles) has also been assumed. Therefore, the total daily employee traffic movements will be as follows:

- **Daily employee movements (light vehicles)**
 - Entering 275 vehicles per day
 - Exiting 275 vehicles per day

Examination of the number of employees and total traffic generation of other mines in the nearby area (obtained from *"Muswellbrook Mine Affected Roads Stage 1 – Road Network Plan"*, Cardno 2015 and other nominated sources) suggests that around 10% of all light vehicle trips are visitors. Therefore, the total daily visitor traffic movements will be as follows:

- **Daily visitor movements (light vehicles)**
 - Entering 31 vehicles per day
 - Exiting 31 vehicles per day

Heavy vehicle traffic generation was determined based on published traffic data from a range of mines including Mt Arthur Coal Mine, Mangoola Coal, Bulga Complex and others that consistently record heavy proportions of total traffic being in the range of 12% to 14%. Therefore, the number of heavy vehicle movements has been estimated to be 13% of total traffic movements as follows:

- **Daily heavy vehicle movements**
 - Entering 46 vehicles per day
 - Exiting 46 vehicles per day

MACH Energy is upgrading Wybong Road so that it can be approved as a B-Double route. Heavy vehicle traffic associated with the Mount Pleasant Operation will be limited to rigid trucks and single trailer combination vehicles until it becomes an approved B-Double route.

The proposed development is therefore expected to generate up to 704 vehicle movements per day, with a 50% entering and exiting split. Heavy vehicles will make up approximately 13% of the traffic accessing the site.

An approximate breakdown of entering and exiting traffic through the morning and afternoon peak periods has been estimated based on the Mangoola Coal access road surveys (Hyder Consulting, 2013), adjusting for shift change times. The expected traffic movements are detailed in Table 3-1.

Table 3-1 Traffic generation detail

Hour Starting	Entering		Exiting	
	Percentage of daily entering volume	No. of vehicles (total and [HVs])	Percentage of daily exiting volume	No. of vehicles (total and [HVs])
Morning				
5:00 AM	6%	23 [3]	2%	5 [1]
6:00 AM	29%	101 [13]	5%	18 [2]
7:00 AM	4%	14 [2]	19%	66 [9]
8:00 AM	2%	5 [1]	4%	15 [2]
Afternoon				
3:00 PM	2%	5 [1]	2%	5 [1]
4:00 PM	2%	5 [1]	2%	5 [1]
5:00 PM	6%	23 [3]	17%	61 [8]
6:00 PM	23%	81 [11]	5%	18 [2]
7:00 PM	4%	14 [2]	19%	66 [9]

The peak periods for analysis are 6:00 am to 7:00 am and 5:00 pm to 6:00 pm. Note that baseline traffic volumes on the external road network drop off significantly after 6:00 pm, particularly on Thomas Mitchell Drive. Therefore, the analysis period for the afternoon peak traffic modelling is between 5:00 pm and 6:00 pm, with 84 vehicles accessing the site, as opposed to 6:00 pm and 7:00 pm when more vehicles are accessing the site but total traffic volumes on the external road network are much lower.

Further, data from the Mangoola Coal access road surveys indicate that the actual afternoon peaks likely to be significantly less than the traffic movements described in Table 3-1, which have been calculated based primarily on the Mount Pleasant Operational shift times. Therefore these traffic generation assumptions result in a conservative afternoon peak assessment of the Mount Pleasant Operation.

3.2.2 Comparison with other coal mines

The number of FTE employees and the daily traffic volumes to and from a number of coal mines were obtained from various sources. The relationship between FTE employees and traffic generation is presented in Figure 3-1, noting recent personnel changes mean the numbers for Mt Arthur Coal Mine and Drayton Mine (in particular) may not accurately reflect current operations.

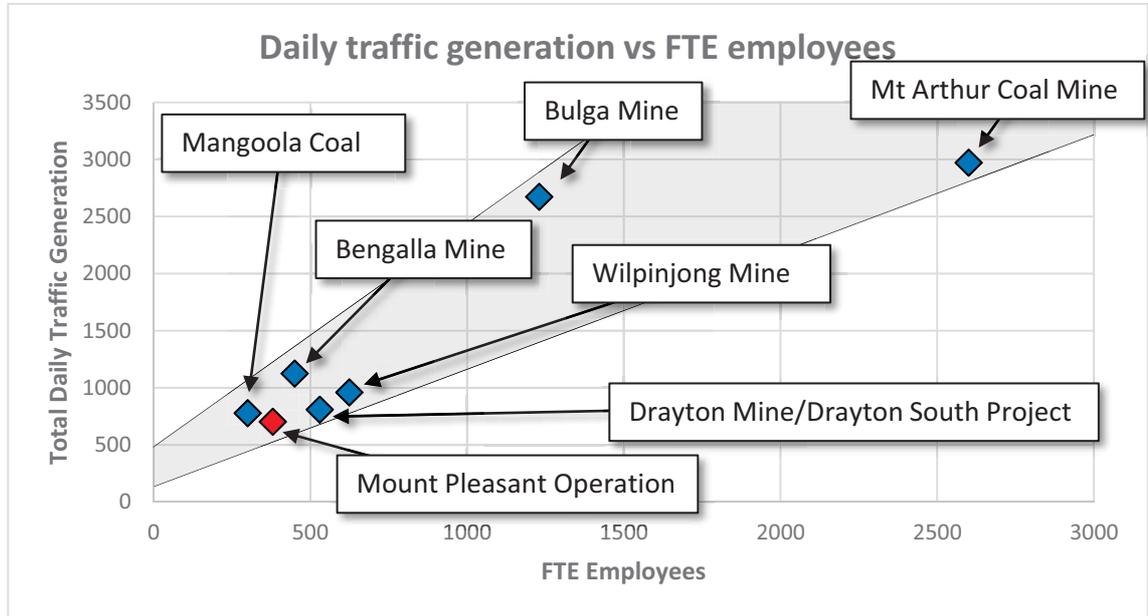


Figure 3-1 Daily traffic generation vs FTE employees

Based on the data presented in Figure 3-1, the adopted traffic generation is generally consistent with other mines that operate under similar conditions and is therefore considered to be reasonable. It is noted that the Mt Arthur Coal has significantly higher production rates than adjacent sites and a direct comparison isn't reasonable, but has been included for completeness and to demonstrate variation resulting from different production rates and methods.

4. Site access routes

4.1 Employees

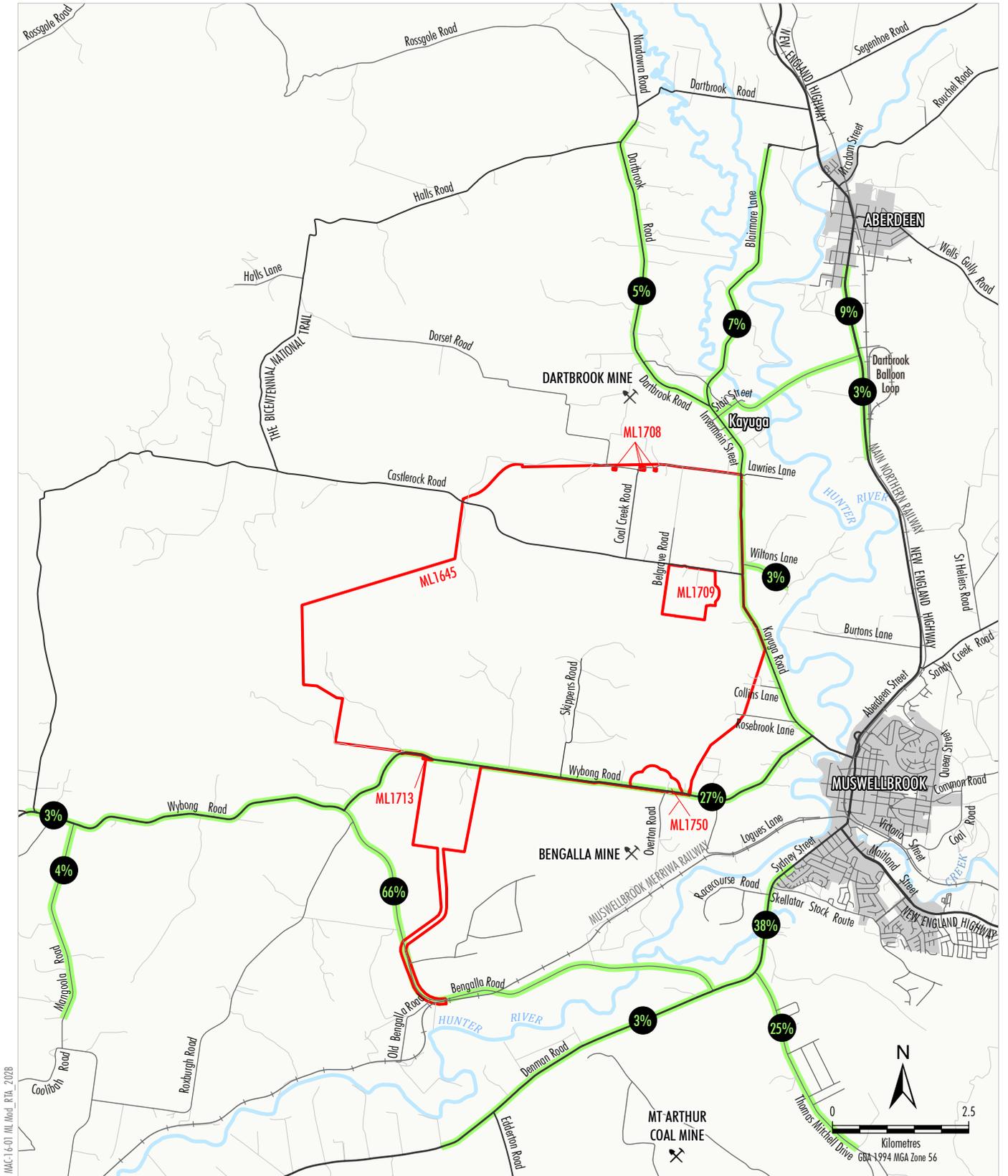
The distribution of employee trips through the road network is primarily dependent on the residential location of the workforce. An estimate of the approximate distribution was provided by MACH Energy and is summarised in Table 4-1.

Table 4-1 Employee residential distribution

Residential location	Proportion of employees	Traffic movements
Muswellbrook	44%	242 vpd
North (Aberdeen)	9%	49 vpd
North (Scone and beyond)	12%	66 vpd
West (Sandy Hollow/Denman)	10%	55 vpd
South (Singleton and beyond)	25%	138 vpd
Total	100%	550 vpd

Note: 550 vpd comprises an entry and a departure for each of the 275 employee vehicles accessing the Mount Pleasant Operation each day.

The resulting distribution of employee (light vehicle) trips on the external road network is displayed in Figure 4-1. It is noted that any future closure of Wybong Road is likely to occur after the proposed life of the Modification (22 December 2026) and has therefore not been considered in this assessment.



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- LEGEND**
- Mining Lease Boundary
 - Employee (Light Vehicle) Transport Route

Source: NSW Land & Property Information (2016); NSW Division of Resources & Energy (2016)

MACHEnergy
 MOUNT PLEASANT OPERATION
 Employee Trip Distribution

Figure 4-1

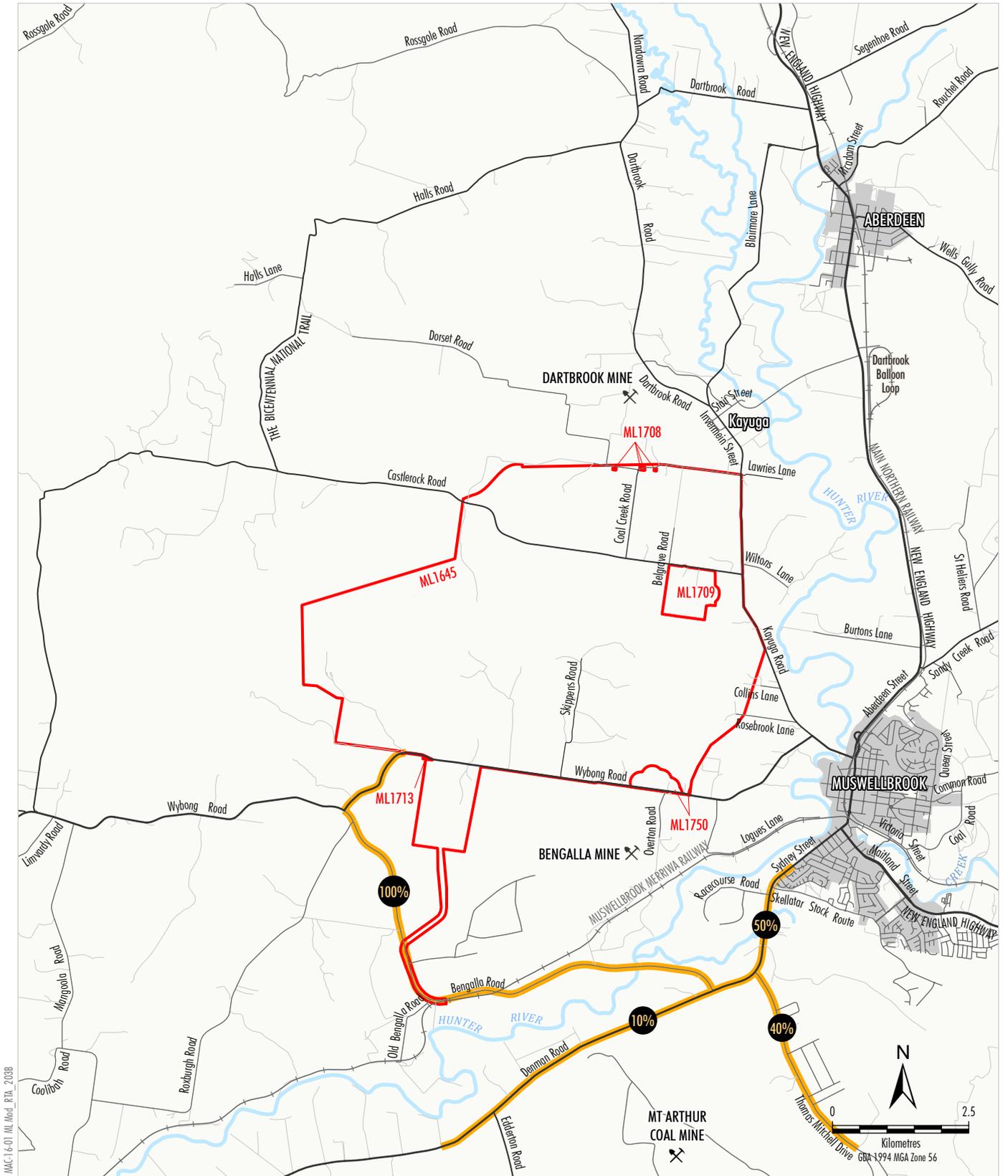
4.2 Visitors and heavy vehicles

The distribution of key visitor (light vehicle) and heavy vehicle trip destinations is presented in Table 4-2 and Figure 4-2.

Table 4-2 Visitor and heavy vehicle destinations

Route	Proportion of trips	Light vehicle movements	Heavy vehicle movements
New England Highway (north)	50%	31 vpd	46 vpd
New England Highway (south)	10%	6 vpd	9 vpd
Denman Road (west)	40%	25 vpd	37 vpd
Total	100%	62 vpd	92 vpd

The resulting distribution of visitor (light vehicle) and heavy vehicle trips on the external road network is displayed in Table 4-2. It is noted that all visitor and heavy vehicle traffic is anticipated to access the site via Bengalla Road.



MAC-16-01 ML Mod. R1A_203B

- LEGEND**
- Mining Lease Boundary
 - Visitor (Light Vehicle) and Heavy Vehicle Trip Distribution

Source: NSW Land & Property Information (2013); NSW Division of Resources & Energy (2016)

MACHEnergy
 MOUNT PLEASANT OPERATION
 Visitor and Heavy Vehicle Trip Distribution

Figure 4-2

5. Impact assessment

5.1 Traffic capacity

5.1.1 Daily traffic volumes (2018)

The Mount Pleasant Operation is approved to operate in 2018. However, there has been a significant change in baseline traffic volumes on key roads near the Mount Pleasant Operation, in particular Thomas Mitchell Drive and Denman Road. Therefore, the Base (2018) and Approved (2018) daily traffic volumes are presented in Table 5-1 to establish a base scenario for forecasting future traffic flows on roads expected to carry traffic from the Mount Pleasant Operation.

Table 5-1 Approved daily traffic volumes (2018)

Location	Base (2018)		Approved (2018)	
	Total	HVs	Total	HVs
Kayuga Road north	938	23	1,087	23
Wybong Road west	1,353	94	1,392	94
Wybong Road (Bengalla Road to mine access)	535	38	1,091	130
Wybong Road east of mine access	619	44	767	44
Bengalla Road north	1,109	96	1,626	188
Bengalla Road south	2,133	229	2,650	321
Thomas Mitchell Drive north	5,151	514	5,304	551
Thomas Mitchell Drive south	4,452	609	4,605	646
Denman Drive west	2,833	206	2,911	215
Denman Drive east	6,979	507	7,265	553
New England Highway south	9,826	1,965	9,979	2,002

5.1.2 Daily traffic volumes (2026)

Traffic volumes on key roads were forecast to 2026 by applying a nominal background traffic growth rate of 1.0% per annum (p.a.) on all roads, with the exception of Thomas Mitchell Drive, which is expected to attract a growth rate of 1.45% p.a. These rates are consistent with the analysis provided in the “*Muswellbrook Mine Affected Roads Stage 1 – Road Network Plan*” (Cardno 2015).

In addition to background traffic growth, there are a number of mine expansions and new mines to be developed in the short to medium term which need to be considered in future traffic growth forecasting including the following:

- Bengalla Mine expansion from 450 FTE employees (current) to around 900 FTE employees, resulting in an additional 1,120 vehicle movements per day (2.49 trips per FTE)

- Mangoola Coal expansion from 300 FTEs (current) to around 540 FTEs, resulting in an additional 620 vehicle movements per day (2.58 trips per FTE)

The additional traffic listed above has been spread across the road network to determine future (2026) traffic conditions approximately according to the traffic distribution in Section 4 of this report, accounting for the varying mine access locations.

Therefore, the changes in daily traffic volumes compared to the base scenario in 2026 are presented in Table 5-2.

Australian Pacific Coal Limited have indicated they intend to re-open the underground Dartbrook Mine and lodge an application for future open cut mining. However, the Dartbrook Mine's contribution to traffic on the roads in Table 5-2 is anticipated to be negligible given Condition 72(f)(ii) of Development Consent (DA 231-07-2000) requires all Dartbrook Mine personnel to access the site via the New England Highway and the western access road constructed for the mine.

Table 5-2 Change in daily traffic volumes (2026)

Location	Base (2026)		Proposed (2026)		Percent change	
	Total	HVs	Total	HVs	Total	HVs
Kayuga Road north	1,421	24	1,569	24	+10%	-
Wybong Road west	1,565	181	1,604	181	+2%	-
Wybong Road (Bengalla Road to mine access)	986	41	1,542	133	+56%	+223%
Wybong Road east of mine access	1,076	48	1,225	48	+14%	-
Bengalla Road North	1,964	249	2,481	341	+26%	+37%
Bengalla Road south	3,525	473	4,042	565	+15%	+19%
Thomas Mitchell Drive north	6,201	663	6,354	700	+2%	+6%
Thomas Mitchell Drive south	5,121	710	5,274	746	+3%	+5%
Denman Drive west	3,123	244	3,201	254	+3%	+4%
Denman Drive east	8,214	660	8,500	706	+3%	+7%
New England Highway south	10,597	2,119	10,750	2,156	+1%	+2%

The traffic generated by the Modification will result in a material increase in daily traffic volumes on two key routes as follows:

- Total daily traffic volumes on Wybong Road (east of the Mount Pleasant Operation site access) and Kayuga Road (north of Wybong Road) are expected to increase by around 14% and 10% compared to the base conditions respectively. It is noted that the increase in traffic on these roads is light vehicles only.
- Total daily traffic volumes on Wybong Road (west of the Mount Pleasant Operation site access and east of Bengalla Road) are expected to almost double, with a significant proportional increase in heavy vehicle traffic. These increases are not unexpected as this section of Wybong Road currently has very low traffic volumes and is expected to attract 100% of the mine's heavy vehicle traffic and 73% of the light vehicle traffic.
- Total daily traffic volumes on Bengalla Road are expected to increase by around 26% on the northern section (near Wybong Road) and 15% on the southern section (near Denman Road), with a significant proportional increase in heavy vehicle traffic.
 - It is noted that the northern section of Bengalla Road carries significantly lower traffic flows than the southern section due to access routes for the Bengalla Mine, however it is constructed to a similar standard.

5.1.3 Peak hour intersection modelling

The key intersections which will experience increased traffic flows as a result of the Modification include the intersections of Wybong Road, Bengalla Road, Denman Road and Thomas Mitchell Drive. The minimum required treatments are already considered to be in place at these locations including turn lanes at Wybong Road / Bengalla Road and Bengalla Road / Denman Road.

The intersection of the site access with Wybong Road would be designed to meet the minimum design standard, with specific turn treatments not considered necessary. This is due to the low traffic volumes within the area, and with Bengalla Road being the main access point to the site, the major movement at the intersection being left-in and right-out.

It is recommended that the width of the intersection be designed to accommodate simultaneous movement by entering and exiting B-Double vehicles for when Wyong Road is upgraded to become an approved B-Double route.

The four intersections of the above listed roads were modelled using SIDRA Intersection 7 Network Modelling for 2018 and 2026 conditions. The results for the worst movement at each intersection are summarised in Table 5-3.

Table 5-3 Intersection modelling – Degree of saturation (volume/capacity) and Level of Service

Location	Base 2018	Approved 2018	Base 2026	Proposed 2026
AM peak (6:00 – 7:00 AM)				
Wybong Road / Bengalla Road	0.043 LOS A	0.102 LOS A	0.075 LOS A	0.136 LOS A
Denman Road / Bengalla Road	0.215 LOS B	0.281 LOS B	0.320 LOS B	0.388 LOS B

Location	Base 2018	Approved 2018	Base 2026	Proposed 2026
AM peak (6:00 – 7:00 AM)				
Denman Road / Thomas Mitchell Drive	0.222 LOS B	0.247 LOS B	0.320 LOS C	0.357 LOS C
Wybong Road / Kayuga Road	0.025 LOS A	0.037 LOS A	0.035 LOS A	0.048 LOS A
PM peak (6:00 – 7:00 PM)				
Wybong Road / Bengalla Road	0.028 LOS A	0.037 LOS A	0.045 LOS A	0.053 LOS A
Denman Road / Bengalla Road	0.120 LOS A	0.154 LOS B	0.181 LOS B	0.232 LOS B
Denman Road / Thomas Mitchell Drive	0.359 LOS B	0.393 LOS B	0.489 LOS C	0.534 LOS C
Wybong Road / Kayuga Road	0.037 LOS A	0.043 LOS A	0.041 LOS A	0.050 LOS A

LOS: Level of Service.

With the exception of the Denman Road / Thomas Mitchell Drive intersection, all movements operated at LOS A or LOS B under existing, proposed and future traffic conditions with low average delays. The worst performing movement was the right turn from Thomas Mitchell Drive onto Denman Road which operated at LOS B for the 2018 baseline and approved models decreasing to LOS C under the baseline and proposed 2026 conditions. The maximum degree of saturation (0.534) suggests significant spare capacity remains in this intersection.

It is acknowledged that the modelling undertaken in the “Mt Arthur Coal Consolidation Project Traffic & Transport Impact Assessment” (Hansen Bailey, 2009) indicated that the Thomas Mitchell Drive / Denman Road intersection would operate at LOS F in 2019 and that an upgrade to a full seagull intersection would be required.

However, traffic volumes on Thomas Mitchell Drive and Denman Drive have been found to have reduced significantly in recent times (since 2013) due to various factors as discussed in Section 2.3.1 of this report. As such, the peak hour 2019 turning movement forecasts reported in the 2009 report are up to 15% higher than the 2026 forecasts provided in this report. In particular, is a large reduction in *right turns* from Thomas Mitchell Drive onto Denman Road (noting that this movement is not performed by vehicles accessing the Mount Pleasant Operation).

It is therefore considered that the LOS C result for Thomas Mitchell Drive provided in Table 5-3 of this report is appropriate given the changed traffic conditions in the area. Based on the modelling results, the surrounding road network is considered to be capable of absorbing the traffic generated by the Modification without significant adverse impact on delays or capacity.

5.2 Road safety

From Section 2.5 of this report, the crash history for roads surrounding the mine site does not suggest any particular road safety deficiencies which might be exacerbated by the proposal. Therefore, in the absence of any specific issues, it is considered that the crash rate (per vehicle-km) would be relatively constant and the number of crashes related primarily to changes in traffic volume.

Based on this, the Mount Pleasant Operation is not expected to cause significant detriment to road safety performance on the external traffic network.

6. Recommendations and conclusions

The Modification would not result in an increase to the approved workforce or traffic generated by the Mount Pleasant Operation.

Notwithstanding, this report has investigated the potential cumulative traffic and road network impacts of the Mount Pleasant Operation in the context of other mining developments and background traffic growth in the Modification operational period to 2026.

Comparison of previous and recent traffic survey data indicates a reduction in traffic on a number of roads relevant to the Mount Pleasant Operation. Of particular note is a significant reduction in the level of traffic using Thomas Mitchell Drive, with daily traffic volumes in 2016 reducing by over 40% compared to those in 2013. This is primarily considered to be a result of recent mine closures and personnel reductions at a number of mines in the Hunter Valley.

Traffic generated by the Mount Pleasant Operation has been estimated based on the approved mine operations and personnel, and benchmarked against neighbouring mines within the surrounding area. In summary:

- The Mount Pleasant Operation is expected to attract up to 704 vehicles movements per day with a 50% entering and exiting split. Heavy vehicles will make up approximately 13% of the traffic accessing the site (92 heavy vehicles per day).
- 119 vehicles are estimated to access the site, including 15 heavy vehicles, during the morning peak hour (which occurs between 6:00 am and 7:00 am).
- 99 vehicles accessing the site, including 13 heavy vehicles, during the evening peak hour (which occurs between 6:00 pm and 7:00 pm). Importantly, this peak hour occurs after the background peak on the public road network. Therefore, 5:00 pm and 6:00 pm was selected as the analysis period for the afternoon peak traffic modelling, when 84 vehicles are estimated to access the site.
- The largest changes in traffic will occur on Bengalla Road and Wybong Road (between the site access and the intersection with Bengalla Road).
- SIDRA Intersection modelling has been undertaken of the approved Mount Pleasant Operation traffic volumes during the revised operational period (2026). This modelling indicates that the additional traffic generated by the Mount Pleasant Operation during peak periods will not adversely impact on the operation of key intersections in 2026.

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