Evolution MINING

APPENDIX H
Road Transport Assessment

COWAL GOLD OPERATIONS
PROCESSING RATE MODIFICATION

Environmental Assessment
2018

Resource Strategies

GTAconsultants

Cowal Gold Operations Modification 14 Road Transport Assessment

Client // Evolution Mining (Cowal) Pty Limited
Office // NSW
Reference // N116060
Date // 27/02/18

Cowal Gold Operations

Modification 14

Road Transport Assessment

Issue: A 27/02/18

Client: Evolution Mining (Cowal) Pty Limited
Reference: N116060
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
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GTAconsultants

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1. Introduction

Evolution Mining (Cowal) Pty Limited (Evolution) is the owner and operator of the Cowal Gold Operations (CGO) located approximately 38 kilometres (km) north-east of West Wyalong in New South Wales (NSW) (Figure 1.1).

Recent feasibility studies have identified potential opportunities to maximise the ore processing capacity of CGO's existing process plant. On this basis, Evolution proposes to modify Development Consent DA 14/98 under Section 75W of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) to increase the CGO's approved ore processing rate from 7.5 million tonnes per annum (Mtpa) to 9.8 Mtpa (herein referred to as the Modification).

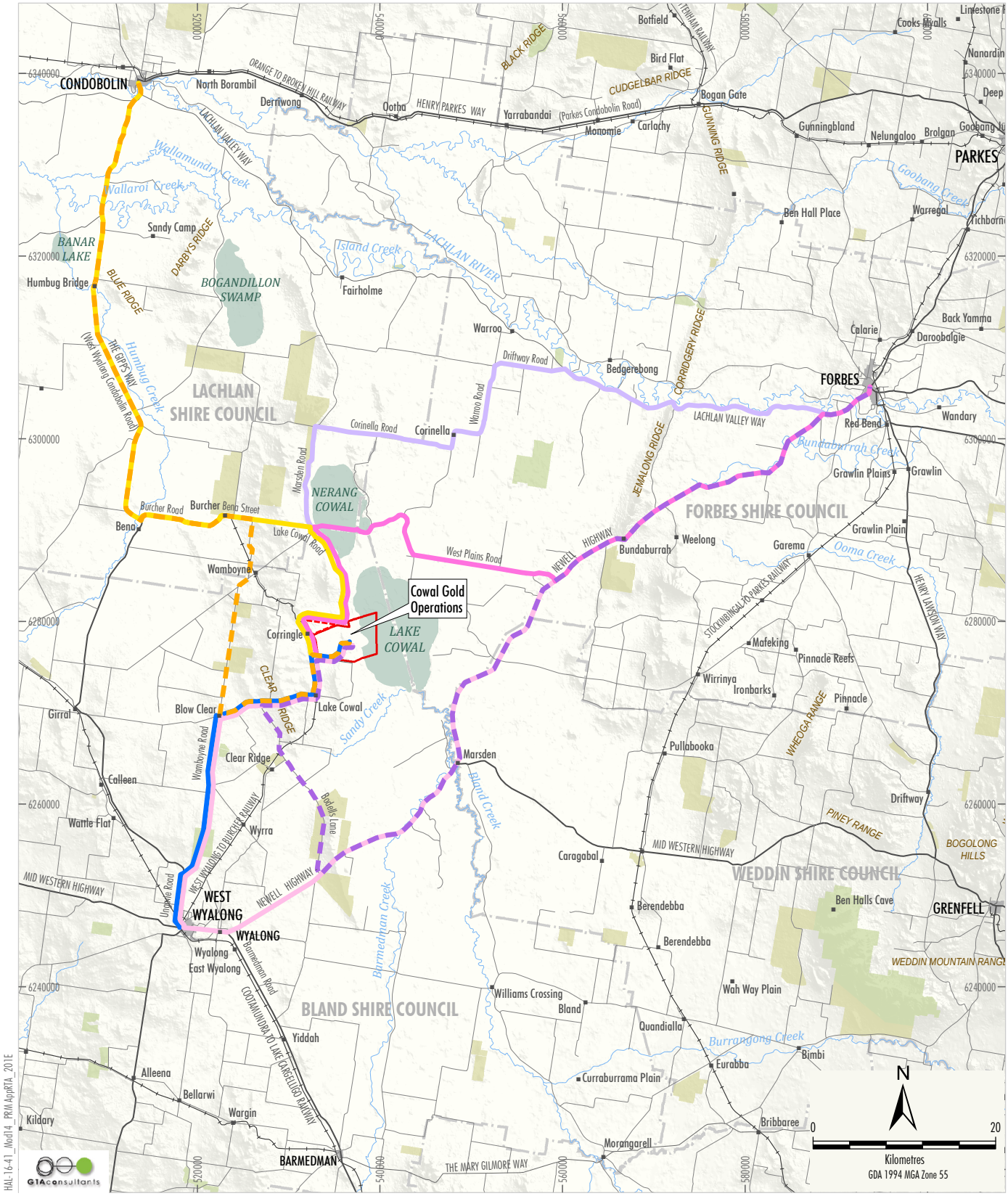
The main activities associated with development of the Modification would include:

- increasing the ore processing rate from 7.5 Mtpa to 9.8 Mtpa;
- modification of the existing Tailings Storage Facilities (TSFs) to form one larger TSF, which would also accommodate mine waste rock (herein referred to as the Integrated Waste Landform);
- relocation of water management infrastructure (i.e. the Up-Catchment diversion system and approved location for contained water storage D10) and other ancillary infrastructure (e.g. internal roads and soil and ore stockpiles) elsewhere within Mining Lease (ML) 1535 and within a new Mining Lease Application Area;
- installation of a secondary crushing circuit within the existing process plant area;
- duplication of the existing water supply pipeline across Lake Cowal;
- increased annual extraction of water from the CGO's external water supply sources;
- increased consumption of cyanide and other process consumables;
- an increase in the average and peak workforce employed at the CGO;
- relocation of a travelling stock reserve and Lake Cowal Road; and
- provision of crushed rock material to local councils to assist with road base supplies.

This report accompanies an Environmental Assessment prepared in accordance with the EP&A Act, with reference to the transport component of the Secretary's Environmental Assessment Requirements (SEARs) issued for the Modification. The road transport component of the SEARs issued by the NSW Department of Planning and Environment for the Modification indicates that:

> *The EA must address the following specific issues: […]*
>
> *- **Transport** – including an assessment of the likely transport impacts of the proposed modification on the capacity, condition, safety and efficiency of the road network;*

In addition, the SEARs refer to guidelines which are relevant to the assessment, including the RMS (formerly Roads and Traffic Authority [RTA]) *Guide to Traffic Generating Developments* (RTA, 2002) the RMS's *Road Design Guide* (N.D) and relevant Australian Standards. It is noted that RMS and other road agencies have adopted the Austroads guides and the Australian Standards as the primary technical references, together with RMS Supplements, rather than the RMS Road Design Guide referred to in the SEARs.



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- National Park & Nature Reserve
- State Forest
- Local Government Area Boundary
- Railway
- Existing Mine Access Route (West Wyalong)
- Existing Preferred Mine Access Route (Condobolin)
- Existing Preferred Mine Access Route (Forbes)
- Existing Mine Access Route (Forbes - Sealed Network)
- Existing Temporary Mine Access Route (Forbes - High Water Level 1)
- Proposed Mine Access Route (Condobolin - Sealed Network)
- Proposed Temporary Mine Access Route (Forbes - High Water Level 2)

Source: Geoscience Australia (2006); NSW Department Planning and Environment (2017); Office of Environment and Heritage NSW (2017)

Evolution MINING Cowal

CGO PROCESSING RATE MODIFICATION

Cowal Gold Operations Location and Regional Road Networks

Figure 1.1

2. Cowal Gold Operations and Modification

Road transport aspects of the CGO and the Modification are described in the section. Existing operational conditions described herein refer to those conditions which occurred in mid to late 2017, and coincide with the conduct of traffic surveys (Section 3.4).

2.1 Cowal Gold Operations

The CGO is located on the western side of Lake Cowal, approximately 38 km north-east of West Wyalong, 65 km south-east of Condobolin and 65 km southwest of Forbes.

ML 1535 is located within the Bland Local Government Area (LGA), while the Bland Creek Palaeochannel and Eastern Saline Borefields are located within the Forbes LGA (Figure 1.1). The preferred access route to the CGO from Condobolin is located within the Lachlan LGA.

The CGO operates 24 hours a day, seven days a week, and is approved to operate to 31 December 2032.

2.1.1 Vehicular Access Routes

Vehicular access to the CGO is provided via Bonehams Lane. The preferred access routes to and from West Wyalong, Forbes and Condobolin were nominated in the Environmental Impact Statement (EIS), and Condition 7.1(a), Schedule 2 of the CGO Development Consent (DA 14/98) states:

a) Mine site access road

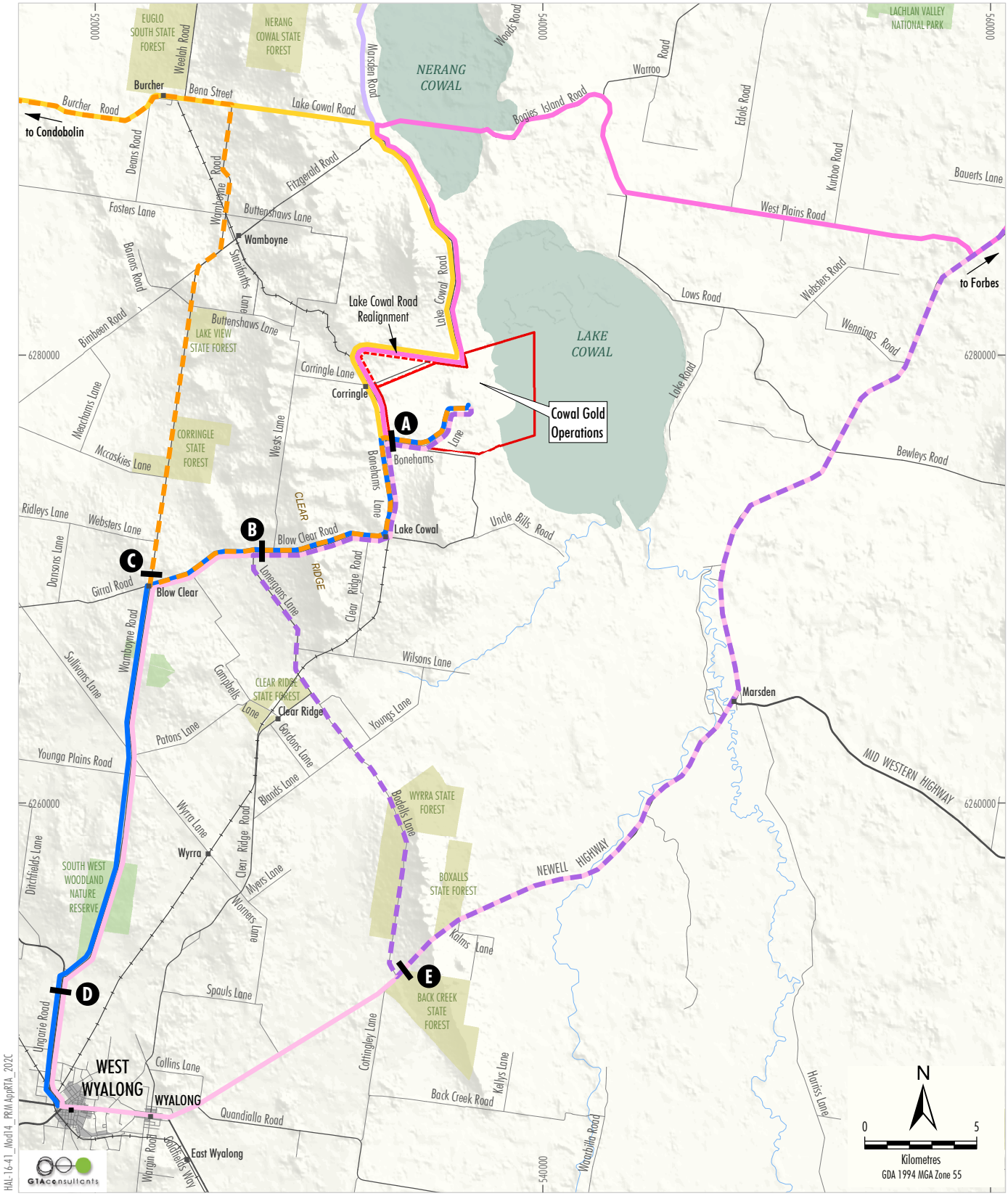
The Applicant shall use its best endeavours to ensure that the preferred mine access road routes as described in the EIS are the only routes used by employees and contractors travelling to and from the mine site.

The existing preferred mine access routes described in the EIS are presented in Figure 1.1 and Figure 2.1. The existing preferred mine access route from West Wyalong is:

- Ungarie Road;
- Wamboyne Road;
- Blow Clear Road;
- Bonehams Lane; and
- the approved mine access road.

The existing preferred mine access route from Condobolin is:

- The Gipps Way;
- Burcher Road;
- Bena Street;
- Lake Cowal Road (east-west);
- Fitzgerald Road;
- Lake Cowal Road (north-south); and
- the approved mine access road.



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- National Park & Nature Reserve
- State Forest
- Railway
- Existing Mine Access Route (West Wyalong)
- Existing Preferred Mine Access Route (Condobolin)
- Existing Preferred Mine Access Route (Forbes)
- Existing Mine Access Route (Forbes - Sealed Network)
- Existing Temporary Mine Access Route (Forbes - High Water Level 1)
- Proposed Mine Access Route (Condobolin - Sealed Network)
- Proposed Temporary Mine Access Route (Forbes - High Water Level 2)
- Traffic Survey Location

Source: Geoscience Australia (2006); NSW Department Planning and Environment (2017); Office of Environment and Heritage NSW (2017)

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CGO PROCESSING RATE MODIFICATION

Local Road Networks

Figure 2.1

On occasions, unsealed roads in the region are closed due to weather conditions, so parts of the preferred mine access route from Condobolin are not available. Under these circumstances, mine traffic from Condobolin uses an alternative route made up of sealed roads only:

- The Gipps Way;
- Burcher Road;
- Bena Street;
- Wamboyne Road (Fitzgerald Road);
- Blow Clear Road;
- Bonehams Lane; and
- the approved mine access road.

The existing preferred mine access route from Forbes is:

- Newell Highway;
- West Plains Road;
- Bogies Island Road;
- Lake Cowal Road (east-west);
- Fitzgerald Road;
- Lake Cowal Road (north-south); and
- the approved mine access road.

When the water level is high in Lake Cowal/Nerang Cowal, the Forbes access route via Lake Cowal Road and Bogies Island Road is closed. Under these circumstances, mine traffic from Forbes uses:

- Newell Highway;
- Lachlan Valley Way;
- Driftway Road;
- Warroo Road;
- Corinella Road;
- Marsden Road;
- Lake Cowal Road (east-west);
- Fitzgerald Road;
- Lake Cowal Road (north-south); and
- the approved mine access road.

On occasions, unsealed roads in the region are closed due to weather conditions. When this occurs, neither the preferred route nor the alternative high water route are available, and mine traffic from Forbes travels via West Wyalong, on a route made up of sealed roads only:

- Newell Highway;
- Ungarie Road;
- Wamboyne Road;
- Blow Clear Road;
- Bonehams Lane; and
- the approved mine access road.

2.1.2 Workforce

The workforce at the CGO includes 333 Evolution employees and 108 on-site contractors (July 2017). Not all workers are present at the CGO each day, and roster and shift arrangements vary for the employees and contractors. Gate log data for the two-month period including August and September 2017 indicates that the number of workers (employees and contractors) present at the CGO each day is as shown in Table 2.1.

Table 2.1: Daily Attendance at CGO August-September 2017

Day	Average Workers Present Per Day
Monday	309
Tuesday	335
Wednesday	340
Thursday	338
Friday	258
Saturday	162
Sunday	154

Includes Evolution employees and contractors, and excludes attendance on shutdown days 11-14 September

The number of people at the CGO is distinctly lower on weekend days than on weekdays. Average weekday attendance is 316 people on site. As a result of roster and shift arrangements, the average attendance on Mondays is slightly below average, and on Fridays is well below average. Tuesday to Thursday attendance is reasonably consistent at an average of 338 people, and these are the busiest days of the typical operating week. It is assumed that of the total people present each day, approximately three-quarters are Evolution employees, and one-quarter are on-site contractors, consistent with the overall workforce composition.

The workers reside in the local area, noting some live more remotely but reside locally during their rostered on periods. The distribution of residential locations of the Evolution employees (while the employees are on shift) is:

- 70.4 percent West Wyalong;
- 10.7 percent Forbes;
- 7.1 percent Other (Barmedman, Bedgerabong, Burcher, Girral, Lake Cowal, Tallimba, Ungarie, Ariah Park, and Warroo);
- 6.8 percent Wyalong; and
- 5.0 percent Condobolin.

Information from the four main on-site contracting companies indicates that the significant majority of contractors reside in West Wyalong, either as local residents or as drive-in drive-out or fly-in fly-out workers staying in company accommodation.

2.1.3 Workforce Transport Characteristics

Workers at the CGO are transported to and from the site using a combination of private vehicles and company-supplied vehicles including shuttle buses.

Evolution provides shuttle bus services to transport its workforce between the CGO and West Wyalong, Forbes and Condobolin. The shuttle bus fleet includes coaches and smaller capacity buses, such as Coasters. Some services operate with a combination of a smaller bus and a coach to meet demand. On Tuesdays to Fridays, the following services operate each day:

- From West Wyalong – 5 small buses and 3 coaches;
- To West Wyalong – 6 small buses and 3 coaches;
- From Condobolin – 2 small buses;
- To Condobolin – 2 small buses;
- From Forbes – 2 small buses; and
- To Forbes – 2 small buses.

Between West Wyalong and the CGO, the buses use the preferred mine access route. Alternative routes exist for the buses to and from Forbes and Condobolin depending on the road conditions. The buses from Forbes use the same routes as described in Section 2.1.1, being the preferred mine access route, the high water alternative route or the sealed road routes depending on road conditions. The buses from Condobolin use the preferred mine access route, unless it is untrafficable due to rain, when a sealed road alternative route is used. The sealed road alternative route for buses from Condobolin is via The Gipps Way, Burcher Road, Bena Street, Wamboyne Road, Blow Clear Road, Bonehams Lane and the approved CGO access road.

Evolution has indicated that, in addition to the shuttle bus services, administration employees travelling to and from Forbes and Condobolin self-drive a small commuter bus between each of those towns and the CGO.

Some of the on-site contractors also operate bus services for their workers to and from West Wyalong. The four main contracting companies at the CGO are BK Hire, SRG, Boart Longyear and Maxam. Travel and employment information supplied by each of the four main contracting companies has been reviewed and is discussed below.

BK Hire: These workers are transported to and from the CGO in a combination of light vehicles and small buses. A review of the travel mode and residential location of the 32 workers indicates the following vehicles are used to transport workers to and from the CGO:

- 6 light vehicles to/from West Wyalong (carrying 14 people including drivers);
- 2 buses to/from West Wyalong (carrying 15 people including drivers);
- 1 light vehicle to/from Condobolin;
- 1 light vehicle to/from Burcher; and
- 1 light vehicle to/from Weethalle.

Boart Longyear: Each crew of three workers travels to and from the CGO in a utility vehicle and work day or night shifts which start or end at 6.00 am and 6.00 pm. Day shift also includes a supervisor and mechanic who each travel in separate utilities. They exclusively reside in West Wyalong, either as local residents or as fly-in fly-out workers staying in company accommodation, so all vehicles only use the preferred mine access route to and from West Wyalong. At the start and end of their shifts, those workers are driven to or from Parkes Airport by a supervisor or other available worker.

Maxam: Two crews of four workers travel to and from the CGO in company supplied transport, and work day shifts between 6.00 am and 6.00 pm. A supervisor works between 6.00 am and 4.00 pm. All personnel reside in West Wyalong, either as local residents or as fly-in fly-out workers, so all employee transport vehicles only use the preferred mine access route to and from West Wyalong.

SRG: Workers are present for day and night shifts which start and end at 6.00 am and 6.00 pm. A typical day shift includes 18 personnel, and night shift includes 14 personnel. All personnel reside in West Wyalong either as local residents or as fly-in fly-out workers, and travel to and from the CGO in company supplied transport. The vehicles include a small bus, a large 5-seat dual cab utility and two 2-seat utilities. These vehicles use the preferred mine access route to and from West Wyalong.

2.1.4 Other Transport Characteristics

Evolution's delivery records for September 2017 indicate that over the month, there was 143 heavy vehicle deliveries to the CGO. The deliveries are made by a range of articulated vehicles including semitrailers, B-doubles, tankers and isotainer trucks. In addition, deliveries for the on-site contractors include B-doubles for explosives deliveries and floats for transporting plant and equipment to and from the CGO.

The sources of deliveries for Evolution (i.e. excluding deliveries for contracting companies) are summarised in Table 2.2.

Table 2.2: Heavy Vehicle Deliveries to CGO September 2017

Source	Percent of Deliveries
Sydney	55.2
West Wyalong	25.2
Yarwun via Dubbo	9.1
Galong	4.9
Kooragang	2.8
Wollongong	2.1
Melbourne	0.7

Considering the sources of the Evolution delivery trips, the majority of heavy vehicle deliveries from beyond West Wyalong would approach the CGO via Newell Highway east of West Wyalong, using the preferred mine access route via Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane. Vehicles making deliveries from West Wyalong use the preferred mine access route via Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane.

Activity at the CGO also generates vehicle trips by visitors who are not direct employees or contractors. Evolution's records for August and September 2017 indicate that over those two months, there were 1,460 individual visitors to the CGO. The majority of visitors attend the site on weekdays rather than weekends, and the number of visitors on any one day can vary. Visitors are transported in a variety of vehicle types, including light vehicles and small buses. It is expected that visitors are drawn from similar locations to the delivery trip locations, with the majority of visitors approaching the CGO via West Wyalong, and using the preferred mine access route via Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane. Visitors in light vehicles approaching from Newell Highway north-east of the CGO would tend to use the preferred mine access route to and from Forbes. A small number of visitors in light vehicles may approach via the preferred mine access route to and from Condobolin.

2.2 The Modification

The main activities associated with development of the Modification are described in Section 1. The general arrangement of the Modification is presented in Figure 2.2.

2.2.1 Modification Construction

The Modification will result in changes to the peak construction workforce and the timing of construction works. During peak construction activity, the total workforce at the CGO is anticipated to be 540 people.

Construction activity would include pipeline construction, which would involve activity on both the eastern and western sides of Lake Cowal and the realignment of part of Lake Cowal Road.

2.2.2 Modification Operations

The Modification would result in an increase in the operational workforce and increased deliveries to the CGO during the mine life. The operational workforce (including Evolution staff and on-site contractor's personnel) would increase by 10 workers, and an increase of approximately 25 percent in deliveries is anticipated with the Modification.

Up to 150,000 tonnes per annum (tpa) of waste rock from the CGO operations would be crushed and made available for on-site collection by the Bland, Forbes and Lachlan Shire Councils and Roads and Maritime Services (RMS) for their use or stockpiling for road base or otherwise as permitted. Crushing would occur on-site using a mobile crusher, and the gravel transported from the CGO by road between 7.00 am and 6.00 pm, up to seven days per week.

With regard to the road transport environment, the Modification would involve no change to the life of the CGO, the site access road, construction or operational hours.

2.2.3 Modification Road Realignment

With the Modification, a portion of Lake Cowal Road would be realigned around the north-western boundary of the CGO. This would involve closure of an existing section of Lake Cowal Road approximately 3.0 km long, and construction of the 5.0 km long Lake Cowal Road Realignment.

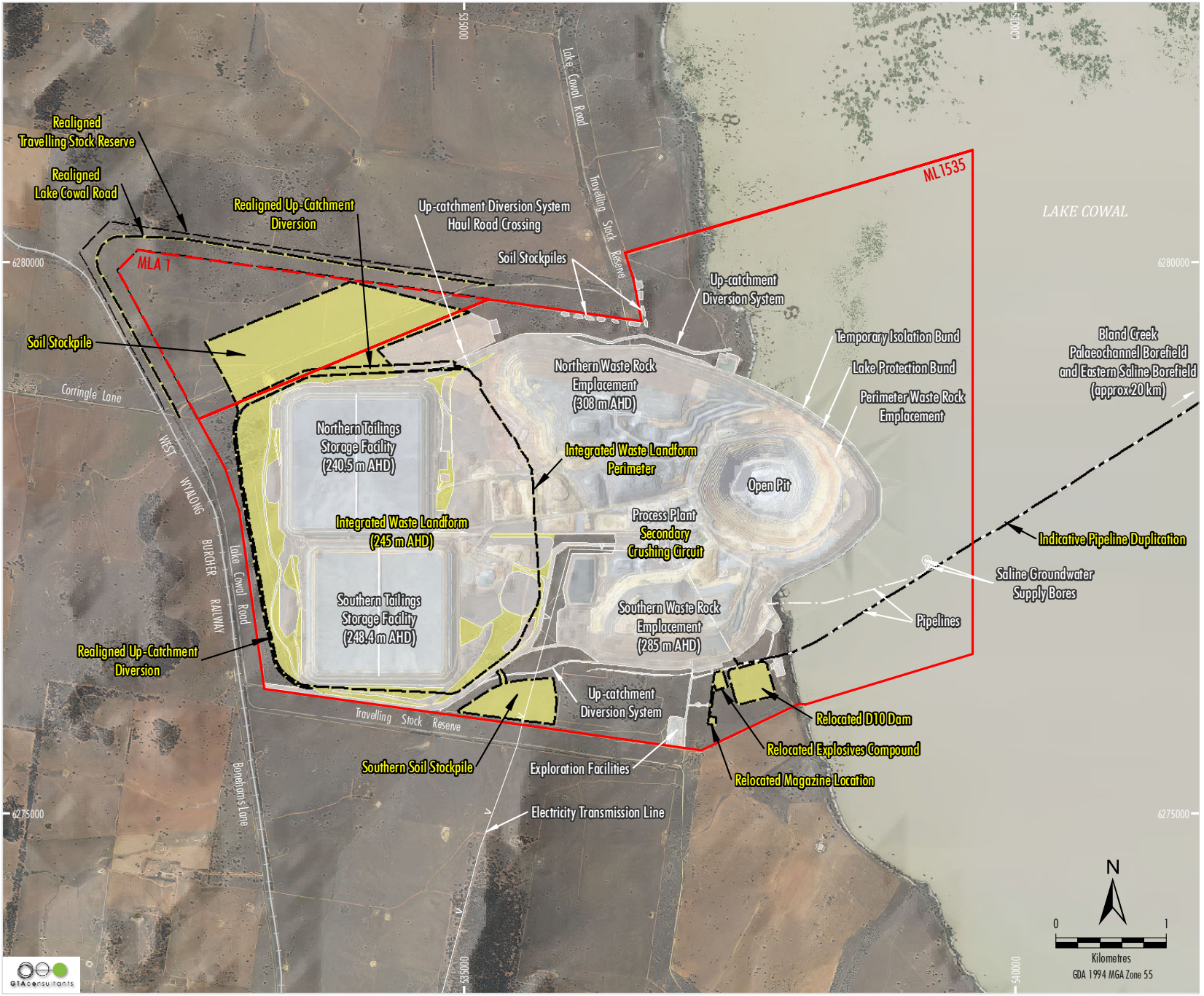
2.2.4 Modification Access Routes

With the Modification, the location of the approved site access road would remain unchanged.

The preferred mine access route from West Wyalong would remain unchanged from the existing preferred route.

The preferred mine access route from Condobolin would remain unchanged from the existing preferred route. The sealed road alternative route from Condobolin would remain unchanged from the existing sealed road alternative route.

The preferred mine access route from Forbes would remain unchanged from the existing preferred route. The alternative high-water route from Forbes via Corinella would remain unchanged. A new route is proposed for those occasions when unsealed roads in the Lachlan Shire and/or Forbes Shire are closed, but unsealed roads in the Bland Shire remain open. When all unsealed roads are closed (in Lachlan Shire, Forbes Shire and/or Bland Shire), the sealed road route from Forbes would remain unchanged from the existing sealed road route.



LEGEND

- Mining Lease Boundary (ML 1535)
- Mining Lease Application Boundary (MLA 1)
- Approximate Extent of Approved Surface Development
- Approximate Extent of Additional Modification Surface Disturbance
- Modification Component

Source: Evolution (2018); © NSW Department of Finance, Services & Innovation (2017)
Orthophoto: Evolution (Oct 2017)

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CGO PROCESSING RATE MODIFICATION

Modification General Arrangement

Figure 2.2

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Table 2.3 summarises the existing and proposed modified mine access routes, which are also presented in Figure 1.1and Figure 2.1.

Table 2.3: Impact of Modification on CGO Access Routes

Origin	Existing	Modification
West Wyalong	**Preferred** Ungarie Road – Wamboyne Road – Blow Clear Road – Bonehams Lane	**Preferred** No change
Condobolin	**Preferred** The Gipps Way – Burcher Road – Bena Street – Lake Cowal Road – Fitzgerald Road – Lake Cowal Road	**Preferred** No change
	Sealed Roads The Gipps Way – Burcher Road – Bena Street – Wamboyne Road – Blow Clear Road – Bonehams Lane	**Sealed Roads** No change
Forbes	**Preferred** Newell Highway – West Plains Road – Bogies Island Road – Lake Cowal Road – Fitzgerald Road – Lake Cowal Road	**Preferred** No change
	High Water Newell Highway – Lachlan Valley Way – Driftway Road – Warroo Road – Corinella Road – Marsden Road – Lake Cowal Road – Fitzgerald Road – Lake Cowal Road	**High Water 1** No change **High Water 2** Newell Highway – Bodells Lane – Clear Ridge Road – Lonergans Lane – Blow Clear Road – Bonehams Lane[A]
	Sealed Roads Newell Highway – Ungarie Road – Wamboyne Road – Blow Clear Road – Bonehams Lane	**Sealed Roads** No change

[A] This route may also be used by CGO traffic travelling from Mid Western Highway, which otherwise travels via Newell Highway and the West Wyalong route

3. Existing Road Environment

3.1 Existing Road Network

The road network in the vicinity of the CGO is described below and presented on Figure 1.1 and Figure 2.1.

Newell Highway (HW17) is an arterial road which forms part of the A39 national highway between Melbourne and Brisbane. Newell Highway links from Tocumwal at the Victorian border to Goondiwindi at the Queensland border. In the vicinity of the CGO, the Newell Highway provides the main road link between West Wyalong, Forbes and Parkes. It is generally a two lane undivided road, with a sealed pavement generally 7-8 metres (m) wide and 1-2 m wide sealed shoulders. It has centre and edge line marking, and auxiliary lanes at major intersections. The Newell Highway carries a range of traffic including heavy vehicles such as B-doubles and road trains. The *Newell Highway Corridor Strategy* (Transport for NSW, 2015) indicates that it is the third most significant heavy vehicle route in NSW in terms of mass and number of vehicles, including High Productivity Freight Vehicles.

The Gipps Way – West Wyalong Condobolin Road – Ungarie Road (MR57) are regional roads which provide the main road link between Condobolin and West Wyalong. The route is typically two lane undivided road with a sealed pavement 7- 8 m wide and 1-2 m wide sealed shoulders. It carries a range of traffic including heavy vehicles such as B-doubles and road trains.

West Plains Road – Bogies Island Road – Lake Cowal Road – Bena Street – Burcher Road are local roads which form an east-west link between The Gipps Way in the west and the Newell Highway in the east. At its western end, Burcher Road intersects with The Gipps Way at a priority controlled T-intersection. Burcher Road provides access to the village of Burcher, and the route continues through the village of Burcher where it is known as Bena Street, then as Lake Cowal Road east of Burcher across Nerang Cowal to Bogeys Island. From there, the route continues eastwards as Bogies Island Road then as West Plains Road to the Newell Highway.

Between The Gipps Way and Burcher, Burcher Road is sealed with 6 m pavement width and grass shoulders. The sealed section of Burcher Road provides a satisfactory horizontal and vertical alignment. Through the village of Burcher on Bena Street, the posted speed limit is 50 kilometres per hour (km/h), with a 40 km/h school zone.

East of Burcher, Lake Cowal Road has sections of sealed 4 m wide road with 1-3 m wide shoulders, and 8 m wide gravel road corridor width. The horizontal alignment of the gravel section of Lake Cowal Road is straight, although there are several vertical crest curves which restrict forward visibility to a minor extent. East of its intersection with Wamboyne Road, the road is unsealed. Approximately 800 m west of Nerang Cowal, Lake Cowal Road intersects with Marsden Road (north) and Fitzgerald Road (south) at a pair of left-right staggered T-intersections.

Bogies Island Road follows a series of right and left hand horizontal curves. At its northernmost point where Bogies Island Road meets Lake Cowal Road, a left hand horizontal curve bend combines with a vertical crest curve which provides restricted forward visibility. It is noted that marker posts are provided for night-time delineation of this combination of horizontal and vertical curvature. Bogies Island Road has a dry weather surface and during wet periods is impassable.

The route continues westwards past Warroo Road as West Plains Road. West Plains Road has a sealed pavement approximately 6 m wide with 1 m sealed shoulders for a distance of approximately 6.5 km to the west of the Newell Highway. Its western section continues as a gravel track of 8 m formation width. A number of intersections along its length are sealed for about 400 m either side of minor side roads.

The horizontal and vertical alignment of West Plains Road on the section between Lows Road and Newell Highway is generally straight and level. At the intersection with Lows Road, West Plains Road turns through a 90-degree bend to the north. At its eastern end, West Plains Road intersects with the Newell Highway at a priority controlled T-intersection, with a widened shoulder for southbound traffic on the Newell Highway.

Lake Cowal Road is a local road, and has two distinct alignments. An east-west alignment extends eastwards from the outskirts of the village of Burcher across Nerang Cowal to Bogeys Island. This section forms part of the aforementioned route between The Gipps Way in the west and the Newell Highway in the east, which is made up of Burcher Road, Bena Street, Lake Cowal Road, Bogies Island Road and West Plains Road. Fitzgerald Road intersects with the east-west section of Lake Cowal Road approximately 800 m west of Nerang Cowal, forming a priority controlled T-intersection. A separate section of Lake Cowal Road intersects with Fitzgerald Road approximately 500 m south of the above priority intersection, and extends in a roughly north-south direction along the western side of Lake Cowal and around the western side of the CGO Mining Lease boundary to intersect with Blow Clear Road at its southern end.

The north-south alignment of Lake Cowal Road provides a combination of dirt and gravel track, generally of 8 m road corridor width. It connects to Fitzgerald Road via an uncontrolled T-intersection at its northernmost point and to the mine access road at a priority controlled intersection. The alignment has a number of horizontal curves some of which include the provision of marker posts and advance directional signage.

Fitzgerald Road – Wamboyne Dip Road are local roads which link between the east-west alignment of Lake Cowal Road to the west of Nerang Cowal and Wamboyne Road at Wamboyne. Some 500 m to the south of the east-west alignment of Lake Cowal Road, Fitzgerald Road provides access to the north-south alignment of Lake Cowal Road via an uncontrolled intersection. It is a dirt track of generally 8 m road corridor width.

Wamboyne Road is a local road which provides a link between Ungarie Road and Bena Street/Lake Cowal Road east of the village of Burcher. At its southern end, Wamboyne Road intersects with Ungarie Road at a priority controlled T-intersection some 6 km north of the Newell Highway. Wamboyne Road provides access to the village of Wamboyne. Wamboyne Road has a sealed surface typically 6 m wide with narrow shoulders. There is a short, unsealed length where Wamboyne Road crosses the former West Wyalong Burcher branch railway and intersects with Fosters Lane and Buttenshaws Lane. The alignment of Wamboyne Road at this location reflects the requirements of the former level crossing, with vehicles passing through a right hand bend then left hand bend so that the former railway and road are perpendicular at the level crossing.

Blow Clear Road is a local road which extends westwards from Wamboyne Road. The extension of this route to the east of Wamboyne Road is Girral Road, which links to West Wyalong Condobolin Road at is eastern end. Blow Clear Road has a sealed surface with a similar cross-section to Wamboyne Road and intersects with Lonergans Lane approximately 5 km from Wamboyne Road, and with Bonehams Lane approximately 11 km from Wamboyne Road. Blow Clear Road, Girral Road (unsealed) and Wamboyne Road intersect at a four way intersection, at which Girral Road and Blow Clear Road are the minor roads, and are aligned at approximately 65 to 70 degrees to Wamboyne Road.

Bonehams Lane is a local road and connects to Blow Clear Road at its southernmost extent via a priority controlled T-intersection just west of the former level crossing with the West Wyalong Burcher railway. Approximately 4.5 km north of Blow Clear Road, the road turns through 90 degrees to continue westward as the mine access road.

Lonergans Lane – Clear Ridge Road – Bodells Lane are local roads which provide a link between Blow Clear Road in the north and the Newell Highway at Back Creek in the south. The intersection of Blow Clear Road with Lonergans Lane is a priority controlled T-intersection. The intersection of Bodells Lane with the Newell Highway is a priority controlled T-intersection, with "give way" signs for Bodells Lane traffic and localised widening of the Newell Highway to two lanes southbound to allow through traffic to pass around a vehicle slowing to turn right into Bodells Lane. Road train access is permitted on Clear Ridge Road between Newell Highway and Blow Clear Road, subject to a maximum 80 km/h speed limit.

3.2 Heavy Vehicle Routes

The CGO is located within a B-Double Area, in which access is generally permitted with some restrictions on heavy vehicle travel. In the Lachlan Shire, general restrictions include:

- no travel if there is water over the road;
- no travel if the road is closed, and no travel on unsealed roads if restricted to light vehicles up to 3 tonnes (t) due to rain, or if other temporary restrictions applies;
- maximum 80 km/h speed on all unsealed roads and sealed roads where the seal is so narrow as to require travelling on the unsealed shoulder to pass another vehicle;
- no reversing in or out of a road or depot;
- no stopping or parking in urban streets within 10 m of a driveway for over 15 minutes;
- no loading or unloading cargo in urban streets; and
- any conditions applied by National Heavy Vehicle Regulator or RMS to heavy vehicles using State Roads apply to Council managed local and regional roads, e.g., escort and signage requirements.

In the Bland Shire, B-Double access is permitted on all roads except for residential streets in Wyalong, West Wyalong, Barmedman, Weethalle, Ungarie and Tallimba unless gazetted as approved for use. A maximum speed limit of 80 km/h applies to all local roads. Daylight hours only travel is permitted except between 7.00 am and 9.00 am and between 3.00 pm and 5.00 pm on school days. Travel is prohibited in wet weather and until the road is dry. At the time of writing, Bland Shire Council has applied to the National Heavy Vehicle Regulator to amend some of the conditions. Once these changes are approved, a maximum speed limit of 80 km/h will apply to all unsealed roads, the time-based restrictions will be deleted, and travel will be prohibited in wet weather and until the road is dry on all unsealed roads, with the operator being responsible for ensuring the route is safe prior to its use.

On the existing high-water alternative employee access route between the CGO and Forbes, B-double access is permitted in the Forbes Shire on Corinella Road, Warroo Road and Driftway Road, subject to a maximum speed limit of 80 km/h, and no travel permitted between 8.00 am and 9.00 am, and between 3.00 pm and 4.00 pm. Road trains are permitted on Lachlan Valley Way.

3.3 Historic Traffic Volumes

Traffic volume data for roads in the region of the CGO have been collated from publicly available sources, and are summarised in Table 3.1. Except where stated, the reported volumes are the average daily number of vehicles measured in both directions over a seven day week.

Table 3.1: Average Two Way Daily Traffic 2006 to 2017 (vehicles per day)

	2006	2007	2008	2009	2010	2011	2012	2015	2016	2017
Blow Clear Road										
West of Clear Ridge Road	-	295	-	-	-	-	-	-	-	-
Burcher Road										
East of The Gipps Way	-	-	46	-	-	-	-	-	-	-
Newell Highway										
at Fleece Street West Wyalong	4,375	-	-	-	2,107[A]	-	-	-	-	-
East of Nicholson Lane, Wyalong	2,142	2,224	-	-	2,257	1,847	-	2,255	2,118	2,238
South of Mid Western Highway	-	-	-	-	1,943	1,823	1,852	1,965	915[A]	1,967
North of West Plains Road	-	-	2,548	-	-	-	-	-	-	-
West of Greens Road, Forbes	-	-	-	-	-	-	-	2,571	1,150[A]	2,591
West of River Road, Forbes	-	-	-	3,136	-	-	-	-	-	-
The Gipps Way										
North of Wamboyne Road	-	-	551	-	-	-	-	-	-	-
South of Burcher Road	117	-	-	-	-	-	-	-	-	-
North of Burcher Road	-	-	163[B]	-	-	-	-	-	-	-
East of Nielsens Lane, Girral	475	-	-	-	476	-	-	-	-	-
Ungarie Road										
North of Mid Western Highway	2,224	-	-	-	1,979	-	-	-	-	-
South of Wamboyne Road	-	-	927	-	-	-	-	-	-	-
Wamboyne Road										
East of Ungarie Road	-	-	333	-	-	-	-	-	-	-
West Plains Road										
West of Newell Highway	72	-	-	-	-	-	-	-	-	-

Sources: RMS (2017) and Masson Wilson Twiney (2008)

[A] Volume in one direction only

[B] Estimate only

Review of the historic data indicates that Newell Highway is the dominant road in the region, and that growth in traffic is generally very low, with some locations showing a decline in traffic volumes over time.

3.4 Traffic Survey Program

To quantify current traffic volumes on routes of relevance to the CGO and the Modification, a program of classified tube count surveys was undertaken during June 2017. Surveys were conducted for a period of one week at the following locations, which are presented on Figure 2.1.

- CGO Access Road;
- Blow Clear Road west of Lonergans Lane;
- Wamboyne Road north of Blow Clear Road;
- Ungarie Road north of West Wyalong; and
- Newell Highway northeast of Bodells Lane.

The results of the traffic surveys have been reviewed, and the surveyed daily traffic volumes are summarised in Table 3.2.

Table 3.2: Surveyed Average Daily Traffic by Day of the Week June 2017 (vehicles per day)

Site[A]	Location	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
A	CGO Access Road	286	328	342	362	261	122	91
B	Blow Clear Road	310	333	329	349	265	126	100
C	Wamboyne Road	97	104	91	86	103	76	54
D	Ungarie Road	1,264	1,305	1,308	1,283	1,303	806	824
E	Newell Highway	1,839	2,091	2,175	2,234	2,004	1,996	1,983

[A] Refer to Figure 2.1

The results indicate that traffic conditions on weekdays are distinctly different from those on weekend days at all surveyed locations, with the exception of the Newell Highway, which are reasonably consistent through the week. On the CGO Access Road, traffic volumes on Monday and Friday are lower than those on the other weekdays, which is consistent with the variation in workers present at the CGO each day (Table 2.1). This effect is also observed on Blow Clear Road, on which a significant proportion of traffic to and from the CGO travels. To ensure a robust representation of the CGO traffic on the road network, for the purpose of this assessment, average weekday daily volumes have been assessed on the following basis:

- CGO Access Road and Blow Clear Road – average daily volumes on Tuesday to Thursday only;
- Wamboyne Road, Ungarie Road and Newell Highway – average daily volumes on Monday to Friday.

The traffic surveys provide data on the composition of the traffic based on standard vehicle classifications. Light vehicles include motorcycles, cars, vans, four-wheel drives (4WDs), and utilities (including those towing a trailer or caravan). Heavy vehicles include single unit trucks and buses and articulated vehicles such as semi-trailers, rigid trucks with trailers, B-Doubles and road trains. It is noted that due to the long wheelbase on some of the 4WDs and utilities used by some classification employees and contractors, these may be classified as heavy vehicles under this system (therefore, the proportion of heavy vehicles is likely to be conservatively high).

Table 3.3 presents the average daily traffic volumes from the June 2017 surveys, together with the contributions of light and heavy vehicles to the total volumes.

Table 3.3: Surveyed Average Weekday Daily Traffic (vehicles per day)

Site[A]	Location	Light	Heavy	Total	Percent Heavy
A	CGO Access Road	243	101	344	29.4
B	Blow Clear Road	236	98	334	29.3
C	Wamboyne Road	80	15	95	15.8
D	Ungarie Road	1,000	292	1,292	22.6
E	Newell Highway	1,239	829	2,068	40.1

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

These results reflect the roles these roads fulfil in the road network. The high number of heavy vehicles on Newell Highway result from its use as a freight route linking between Melbourne and Brisbane.

The spread of traffic throughout the average weekday is such that the busiest hour at each of the surveyed locations does not necessarily occur at the same time. Table 3.4 presents the volumes surveyed during the busiest hour in the morning (midnight to midday) and busiest hour in the evening (midday to midnight) on the average weekday, and the time at which the busiest hour occurred.

Table 3.4: Surveyed Average Weekday Peak Hour Traffic (vehicles per hour)

Site[A]	Location	AM Peak Hour				PM Peak Hour			
		Time[B]	Light	Heavy	Total	Time[B]	Light	Heavy	Total
A	CGO Access Road	5:00	46	8	54	17:00	37	11	48
B	Blow Clear Road	5:00	40	11	51	17:00	37	8	45
C	Wamboyne Road	11:00	6	2	8	17:00	11	1	12
D	Ungarie Road	8:00	79	22	101	16:00	94	25	119
E	Newell Highway	11:00	116	56	172	14:00	122	46	168

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only
[B] Hour starting

The results demonstrate that the busiest hours on each of the surveyed roads do not coincide. The busiest hours on Blow Clear Road align with those on the CGO Access Road.

3.5 CGO Traffic Generation

As noted (Section 0), Tuesday to Thursday are typically the busier days with regard to attendance at the CGO, which is reflected by the variation in the surveyed daily traffic volumes on the CGO Access Road (Table 3.2). In order to consider a typical but busy day at the CGO with regard to traffic on the public road network, the average traffic generation over Tuesday to Thursday has been adopted as the existing operational day for traffic generation of the CGO. The surveys demonstrate that over the surveyed Tuesday to Thursday, the CGO generated 344 vehicle trips per day, of which 101 trips (29.4 percent) were made by heavy vehicles and 243 trips (70.6 percent) were made by light vehicles (Table 3.3).

The spread of traffic generated by the CGO through the typical operational day (Tuesday to Thursday) is summarised in Table 3.5.

Table 3.5 demonstrates that the overall busiest hours during the morning and evening respectively occurred between 5.00 am and 6.00 am, and between 5.00 pm and 6.00 pm. Between 6.00 am and 7.00 am, and between 4.00 pm and 5.00 pm, the CGO traffic generation was only slightly less than that during the peak hours. The surveys indicate that the morning peak hour traffic is 100 percent inbound, while the evening peak hour traffic is 23 percent inbound and 77 percent outbound.

The majority of the traffic generated by the CGO occurs between 5.00 am and 7.00 pm, with less than one percent of average daily traffic occurring between 7.00 pm and 5.00 am. No vehicles enter or exit between 11.00 pm and 5.00 am over the existing operational day.

Table 3.5: Surveyed Tuesday-Thursday Hourly CGO Traffic Generation (vehicles per hour)

Morning				Afternoon			
Hour Starting	Inbound	Outbound	Total	Hour Starting	Inbound	Outbound	Total
0:00	0	0	0	12:00	5	10	15
1:00	0	0	0	13:00	5	7	12
2:00	0	0	0	14:00	4	7	11
3:00	0	0	0	15:00	3	9	12
4:00	0	0	0	16:00	6	35	41
5:00	**54**	**0**	**54**	**17:00**	**11**	**37**	**48**
6:00	40	11	51	18:00	1	22	23
7:00	14	9	23	19:00	1	1	2
8:00	10	6	16	20:00	0	0	0
9:00	7	4	11	21:00	1	0	1
10:00	6	7	13	22:00	1	0	1
11:00	5	5	10	23:00	0	0	0

3.6 CGO Traffic Distribution

The distribution of the existing traffic generated by the CGO has been estimated based on the travel and residential characteristics described in Section 0. The estimated distribution of vehicle trips to the preferred mine access routes over the typical weekday is summarised in Table 3.6. For the purpose of this assessment, the small number of vehicles using other minor routes has been excluded, e.g. workers who reside in other areas such as Warroo and Girral.

Table 3.6: Average Daily CGO Vehicle Trip Distribution (percent)

Vehicle	West Wyalong Route	Forbes Route	Condobolin Route
Delivery heavy vehicles	100	0	0
Evolution buses	60	20	20
Contractor buses	100	0	0
Visitor light vehicles	80	10	10
Visitor heavy vehicles	100	0	0
Contractor workforce vehicles	90	0	10
Employee workforce vehicles	70	20	10

Table 3.7 summarises the resulting distribution of vehicle trips on the preferred mine access routes during the peak hours associated with the CGO, and over the typical weekday.

Table 3.7: Existing CGO Vehicle Trip Generation by Access Route

Mine Access Route	AM Peak Hour		PM Peak Hour		Daily	
	Light	Heavy	Light	Heavy	Light	Heavy
West Wyalong Route	34	4	27	7	184	89
Forbes Route	7	2	6	2	35	6
Condobolin Route	5	2	4	2	24	6
Total	**46**	**8**	**37**	**11**	**243**	**101**

The estimated contribution of the CGO to surveyed daily traffic at the surveyed locations is summarised in Table 3.8. Delivery vehicles approaching and departing the CGO via Mid Western Highway would be likely to contribute to the traffic at the surveyed location on Newell Highway.

Table 3.8 assumes that 10 percent of light vehicles and 20 percent of heavy vehicles on the West Wyalong access route currently also use Newell Highway north-east of West Wyalong.

Table 3.8: Existing Contribution of CGO to Daily Traffic at Survey Locations (vehicles per day)

Site[A]	Location	CGO Generated Traffic			Non-CGO Generated Traffic		
		Light	Heavy	Total	Light	Heavy	Total
A	CGO Access Road	243	101	344	0	0	0
B	Blow Clear Road	184	89	273	52	9	61
C	Wamboyne Road	0	0	0	80	15	95
D	Ungarie Road	184	89	273	816	203	1,019
E	Newell Highway	19	17	36	1,220	812	2,032

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

3.7 Changes to CGO Traffic

The Mine Life Extension Modification (Modification 13) has been approved and will result in some changes to traffic conditions compared with those surveyed during June 2017. Compared with surveyed conditions, Modification 13 is expected to result in the following ongoing changes to deliveries to the CGO:

- increase in cyanide, requiring one additional delivery per week, using an isotainer articulated vehicle;
- increase in SMBS, requiring one additional delivery per week, using an articulated vehicle;
- increase in lime, requiring four additional deliveries per week, using articulated vehicles; and
- increase in carbon, requiring one additional delivery every three months.

The CGO is therefore anticipated to require an additional six to seven heavy vehicle deliveries per week. For the purpose of this assessment, this is assumed to equate to up to two additional deliveries per day between Tuesday to Thursday, generating up to four heavy vehicle trips per day, and one heavy vehicle trips during the AM and PM peak hours. The additional delivery trips would travel to and from the CGO on the West Wyalong mine access route, and approximately half would use Newell Highway north-east of West Wyalong. The estimated distribution of the baseline peak hour and daily CGO traffic by access route is summarised in Table 3.9.

Table 3.9: Baseline CGO Vehicle Trip Generation by Access Route

Mine Access Route	AM Peak Hour		PM Peak Hour		Daily	
	Light	Heavy	Light	Heavy	Light	Heavy
West Wyalong Route	34	5	27	8	184	93
Forbes Route	7	2	6	2	35	6
Condobolin Route	5	2	4	2	24	6
Total	**46**	**9**	**37**	**12**	**243**	**105**

The estimated contribution of the baseline CGO to daily traffic at the surveyed locations is summarised in Table 3.10. Delivery and other vehicles approaching and departing the CGO via Mid Western Highway would be likely to contribute to the traffic at the surveyed location on Newell Highway.

Table 3.10: Baseline Contribution of CGO to Daily Traffic at Survey Locations (vehicles per day)

Site[A]	Location	CGO Generated Traffic			Non-CGO Generated Traffic		
		Light	Heavy	Total	Light	Heavy	Total
A	CGO Access Road	243	105	348	0	0	0
B	Blow Clear Road	184	93	277	52	9	61
C	Wamboyne Road	0	0	0	80	15	95
D	Ungarie Road	184	93	277	816	203	1,019
E	Newell Highway	19	19	38	1,220	812	2,032

Baseline assumes preferred mine access routes are used

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

3.8 Road Network Performance

The Austroads (2017a) *Guide to Traffic Management Part 3: Traffic Studies and Analysis* provides guidelines for the capacity and performance of two lane, two-way rural roads, which in turn, refers to the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2016).

The capacity of a road is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions. The capacity of a single traffic lane will be affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades.

Level of Service (LOS) is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. A LOS definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. LOS A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. LOS B to D describes progressively worse traffic conditions. LOS E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for LOS E is taken as the capacity of a lane or roadway. In rural situations, LOS C is generally considered to be acceptable. At LOS C, most vehicles are travelling in platoons, and travel speeds are curtailed. At LOS D, platooning increases significantly, and the demand for passing is high, but the capacity to do so is low.

The LOS experienced by drivers on two-way rural roads is dependent on the drivers' expectations regarding the road, and three classes of road are defined in the HCM. Class I roads are those on which motorists expect to travel at relatively high speeds. They most often serve long-distance trips or provide connecting links between facilities that serve long-distance trips. Class II roads are those on which motorists do not necessarily expect to travel at high speeds, and may function as access routes to Class I facilities, serve as scenic or recreational routes or pass through rugged terrain. Class III roads serve moderately developed areas, and may be portions of a Class I or Class II highway that pass through small towns or developed recreational areas, where local traffic mixes with through traffic, and the density of unsignalised roadside access points increases.

The primary determinant of a road's classification for operational analysis is the drivers' expectations, which may not necessarily agree with the functional classification. With the exception of Newell Highway, the surveyed two lane two way roads would typically be considered as Class II roads under the HCM descriptions, as drivers would expect some level of restriction to their freedom of movement along the routes as a result of characteristics of the

route such as limits on the opportunities for overtaking (e.g. centre line marking, sight distances, lack of overtaking lanes). Newell Highway would be considered a Class I road.

On Class I roads, LOS is defined in terms of Percent Time Spent Following (PTSF) and Average Travel Speed (ATS). On Class II roads, LOS is defined only in terms of PTSF. The PTSF is a measure of the level of opportunities to overtake, and is estimated from the demand traffic volumes, the directional distribution of that traffic, and the percentage of no-passing zones. The LOS criteria for Class I and Class II two lane roads are as shown in Table 3.11, noting that the HCM defines ATS in miles per hour (mi/h).

Table 3.11: LOS Criteria for Class I and Class II Two Lane Roads

LOS	Class I		Class II
	PTSF (percent)	ATS (mi/h)[A]	PTSF (percent)
A	≤ 35	≥ 55	≤ 40
B	> 35 – 50	> 50 – 55	> 40 – 55
C	> 50 – 65	> 45 – 50	> 55 – 70
D	> 65 – 80	> 40 – 45	> 70 – 85
E	≥ 80	≤ 40	≥ 85

[A] note that 1 mi/h is equivalent to approximately 1.6 km/h

Table 3.12 presents the results of the assessment of midblock conditions at the surveyed locations on the road network during the busiest hours associated with the CGO traffic. These results include the additional CGO traffic expected to occur with the additional trips generated by approved Modification 13.

Table 3.12: Baseline Weekday Peak Hour Midblock Road Performance

Site[A]	Road and Location	Class	Inbound to CGO		Outbound from CGO	
			PTSF (ATS)	LOS	PTSF (ATS)	LOS
Morning Peak Hour 5.00am to 6.00am						
A	CGO Access Road	II	50.5	B	-	-
B	Blow Clear Road west of Lonergans Lane	II	31.0	A	-	-
C	Wamboyne Road[B] north of Blow Clear Road	II	-	-	-	-
D	Ungarie Road north of West Wyalong	II	29.3	A	3.7	A
E	Newell Highway[B] northeast of Bodells Lane	I	16.1 (66.7)	A (A)	23.9 (66.7)	A (A)
Evening Peak Hour 5.00pm to 6.00pm						
A	CGO Access Road	II	12.7	A	42.9	B
B	Blow Clear Road west of Lonergans Lane	II	9.0	A	25.2	A
C	Wamboyne Road[B] north of Blow Clear Road	II	7.5	A	5.3	A
D	Ungarie Road north of West Wyalong	II	20.8	A	24.9	A
E	Newell Highway[B] northeast of Bodells Lane	I	28.3 (65.9)	A (A)	22.5 (65.9)	A (A)

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only
[B] Inbound taken to be southbound, outbound taken to be northbound
No result indicates no traffic in specified direction

It should be noted that Newell Highway has numerous sections in both directions of travel where two travel lanes are provided, thus the HCM model does not strictly apply to those sections. For the purpose of this assessment, the calculated LOS for Newell Highway should be considered to apply only to those parts of the highway which have a single travel lane in each direction. The presence of the overtaking lanes will tend to decrease the PTSF and increase the ATS along the route as a whole, thus the calculated values will tend to suggest a worse LOS than would be experienced.

The results indicate that drivers experience good levels of service on the roads in the region during the busiest hours associated with CGO traffic generation at each of the surveyed locations.

3.9 Operation of Intersections

At unsignalised intersections with minor roads, where there are relatively low volumes of through and turning vehicles, capacity considerations are usually not significant, and detailed analysis of capacity is not warranted. As a guide, at volumes below the following combinations of maximum hourly volumes at a cross intersection with a two lane two-way road, capacity analysis is not warranted:

- major road 400 vehicles per hour, minor road 250 vehicles per hour;
- major road 500 vehicles per hour, minor road 200 vehicles per hour; and
- major road 650 vehicles per hour, minor road 100 vehicles per hour.

The majority of intersections in the vicinity of the CGO are T-intersections and so have fewer potentially conflicting movements than a cross intersection. Comparison between these threshold volumes and the peak hourly volumes on the key roads (Table 3.4) indicates that the existing peak hourly traffic volumes on all roads are well below the threshold volumes above, and as such, there is no capacity concerns regarding the operation of intersections in the vicinity of the CGO.

3.10 Road Safety

Validated crash data was obtained from RMS covering the period from 1 July 2011 to 30 September 2016, but also including provisional data for the period from 1 October 2016 to 13 July 2017. The data includes those crashes which conform to the national guidelines for reporting and classifying road vehicles crashes based on the following criteria:

- The crash was reported to the police.
- The crash occurred on a road open to the public.
- The crash involved at least one moving vehicle.
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Crash data was reviewed on the following routes in the region of the CGO:

i Newell Highway between Bodells Lane and West Plains Road;
ii Wamboyne Road;
iii Ungarie Road;
iv Burcher Road – Bena Road – Lake Cowal Road (east-west) – Bogies Island Road – West Plains Road;
v Marsden Road – Corinella Road – Warroo Road – Driftway Road – Lachlan Valley Way to Newell Highway);
vi Blow Clear Road – Bonehams Lane – Lake Cowal Road (north-south); and
vii Bodells Lane – Lonergans Lane.

Table 3.13 summarises the number and general types of crashes which occurred on the sections of road under consideration.

Table 3.13: General Crash Types on Access Routes (1 July 2011 to 3 July 2017)

Access Route	Route Length (km)	Pedestrian	Multiple Vehicles					Single Vehicle			Other
			Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	
i Newell Highway	45.2	-	-	6[A]	4	1	1	-	10	1	-
ii Wamboyne Road	40.9	-	-	-	-	-	-	-	1	1	-
iii Ungarie Road	5.0	-	-	1	-	-	-	-	2	2	-
iv Burcher Road	51.6	-	-	-	-	-	-	-	-	-	-
v Marsden Road	77.9	-	-	-	-	-	-	2	5	2	-
vi Blow Clear Road	34.0	-	-	-	-	-	-	1	1	-	-
vii Bodells Lane	21.4	-	-	-	-	-	-	-	-	-	-
Total Crashes by Type		**-**	**-**	**7**	**4**	**1**	**1**	**3**	**19**	**6**	**-**
Total People Injured		**-**	**-**	**19**	**2**	**-**	**-**	**3**	**15**	**7**	**-**
Total People Killed		**-**	**-**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

[A] Includes three fatal crashes

Over the investigation period and routes reviewed, a total of 41 crashes occurred, resulting in four fatalities and 46 people being injured. The section of the Newell Highway under investigation accounted for more than half of the reported crashes. No reported crashes occurred on the Burcher Road – Bena Street – Lake Cowal Road – Bogies Island Road – West Plains Road route, or on the Bodells Lane – Lonergans Lane route.

Table 3.13 demonstrates that over all the roads investigated, the most common types of crashes involved single vehicles leaving the carriageway, known as run-off-road (ROR) crashes, which made up approximately 61 percent of the reported crashes in Table 3.13, and 48 percent of injured people. This is consistent with Austroads (2015), which found that in rural road environments in Australia, off-path crashes were the most likely. ARRB Group (2011) states that known causes of ROR crashes include:

- driver behaviours such as speed, inattention, avoidance manoeuvres, errant vehicles;
- driver impairment including fatigue, alcohol, drugs, mood state;
- road conditions such as horizontal alignment, shoulder deficiencies, slippery surface, poor delineation, damaged surfaces;
- vehicle failure; and
- environmental conditions such as rain, fog, snow, livestock or native fauna.

A detailed review of the crashes on each route is provided in the following sections.

3.10.1 Newell Highway – Bodells Lane to West Plains Road

Over the period under investigation, 23 crashes were reported on Newell Highway between Bodells Lane and West Plains Road, and the characteristics of these are summarised in Table 3.14. This included three fatal crashes, all of which involved head on crashes where none of the vehicles was overtaking at the time of the crash. Each of the three fatal crashes occurred in fine weather on a dry road surface, and involved at least one heavy vehicle. One involved three vehicles on a straight section of road, and resulted in one fatality and eight people injured. Fatigue was nominated as a factor in two of the three fatal crashes.

None of the crashes were directly related to intersections along Newell Highway ("Adjacent Approaches" in Table 3.14). Nineteen of the crashes occurred on straight sections of road, and four occurred on curves. Three of the four crashes which occurred on curves were head on crashes in which the vehicles were not overtaking at the time.

One crash was reported to have occurred at the intersection of Newell Highway and Bodells Lane. This occurred at 10.10 am on Sunday 13 October 2013. An eastbound vehicle moved to the opposite carriageway to overtake an eastbound vehicle which was turning right. It is assumed that the vehicle turning right was entering the Back Creek State Forest access gate which lies almost opposite but slightly offset from the end of Bodells Lane. Access to the gate is not a formal part of the Bodells Lane intersection, with an unsealed track between the edge of Newell Highway and the gate. The non-injury crash occurred in fine weather on a dry road surface.

Table 3.14: Newell Highway[A] Crash Summary (1 July 2011- 3 July 2017)

		Multiple Vehicles					Single Vehicle			
	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	Other
Total Crashes	-	-	6	4	1	1	-	10	1	-
Road Surface Condition										
Dry Road	-	-	5	4	1	1	-	9	1	-
Wet Road	-	-	1	-	-	-	-	1	-	-
Weather										
Fine	-	-	5	4	1	1	-	9	1	-
Raining	-	-	1	-	-	-	-	1	-	-
Overcast	-	-	-	-	-	-	-	-	-	-
Vehicle Type										
Motorcycle	-	-	-	-	-	-	-	-	-	-
Car, station wagon, 4WD, van	-	-	8	3	1	1	-	5	1	-
Light or Large Truck or Bus	-	-	2	1	1	1	-	1	-	-
Articulated Vehicle	-	-	3	4	-	-	-	3	-	-
Other	-	-	-	-	-	-	-	1	-	-
Severity of Crash										
Fatal	-	-	3	-	-	-	-	-	-	-
Serious injury	-	-	2	-	-	-	-	1	-	-
Moderate injury	-	-	1	1	-	-	-	4	-	-
Non-injury	-	-	-	2	1	1	-	3	1	-
Other/Unclassified	-	-	-	1	-	-	-	2	-	-
People Killed or Injured										
Killed	-	-	4	-	-	-	-	-	-	-
Injured	-	-	17	2	-	-	-	7	-	-
Factors[B]										
Speed	-	-	-	1	-	-	-	-	1	-
Fatigue	-	-	4	-	-	-	-	3	1	-
Alcohol	-	-	-	-	-	-	-	1	-	-
None	-	-	2	3	1	1	-	7	-	-

[A] between Bodells Lane and West Plains Road
[B] Factors considered to have contributed to the crash. More than one factor can be nominated for a single crash.

3.10.2 Wamboyne Road

Over the period under investigation, two crashes were reported on Wamboyne Road between Ungarie Road and Lake Cowal Road, both of which involved a single vehicle leaving the carriageway on the section of Wamboyne Road which is currently the preferred mine access road to and from West Wyalong:

- 5:30 am on Wednesday 30 November 2011, a northbound 4WD left the carriageway 6 km north of Wyalong Road during raining weather, on a wet road surface. This was a non-injury crash with no contributing factors specified.
- 4:36 pm on Monday 21 March 2016, a westbound station wagon left the carriageway to the left on a right hand bend 110 m east of Ungarie Road. This resulted in one person being moderately injured. Speed and fatigue were nominated as contributing factors.

3.10.3 Ungarie Road

Over the period under investigation, five crashes were reported on Ungarie Road between Wamboyne Road and Newell Highway.

- 6:40 am on Wednesday 27 July 2011, a southbound ute on the incorrect side of Ungarie Road struck a northbound car head on, 5 m north of Wilsons Lane. RMS data reports this as having occurred in a 100 km/h zone, however the described location lies over 700 m south of the commencement of the West Wyalong 50 km/h speed zone. The crash occurred in fine weather on a dry road surface, and resulted in two people being seriously injured. No contributing factors were identified.
- 5:45 pm on Wednesday 18 January 2012, a southbound car left the carriageway to the right and struck a tree/bush 50 m south of Dumaresq Street. As above, the reported location lies within the West Wyalong 50 km/h speed zone. The crash occurred in fine weather on a dry road surface, and resulted in one person being moderately injured. Fatigue was nominated as a contributing factor.
- 4.36 pm on Wednesday 14 March 2012, a southbound 4WD left the carriageway to the left on a right hand bend, 50 m north of Quota Drive. The crash occurred in fine weather on a dry road surface, and resulted in one person being seriously injury and two people being moderately injured. Speed and fatigue were nominated as contributing factors. The crash occurred in the 50 km/h speed zone.
- 3:00 pm on Wednesday 1 May 2013, a southbound light truck left the carriageway to the right and struck a fence, 300 m south of Hatleys Lane. The crash occurred in fine weather on a dry road surface, and resulted in one person being seriously injured. Fatigue was nominated as a contributing factor.
- 4:51 pm on Monday 5 December 2016, a southbound B-Double in Ungarie Road turning right at Hatleys Lane lost control on the carriageway. The crash occurred in fine weather on a dry road surface, and speed was nominated as a contributing factor. This was a non-injury crash.

3.10.4 Blow Clear Road – Bonehams Lane – Lake Cowal Road

Over the period under investigation, two crashes occurred on the route between the CGO and Lake Cowal Road (north-south) at its intersection with Lake Cowal Road (east-west) near Marsden Road:

- 6:30 pm on Saturday 1 October 2011, a northbound car left he carriageway to the road 6 km east of Corringle Lane (which meets Lake Cowal Road at the north-western boundary of the CGO) and struck a tree/bush. The crash resulted in one person being injured. This occurred in overcast weather on a wet road surface, and alcohol was nominated as a contributing factor.
- 2:30 pm on Monday 17 February 2014, a northbound light truck struck equipment on the carriageway at a temporary roadworks site 1.6 km north of the CGO access road. The crash resulted in one person being seriously injured. It occurred in fine weather on a dry road surface, and no contributing factors were identified.

3.10.5 Bodells Lane – Lonergans Lane

Over the period under investigation, no crashes were reported on the route between Newell Highway and Blow Clear Road via Bodells Lane and Lonergans Lane. As described in Section 0, one crash occurred near the intersection of Bodells Lane and Newell Highway, which was not related to vehicles turning into or out of Bodells Lane.

3.10.6 Marsden Road – Corinella Road – Warroo Road – Driftway Road – Lachlan Valley Way

Over the period under investigation, four crashes were reported on the route between Lake Cowal Road and Lachlan Valley Way via Marsden Road, Corinella Road, Warroo Road and Driftway Road, and five crashes occurred on Lachlan Valley Way between Driftway Road and Newell Highway. The characteristics of the crashes along this route are summarised in Table 3.15. All nine reported crashes along the route involved a single vehicle, and no contributing factors (speed, alcohol or fatigue) were identified in eight of the crashes.

Table 3.15: Marsden Road Route[A] Crash Summary (1 July 2011- 3 July 2017)

		Multiple Vehicles					Single Vehicle			
	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	Other
Total Crashes	-	-	-	-	-	-	2	5	2	-
Road Surface Condition										
Dry Road	-	-	-	-	-	-	2	5	2	-
Wet Road	-	-	-	-	-	-	-	-	-	-
Weather										
Fine	-	-	-	-	-	-	2	5	2	-
Raining	-	-	-	-	-	-	-	-	-	-
Overcast	-	-	-	-	-	-	-	-	-	-
Vehicle Type										
Motorcycle	-	-	-	-	-	-	-	-	-	-
Car, station wagon, 4WD, van	-	-	-	-	-	-	1	-	-	-
Light or Large Truck or Bus	-	-	-	-	-	-	1	1	1	-
Articulated Vehicle	-	-	-	-	-	-	-	3	1	-
Other	-	-	-	-	-	-	-	1	-	-
Severity of Crash										
Fatal	-	-	-	-	-	-	-	-	-	-
Serious injury	-	-	-	-	-	-	1	2	2	-
Moderate injury	-	-	-	-	-	-	1	2	-	-
Non-injury	-	-	-	-	-	-	-	-	-	-
Other/Unclassified	-	-	-	-	-	-	-	1	-	-
People Killed or Injured										
Killed	-	-	-	-	-	-	-	-	-	-
Injured	-	-	-	-	-	-	2	5	3	-
Factors[B]										
Speed	-	-	-	-	-	-	-	-	-	-
Fatigue	-	-	-	-	-	-	-	1	-	-
Alcohol	-	-	-	-	-	-	-	1	-	-
None	-	-	-	-	-	-	2	4	2	-

[A] Lake Cowal Road to Newell Highway via Marsden Road, Corinella Road, Warroo Road, Driftway Road and Lachlan Valley Way
[B] Factors considered to have contributed to the crash. More than one factor can be nominated for a single crash.

3.11 School Buses

Kelly's Coaches operates school bus routes from its depot on Railway Road in West Wyalong, including the following routes which operate on roads used by CGO traffic:

- Calleen – the morning bus operates between 7.30 am and 9.00 am, and the afternoon bus operates between 3.15 pm and 5.00 pm. The buses use Ungarie Road, West Wyalong Condobolin Road, Merrengreen Road, Younga Plains Road and Ditchfields Lane.
- Lake Cowal – the morning bus operates between 7.15 am and 9.00 am, and the afternoon bus operates between 3.00 pm and 5.00 pm. The buses use Ungarie Road, Wamboyne Road, Blow Clear Road, and Clear Ridge Road.
- Burcher – the morning bus operates between 6.45 am and 9.00 am, and the afternoon bus operates between 3.15 am and 5.30 pm. The buses use West Wyalong Condobolin Road, Burcher Road, Lake Cowal Road, Fitzgerald Road, Wamboyne Road and Ungarie Road.

The school buses therefore operate on the following roads which form part of the existing preferred mine access routes:

- West Wyalong Route:
  - Ungarie Road between West Wyalong and Wamboyne Road;
  - Wamboyne Road between Ungarie Road and Blow Clear Road; and
  - Blow Clear Road between Wamboyne Road and Clear Ridge Road.
- Condobolin Route:
  - Burcher Road between The Gipps Way and Bena Street;
  - Bena Street between Burcher Road and Lake Cowal Road;
  - Lake Cowal Road between Bena Street and Fitzgerald Road; and
  - Fitzgerald Road between Lake Cowal Road (east-west) and Lake Cowal Road (north-south).
- Forbes Route:
  - Fitzgerald Road between Lake Cowal Road (east-west) and Lake Cowal Road (north-south).

The timing of the school buses results in only minor overlap between the buses being on any part of the routes and the peak periods of traffic generation by the CGO traffic (refer to Table 3.5).

3.12 Fatigue Management

Evolution implements a fatigue management program, Project Arrive Alive, which aims to reduce the risks associated with fatigue-related incidents. This includes consideration of the time taken for the workers to travel to and from the CGO at the start and end of their shift.

All Evolution employees are required to declare their usual place of residence while on shift/roster, which together with their shift time determines each worker's entitlements with respect to their allowed travel times and the type of travel permitted. Only private vehicles with authorisation are permitted to travel to and from the CGO. Approval for employees using private vehicles includes a Journey Management Plan, which sets out conditions under which the employee must travel. Company-provided transport to and from the site is expected to be used by employees where possible. Contractors are also expected to provide transport for their employees.

A number of initiatives have been implemented under the fatigue management program, including fatigue awareness training for employees and for the community, upgrades to the buses for passenger comfort, and a health and wellness program including supply of movement trackers (i.e. Fitbits) to employees to monitor their sleep patterns.

4. Modification Traffic

4.1 Modification Construction Traffic

4.1.1 Workforce

The Modification construction activity would increase the workforce at the CGO by approximately 100 people, who would travel to and from the CGO at the start and end of their shifts. Construction activity would occur between 7.00 am and 6.00 pm, seven days per week. On a typical day, a proportion of the additional workers would not be on-site at the CGO, due to roster arrangements and absenteeism, however this assessment assumes that 100 additional workers would travel to and from the site each day.

The additional workers would have similar travel characteristics to the existing workforce at the CGO, with Evolution planning to provide buses to meet demand as required. The majority of the additional workers would therefore travel by bus, and a small proportion would travel by light or heavy vehicles. Based on the existing travel characteristics, it is estimated that two additional coaches would be provided to transport workers, however to allow for variations in the residential distribution of the additional workers, this assessment assumes that additional buses would be provided on all routes:

- two additional coaches to and from West Wyalong;
- one additional small bus to and from Forbes; and
- one additional small bus to and from Condobolin.

This will tend to overestimate the total number of buses used to/from the CGO, as a robust assessment of future traffic conditions. On this basis, buses for transporting the workers would generate eight additional vehicle trips per day on the road network. In addition, some of the construction workers would travel by private vehicle, generating an estimated 16 vehicle trips per day, being 12 light vehicle trips and 4 heavy vehicle trips.

The workforce traffic would arrive at the CGO prior to 7.00 am and depart after 6.00 pm, and so would occur later than the existing peak hours for traffic generation of the CGO, which occur between 5.00 am and 6.00 am, and 5.00 pm and 6.00 pm. As a robust assessment of the potential impacts of the Modification, it has been assumed that the construction workforce would all travel during the existing CGO peak hours. This will overestimate the impacts of the Modification on the operation of the road network during peak hours.

It is noted that some of the 30 workers associated with the pipeline construction activity would work at times from the eastern side of Lake Cowal, and so may not travel to and from the CGO Access Road. The implications of this are discussed in Section 5.13.

4.1.2 Deliveries

For the purpose of this assessment, construction activity is estimated to generate an additional 10 deliveries per day to the CGO, generating 20 heavy vehicle trips on the road network on a typical day. This is considered a high estimate of average daily deliveries, likely to occur only on occasional days during the peak of the construction period. These deliveries are assumed to be sourced:

- West Wyalong access route 8 deliveries per day;
- Forbes access route 1 delivery per day; and
- Condobolin access route 1 delivery per day.

The assessment which follows assumes that all deliveries are made via the CGO Access Road, however it is noted that some deliveries would be made to the eastern side of Lake Cowal. Such deliveries would occur on a limited basis, and would include delivery of pipes and materials for the pipeline construction activity. The implications of this are discussed in Section 5.13.

4.1.3 Modification Construction Traffic

Table 4.1 summarises the forecast increase in peak construction period traffic generation of the CGO as a result of the Modification.

Table 4.1: Modification Construction Period Traffic by Access Route

Mine Access Route	5.00 am to 6.00 am (vehicles per hour)		5.00 pm to 6.00 pm (vehicles per hour)		Daily (vehicles per day)	
	Light	Heavy	Light	Heavy	Light	Heavy
Workforce	**6**	**6**	**6**	**6**	**12**	**12**
West Wyalong Route	4	4	4	4	8	8
Forbes Route	1	1	1	1	2	2
Condobolin Route	1	1	1	1	2	2
Deliveries	**0**	**1**	**0**	**1**	**0**	**20**
West Wyalong Route	0	1	0	1	0	16
Forbes Route	0	0	0	0	0	2
Condobolin Route	0	0	0	0	0	2
Total Additional	**6**	**7**	**6**	**7**	**12**	**32**
West Wyalong Route	4	5	4	5	8	24
Forbes Route	1	1	1	1	2	4
Condobolin Route	1	1	1	1	2	4

On the basis of the discussion above, the construction phase of the Modification is therefore expected to generate 44 additional vehicle trips per day and 13 additional vehicle trips during the peak hours. The majority of the additional trips would use the mine access route between West Wyalong and the CGO.

4.2 Modification Operational Traffic

4.2.1 Workforce

The additional 10 workers would travel to and from the CGO at the start and end of their shift. Based on the existing site attendance rate, of the 10 additional workers, seven or eight would be expected to be on site on a typical weekday. The mode of travel of the additional workers would depend on their shift arrangements and residential location. It is likely that this small number of additional workers would be accommodated in the existing buses to and from the CGO which currently operate with spare seating capacity, and so would not generate any additional vehicle trips on the road network.

To allow for variations in the residential distribution of the additional workers and the possibility that some may need to travel by private vehicle, this assessment assumes that the additional workers would travel as follows:

- West Wyalong access route 1 light vehicle;
- Forbes access route 1 light vehicle; and
- Condobolin access route 1 light vehicle.

These workers are assumed to travel during the CGO peak hours.

4.2.2 Deliveries

The Modification is expected to result in an increase of approximately 25 percent in deliveries made to the CGO. Deliveries currently account for some 52 heavy vehicle trips per day to and from the CGO, with an additional four heavy vehicle trips expected with the approved Modification 13. The Modification is therefore expected to generate an additional 14 heavy vehicle delivery trips per day.

The additional deliveries resulting from the Modification are expected to be sourced from similar locations to the existing deliveries. On this basis, all additional delivery vehicles are assumed to approach and depart the CGO via West Wyalong, using the existing mine access route.

4.2.3 Gravel Transport

Up to 150,000 tpa of crushed waste rock would be made available on-site for collection by the Bland, Forbes and Lachlan Shire Councils and RMS. The gravel would be transported from the CGO by road between 7.00 am and 6.00 pm, up to seven days per week, using B-doubles or other articulated vehicles. It is anticipated that while such transport may occur seven days per week, the demand would tend to be reduced on Sundays, so the majority of waste rock haulage would occur Mondays to Saturdays. On this basis, and assuming an average load of 25 t per truck, operating over an average of 50 weeks per year, gravel haulage would attract an average of 20 trucks per day to the CGO. This would generate 40 heavy vehicle trips per day to and from the CGO. Demand would vary throughout the year, and each Council is likely to transport gravel on a campaign basis, with periods of higher activity and periods of lower activity.

For the purpose of this assessment, to take into account the expected fluctuations in gravel haulage, on a busy day, the transport of gravel from the CGO is assumed to generate double the average number of trips:

- 80 heavy vehicle trips per day (40 inbound empty trucks and 40 outbound laden trucks).
- Up to 8 heavy vehicle trips per hour (4 inbound empty and 4 outbound laden trucks).

The distribution of trips made by heavy vehicles transporting gravel from the CGO would vary depending on the project or stockpile location relevant to each authority.

- Bland Shire Council would use the gravel directly on roads or stockpile it within existing gravel/road pits, which are generally within a 15 km radius of the CGO;
- Forbes Shire Council would transport gravel to current roadworks sites for immediate use or stockpiling; and
- Lachlan Shire Council would transport gravel to roadworks in the Burcher area.

During any one haulage campaign, the gravel trucks may all use one route, however over an extended period, the trips would be distributed over various routes depending on the locations of stockpiles and roadworks. The assessment which follows therefore considers the impacts of gravel haulage with the forecast number of gravel trucks using each of the proposed mine access routes. This represents the busy day conditions on each of the mine access routes, noting that such conditions would not ever occur simultaneously.

4.2.4 Modification Operational Traffic

Table 4.2 summarises the forecast increase in operational traffic generation of the CGO as a result of the Modification.

Table 4.2: Summary of Modification Additional Operational Traffic by Access Route

Mine Access Route	5.00 am to 6.00 am (vehicles per hour)		5.00 pm to 6.00 pm (vehicles per hour)		Daily (vehicles per day)	
	Light	Heavy	Light	Heavy	Light	Heavy
Workforce	**3**	**0**	**3**	**0**	**6**	**0**
West Wyalong Route	1	0	1	0	2	0
Forbes Route	1	0	1	0	2	0
Condobolin Route	1	0	1	0	2	0
Deliveries	**0**	**1**	**0**	**2**	**0**	**14**
West Wyalong Route	0	1	0	2	0	14
Forbes Route	0	0	0	0	0	0
Condobolin Route	0	0	0	0	0	0
Gravel Haulage	**0**	**0**	**0**	**8**	**0**	**80**
West Wyalong Route	0	0	0	8	0	80
Forbes Route	0	0	0	8	0	80
Condobolin Route	0	0	0	8	0	80
Total	**3**	**1**	**3**	**10**	**6**	**94**
West Wyalong Route	1	1	1	10	2	94
Forbes Route	1	0	1	8	2	80
Condobolin Route	1	0	1	8	2	80

Assumes gravel haulage occurs on each access route, however haulage would occur on one access route only on any one day

The Modification is thus expected to result in an increase of 100 vehicles per day above its baseline traffic generation on a busy day during a gravel haulage campaign. Outside of gravel haulage periods, the Modification would increase the daily traffic generation of the CGO by 20 vehicle trips per day.

4.3 Changes to Mine Access Routes

The key changes to the mine access routes are summarised in Table 2.3.

The Modification would not result in any change to the baseline CGO traffic distribution under most circumstances. Some redistribution would occur when the Forbes High Water 2 route is used, which may also carry some traffic to and from Mid Western Highway which would otherwise travel via West Wyalong.

4.4 Total CGO Traffic Distribution

Table 4.3 summarises the distribution of morning peak hour CGO-generated traffic under the existing baseline conditions, and with the Modification during the peak construction period and operational period (during a gravel haulage campaign assuming haulage along all mine access routes, refer to Section 4.2.3). The comparison assumes CGO traffic uses the preferred mine access routes.

Table 4.3: AM Peak Baseline and Modification CGO Traffic Distribution (vehicles per hour)

Road	Baseline		Modification Construction		Modification Operational	
	Light	Heavy	Light	Heavy	Light	Heavy
Bena Street Wamboyne Road to Burcher Road	5	2	6	3	6	2
Blow Clear Road Bonehams Lane to Wamboyne Road	34	5	38	10	35	6
Bonehams Lane CGO Access to Blow Clear Road	34	5	38	10	35	6
Burcher Road Bena Street to The Gipps Way	5	2	6	3	6	2
CGO Access Road East of Bonehams Lane/Lake Cowal Road	46	9	52	16	49	10
Lake Cowal Road/Bogies Island Road/West Plains Road Newell Highway to Fitzgerald Road	7	2	8	3	8	2
Lake Cowal Road/Fitzgerald Road CGO Access to Lake Cowal Road	12	4	14	6	14	4
Lake Cowal Road Fitzgerald Road to Wamboyne Road	5	2	6	3	6	2
Mid Western Highway East of Newell Highway	4	2	4	5	4	2
Newell Highway West Wyalong to Mid Western Highway	4	2	4	5	4	2
Newell Highway West Plains Road to Forbes	7	2	8	3	8	2
Ungarie Road Wamboyne Road to West Wyalong	34	5	38	10	35	6
Wamboyne Road Blow Clear Road to Ungarie Road	34	5	38	10	35	6

Assumes use of the preferred mine access routes

Table 4.4 summarises the distribution of evening peak hourly CGO-generated traffic under the existing baseline conditions, and with the Modification during the peak construction period and operational period (during a busy day gravel haulage campaign assuming haulage along all mine access routes, refer to Section 4.2.3). The comparison assumes CGO traffic uses the preferred mine access routes.

Table 4.4: PM Peak Baseline and Modification CGO Traffic Distribution (vehicles per hour)

Road	Baseline		Modification Construction		Modification Operational	
	Light	Heavy	Light	Heavy	Light	Heavy
Bena Street Wamboyne Road to Burcher Road	4	2	5	3	5	10
Blow Clear Road Bonehams Lane to Wamboyne Road	27	8	31	13	28	18
Bonehams Lane CGO Access to Blow Clear Road	27	8	31	13	28	18
Burcher Road Bena Street to The Gipps Way	4	2	5	3	5	10
CGO Access Road East of Bonehams Lane/Lake Cowal Road	37	12	43	19	40	22
Lake Cowal Road/Bogies Island Road/West Plains Road Newell Highway to Fitzgerald Road	6	2	7	3	7	10
Lake Cowal Road/Fitzgerald Road CGO Access to Lake Cowal Road	10	4	12	6	12	12
Lake Cowal Road Fitzgerald Road to Wamboyne Road	4	2	5	3	5	10
Mid Western Highway East of Newell Highway	3	2	3	5	3	2
Newell Highway West Wyalong to Mid Western Highway	3	2	3	5	3	2
Newell Highway West Plains Road to Forbes	6	2	7	3	7	10
Ungarie Road Wamboyne Road to West Wyalong	27	8	31	13	28	18
Wamboyne Road Blow Clear Road to Ungarie Road	27	8	31	13	28	18

Assumes use of the preferred mine access routes

Table 4.5 summarises the distribution of daily CGO-generated traffic under the existing baseline conditions, and with the Modification during the peak construction period and operational period (during a busy day gravel haulage campaign assuming haulage along all mine access routes, refer to Section 4.2.3). The comparison assumes CGO traffic uses the preferred mine access routes.

Table 4.5: Daily Baseline and Modification CGO Traffic Distribution (vehicles per day)

Road	Baseline		Modification Construction		Modification Operational	
	Light	Heavy	Light	Heavy	Light	Heavy
Bena Street Wamboyne Road to Burcher Road	24	6	26	10	26	86
Blow Clear Road Bonehams Lane to Wamboyne Road	184	93	192	117	186	187
Bonehams Lane CGO Access to Blow Clear Road	184	93	192	117	186	187
Burcher Road Bena Street to The Gipps Way	24	6	26	10	26	86
CGO Access Road East of Bonehams Lane/Lake Cowal Road	243	105	255	137	249	199
Lake Cowal Road/Bogies Island Road/West Plains Road Newell Highway to Fitzgerald Road	35	6	37	10	37	86
Lake Cowal Road/Fitzgerald Road CGO Access to Lake Cowal Road	59	12	63	20	63	92
Lake Cowal Road Fitzgerald Road to Wamboyne Road	24	6	26	10	26	86
Mid Western Highway East of Newell Highway	19	19	19	31	19	25
Newell Highway West Wyalong to Mid Western Highway	19	19	19	31	19	25
Newell Highway West Plains Road to Forbes	35	6	37	10	37	86
Ungarie Road Wamboyne Road to West Wyalong	184	93	192	117	186	187
Wamboyne Road Blow Clear Road to Ungarie Road	184	93	192	117	186	187

Assumes use of the preferred mine access routes

4.5 Alternative Mine Access Routes

Alternative routes are used to/from Forbes when local conditions require the closure of the preferred mine access route. The Modification proposes:

- continued use of the existing alternative route to and from Forbes via Corinella for those occasions when the water level in Nerang Cowal closes Bogies Island Road;
- use of an alternative route to and from Forbes for those occasions when the water level in Nerang Cowal closes Bogies Island Road, the alternative route via Corinella is closed (typically when all unsealed roads in Lachlan Shire and/or Forbes Shire are closed) but the unsealed roads in Bland Shire remain open; and
- continued use of the alternative sealed road route to and from Forbes via West Wyalong for those occasions when all unsealed roads in the region are closed.

An alternative route is used to/from Condobolin when local conditions require the closure of the unsealed roads on the preferred mine access route. The Modification proposed continued use of the existing alternative sealed roads route to/from Condobolin.

With regard to the frequency of use of the alternative routes, Evolution has advised that road condition reports from Forbes Shire indicate that the unsealed roads in Forbes Shire were closed seven times for a total period of approximately two weeks during 2017. This was considered to be a "typical" year. Review of road condition reports for Lachlan Shire indicate that the unsealed roads in Lachlan Shire were closed three times in 2017, for a total of 18 days.

It is expected that the alternative routes would therefore be used infrequently, and typically for only a short period of a few days or weeks at a time. The infrequency of their use does not warrant detailed assessment of those routes, however for the purpose of this assessment, the distribution of the operational CGO traffic with the Modification is summarised in Table 4.6, including busy day gravel haulage (refer to Section 4.2.3).

The three scenarios represent a range of road conditions which may occur on occasion, which would result in the alternative routes being used:

- High water in Nerang Cowal closes Bogies Island Road, but all other unsealed roads in the region remain open. Under these circumstances, the High Water 1 route to/from Forbes would be used, and the preferred mine access routes to/from Condobolin and West Wyalong would be used;
- Unsealed roads in Lachlan and/or Forbes Shire are closed and unsealed roads in Bland Shire remain open. Under these circumstances, the High Water 2 route to/from Forbes would be used, the sealed road route to/from Condobolin would be used, and the preferred mine access route to/from West Wyalong would be used; and
- All unsealed roads in the region are closed. Under these circumstances, the sealed roads routes to/from Forbes, Condobolin and West Wyalong would be used.

Table 4.6: Daily Operational CGO Traffic Distribution with Alternative Access Routes (vehicles per day)

Road	Scenario 1 Forbes High Water 1 Condobolin Preferred West Wyalong Preferred		Scenario 2 Forbes High Water 2 Condobolin Sealed West Wyalong Preferred		Scenario 3 Forbes Sealed Condobolin Sealed West Wyalong Preferred	
	Light	Heavy	Light	Heavy	Light	Heavy
Bena Street Wamboyne Road to Burcher Road	26	86	26	86	26	86
Blow Clear Road Bonehams Lane to Lonergans Lane	186	187	249	199	249	199
Blow Clear Road Lonergans Lane to Wamboyne Road	186	187	193	168	249	199
Bonehams Lane CGO Access to Blow Clear Road	186	187	249	199	249	199
Burcher Road Bena Street to The Gipps Way	26	86	26	86	26	86
CGO Access Road East of Bonehams Lane/Lake Cowal Road	249	199	249	199	249	199
Lake Cowal Road (NS) and Fitzgerald Road CGO Access Road to Lake Cowal Road (EW)	63	92	0	0	0	0
Lonergans Lane/Clear Ridge Road/Bodells Lane Blow Clear Road to Newell HIghway	0	0	56	111	0	0
Marsden Road – Corinella Road – Warroo Road – Driftway Road – Lachlan Valley Way	37	86	0	0	0	0
Mid Western Highway East of Newell Highway	19	25	19	25	19	25
Newell Highway West Wyalong to Bodells Lane	19	25	0	0	19	25
Newell Highway Bodells Lane to Mid Western Highway	19	25	56	111	56	111
Newell Highway Mid Western Highway to West Plains Road	0	0	37	86	37	86
Newell Highway West Plains Road to Lachlan Valley Way	0	0	37	86	37	86
Newell Highway Lachlan Valley Way to Forbes	37	86	37	86	37	86
Ungarie Road Wamboyne Road to West Wyalong	186	187	167	162	186	187
Wamboyne Road Blow Clear Road to Ungarie Road	186	187	167	162	186	187
Wamboyne Road Blow Clear Road to Bena Street	0	0	26	86	26	86

All options are with the Modification operational including busy day gravel haulage on all routes (refer to Section 4.2.3)

5. Future Road Environment

5.1 Assessment Scenarios

The following process has been adopted in assessing the impacts of the Modification on the operation of the road network during peak times:

I. Future traffic volumes on the road network are first determined based on background traffic growth and assuming that the Modification has not been implemented.
II. The numbers of trips generated by the Modification are then determined and added to the future traffic numbers forecast in I above.
III. The results from I and II are then compared to identify the impact of the Modification.

Regarding step II above, two future scenarios relating to the Modification traffic have been considered for assessment:

- Construction traffic – peak activity is expected to occur during 2020. This will coincide with ongoing operational activity at the CGO consistent with existing conditions, plus the additional activity associated with the approved Modification 13.
- Operational traffic – operational activity is expected to reach its future peak level by 2024. This assessment adopts 2024 for the operational assessment scenario to include the cumulative effects of the Modification with unrelated background traffic growth.

5.2 Background Traffic Growth

Review of the traffic volume data (refer to Section 3.3) indicates that historically, growth in traffic is generally very low, with some locations showing a decline in traffic volumes over time. For the purpose of this assessment, light and heavy vehicle traffic not associated with the CGO on the roads relevant to the CGO is assumed to grow at an average rate of one percent per annum.

Observations made by GTA Consultants on site indicate that the existing volumes of traffic along the Bodells Lane – Clear Ridge Road – Lonergans Lane route are very low, and for the purpose of this assessment are estimated at 50 vehicles per day, and five vehicles per hour during the CGO peak hours.

Table 5.1 summarises the peak hourly and daily traffic forecasts at each of the survey locations for the existing and two future scenario years.

Table 5.1: Existing and Forecast Background (Non-CGO) Traffic

Site[A]	Location	5.00 am to 6.00 am (vehicles per hour)		5.00 pm to 6.00 pm (vehicles per hour)		Daily (vehicles per day)	
		Light	Heavy	Light	Heavy	Light	Heavy
Year 2017							
A	CGO Access Road	0	0	0	0	0	0
B	Blow Clear Road	6	7	10	1	52	9
C	Wamboyne Road	0	0	11	1	80	15
D	Ungarie Road	15	9	71	8	816	203
E	Newell Highway	8	15	62	38	1,220	812
Year 2020							
A	CGO Access Road	0	0	0	0	0	0
B	Blow Clear Road	6	7	10	1	54	9
C	Wamboyne Road	0	0	11	1	82	15
D	Ungarie Road	15	9	73	8	840	209
E	Newell Highway	8	15	64	39	1,257	836
Year 2024							
A	CGO Access Road	0	0	0	0	0	0
B	Blow Clear Road	6	7	11	1	56	10
C	Wamboyne Road	0	0	12	1	86	16
D	Ungarie Road	16	10	76	9	873	217
E	Newell Highway	9	16	66	41	1,305	869

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

5.3 Future Traffic Volumes Year 2020

Table 5.2 summarises the forecast peak hourly and daily traffic volumes at key locations with and without the Modification during 2020.

Table 5.2: Forecast Future Traffic Volumes With and Without the Modification in 2020

Site[A]	Location	5.00 am to 6.00 am (vehicles per hour)		5.00 pm to 6.00 pm (vehicles per hour)		Daily (vehicles per day)	
		Light	Heavy	Light	Heavy	Light	Heavy
No Modification							
A	CGO Access Road	46	9	37	12	243	105
B	Blow Clear Road	40	12	37	9	238	102
C	Wamboyne Road	0	0	11	1	82	15
D	Ungarie Road	49	14	100	16	1,024	302
E	Newell Highway	11	17	67	41	1,276	855
With Modification							
A	CGO Access Road	52	16	43	19	255	137
B	Blow Clear Road	44	17	41	14	246	126
C	Wamboyne Road	0	0	11	1	82	15
D	Ungarie Road	53	19	104	21	1,032	330
E	Newell Highway	11	20	67	44	1,276	867

Assumes use of the preferred mine access routes

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

5.4 Future Traffic Volumes Year 2024

Table 5.3 summarises the forecast peak hourly and daily traffic volumes at key locations with and without the Modification.

Table 5.3: Future Traffic Volumes With and Without the Modification in 2024

Site[A]	Location	5.00 am to 6.00 am (vehicles per hour)		5.00 pm to 6.00 pm (vehicles per hour)		Daily (vehicles per day)	
		Light	Heavy	Light	Heavy	Light	Heavy
No Modification							
A	CGO Access Road	46	9	37	12	243	105
B	Blow Clear Road	40	12	38	9	240	103
C	Wamboyne Road	0	0	12	1	86	16
D	Ungarie Road	50	15	103	17	1,057	310
E	Newell Highway	11	18	69	43	1,324	888
With Modification							
A	CGO Access Road	49	10	40	22	249	199
B	Blow Clear Road	41	13	39	11	242	117
C	Wamboyne Road	0	0	12	1	86	16
D	Ungarie Road	51	16	104	27	1,059	404
E	Newell Highway	11	18	69	43	1,324	894

Assumes use of the preferred mine access routes

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

5.5 Future Road Network Performance Year 2020

The future operational performance of the road network has been assessed using the HCM methodology (Section 3.8) both with and without the Modification in 2020. The results are summarised in Table 5.4 for the peak hours associated with CGO traffic.

The results indicate that the Modification would have negligible impact on the operational performance of the key access routes for the CGO. Drivers would continue to experience good levels of service during the CGO peak hours without need for additional capacity.

Table 5.4: Future Weekday Peak Hour Midblock Road Performance in 2020

Site[A]	Road and Location	Class		Inbound to CGO		Outbound from CGO	
				PTSF (ATS)	LOS	PTSF (ATS)	LOS
Morning Peak Hour 5.00 am to 6.00 am							
A	CGO Access Road	II	No Modification With Modification	50.5 52.4	B B	- -	- -
B	Blow Clear Road	II	No Modification With Modification	31.0 32.2	A A	- -	- -
C	Wamboyne Road	II	No Modification With Modification	- 4.7	- A	- -	- -
D	Ungarie Road	II	No Modification With Modification	29.3 30.8	A A	3.7 3.4	A A
E	Newell Highway[B]	I	No Modification With Modification	17.0 (66.7) 19.8 (66.7)	A (A) A (A)	23.1 (66.7) 21.3 (66.7)	A (A) A (A)
Evening Peak Hour 5.00 pm to 6.00 pm							
A	CGO Access Road	II	No Modification With Modification	12.7 10.2	A A	42.9 46.6	B B
B	Blow Clear Road	II	No Modification With Modification	9.0 7.7	A A	25.2 27.3	A A
C	Wamboyne Road	II	No Modification With Modification	7.5 7.5	A A	5.3 5.3	A A
D	Ungarie Road	II	No Modification With Modification	20.9 20.2	A A	25.0 27.6	A A
E	Newell Highway[B]	I	No Modification With Modification	28.5 (65.8) 28.0 (65.8)	A (A) A (A)	22.8 (65.8) 23.8 (65.8)	A (A) A (A)

Assumes use of the preferred mine access routes, no result indicates no traffic in specified direction

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

[B] Inbound taken to be southbound, outbound taken to be northbound

5.6 Future Road Network Performance Year 2024

The future operational performance of the road network has been assessed using the HCM methodology (Section 3.8) both with and without the Modification in 2024. The results are summarised in Table 5.5 for the peak hours associated with CGO traffic.

The results indicate that the Modification would have negligible impact on the operational performance of the key access routes for the CGO. Drivers would continue to experience good levels of service during the CGO peak hours without need for additional capacity.

Table 5.5: Future Weekday Peak Hour Midblock Road Performance in 2024

Site[A]	Road and Location	Class		Inbound to CGO		Outbound from CGO	
				PTSF (ATS)	LOS	PTSF (ATS)	LOS
Morning Peak Hour 5.00 am to 6.00 am							
A	CGO Access Road	II	No Modification With Modification	50.5 51.0	B B	- -	- -
B	Blow Clear Road	II	No Modification With Modification	31.0 31.2	A A	- -	- -
C	Wamboyne Road	II	No Modification With Modification	- 4.7	- A	- -	- -
D	Ungarie Road	II	No Modification With Modification	29.6 30.0	A A	3.6 3.6	A A
E	Newell Highway[B]	I	No Modification With Modification	16.5 (66.7) 16.5 (66.7)	A (A) A (A)	23.8 (66.7) 23.8 (66.7)	A (A) A (A)
Evening Peak Hour 5.00 pm to 6.00 pm							
A	CGO Access Road	II	No Modification With Modification	12.7 15.2	A A	42.9 42.2	B B
B	Blow Clear Road	II	No Modification With Modification	9.0 9.3	A A	25.2 26.0	A A
C	Wamboyne Road	II	No Modification With Modification	7.5 7.5	A A	5.3 6.8	A A
D	Ungarie Road	II	No Modification With Modification	21.4 22.0	A A	24.9 25.8	A A
E	Newell Highway[B]	I	No Modification With Modification	28.7 (65.8) 28.7 (65.8)	A (A) A (A)	23.2 (65.8) 23.2 (65.8)	A (A) A (A)

Assumes use of the preferred mine access routes, no result indicates no traffic in specified direction

[A] Refer to Figure 2.1, Sites A and B are Tuesday to Thursday only

[B] Inbound taken to be southbound, outbound taken to be northbound

5.7 Mine Access Routes Road Standards

5.7.1 Forbes Mine Access Route

The Modification would not alter the preferred Forbes mine access route, which is comprised of unsealed two-way two-lane roads between the CGO and Newell Highway, and is generally constructed to a good standard, subject to continued maintenance of the surface and roadside signage. During a busy day on which the preferred route is used for gravel haulage, the forecasts (Table 4.5) indicate that the CGO would generate 123 vehicles per day on the Forbes access route. Outside of gravel haulage campaigns, the CGO would generate approximately 43 vehicles per day on the route. It is estimated that non-CGO traffic on that route would be less than 100 vehicles per day.

The forecast volume when the preferred mine access is used during a gravel campaign to Forbes is therefore consistent with a class 4A unsealed road (ARRB, 2009), which carry in excess of 150 vehicles per day. Such roads generally operate at a speed of 50 km/h to 80 km/h according to the terrain, have a minimum carriageway width of 7 m, and are typically an all weather two-lane road. They may carry heavy vehicles, and can be sealed if economically justifiable.

The forecast volume of CGO-generated traffic when gravel haulage does not occur is consistent with that of a class 4B unsealed road (ARRB, 2009). Such roads generally operate at a speed of 30 km/h to 70 km/h according to terrain, have a minimum carriageway width of 5.5 m, and are typically an all weather two-lane road or single lane sealed road with gravel shoulders.

The route is generally constructed to an adequate standard to accommodate the traffic demands. The width is sufficient to permit two heavy vehicles to pass, and it supports travel speeds in excess of 70 km/h. No upgrading of the route is considered to be warranted by the Modification, subject to continued maintenance of the surface.

Forbes Alternative Route – High Water 1

The Modification would not alter the alternative Forbes High Water 1 mine access route, which is comprised of sealed and unsealed two-way two-lane roads between the CGO access road and Lachlan Valley Way, and is generally constructed to an adequate standard to accommodate the traffic demands. The forecast volumes on the High Water 1 route would be similar to those on the preferred mine access route, with non-CGO traffic of less than 100 vehicles per day.

The width is generally sufficient to permit two heavy vehicles to pass, and the unsealed surface supports travel speeds in excess of 50 km/h. The route would continue to be used only when Bogies Island Road is closed due to high water levels in Nerang Cowal and the unsealed roads in Forbes and Lachlan Shires remain open. No upgrading of the route is considered to be warranted by the Modification, subject to continued maintenance of the unsealed surfaces.

Forbes Alternative Route – High Water 2

The proposed alternative High Water 2 mine access route to and from Forbes would use a route between Blow Clear Road and Newell Highway which is currently an unsealed formed road, with the exception of a short length of sealed road at the intersection of Bodells Lane and Clear Ridge Road. Between Lonergans Lane and the CGO, the route follows the same roads as the existing preferred mine access route from West Wyalong (refer to Section 5.7.3).

The forecasts in Table 4.6 suggest that the route may carry approximately 167 CGO-generated vehicles per day if it is used on a busy day during a gravel haulage campaign to Newell Highway. It is estimated that the route currently carries in the order of 50 vehicles per day. The forecast volume when the High Water 2 is used during a gravel campaign to Forbes is therefore consistent with a class 4A unsealed road (ARRB, 2009). Outside of a gravel haulage campaign period when the High Water 2 route is used, the forecast volume of CGO-generated traffic would be less than 90 vehicles per day, with forecast volumes consistent with that of a class 4B unsealed road (ARRB, 2009).

Considering the likely infrequent use of the route by CGO traffic, it may appropriately remain unsealed, subject to continued maintenance to ensure the route is trafficable when required. It is anticipated that the terrain would permit speeds at the upper end of the range for class 4A roads. The route is generally constructed to an adequate width to permit two heavy vehicles to pass, and is considered satisfactory to accommodate the occasional use by CGO traffic during periods in which unsealed roads in the Forbes and/or Lachlan Shire are closed, but those in the Bland Shire remain open. No upgrading of the route is considered to be warranted by the Modification, subject to continued maintenance of the road surface and roadside signage.

Forbes Alternative Route – Sealed Road Route

The Modification would not alter the sealed road Forbes mine access route, which follows Newell Highway and the preferred West Wyalong mine access route sealed two-way two-lane roads and generally constructed to a good standard. The introduction of the proposed High Water 2 alternative access route from Forbes would be likely to decrease the frequency with which the alternative sealed road route is used by CGO traffic. No upgrading of the route would be warranted by the Modification.

5.7.2 Condobolin Mine Access Route

The Modification would not alter the preferred Condobolin mine access route. Between the CGO and the intersection of Bena Street and Wamboyne Road, the route is comprised of unsealed two-way two-lane roads. Background traffic on this part of the route is observed by GTA Consultants to be very low. On a busy day during a gravel haulage campaign, the CGO is forecast to generate 112 vehicle movements per day, reducing to 32 vehicle movements per day outside of a gravel haulage campaign. The forecast volumes on this route and the standard of the road are generally consistent with that of a class 4B unsealed road (ARRB, 2009). Heavy vehicles are able to pass each other along the route. No upgrading of this part of the route would be warranted by the Modification, subject to continued maintenance of the unsealed surface.

Between the intersection of Bena Street and Wamboyne Road and the eastern end of Burcher, Bena Street has a single lane wide sealed surface and wide unsealed shoulders. Background traffic on Bena Street is observed by GTA Consultants to be very low. At volumes of up to 150 vehicles per day, Austroads (2016a) indicates that a single 3.7 m wide traffic lane with a 2.5 m wide shoulder on each side is satisfactory. The wide shoulders allow vehicles to move off the sealed lane onto the shoulder to pass if required. Sight distances for vehicles travelling along Bena Street are good, with drivers able to observe an approaching vehicle with adequate time to slow and move to the left to pass. The highest use of Bena Street would occur during a gravel haulage campaign, which is likely to use a small fleet of trucks such that drivers are familiar with the route and the need to move off the seal to pass. The probability of gravel haulage trucks needing to pass on Bena Street is very low, at less than one percent assuming random truck arrivals. During a haulage campaign, use of the single lane section of Bena Street may also be managed via driver communication to further reduce the likelihood of trucks needing to pass on Bena Street. It is recommended that a Traffic Management Plan be prepared to manage the operation of gravel haulage trucks, and that this include driver behaviour with regard to interaction with other vehicles on Bena Street. The gravel haulage trucks would be operated by the local councils and RMS, thus the preparation and implementation of a Traffic Management Plan should be developed in consultation with those authorities.

The existing typical layout of Bena Street between Wamboyne Road and Burcher is therefore generally satisfactory to accommodate the forecast future number of vehicles expected to use it with the Modification. Should Bena Street be upgraded to provide a sealed surface sufficient for two way traffic, this would be designed and constructed in accordance with Austroads guidelines and in consultation with Lachlan Shire Council.

Between Burcher and Condobolin, the route is typically a sealed two-way two-lane road, and generally constructed to a good standard. No upgrading of the route would be warranted by the Modification.

Condobolin Alternative Route – Sealed Road Route

The Modification would not change the alternative sealed road mine access route to and from Condobolin. The route is primarily comprised of sealed two-lane two-way roads, with the exception of Bena Street as discussed above, and a short length of unsealed road at the location of the former railway level crossing on Wamboyne Road approximately 1.6 km north of its intersection with Fitzgerald Road. This portion of Wamboyne Road generally lacks centre or edge line marking and has guide posts with delineators. This general arrangement is consistent with Austroads (2016b), noting that some guide posts and/or delineators were observed to be damaged or missing, and it is recommended that regardless of the Modification, these be replaced such that guide post spacing is consistent with the guidelines, noting that Wamboyne Road follows a generally straight alignment and carries traffic volumes sufficiently low that increased spacing of guide posts up to 300 m is acceptable.

During gravel haulage campaigns in the Condobolin area, the CGO would generate 112 vehicles per day on the sealed road alternative route (Table 4.5). The forecast traffic volumes would not necessarily warrant sealing of the short unsealed section of Wamboyne Road, nor provision of line marking. As the route is to be used when unsealed roads are closed, it is however recommended that the unsealed length be sealed to ensure the route remains trafficable at all times. Should it remain unsealed, ongoing maintenance is recommended to ensure that the surface remains safe and trafficable.

5.7.3 West Wyalong Mine Access Route

The Modification would not alter the West Wyalong mine access route, which is comprised of sealed two-way two-lane roads and generally constructed to a good standard, with centre and/or edge line marking and guideposts. The additional traffic generated by the Modification would not warrant upgrading of the route.

5.8 Impacts on Intersection Operation

The Modification would result in increases to the vehicle turning movements at a number of key intersections along the proposed mine access routes. The number of vehicles turning at or travelling through each intersection depends on the number of inbound and outbound vehicles along each route. The inbound and outbound CGO-generated traffic along each route during the morning and evening peak hours is summarised in Table 5.6.

Table 5.6: CGO Peak Hourly Inbound and Outbound Traffic (vehicles per hour)

	5.00am to 6.00am (vehicles per hour)		5.00pm to 6.00pm (vehicles per hour)	
	Inbound	Outbound	Inbound	Outbound
Baseline Approved CGO	**55**	**0**	**11**	**38**
Forbes Mine Access Route	9	0	2	6
Condobolin Mine Access Route	7	0	2	4
West Wyalong Mine Access Route	39	0	7	28
Via Newell Highway/Mid Western Highway	*6*	*0*	*2*	*4*
Via Main West Wyalong route	*33*	*0*	*5*	*24*
With Modification – Construction	**68**	**0**	**11**	**51**
Forbes Mine Access Route	11	0	2	8
Condobolin Mine Access Route	9	0	2	6
West Wyalong Mine Access Route	48	0	7	37
Via Newell Highway/Mid Western Highway	*9*	*0*	*1*	*7*
Via Main West Wyalong route	*39*	*0*	*6*	*30*
With Modification – Operational	**59**	**0**	**16**[A]	**42**[A]
Forbes Mine Access Route	10	0	6	11
Condobolin Mine Access Route	8	0	6	5
West Wyalong Mine Access Route	41	0	12	34
Via Newell Highway/Mid Western Highway	*6*	*0*	*1*	*4*
Via Main West Wyalong route	*35*	*0*	*11*	*30*

Assumes use of the preferred mine access routes

[A] Total is less than the sum of the traffic on each route due to gravel haulage which is assumed to occur at peak rate on all routes

The changes in vehicle movements at the intersections along the proposed mine access routes are sufficiently low that future volumes would remain at such a level that intersection capacity and delays would remain acceptable. Formal analysis of the operation of the intersections is not warranted.

5.9 Intersection Designs

The Modification would result in changes to the vehicle movements at a number of key intersections in the region. The suitability of the intersection layouts is discussed below, with regard to the current Austroads rural intersection treatment warrants and design layouts (Austroads, 2017b, 2017c and 2017d). The following discussion assumes use of the Modification preferred mine access routes, except where an alternative route is specified.

5.9.1 Intersection Treatments

Basic Intersection Treatment

The general minimum preferred treatment at rural road intersections are Basic Auxiliary Left (BAL) and Basic Auxiliary Right (BAR) treatments. The rural BAL treatment on the major road has a widened shoulder, which assists turning vehicles to move further off the through carriageway, making it easier for through vehicles to pass a vehicle turning left into the minor road. The rural BAR treatment features a widened shoulder on the major road that allows through vehicles, having slowed, to pass to the left of vehicles turning right into the minor road. The BAL treatment on the minor road allows turning movements to occur from a single lane, with a shoulder that is too narrow to be used by left-turning vehicles, so as to prevent vehicles from standing two abreast at the holding line. These design features are preferred to safely manage the movement of vehicles in the high speed rural environment.

Auxiliary Lane Treatment

Auxiliary lane turn treatments have short lengths of auxiliary lane provided to improve safety, especially on high speed roads. The Auxiliary Right-turn treatment (AUR) on the major road is created by the use of a short lane with standard painted stripes, where the median lane is shared between through and right turning vehicles, and the auxiliary kerbside lane allows through vehicles to pass a vehicle which has slowed to turn right. AUR treatments are not used in NSW, rather a channelised right turn (CHR) treatment with a short turn bay known as a CHR(S) treatment is preferred. This is a modification of the channelised treatment described below.

Auxiliary Left-turn (AUL) treatments on the major and minor road are normal indented turn lanes, used only by vehicles turning left. The auxiliary lane treatment on the major road is safer than a basic treatment, however the channelised treatment described below is preferred where practicable, as the risk of collisions is lower. Consequently, Austroads (2017d) indicates that a channelised left turn (CHL) treatment should be used wherever practicable. The AUL treatment on the minor road is less safe than a basic or channelised treatment, and is therefore while it is included in the warrants, it is not recommended, and Austroads (2017d) indicates that a BAL or CHL treatment should be used wherever practicable.

Channelised Treatment

Channelised treatments at the intersections are CHR and CHL treatments for right and left turns respectively. The channelised "CH" treatments separate conflicting vehicle paths by raised or painted medians and/or islands, and often use auxiliary lanes in conjunction with channelisation. The CHR treatment on the major road provides a continuous lane for through vehicles only, and an auxiliary turn lane for right turning vehicles only. CHL treatments on the major or minor road provide a separate left turn "slip" lane, separated from the adjacent lane by a painted or raised island.

Channelised treatments are preferred over auxiliary lane treatments where practicable, as the risk of collisions is lower.

5.9.2 CGO Access Road, Bonehams Lane and Lake Cowal Road

With the Modification, all CGO traffic to and from West Wyalong would continue to enter and exit the CGO Access Road from Bonehams Lane. CGO traffic to and from Forbes and Condobolin would continue to enter and exit via Lake Cowal Road North, except when the High Water 2 route to/from Forbes or the sealed road routes are in use. The existing intersection layout is generally satisfactory for the future demands under any of the route options, subject to clarification of priority. It is recommended that "give way" lines be provided across Lake Cowal Road on its approaches to Bonehams Lane/CGO Access Road to supplement the existing "give way" signs.

It is also recommended that signage be improved at the 90-degree bend (stub T-intersection) in Bonehams Lane with chevron alignment markers or similar.

5.9.3 Blow Clear Road and Bonehams Lane

With the Modification, there would be an increase in the number of vehicles turning between Blow Clear Road (West) and Bonehams Lane compared with the baseline conditions. All vehicles travelling to the CGO from West Wyalong would turn left from Blow Clear Road to Bonehams Lane, and all vehicles departing the CGO to West Wyalong would turn right from Bonehams Lane to Blow Clear Road. When the sealed road routes are in use, all vehicles to and from the CGO would turn at this intersection.

The existing and forecast traffic volumes at the intersection warrant the minimum preferred intersection treatment. The existing layout of the intersection is generally consistent with this, with advance warning signs to "reduce speed" prior to the bends in Blow Clear Road, pavement markings on the bend approaching Bonehams Lane, and warning signs relating to the railway level crossing of the closed Cootamundra Lake Cargelligo Railway, which lies immediately east of Bonehams Lane.

It is recommended that a give way line be provided across Bonehams Lane at the intersection, regardless of the Modification. No amendments to the intersection would be required to accommodate the Modification traffic.

5.9.4 Wamboyne Road, Blow Clear Road and Girral Road

With the Modification, CGO traffic would continue to turn between Wamboyne Road South and Blow Clear Road (to/from West Wyalong). When the sealed road routes are in use, CGO traffic would also turn between Wamboyne Road North and Blow Clear Road (to/from Condobolin).

At this four-way intersection, Wamboyne Road is the main road, and Blow Clear Road and Girral Road are the minor roads. The roads intersect at an angle of approximately 65 degrees, which is less than the generally accepted limit of 70 degrees to ensure satisfactory sight distance for the minor road traffic. Sight distances are however estimated to be greater than the minimum at which "stop" sign control would be considered. Approaching drivers on Blow Clear Road are alerted to the presence of the intersection and the need to slow by pavement markings and a "reduce speed" sign. It is noted that a crossroad warning sign is installed on Blow Clear Road, which is inconsistent with the "give way" controls at the intersection, and should be replaced with the appropriate "give way ahead" (W3-2) warning sign. Crossroad warning signs for the intersection are appropriate on Wamboyne Road only.

The Modification would increase the number of vehicles turning between Wamboyne Road South and Blow Clear Road, most notably during a gravel haulage campaign to West Wyalong. The existing and future right-turn volumes from Wamboyne Road warrant a minimum BAR treatment, and the existing layout is generally consistent with this, subject to maintenance of signage and linemarking.

Condobolin Alternative Route – Sealed Roads

When the sealed road routes are in use, the Modification would increase the number of vehicles turning left from Wamboyne Road North into Blow Clear Road, notably if the route is used during a gravel haulage campaign to Condobolin. The pavement condition on the road area used for this left turn manoeuvre appears poor, with loose gravel. The existing and future left-turn volumes at this location warrant a BAL treatment, and the layout is generally consistent with this, subject to maintenance and/or upgrading of the road surface, signage and linemarking.

5.9.5 Wamboyne Road and Fitzgerald Road

The CGO would not generate vehicle movements through this intersection when the preferred mine access route from Condobolin is used.

Condobolin Alternative Route – Sealed Roads

This intersection would continue to be used by CGO traffic only when the sealed road route to/from Condobolin is in use. Traffic generated by the CGO travelling to and from Condobolin at those times would turn between Wamboyne Road (south-west) and Wamboyne Road (north). The existing and forecast traffic volumes at the intersection warrant the minimum preferred intersection treatment.

There is limited signage and line marking at the intersection, and it is recommended that this be upgraded in accordance with Austroads guidelines, notably to provide a give way line and sign to clarify priority. The heaviest demands at the intersection are likely to be the left turn into and the right turn out of the minor road (Wamboyne Road north), however traffic volumes are sufficiently low, and use of the route by CGO traffic is sufficiently infrequent that realignment of the intersection priority to reflect the demand is not warranted. Considering the infrequent use of the route by CGO traffic, advance directional signage may also be appropriate to alert drivers travelling northeast on Wamboyne Road of the need to turn left to reach Burcher and Condobolin. It is noted that the sight board installed to face the stem of the T-intersection is non-standard, and should be upgraded to meet current requirements.

5.9.6 Wamboyne Road, Bena Street and Lake Cowal Road

With the Modification, traffic generated by the CGO would continue to travel in both directions along Bena Street and Lake Cowal Road when travelling to/from Condobolin. The Modification would increase the number of vehicles on this route, notably during a gravel haulage campaign to Condobolin.

At the intersection of Wamboyne Road, Bena Street and Lake Cowal Road, the pavement is in poor condition, with a loose gravel surface and no signage. The sealed width of Bena Street on approach to the intersection is inadequate to allow two vehicles to pass without one vehicle needing to move to the unsealed shoulder. Sight distance to this intersection is somewhat limited, and it is recommended that the pavement at the intersection be upgraded, with localised widening of Bena Street on its approach to the intersection to allow two heavy vehicles to pass and remain on the sealed surface. Similarly, sealing of Lake Cowal Road on its approach to the intersection is recommended to allow two heavy vehicles to pass and remain on the sealed surface in the vicinity of the intersection. This would also reduce the amount of gravel and dust collecting on the road surface at the intersection. Signage and linemarking should also be provided to clarify the priority, with give way signs and a give way line for traffic on Wamboyne Road.

Condobolin Alternative Route – Sealed Roads

As at present, when the sealed road route from Condobolin is in use, traffic generated by the CGO would turn between Bena Street and Wamboyne Road, rather than travelling along Bena Street and Lake Cowal Road. The Modification would increase the number of vehicles using this route, notable if the route is used during a gravel haulage campaign to Condobolin.

Under such conditions, the existing and forecast traffic volumes at the intersection warrant the minimum preferred intersection treatment. As discussed above, to accommodate the movement of CGO traffic when the sealed road route is used, it is recommended that the pavement at the intersection be upgraded, with localised widening of Bena Street on its approach to the intersection to allow a vehicle turning right into Wamboyne Road to remain clear of a vehicle turning left from Wamboyne Road to Bena Street. Signage and linemarking should also be provided to clarify the priority, with give way signs and a give way line for traffic on Wamboyne Road.

The heaviest demands at the intersection when the sealed road route is in use are likely to be the movements between Bena Street and Wamboyne Road, which is the minor road of the T-intersection. Existing and forecast traffic volumes are sufficiently low and the frequency of use of the sealed road route is sufficiently low that realignment of the intersection priority to reflect the demand is not warranted.

5.9.7 Wamboyne Road and Ungarie Road

With the Modification, there would be an increase in the number of vehicles turning between Ungarie Road (south) and Wamboyne Road to travel to and from West Wyalong. Drivers approaching on Wamboyne Road are required to give way at Ungarie Road, and are alerted to the approaching intersection by a "REDUCE SPEED" (G9-9) sign, a curve warning sign (W1-3R) and a T-intersection sign (W2-3). Additional non-standard pavement markings are also provided on the southbound travel lane on Wamboyne Road and provide a visual cue to encourage drivers to reduce speed.

The forecast traffic volumes suggest that a basic intersection treatment would be warranted, and it is noted that the intersection has previously been upgraded to provide an AUR treatment in Ungarie Road to allow northbound vehicles to pass a vehicle which slows to turn right into Wamboyne Road. While this does not meet with current guidelines which prefer use of the CHR or CHR(S) treatment, the minor changes to turning movements resulting from the Modification would not warrant further upgrading of the intersection. Continued maintenance of signage and line marking is recommended.

5.9.8 Blow Clear Road and Lonergans Lane

With the Modification, there would be an increase in the number of vehicles travelling along Blow Clear Road past its intersection with Lonergans Lane. When the sealed road route to and from Forbes is used, the number of vehicles travelling along Blow Clear Road would be somewhat higher, as all CGO traffic would use this part of Blow Clear Road. The number of vehicles turning into or out of Lonergans Lane would remain very low, and the existing and forecast traffic volumes at the intersection with use of the preferred mine access routes or the sealed road routes warrant the general minimum preferred intersection treatment.

Forbes Alternative Route – High Water 2

When the proposed High Water 2 alternative route is used to and from Forbes, traffic generated by the CGO would turn between Blow Clear Road (East) and Lonergans Lane (to/from Forbes), and travel along Blow Clear Road in both directions past Lonergans Lane (to/from West Wyalong and Condobolin).

The existing and forecast traffic volumes at the intersection when the High Water 2 route is in use warrant the general minimum preferred intersection treatment. The number of vehicles expected to turn right into Lonergans Lane would be low, and the Modification would not contribute to that movement.

The infrequent nature of the use of this route would mean that drivers to and from the CGO would not be as familiar with the intersection layout. It is recommended that with the Modification, the signage and linemarking at the intersection be upgraded to Austroads requirements, notably to include give way signs for drivers in Lonergans Lane, and a give way line for approaching vehicles on Lonergans Lane.

It recommended that with the Modification, Lonergans Lane be sealed on its immediate approach to Blow Clear Road, for a distance of approximately 20 m, to reduce the likelihood of dust and gravel being moved from Lonergans Lane on to the road surface at the intersection, which can result in slippery conditions. If not sealed, it is recommended that cleaning of the road surface near the intersection be undertaken when the alternative route is being used or has recently been used by CGO traffic.

5.9.9 Bodells Lane and Newell Highway

When the sealed road routes are in use, CGO traffic to and from Forbes and Mid Western Highway would continue to travel through the intersection along Newell Highway past Bodells Lane. An increase in CGO traffic past this intersection would be expected with the Modification during a gravel haulage campaign to Forbes or Newell Highway when the sealed road routes are in use.

The existing intersection provides an AUR treatment in Newell Highway to allow westbound vehicles to pass a vehicle which slows to enter Bodells Lane, and a sealed shoulder eastbound. AUR treatment permits vehicles to pass a vehicle slowing or waiting to turn right into Bodells Lane, however does not meet with current guidelines which do not recommend use of the AUR treatment, preferring upgrading to CHR or CHR(S) treatments where warranted, or BAR treatment where a higher treatment is not warranted. The AUR treatment at Bodells Lane is consistent with treatments at other intersections with low traffic volumes along Newell Highway.

The existing and forecast traffic volumes at the intersection with the Modification warrant the minimum preferred intersection treatments in Newell Highway for use of the preferred mine access route and the sealed road route. The existing layout thus exceeds these requirements, although is not consistent with current guidelines. Upgrading of the existing AUR layout to the preferred CHR or CHR(S) treatments would not be warranted by the existing or forecast volumes.

Forbes Alternative Route – High Water 2

When the proposed High Water 2 alternative route is used to and from Forbes, traffic generated by the CGO would turn between Newell Highway (East) and Bodells Lane (to/from Forbes).

The existing and forecast traffic volumes at the intersection warrant BAR and BAL treatments in Newell Highway, being the general minimum preferred intersection treatment. The existing layout thus exceeds these requirements, although is not consistent with current guidelines. Given the likely infrequency of use of this alternative route, the existing AUR layout is considered to be satisfactory.

It is recommended that when the route is in use, consideration be given to providing temporary directional signage to the CGO at this intersection and on approach to the intersection on Newell Highway to alert drivers to the approaching intersection. It is recommended that Bodells Lane be sealed on its immediate approach to Newell Highway for a distance of approximately 20 m, to reduce the likelihood of dust and gravel being moved from Bodells Lane on to the road surface of Newell Highway, which can result in slippery conditions, and to allow a give way line to be provided for Bodells Lane traffic. If the approach is not sealed, it is recommended that cleaning of the road surface near the intersection be undertaken when the alternative route is being used or has recently been used by CGO traffic.

5.10 Lake Cowal Road Realignment

Realignment of Lake Cowal Road is required to allow continued public access around the CGO Figure 2.2). The Lake Cowal Road realignment would be constructed adjacent to the western and northern boundaries of the CGO and would be designed and constructed in accordance with the Austroads guidelines and in consultation with Bland Shire Council.

The Lake Cowal Road realignment would add approximately 2.0 km to the travel distance along Lake Cowal Road between the CGO Access Road and Fitzgerald Road, and would not impact access to any privately owned land on Lake Cowal Road.

5.11 Impacts on Road Safety

The increase in traffic expected to occur on the road network as a result of changes directly associated with the Modification and unrelated to the Modification would typically result in an increase in exposure to crashes, with a corresponding increase in the number of crashes.

The review of historic crashes in the region (Section 3.10) did not highlight any particular causation factors on the modified mine access routes, thus the Modification traffic is not expected to exacerbate any specific safety concerns at any particular location. The recommended upgrades to a number of aspects of the road environment as described in this report would reduce the risk of crashes by improving conditions for all drivers.

5.12 Impacts on School Buses

The Modification would result in CGO traffic using routes on which the school buses operate. With the Modification, when the High Water 2 alternative route from Forbes is used, CGO traffic would use Clear Ridge Road between Lonergans Lane and Bodells Lane, which is also used by the Lake Cowal bus.

When the sealed roads route from Condobolin is used, CGO traffic would continue to use Wamboyne Road between Blow Clear Road and Bena Street. With the Modification, gravel haulage may also occur on that route.

The school bus operates later in the morning than the CGO peak traffic, and earlier in the afternoon than the evening CGO peak traffic, thus the potential impact of CGO traffic on the school buses is low. During a gravel haulage campaign, gravel haulage trucks may operate during the times that the school bus operates, generating up to eight heavy vehicle movements in an hour.

It is recommended that a Traffic Management Plan be prepared to manage the operation of gravel haulage trucks, and that this include driver behaviour with regard to interaction with school buses.

5.13 Pipeline Duplication Construction Access

As noted in Section 4.1.1, some of the 30 workers associated with the pipeline construction activity would work at times from the eastern side of Lake Cowal, and so may not travel on the CGO Access Road as assumed in the foregoing assessment. A dedicated bus route is likely to operate as required from West Wyalong to the eastern side of Lake Cowal, and workers may also be occasionally transported from the CGO Access Road to the eastern side of Lake Cowal by bus. If required, that bus would primarily travel via the existing preferred mine access route to/from Forbes, i.e., Lake Cowal Road, Fitzgerald Road, Lake Cowal Road and Bogies Island Road then Lows Road.

As noted in Section 0, some deliveries of materials would be made to the eastern side of Lake Cowal during the pipeline construction activity, rather than to the CGO Access Road as assumed above. Approximately 50 deliveries of pipe would be required for the pipeline construction activity, using articulated vehicles with extendable trailers, half of which would travel to the eastern side of Lake Cowal. These are likely to be sourced from Newcastle, and so would approach the CGO via Forbes, and use part of the existing Forbes mine access route to access the eastern side of Lake Cowal. The trucks would use West Plains Road and Lows Road.

Some deliveries of sand and other materials would also occur to the eastern side of Lake Cowal. These deliveries are expected to be primarily sourced from West Wyalong or Jemalong, so the trucks would use Newell Highway (north or south), West Plains Road and Lows Road to access the eastern construction site.

The number of vehicles travelling to and from the eastern side of Lake Cowal during the pipeline construction activity would have negligible impact on the operating conditions of the road network. It is recommended that a Construction Traffic Management Plan be prepared to manage the heavy vehicles associated with the pipeline construction, including identification of routes to be used.

5.14 Oversize Vehicles

A number of oversize vehicle movements may be generated on an occasional basis during the life of the Modification. The proposed movement for any oversize vehicles would be negotiated with RMS and relevant local councils on a case-by-case basis. All oversize loads would be transported with the relevant permits and load declarations obtained in accordance with *Additional Access Conditions for oversize and overmass heavy vehicles and loads* (RMS, 2016), and any other licences and escorts as required by regulatory authorities.

6. Conclusions

This study has examined the likely road transport implications of the Modification. It is concluded that the Modification can be satisfactorily accommodated by the road network, with acceptable impacts on the capacity, condition, safety and efficiency of the road network, subject to consideration of the following:

- The existing typical layout of Bena Street between Wamboyne Road and Burcher may be retained, subject to localised widening of Bena Street and Lake Cowal Road on approach to Wamboyne Road to allow vehicles to pass in the vicinity of the intersection. Should Bena Street be upgraded to provide a sealed surface sufficient for two way traffic, this would be designed and constructed in accordance with Austroads guidelines and in consultation with Lachlan Shire Council.
- Maintenance of guide posts on Wamboyne Road between Blow Clear Road and Bena Street to meet Austroads requirements.
- Preparation and implementation of a Traffic Management Plan in consultation with the Lachlan, Forbes and Bland Shire Councils and RMS to manage the movement of trucks transporting gravel from the CGO during haulage campaigns.
- Preparation and implementation of a Construction Traffic Management Plan to manage the heavy vehicles associated with the pipeline construction.
- Upgrading of intersections on the mine access routes to meet Austroads requirements for signage, linemarking and intersection treatments, with the following specific measures recommended:
    - install give way lines across Lake Cowal Road at the intersection with Bonehams Lane and the CGO Access Road to supplement the give way signs;
    - improve signage at the 90-degree bend in Bonehams Lane with chevron alignment markers or similar;
    - install give way line across Bonehams Lane at Blow Clear Road;
    - replace the non-compliant crossroad warning sign from Blow Clear Road on approach to Wamboyne Road with a give way ahead (W3-2) sign;
    - upgrade the pavement for left turns from Wamboyne Road into Blow Clear Road, and upgrade intersection signage and linemarking;
    - install give way signs and line marking across Wamboyne Road (north) at its intersection with Wamboyne Road (southwest) and Fitzgerald Road, and replace the non-compliant sight board;
    - install give way signs and line marking across Wamboyne Road at its intersection with Bena Street and Lake Cowal Road;
    - install give way signs and line marking across Lonergans Lane at Blow Clear Road;
    - seal Lonergans Lane on its immediate approach to Blow Clear Road for approximately 20 m, or ensure the road surface of the intersection is cleaned when the High Water 2 route is being used or has recently been used; and
    - seal Bodells Lane on its immediate approach to Newell Highway for approximately 20 m, or ensure the road surface of the intersection is cleaned when the High Water 2 route is being used or has recently been used.

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