Appendix L.
Traffic and transport impact assessment

Shoalhaven Hydro Expansion Project - Main Works Environmental Impact Statement

SSI-10033

Origin Energy Eraring Pty Ltd

November 2022

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Shoalhaven Hydro Expansion Project - Main Works

Traffic and transport impact assessment

SSI-10033

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Shoalhaven Hydro Expansion Project - Main Works

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Executive summary

Origin proposes to develop the Shoalhaven Hydro Expansion Project (the Project), to construct and operate a new pumped hydro power station between the Fitzroy Falls Reservoir and Lake Yarrunga. The Project would pump water up from Lake Yarrunga to Fitzroy Falls Reservoir, consuming energy when it is in less demand. Energy would then be generated through the return of water from Fitzroy Falls Reservoir to Lake Yarrunga when demand for energy increases. The Project would almost double the electricity generation capacity of the existing scheme, providing an approximate additional 235 megawatts (MW) of generation capacity.

Project overview

The Project consists of the construction and operation of scheme components including at the upper intake at the southern end of Fitzroy Canal, the lower intake/outlet structure west of the Bendeela Power Station, pipelines connecting the intakes to a new underground power station, and other associated operational and safety infrastructure.

The Project would also require ancillary works which may include the carrying out of works to upgrade or construct access roads, spoil disposal sites, utilities infrastructure, construction compounds and construction power and water supply. It is proposed that certain non-oversized/over-mass vehicles (28-seater buses and 20 tonne (t) dump trucks) would access the site from the township of Kangaroo Valley via Hampton Bridge.

Purpose of this report

This report details the traffic and transport impact assessment for the Project and addresses the relevant Secretary's Environmental Assessment Requirements (SEARs) for the Project. In addition, this report provides an overview of the existing traffic and transport environment, an assessment of potential traffic and transport impacts of the Project and the required mitigation measures.

Existing environment

Access to the Project would be via a network of local council and state managed roads including Moss Vale Road (B73), Nowra Road (B73), Promised Land Trail, Bendeela Road, Jacks Corner Road and Lower Bendeela Road.

Key identified impacts

The results of the traffic and transport impact assessment indicate that the construction and operation of the Project is expected to have a negligible impact on the performance of key intersections in the study area including Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail, Moss Vale Road (B73) / Bendeela Road and Bendeela Road / Jacks Corner Road / Lower Bendeela Road. The potential impacts to public transport, pedestrians and cyclists, road safety and parking during the construction and operation of the Project are also expected to be negligible.

Summary of mitigation measures

A Construction Traffic Management Plan (CTMP) for the Project would be prepared in consultation with Transport for NSW and WaterNSW to minimise the potential impacts of the Project during construction. Relevant traffic safety measures included in the CTMP would be traffic control and signage, driver conduct, safety protocols and management of Oversized and / or over mass vehicle (OSOM) vehicles.

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Glossary and terms

Term	Definition
%	per cent
24/7	24-hour day and seven days per week
CSSI	Critical State significant infrastructure
CTMP	Construction Traffic Management Plan
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
Existing Scheme	The existing Shoalhaven Pumped Hydro Energy Storage Scheme (owned and operated by Origin).
HV / Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Km	Kilometre
Km/hr	Kilometres per hour
LGAs	Local government areas
Local road	A road or street used primarily for access to abutting properties
LoS	Level of service
Lower scheme	The Lower Scheme refers to works carried out at Kangaroo Valley portal, tail race portal, Laydown Area 7 and spoil emplacement area and traffic between portals and storage/spoil sites.
m	Metres
vehicle movement	A single vehicle movement is assumed to consist of two trips (one inbound trip and one outbound trip)
MW	Megawatts
NHVR	National Heavy Vehicle Regulator
NPWS	National Parks and Wildlife Service
NSW	New South Wales
Origin	Origin Energy Eraring Pty Ltd
OSOM	Oversized and / or over mass vehicle
Q_M	Traffic volume parameter
RUM	Road user movement
Penstock	A water transfer pipeline and associated infrastructure also referred to as a pipeline
SEARs	Secretary's Environmental Assessment Requirements
SSI	State significant Infrastructure
t	Tonne
The Project	Shoalhaven Hydro Expansion Project
The Proponent	Origin Energy Eraring Pty Ltd
TfNSW	Transport for New South Wales
Transport routes	Public roads that are to be used for delivery of materials and equipment
Upper scheme	The Upper Scheme refers to works carried out above Kangaroo Valley portal revolving around site access improvements, upper laydown works, pipeline installation and shaft boring.

1 Introduction

1.1 Project overview

Origin Energy Eraring Pty Ltd (Origin) proposes to develop the Shoalhaven Hydro Expansion Project, to construct and operate a new pumped hydro power station on and under the land between the Fitzroy Falls Reservoir and Lake Yarrunga (the Project). The Project would draw on Origin's existing water allocations to pump water up from Lake Yarrunga consuming energy when it is in less demand. Energy would then be generated through the return of water from Fitzroy Falls Reservoir to Lake Yarrunga when demand for energy increases.

The Project would involve almost doubling the electricity generation capacity of the current Shoalhaven Pumped Hydro Energy Storage Scheme (the existing scheme), providing an approximate additional 235 megawatts (MW) of generation capacity. The operation of the scheme would respond to the needs of the National Energy Market (NEM) and involving up to one pumping and generation cycle per day. Each generation cycle is anticipated to involve up to 8 hours of generation and 16 hours of pumping, each of which could be divided into shorter durations to best satisfy the needs of the NEM.

The Project is located in the New South Wales (NSW) Southern Highlands, approximately 150 kilometres (km) southeast of Sydney, as shown in **Figure 1-1**. The indicative Project layout is shown in **Figure 1-2** and consists of the construction and operation of:

- Upper scheme components (Upper Scheme) including:
  - Connection to existing upper intake control structure at the southern end of the Fitzroy Canal
  - A surface penstock (water transfer pipeline and associated infrastructure) from the existing Fitzroy Canal control structure to the vicinity of the Existing Scheme surge tank
  - A new surge tank adjacent to the Existing Scheme surge tank
  - A further section of surface penstock, adjacent to the Existing Scheme, from the new surge tank to the high pressure shaft
- Underground works including:
  - Vertical shaft and headrace tunnel connecting to the southern end of Upper Scheme surface penstock to an underground power station
  - An underground power station cavern housing a transformer, reversible motor generator and pump turbine capable of supplying a nominal 235 MW of hydroelectric power
  - Associated access tunnel and multipurpose (egress, ventilation and services) tunnel with an entrance in the vicinity of the existing Kangaroo Valley Power Station
  - A tailrace tunnel, including an underground surge chamber located just downstream of the underground power station, terminating west of the existing Bendeela Power Station on Lake Yarrunga
- Lower scheme surface components (Lower Scheme) including:
  - Lower intake /outlet structure west of the Bendeela Power Station connected to the tailrace tunnel
  - Spoil emplacement facility east of Bendeela Pondage
  - High voltage network connection to existing Kangaroo Valley substation
  - Operational surface infrastructure including administration building, water treatment infrastructure and ventilation building.

The Project would also require ancillary works which may include the carrying out of works to upgrade or construct access roads, spoil disposal sites, utilities infrastructure, construction compounds and construction power and water supply.

Importantly, the Project essentially duplicates the existing scheme and as such, the Project does not propose any new water storages or connections between waterbodies that have not already been utilised for the existing scheme. In addition, no transmission line augmentations are required to receive or distribute electricity from the existing Kangaroo Valley Power Station substation.

A full Project description is provided in **Chapter 3** of the Environmental Impact Statement (EIS). Key components of the Project of relevance to this report are provided in **Sections 5** and **6**.

Legend

- Points of interest
- Indicative Project footprint
- Project location
- NPWS Reserve
- State Forest

0 5 10 km

1:300,000 at A4

GDA2020 MGA Zone 56

Data sources

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Figure 1-1 Project location

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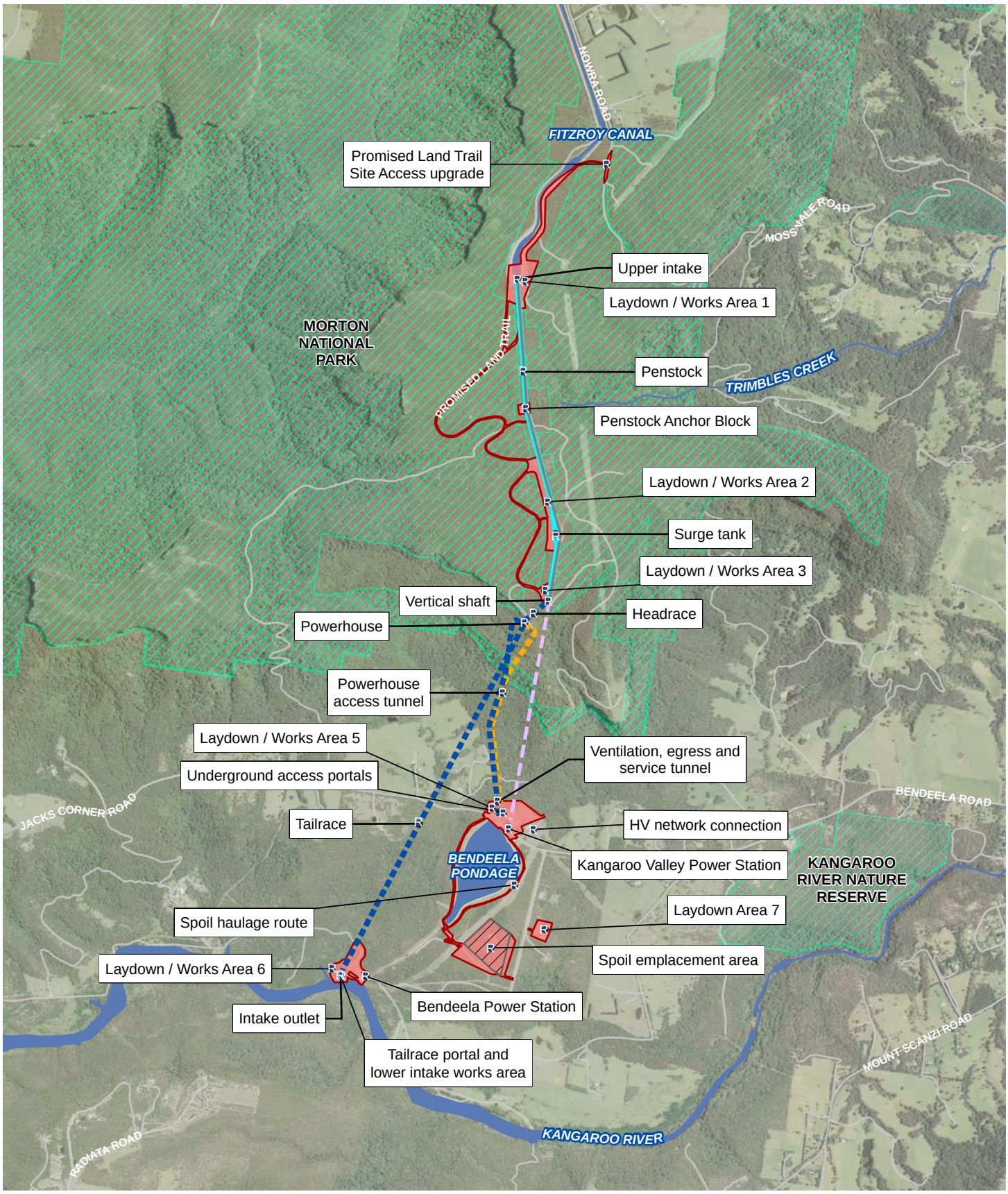

Legend

- Points of interest
- Existing KV tunnel alignment
- Existing scheme pipeline
- Indicative above ground pipeline
- Indicative tunnel alignment
- Indicative access tunnel
- Disturbance area
- Spoil site
- Waterway
- Road
- NPWS Reserve
- Waterbody

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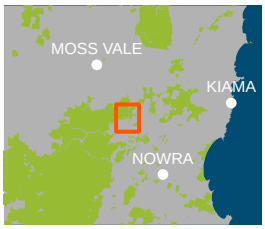

Data sources

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Figure 1-2 Indicative Project layout

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1.2 Project location

The Project would be carried out in the Wingecarribee and Shoalhaven Local Government Areas (LGAs). Access to the upper portion of the Project on the plateau, for pipeline, surge tank and vertical shaft construction would be via the Promised Land Trail. The Promised Land Trail is accessed from Moss Vale Road and traverses both WaterNSW land and the Morton National Park and was constructed as part of the original scheme. Access to the lower portion of the Project within Kangaroo Valley would be via Bendeela Road from Moss Vale Road in the vicinity of the townships of Kangaroo Valley and Barrengarry.

1.3 Secretary's Environmental Assessment Requirements

This assessment forms part of the EIS for the Project. The EIS has been prepared under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) [SSI-10033] relating to traffic and transport and will assist the Minister for Planning to make a determination on whether or not to approve the Project.

Table 1-1 outlines the SEARs relevant to this assessment along with a reference to where these are addressed.

Table 1-1. SEARs relevant to traffic and transport

Secretary's requirement	Where addressed in this report
Transport - an assessment of the transport impacts of the Project on the capacity, condition, safety and efficiency of the local road network (including Moss Vale Road, Jacks Corner Road, Lower Bendeela Road and Promised Lands Trail).	Construction and operation impacts on the capacity and efficiency of the local road network are discussed in **Section 5.4** and **Section 6.2**, respectively. Construction impacts on the condition and safety of the local road network are discussed in **Section 5.5** and **Section 5.10**, respectively. Operational impacts on the condition and safety of the local road network are discussed in **Section 6.4** and **Section 6.8**, respectively.

1.4 Structure of this report

The structure and content of this report are outlined in **Table 1-2**.

Table 1-2. Report structure and content

Chapter	Description
Chapter 1 Introduction	Outlines key elements of the Project, SEARs and the purpose of this report (this Chapter).
Chapter 2 Policy and planning setting	Provides an outline of the statutory context, including applicable legislation and planning policies.
Chapter 3 Assessment methodology	Provides a description of the assessment methodology for this assessment.
Chapter 4 Existing environment	Provides a description of the existing traffic and transport environment, including key roads, traffic volumes and patterns, road safety, public transport and active transport.
Chapter 5 Potential construction impacts	Presents the outcomes of the construction impact assessment, including impacts on road capacity and performance, road safety, public transport, active transport and parking.
Chapter 6 Potential operational impacts	Presents the outcomes of the operational impact assessment, including impacts on road capacity and performance, road safety, public transport, active transport and parking.
Chapter 7 Potential cumulative impacts	Presents the qualitative assessment of potential cumulative traffic and transport impacts with other projects near the Project.

Chapter	Description
Chapter 8 Mitigation measures	Presents the traffic and transport management measures applicable for the Project.
Chapter 9 Conclusion	Summarises the findings of this report.
References	Provides details of external resources used.
Appendix A	Presents an example Driver Code of Conduct.
Appendix B	Provides an indicative intersection upgrade layout for a channelised right and left turn to the Promised Land Trail

2 Legislative and policy context

2.1 State legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act and *Environmental Planning and Assessment Regulation 2021* establish the framework for development assessments in NSW. The EP&A Act and the Regulation include provisions to ensure that the potential environmental impacts of a development are considered in the decision-making process prior to proceeding to construction.

The Project is declared Critical State significant infrastructure (CSSI) and would require approval under Part 5 Division 5.2 of the EP&A Act. The NSW Minister for Planning is the approval authority for CSSI under Part 5 of the EP&A Act. This assessment forms part of the EIS in order to comply with the SEARs and assess traffic and transport impacts of the Project in accordance with any relevant Government legislation, plans, policies and guidelines.

2.1.2 Roads Act 1993

The NSW *Roads Act 1993* sets out the rights of members of the public to pass along public roads and the rights of persons who own land adjoining a public road to have access to the public road. In addition, the Act provides guidance on the classification of roads and establishes the procedures for the opening and closing of a public road.

Consent under Section 138 of the *Roads Act 1993* is required from the relevant road authority for any works undertaken on or over a public road, including work associated with the connection of a new road (whether public or private) to a public road. It is noted that in addition to consent from the relevant road authority, consent must also be obtained from Transport for NSW (TfNSW) with respect to a classified road under the Act. However, if the works form part of a CSSI which has been granted planning approval, then consent under Section 138 cannot be refused if it is necessary for carrying out the Project.

2.2 Regulatory policies/relevant guidelines

The *Future Transport Strategy 2056* is a 40-year strategy that guides transport investment to deliver customer mobility for Sydney and regional NSW. It sets out a vision, strategic directions and customer outcomes with a focus on harnessing advances in technology and innovation to create and maintain a world-class, safe, efficient and reliable transport system.

The *Future Transport Strategy 2056* outlines the following six guiding principles which aim to positively impact the economy, communities and environment of NSW:

- Customer focused - customers' experiences and their end-to-end journeys are seamless, interactive and personalised, supported by technology and data
- Successful places - the liveability, amenity and economic success of communities and places are enhanced by transport
- A strong economy - in 2056, the transport system powers NSW's $1.3 trillion economy and enables economic activity across the State
- Safety performance - every customer enjoys safe travel, regardless of transport mode or location, across a high-performing, integrated and efficient network
- Accessible services - transport enables everyone to get the most out of life, wherever they live and whatever their age, ability or personal circumstances
- Sustainability - the transport system is economically, environmentally and socially sustainable, operationally resilient, affordable for customers and supports emissions reductions.

The Project seeks to support appropriate integration of land use in accordance with the *Future Transport Strategy 2056*. In addition, the Project seeks to support objectives of the strategy by maintaining the safety and efficiency of the transport network for all road users during the Project.

2.2.1 Guide to Traffic Generating Developments

The *Guide to Traffic Generating Developments* (Version 2.2) (Roads and Traffic Authority, 2002) provides guidance on a number of matters related to the traffic impacts of land use developments, notably matters relating to traffic generation. The Guide provides information regarding traffic issues for those submitting Development Applications, including methods for conducting traffic impact studies and compiling traffic impact statements.

The *Guide to Traffic Generating Developments* has been used to guide the structure and development of this traffic and transport impact assessment.

2.2.2 EIS Guidelines – Roads and Related Facilities

The *EIS Guidelines – Roads and Related Facilities* (Department of Urban Affairs and Planning, 1996) outlines the factors to be considered when preparing the traffic and transport component of an EIS. The key factors identified in the guide for roads and related facilities include:

- Strategic planning context
- Traffic issues
- Community issues, including noise and visual impacts
- Air and water quality issues.

The *EIS Guidelines - Roads and Related Facilities* also outlines commitments to the ongoing management of proposals, including monitoring. The Guidelines have been used to guide the structure and development of this traffic and transport impact assessment.

2.2.3 NSW Planning Guidelines for Walking and Cycling

The *NSW Planning Guidelines for Walking and Cycling* (Department of Infrastructure, Planning and Natural Resources, 2004) aim to assist land-use planners and related professionals to improve consideration of walking and cycling in their network. It is anticipated that improving practice in planning for walking and cycling will create more opportunities for people to live in places with easy walking and cycling access to urban services and public transport. The Guidelines outline the city-scale design principles that assist the creation of walkable and cyclable cities and neighbourhoods as well as methods to achieve this including Transport Management and Accessibility Plans and Transport Access Guides.

The *NSW Planning Guidelines for Walking and Cycling* have not been used in this assessment as there are limited pedestrian and cycling facilities in the immediate vicinity of the Project (discussed further in **Section 4.7**).

2.2.4 Guide to Traffic Management Part 3: Traffic Studies and Analysis

The *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (Austroads, 2017) is concerned with the collection and analysis of traffic data for the purpose of traffic management and traffic control within a network. It serves as a means to ensure some degree of consistency in conducting traffic studies and surveys. It provides guidance on the different types of traffic studies and surveys that can be undertaken, their use and application, and methods for traffic data collection and analysis.

The *Guide to Traffic Management Part 3: Traffic Studies and Analysis* has been used to guide the structure and development of this traffic and transport impact assessment.

2.2.5 Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments

The *Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments* (Austroads, 2020a) is concerned with identifying and managing the impacts on the road system arising from land use developments. It provides guidance for planners and engineers associated with the design, development and management of a variety of land use developments. The aim is to ensure consistency in the assessment and treatment of traffic impacts, including addressing the needs of all road users and the effect upon the broader community.

The *Guide to Traffic Management Part 12: Integrated Transport Assessments* has been used to guide the structure and development of this traffic and transport impact assessment.

2.2.6 Roads and Maritime Supplements to Austroads Guides

The *Supplements to Austroads Guides* (Roads and Maritime Services, 2013) were produced to support the Austroads Guides and address specific issues concerning the design, construction, maintenance, operation and safety of road network issues in NSW.

The *Supplements to Austroads Guides* have been used to guide the structure and development of this traffic and transport impact assessment.

2.2.7 2026 Road Safety Action Plan

The *2026 Road Safety Action Plan* (TfNSW, 2021) recognises the importance of reducing road trauma on NSW roads and sets out targeted actions to halve deaths and reduce serious injuries by 30 per cent (%) on NSW roads by 2030. The *2026 Road Safety Action Plan* seeks to increase road safety through five focus areas including:

- Creating safer country roads and urban places
- Enhancing road safety in local communities
- Increasing the safety of light vehicles, heavy vehicles and protective equipment
- Making safer choices on our roads
- Ensuring the safety of vulnerable and other at-risk road users.

The Project seeks to support the objectives of the *2026 Road Safety Action Plan* by ensuring road safety is prioritised at all times during the construction and operation of the Project.

3 Assessment methodology

3.1 Study area

The study area for this traffic and transport impact assessment is shown in **Figure 3-1** and comprises the transport network servicing the Project, including the roads which form part of the proposed access routes for construction and operational vehicles. These roads include Moss Vale Road (B73), Nowra Road (B73), Promised Land Trail, Bendeela Road, Jacks Corner Road and Lower Bendeela Road.

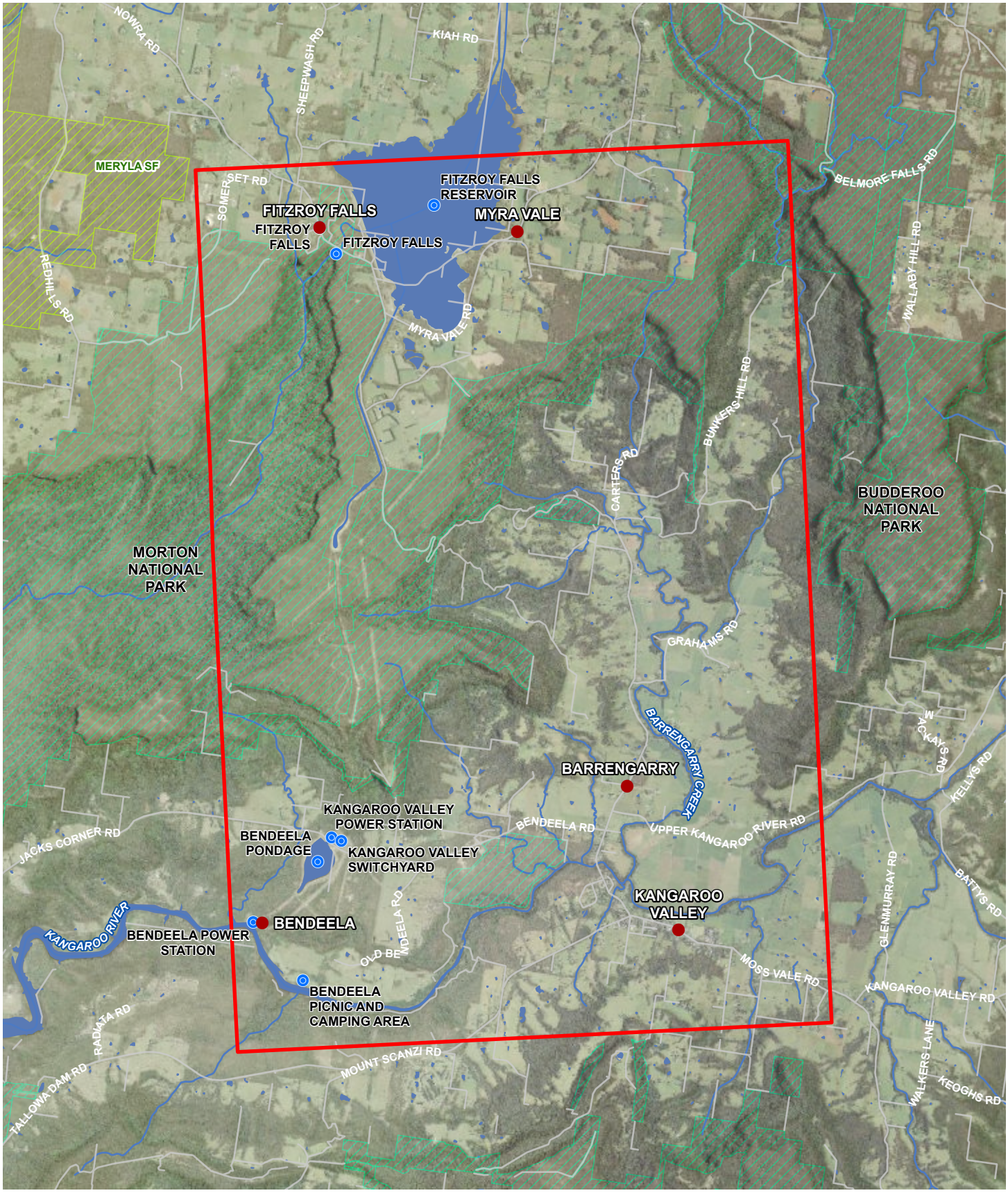
The OSOM route study additionally considers impacts to roads located outside of the study area that form part of the proposed OSOM haulage route between the Port Kembla and the Project. These roads are further described in **Section 4.1**.

3.2 Methodology

To assess the impact of the Project on the transport and traffic network, the following methodology has been used to identify and, where possible, quantify the following:

- Impacts on road network capacity and performance – assessed using traffic modelling to determine the performance of the road network with and without vehicles associated with the construction and operation of the Project
- Impacts on public transport – assessed through an analysis of proposed changes to public transport operations including routes and stop infrastructure to determine impacts on public transport customers
- Impacts on pedestrians and cyclists – assessed through an analysis of proposed changes to cycleways and footpaths to determine potential impacts on access as well as availability of pedestrian and cycling infrastructure during construction and operation phases of the Project
- Impacts on road safety – assessed through an analysis of safety issues and trends associated with the roads forming part of the proposed access routes to the Project
- Cumulative impacts – assessed through a qualitative analysis of the performance of the road network with vehicle movements generated by other major Projects expected to be occurring concurrently with the Project using currently publicly available information
- Impacts of OSOM vehicles – assessed through an analysis of OSOM requirements and potential routes
- Provide details of measures to manage potential impacts during the construction and operation of the Project.

Further details on the traffic modelling for the road network capacity and performance assessment are provided below.



Legend

- Points of interest
- Study area
- Road
- Waterways
- Waterbody
- NPWS Reserve
- State Forest

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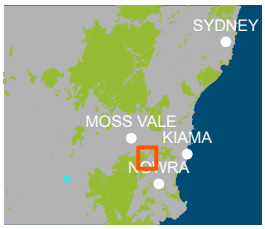
GDA2020 MGA Zone 56



Data sources

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Department of Planning and Environment 2022
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Figure 3-1 Study area

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3.2.1 Traffic modelling

Traffic modelling has been undertaken to assess the traffic impacts of the Project on road network capacity and performance. The approach to traffic modelling undertaken for this assessment aligns with the *Traffic Modelling Guidelines* (Roads and Maritime, 2013) and includes the following broad steps:

- Development of calibrated and validated single intersection base models (validated against Google typical traffic data) to align with existing operational conditions along the proposed vehicle access routes
- Application of anticipated construction, operational or cumulative traffic demands to the base models to enable the identification of potential impacts on road network performance.

Models were developed using the SIDRA Intersection 9 traffic modelling software package. SIDRA Intersection 9 is a micro-analytical tool for evaluation of intersection performance mainly in terms of capacity, level of service (LoS) and a wide range of other performance measures such as delay, queue length and stops for vehicles and pedestrians, as well as fuel consumption, pollutant emissions and operating cost.

3.2.1.1 Performance indicators

The criteria for evaluating the operational performance of intersections are defined in Table 3-1 and is adopted from the *Guide to Traffic Generating Developments* (Roads and Maritime, 2002). For priority (sign-controlled) intersections, the criteria for evaluating the performance of intersections are based on the worst delay across all legs of the intersection during the peak hour. This average vehicle delay is equated to a corresponding LoS from A (best) to F (worst). In rural areas, LoS C can be considered a minimum desirable standard; a deterioration of the LoS under this level would imply that remedial measures to maintain the existing LoS should be sought.

Table 3-1. Level of service definitions

LoS	Average delay (seconds/vehicle)	Give way and stop signs
A	Less than 15	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity and accident study required
E	57 to 70	At capacity, requires other control mode
F	Over 70	Extreme delay, traffic signal or other major treatment required

Source: Guide to Traffic Generating Developments (RMS, version 2.2, 2002)

3.2.1.2 95th percentile queue

95th percentile queue is the length (in metres (m)) below which 95% of all observed cycle queues lengths fall. In other words, this queue length is expected to be exceeded only for 5% of observed queues. The 95th percentile queue is often interpreted as a design queue and is used to determine the desirable turn lane and storage lengths. Ideally, the 95th percentile queue should fit within the provided turning lane without spilling into the adjacent through lanes.

3.2.1.3 Average delay

Average delay refers to the average additional amount of time it takes a vehicle to pass through the intersection than free flow conditions and takes into account congestion (i.e. queueing), signal delays, pedestrian crossing and the physical size of the intersection. This parameter is usually described in units of 'seconds' which provides a tangible measurement.

3.2.2 Austroads warrants for turn treatments

Section 2.3.6 of *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings* (Austroads, 2018) provides guidance on the preferred left and right turn treatments for major roads at unsignalised intersections based on traffic flows and achieving a specific level of safety performance.

The selection of a turn treatment is depended on the design speed of the road, as shown in **Figure 3-2**. The major road traffic volume parameter (Q_M) referenced in the figures is determined as per **Figure 3-3** and Table 3-2.

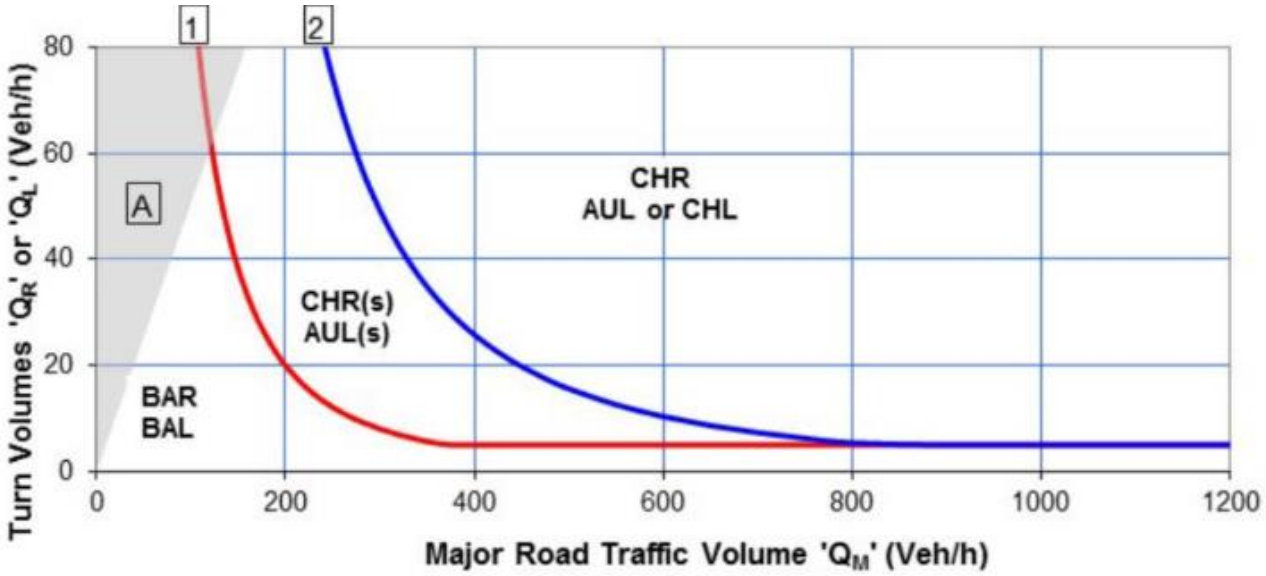


Figure 3-2 Warrants for turn treatments on major roads with a design speed ≥ 100 km per hour (km/h)
Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management

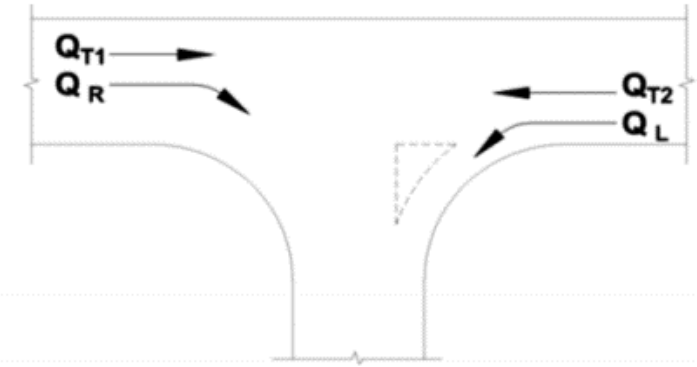


Figure 3-3 Major road traffic volume parameters
Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management

Table 3-2. Calculation of the major road traffic volume (QM)

Road type	Turn type	Splitter island	Q_M (veh/hr)
Two-lane two way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
	Left	Yes or no	= Q_{T2}

Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management

4 Existing environment

4.1 Road network

Access to the Project would be via a network of local council and state managed roads including Moss Vale Road (B73), Nowra Road (B73), Promised Land Trail, Bendeela Road, Jacks Corner Road and Lower Bendeela Road. These roads are described in further detail below.

4.1.1 Moss Vale Road (B73)

Moss Vale Road (B73) is a sealed State road that extends between Promised Land Trail to the north and the township of Bombaderry to the south. The road forms part of route B73 linking the NSW Southern Highlands to the City of Shoalhaven via Kangaroo Valley. In the study area, Moss Vale Road (B73) is a single carriageway road with one lane in each direction as shown in **Figure 4-1**. The road has sealed shoulders approximately 0.5 m in width on both sides of the road.

The posted speed limit of Moss Vale Road (B73) varies in the study area. To the south of Bendeela Road, the road has posted speed limit of 60 km/hr. Between Bendeela Road and Barrengarry, the posted speed limit is 80 km/hr. The section of Moss Vale Road (B73) traversing Barrengarry Mountain has a posted speed limit of 60 km/hr. Near Promised Land Trail at the top of Barrengarry Mountain, the posted speed limit increases to 100 km/hr.

The NSW heritage listed Hampton Bridge is located on Moss Vale Road (B73) approximately 500 m south of Bendeela Road. The single-lane bridge spans Kangaroo River and can accommodate only one direction of traffic flow at any one time, where southbound vehicles are required to give way to northbound vehicles, as shown in **Figure 4-2**. Hampton Bridge has a vertical clearance of 4.9 m and a 42.5 t load limit. Only one heavy vehicle is permitted on the bridge at any one time.

Figure 4-1. Moss Vale Road (B73), 300 m south of Paddington Lane, facing in the southern direction
Image source: Google Street View, 2021

Figure 4-2. Hampton Bridge, facing in the southern direction
Image source: Google Street View, 2021

4.1.2 Nowra Road (B73)

Nowra Road (B73) is a sealed State road that extends between Sheepwash Road to the north and Promised Land Trail to the south. As with Moss Vale Road (B73), the road forms part of route B73 linking the NSW Southern Highlands to the City of Shoalhaven via Kangaroo Valley. Nowra Road (B73) is a single carriageway road with one traffic lane in each direction. The road has a posted speed limit of 100 km/hr which reduces to 60 km/hr near the township of Fitzroy Falls.

Figure 4-3. Nowra Road (B73) near Promised Land Trail, facing in the northern direction
Image source: Google Street View, 2020

4.1.3 Promised Land Trail

Promised Land Trail is an unsealed road that extends in the western direction from Moss Vale Road / Nowra Road (B73) before heading south along the eastern bank of the Fitzroy Canal. The road traverses both WaterNSW land and the Morton National Park, and features a secured gated entrance as shown in **Figure 4-4**. Promised Land Trail connects to Moss Vale Road (B73) and Nowra Road (B73) via an uncontrolled T-intersection, as shown in **Figure 4-5**. The road has a posted speed limit of 40 km/hr.

Figure 4-4. View of the gated entrance to Promised Land Trail, facing east
Image source: Jacobs site visit, 2019

Figure 4-5. Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail intersection, facing south
Image source: Google Street View, 2020

4.1.4 Bendeela Road

Bendeela Road is a 3.8 km sealed local road that extends in the east-west direction between Moss Vale Road (B73) and Jacks Corner Road. At its eastern end, the road connects to Moss Vale Road (B73) via an uncontrolled T-intersection, as shown in **Figure 4-6**. West of Lower Bendeela Road, Bendeela Road continues as Jacks Corner Road. Bendeela Road has one lane of traffic in each direction and a posted speed limit of 80 km/hr. The road has no painted centreline, however, give way lines are provided at its intersection with Moss Vale Road (B73). The road is managed by Shoalhaven City Council.

Figure 4-6. Bendeela Road, facing east
Image source: Jacobs site visit, 2019

4.1.5 Lower Bendeela Road

Lower Bendeela Road is a local sealed road that provides access to the Bendeela Hydroelectric Pumping Station and Bendeela Recreation Area. The road connects to Bendeela Road and Jacks Corner Road via a priority ('Stop') controlled T-intersection and has one lane of traffic in each direction, refer to **Figure 4-7**. The northernmost section of Lower Bendeela Road has a posted speed limit of 80 km/hr. The posted speed limit reduces to 60 km/hr approximately 900 m south of the Bendeela Road / Jacks Corner Road intersection. The road is managed by Shoalhaven City Council.

Figure 4-7. Lower Bendeela Road, facing south
Image source: Jacobs site visit, 2019

4.1.6 Jacks Corner Road

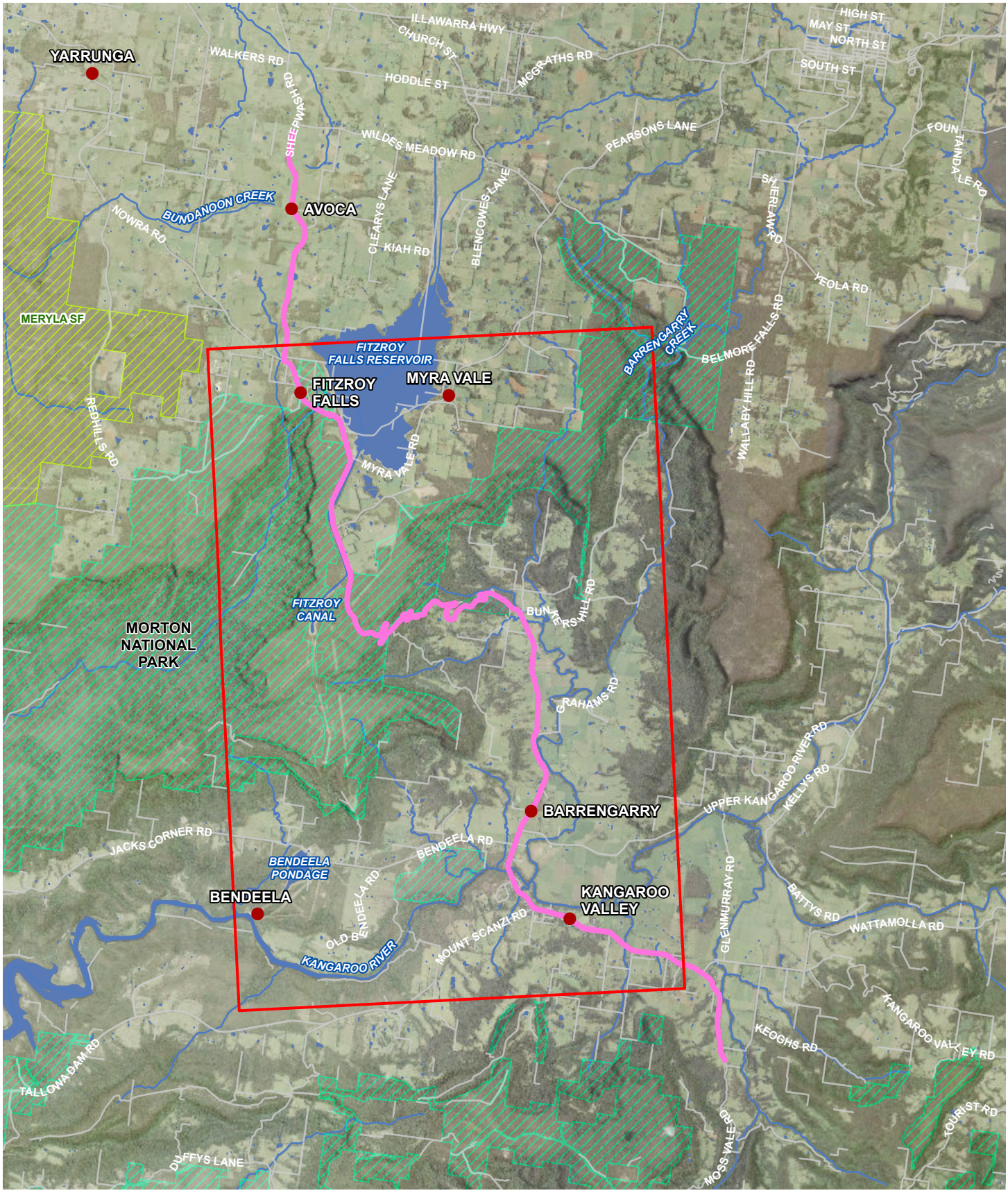
Jacks Corner Road is a local sealed road that provides access to the Kangaroo Valley Hydro Plant and associated infrastructure. The road has one lane of traffic in each direction and a posted speed limit of 60 km/hr, refer to **Figure 4-8**. The road is managed by Shoalhaven City Council.

Figure 4-8. Jacks Corner Road, west of Bendeela Road, facing west
Image source: Jacobs site visit, 2019

4.2 Heavy vehicle haulage routes

Moss Vale Road (B73), Nowra Road (B73), Promised Land Trail, Bendeela Road, Jacks Corner Road and Lower Bendeela Road all form part of the NSW approved network for general access vehicles. General access vehicles which comply with the prescribed mass and dimension limits outlined in the Heavy Vehicle (Mass, Dimension and Loading) National Regulation can access all roads without a permit or notice, except where a road or bridge is sign posted otherwise.

The allowable height limit for general access vehicles under the Road Transport Regulation 2017 is 4.3 m. However, the NSW approved network for 4.6-m-high vehicles permits eligible vehicles operating under a height of 4.6 m access without a permit or notice providing they comply with the 4.6-Metre-High Vehicle Route Notice 2013 (2022a). Roads in the study area that form part of the NSW approved network for 4.6-m-high vehicles includes Moss Vale Road (B73) and Nowra Road (B73), as shown in **Figure 4-9**.



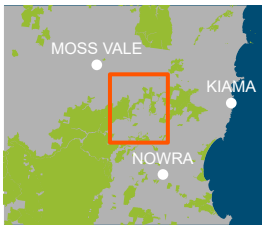
Legend

- 4.6m-high-vehicle route
- Study area
- Road
- Waterways
- Waterbodies
- State Forest
- NPWS Reserve

0 1 2 km

1:100,000 at A4

GDA2020 MGA Zone 56



Data sources

Jacobs 2022
Department of Planning and Environment 2022
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Figure 4-9 TfNSW approved road network for 4.6-metre-high vehicles

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Created by : JB | QA by : CC

4.3 Traffic volumes and patterns

Tube counts were undertaken on Moss Vale Road (B73) and Bendeela Road over a one-week period between Monday 4 February 2019 to Sunday 10 February 2019, inclusive. In addition, intersection turn movement counts were conducted on Friday 8 February 2019 at the following intersections:

- Nowra Road (B73) / Myra Vale Road
- Moss Vale Road (B73) / Bendeela Road
- Bendeela Road / Jacks Corner Road / Lower Bendeela Road.

To account for traffic growth from 2019 to the current year (2022), the traffic counts were scaled using a 3.0 % annual growth rate factor based on outputs from Shoalhaven City Council's strategic traffic model (TRACKS). This approach provides a highly conservative traffic volume forecast for the study area, given there have been no major developments that have occurred within the vicinity of the Project since 2019. Additionally, the traffic counts were undertaken prior to the COVID-19 pandemic and pre-floods and are therefore considered conservative. Nevertheless, updated traffic counts and potential seasonal fluctuations should be considered during detailed design stage of the Project.

4.3.1 Moss Vale Road (B73)

A breakdown of the number of vehicles travelling on Moss Vale Road (B73) by the day of week is shown in **Figure 4-10**. North of Bendeela Road, Moss Vale Road (B73) experiences a peak of approximately 645 vehicles per hour between 11:45 am and 12:45 pm on a Sunday. Traffic volumes are also relatively high on Moss Vale Road (B73) during the Friday evening period (440 vehicle per hour) and Saturday midday period (430 vehicles per hour). Heavy vehicles account for approximately 12.6 % of the total traffic travelling on Moss Vale Road (B73).

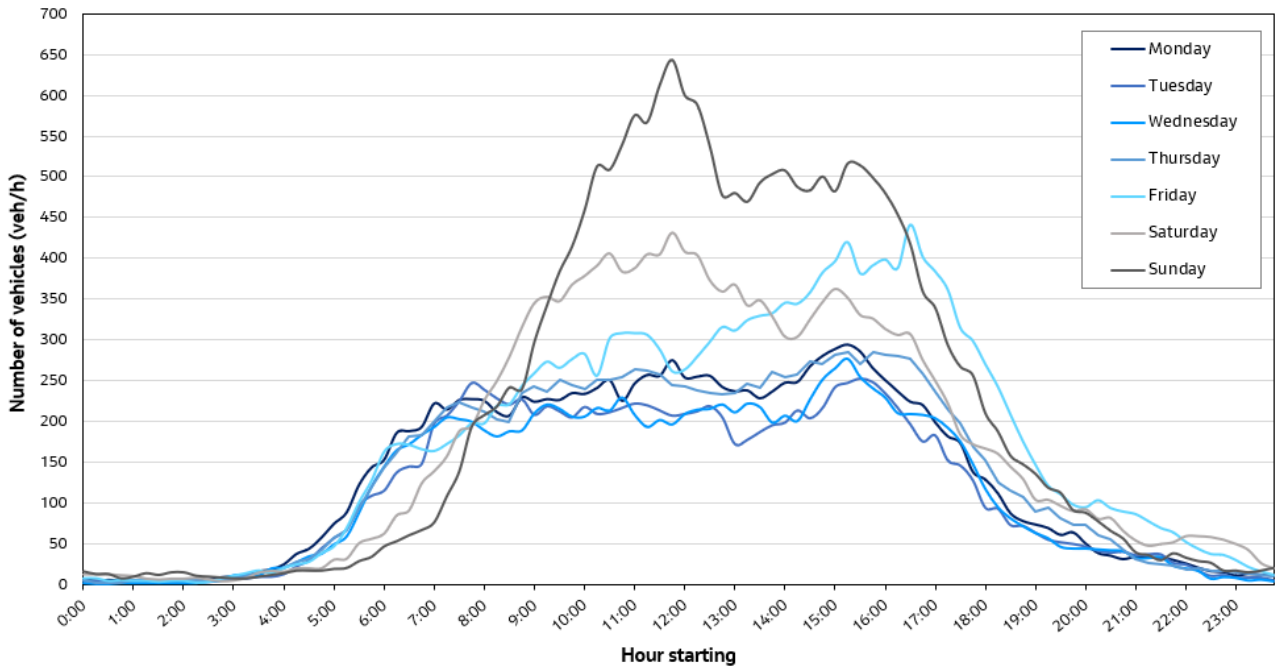


Figure 4-10. Weekly traffic profile for Moss Vale Road (B73), north of Bendeela Road
Data source: Tube counts, 2019

4.3.2 Bendeela Road

A breakdown of the number of vehicles travelling on Bendeela Road by the day of week is shown **in Figure 4-11**. Bendeela Road experiences a peak of 145 vehicles per hour on Sunday between 12:00 pm and 1:00 pm. Similar to Moss Vale Road (B73), Bendeela Road also experiences relatively high traffic volumes during the Saturday midday period (110 vehicles per hour). Heavy vehicles account for approximately 15.3 % of the total traffic travelling on Moss Vale Road (B73).

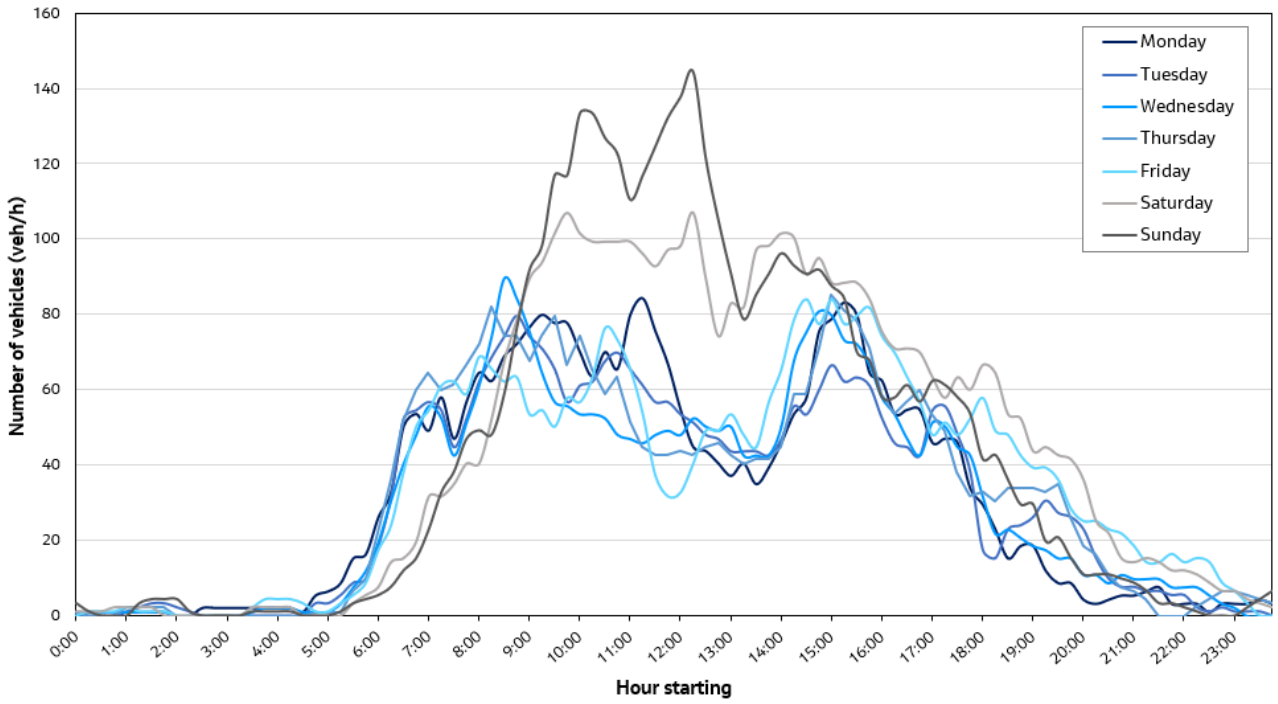


Figure 4-11. Weekly traffic profile for Bendeela Road, west of Moss Vale Road (B73)
Data source: Tube counts, 2019

4.3.3 Nowra Road (B73)

Intersection counts undertaken at the Nowra Road (B73) / Myra Vale Road intersection indicate peak hour volumes on Jacks Corner Road typically range up to 495 vehicles per hour. Heavy vehicles comprise approximately 9.7 % of the total traffic travelling on Nowra Road (B73).

4.3.4 Jacks Corner Road

Intersection counts undertaken at the Bendeela Road / Jacks Corner Road / Lower Bendeela Road intersection indicate peak hour volumes on Jacks Corner Road typically range up to 100 vehicles per hour. Heavy vehicles comprise approximately 5.5 % of the total traffic travelling on Jacks Corner Road.

4.3.5 Lower Bendeela Road

Intersection counts undertaken at the Bendeela Road / Jacks Corner Road / Lower Bendeela Road intersection indicate peak hour volumes on Lower Bendeela Road typically range up to 40 vehicles per hour. Heavy vehicles comprise approximately 4.4 % of the total traffic travelling on Lower Bendeela Road.

4.3.6 Promised Land Trail

As discussed in **Section 4.1.3**, Promised Land Trail provides vehicular access to the Morton National Park and WaterNSW land via a secure gated entrance. As such, traffic volumes on Promised Land Trail are typically negligible on an average weekday or weekend.

4.4 Existing road performance

Traffic modelling was undertaken to determine the existing performance of key intersections within the study area during the Sunday midday peak period (11:45 am to 12:45 pm). The modelling was performed for this period only as the Sunday 11:45am to 12:45 pm hour presents the highest traffic volumes and therefore is indicative of the worst level of performance experienced by the local road network.

To account for traffic growth between the year when the intersection counts undertaken (2019) and the current year (2022), the counts were scaled using a 3.0 % annual growth rate factor as per the Shoalhaven

City Council strategic model (TRACKS). Furthermore, as the intersection counts were only available for a Friday, the counts were factored based on the one-week tube counts to provide volumes indicative of a Sunday.

The traffic modelling results are shown in Error! Reference source not found. and indicate that all roads currently operate satisfactorily at a LoS A. The modelling results indicate that the network is currently operating well within its capacity, which is primarily due to the low traffic volumes present.

Table 4-1. Existing intersection performance (2022)

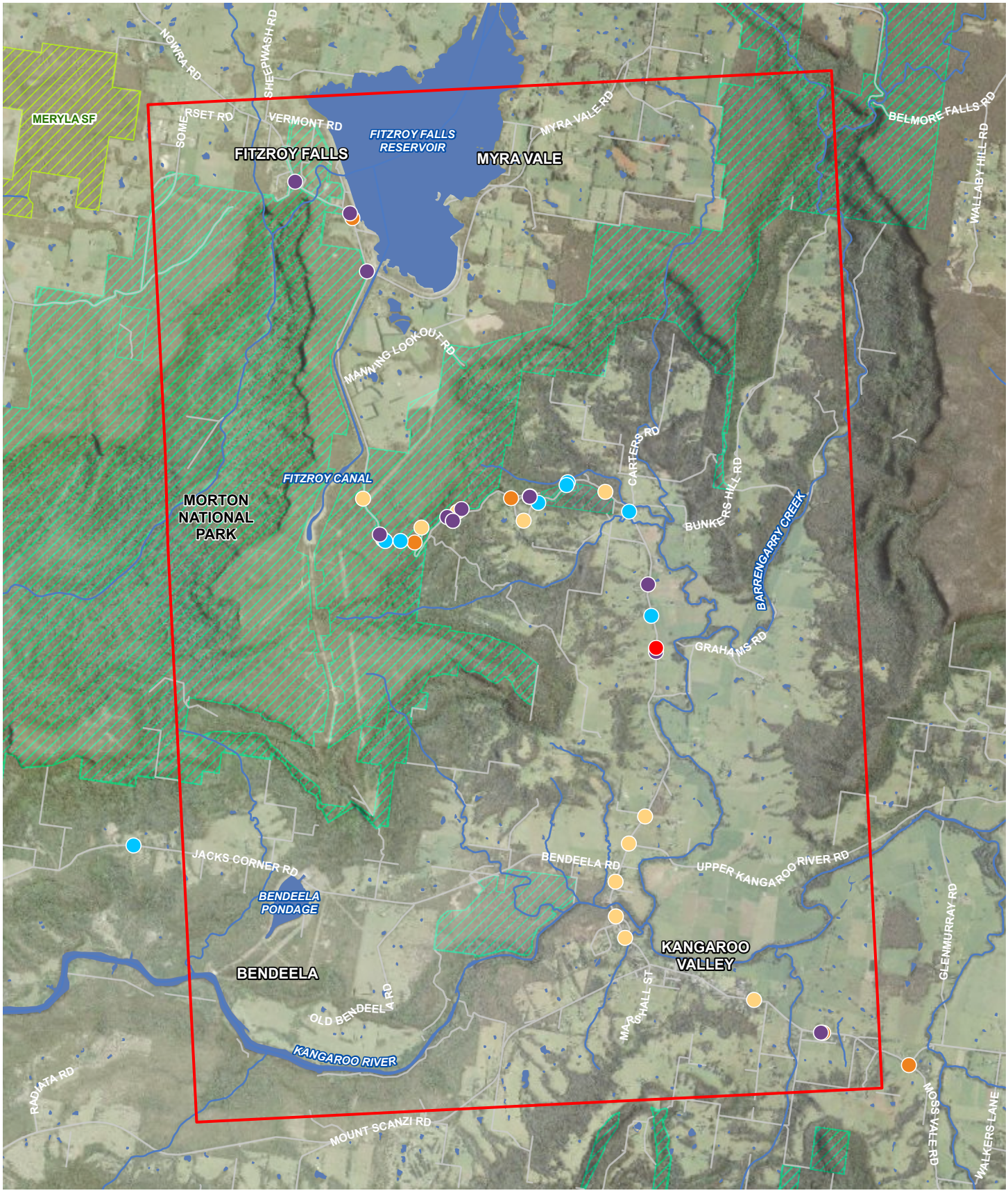
Intersection	Peak period	Degree of Saturation	Intersection delay (sec)	LoS	95th percentile queue length (m)
Moss Vale Road / Nowra Road / Promised Land Trail	Sunday (11:45 am to 12:45 pm)	0.15	8.4	A	<5
Moss Vale Road / Bendeela Road	Sunday (11:45 am to 12:45 pm)	0.27	10.6	A	<5
Bendeela Road / Jacks Corner Road / Lower Bendeela Road	Sunday (11:45 am to 12:45 pm)	0.02	8.9	A	<5

4.5 Road safety

A review of crash data was undertaken to provide an assessment of safety issues and trends associated with the proposed access routes to the Project. Crash data for was sourced from TfNSW's Centre for Road Safety database (TfNSW Centre for Road Safety, 2022). The crash data comprised self-reported crashes in the five-year period from January 2016 to December 2020.

4.5.1 Crash analysis

In the five-year period from 2016 to 2020, a total of 41 crashes were reported on roads in the study area. The distribution of crashes in the study area is shown in **Figure 4-12**. Approximately 87.8 % of crashes (36 crashes) occurred on Moss Vale Road (B73), 9.8 % of crashes (4 crashes) occurred on the Nowra Road (B73) and 2.4 % of crashes (1 crash) occurred on Jacks Corner Road. No crashes were reported on Bendeela Road or Lower Bendeela Road.



Legend

Degree of crash reported

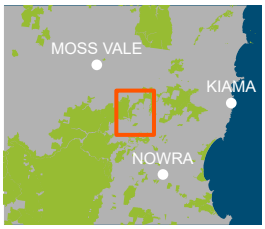
- Fatal
- Serious Injury
- Moderate Injury
- Minor/Other Injury
- Non-casualty (towaway)
- Study area

- Road
- Waterways
- Waterbody
- State Forest
- NPWS Reserve

0 1 2 km

1:65,000 at A4

GDA2020 MGA Zone 56



Data sources

Jacobs 2022
Department of Planning and Environment 2022
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Figure 4-12 Location of crashes reported in the study area

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Created by : NT | QA by : CC

The number of crashes by reporting year is summarised in **Figure 4-13**. The year 2020 observed the highest number of crashes, with a total of 12 crashes reported. 2018 observed the lowest number of crashes, with a total of 5 crashes all occurring on Moss Vale Road (B73).

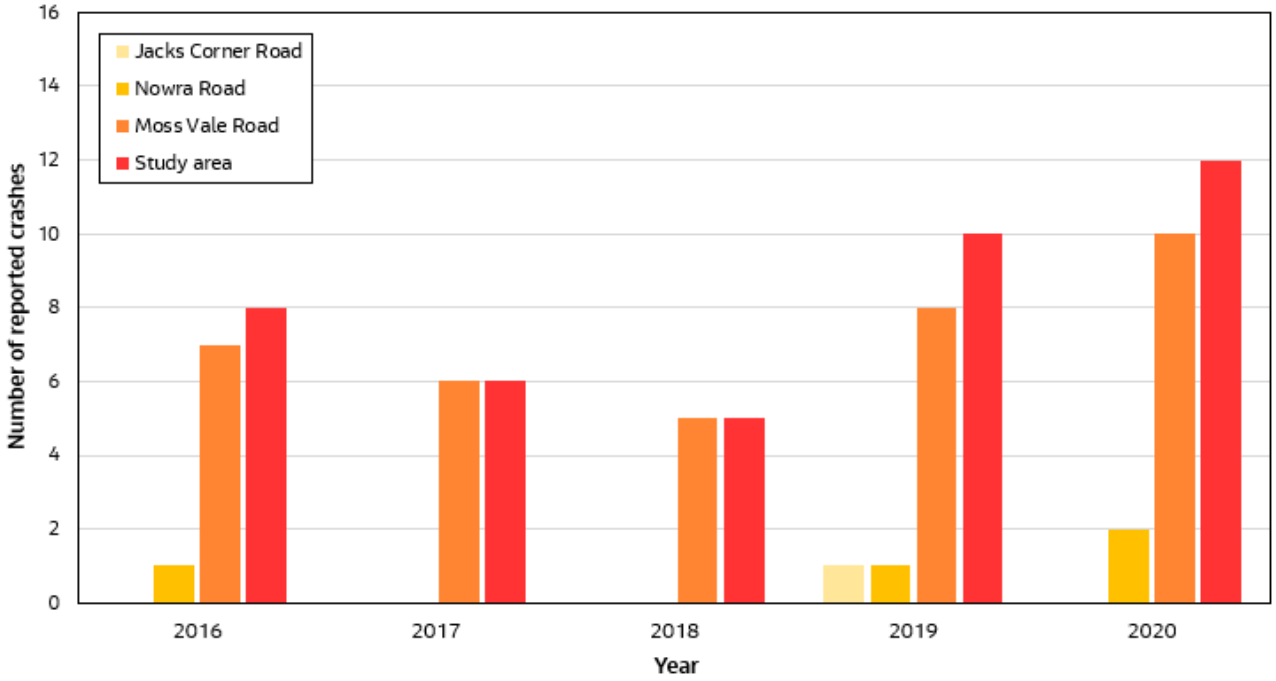


Figure 4-13. Number of crashes by reporting year
Data source: NSW Centre for Road Safety (2016-2020)

Figure 4-14 shows the breakdown of crashes by injury severity. The majority of crashes that occurred in the study area (34.1 %) resulted in a towaway with no casualty. Moss Vale Road (B73) was the only road in the study area that observed fatal crashes, with 2.8 % of crashes occurring on the road resulting in a fatality.

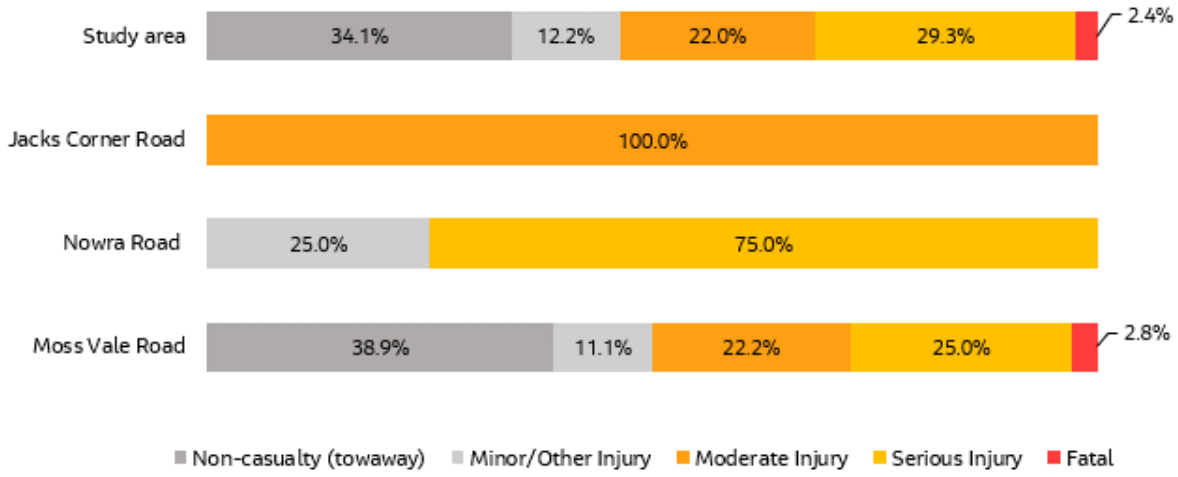


Figure 4-14. Crashes by injury severity
Data source: NSW Centre for Road Safety (2016-2020)

The number of crashes by road user movement (RUM) group[1] are shown in **Figure 4-15**. The most common crash type involved vehicles travelling off the road on a curved section (41.3 % of all crashes), followed by

[1] RUM group refers to road user movement group, which includes a group of movements or actions (classified by a RUM number) undertaken by the vehicles involved directly before the crash.

vehicles travelling off the road on a straight section (19.5 % of all crashes). 13.0 % of all crashes involved the collision of vehicles travelling in the opposing direction.

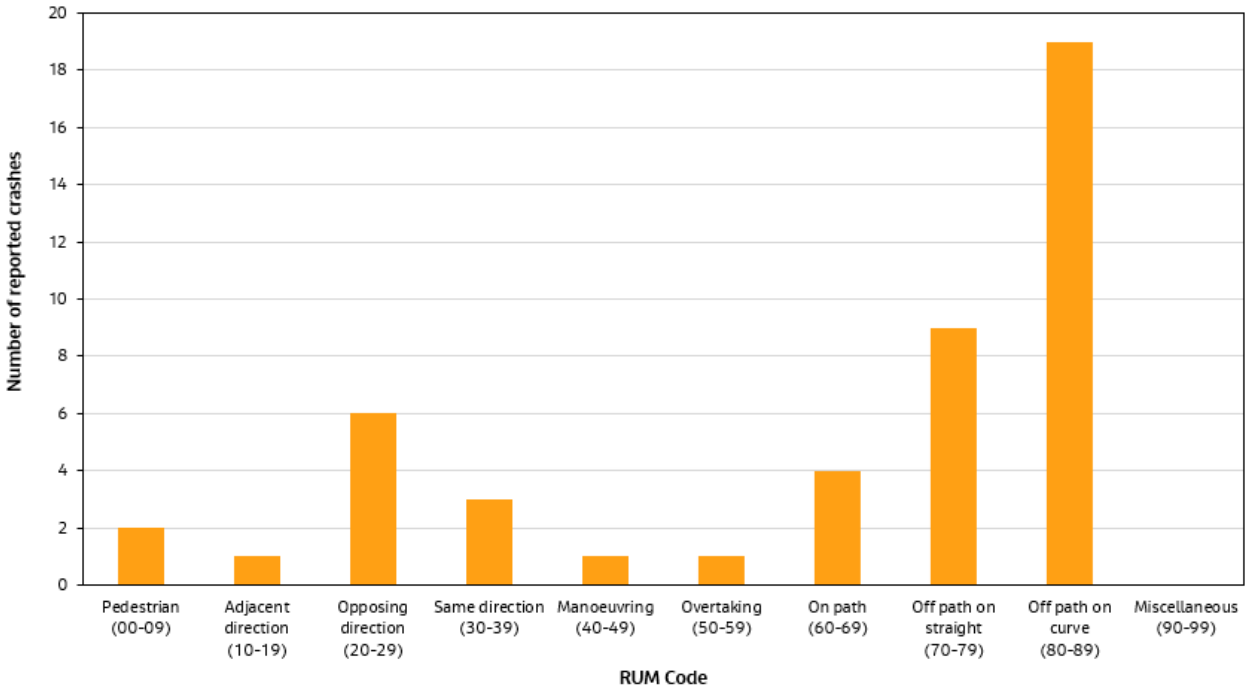


Figure 4-15. Crashes by RUM group
Data source: NSW Centre for Road Safety (2016-2020)

The proportion of crashes by lighting condition and road pavement condition is shown in **Figure 4-16**. As shown in the figure, 22 % of crashes reported on roads within the study area between 2016 and 2020 occurred at dawn, dusk or in darkness. Approximately 29 % of crashes occurred on a road with wet pavement.

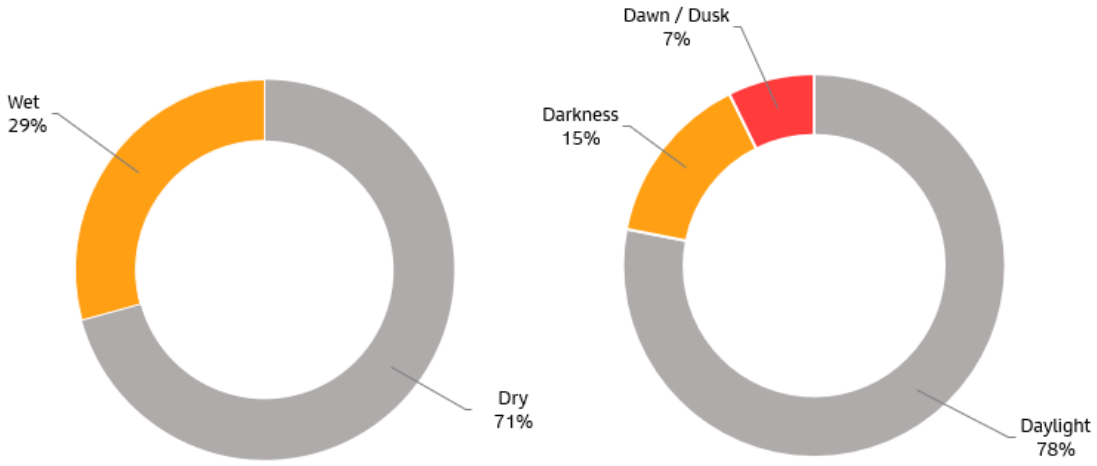


Figure 4-16. Crashes by lighting and road pavement conditions
Data source: NSW Centre for Road Safety (2016-2020)

Crashes by contributing factor are shown in **Figure 4-17**. Approximately 27 % of crashes in the area involved speeding and 5 % involved fatigue as a contributing factor.

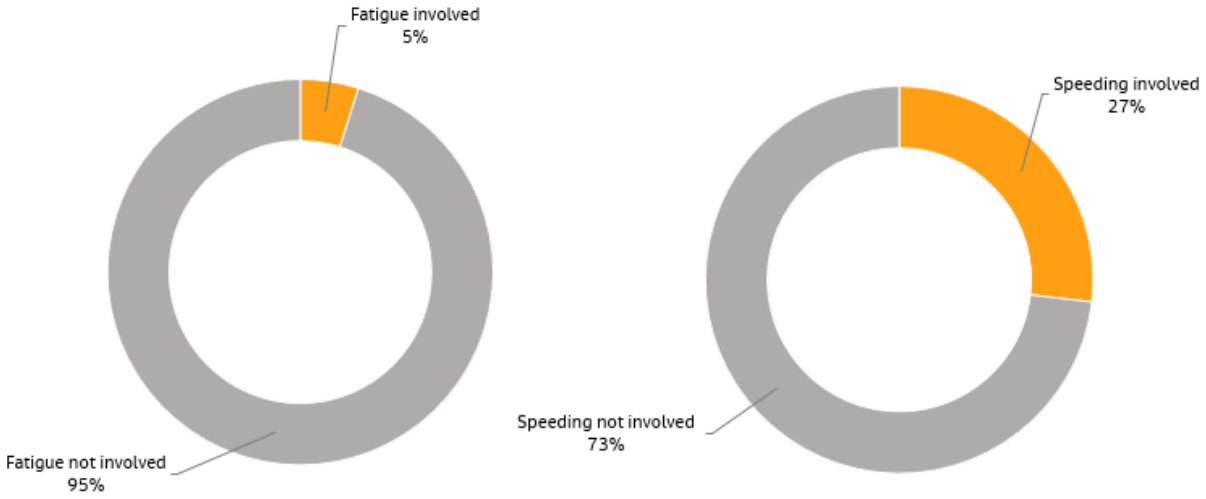


Figure 4-17. Crashes by contributing factors
Data source: NSW Centre for Road Safety (2016-2020)

4.6 Public transport network

There are two public bus routes that operate in the study area. Route 810 is operated by Berrima Buslines and travels between Nowra and Moss Vale via Fitzroy Falls and Kangaroo Valley. Route 112 is operated by Kennedy's Bus and Coach and travels between Kangaroo Valley and Nowra via Cambewarra and Bomaderry. The frequency of bus services is summarised in **Table 4-2** and the location of bus stops servicing routes 810 and 112 are shown in **Figure 4-18**.

Table 4-2. Bus services operating in the study area

Route	Operator	Direction	Frequency
810	Berrima Buslines	Moss Vale to Nowra via Fitzroy Falls and Kangaroo Valley	1 bus per day on school days only
		Nowra to Moss Vale via Kangaroo Valley & Fitzroy Falls	1 bus per day on school days only
112	Kennedy's Bus and Coach	Nowra to Kangaroo Valley via Cambewarra and Bomaderry	3-4 buses per weekday 4 buses on a Saturday
		Kangaroo Valley to Nowra via Cambewarra and Bomaderry	2-3 buses per weekday

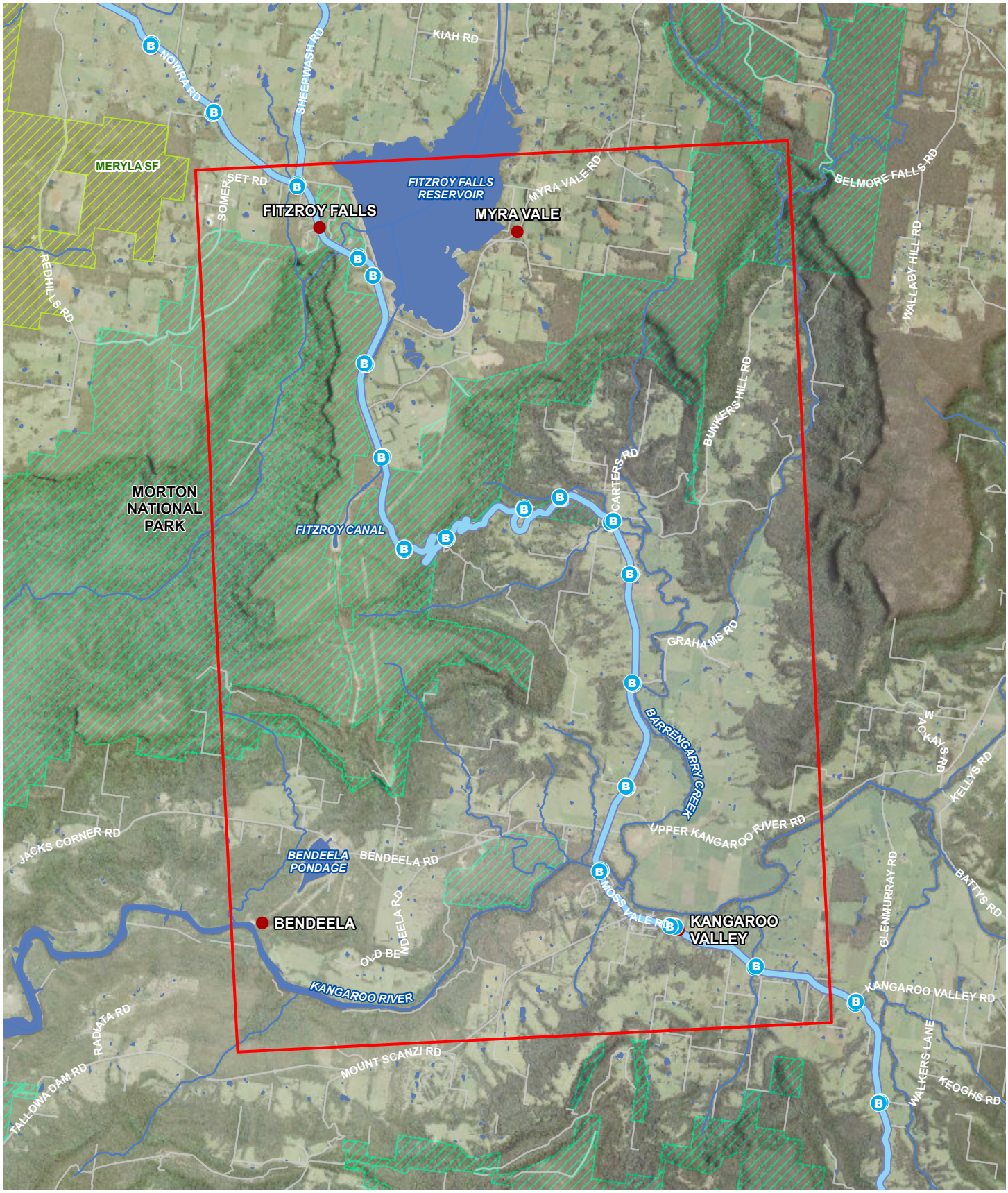
Source: TfNSW, July 2022

Three privately run school bus services also operate for the Kangaroo Valley Public School, which routes in the vicinity of the Project including along Jacks Corner Road and Moss Vale Road. These services are infrequent, and run in the morning and afternoon periods on school days.

4.7 Pedestrian and cycling network

Facilities for pedestrians and cyclists are limited in the study area. A concrete footpath 4.2 km in length is provided on the eastern side of Moss Vale Road (B73) between Cavan Road to the north and Nugents Creek Road to the south. A concrete footpath 500 m in length is also provided on the western side of Moss Vale Road (B73) within the township of Kangaroo Valley.

The Hampden Bride is lane-marked to provide two narrow pedestrian walkways on each side of the one-way bridge lane.



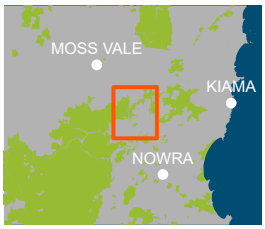
Legend

- Bus stop
- Bus route
- Study area
- Road
- Waterways
- Waterbody
- State Forest
- NPWS Reserve

0 2 4 km

1:75,000 at A4

GDA2020 MGA Zone 56



Data sources

Jacobs 2022
Department of Planning and Environment 2022
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Figure 4-18 Bus routes and stops in the study area

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Created by : NT | QA by : CC

5 Potential construction impacts

The construction of the Project would be subject to comprehensive traffic management measures to ensure the ongoing functionality of surrounding roads, and the safety of members of the public, motorists and construction workers. Temporary lane and/or road closures would be required to enable the construction of required road works and traffic controls such as temporary traffic lights used to facilitate construction traffic movements.

Temporary changes to access arrangements would also be required during construction. Specific engagement with affected properties during further design development would be required to determine appropriate mitigation measures.

5.1 Construction schedule and working hours

Subject to planning approval, construction of the Project is anticipated to commence in 2023. Construction is anticipated to take approximately five years including mobilisation and commissioning. The completion of construction is targeting mid-2028. However the precise timing of construction activities would be adapted based on construction needs.

The majority of construction activities, particularly surface works, would be carried out during the following hours:

- 7 am - 6 pm Monday to Friday
- 8 am - 1 pm on Saturdays
- No work on Sundays or Public Holidays.

To enable the construction of the Project to be completed within the proposed timeline, some construction activities, particularly below-ground works, would be required to be undertaken on a 24-hour day and seven days per week (24/7) basis. Shift timings for the 24/7 below-ground works are anticipated to be from 7:00 am to 7:00 pm and from 7:00 pm to 7:00 am. It should be noted that shift hours will be adjusted to suit the operation and local conditions and may include three-hour shifts within 24 hours.

Other activities that would be carried out outside of the standard daytime construction hours may include:

- Work determined to comply with the relevant noise management level
- The delivery of materials as required by the authorities for safety reasons
- Emergency situations to prevent the loss of lives and properties and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers
- Emergency situations where it is required to avoid the loss of lives and properties and/or to prevent environmental harm
- Situations where agreement is reached with Project landowners and neighbours
- Works under a negotiated agreement with affected receivers
- Other activities approved under an Environmental Protection licence.

5.2 Construction site access

Access to the upper portion of the Shoalhaven Hydro Expansion Project on the plateau would be via Moss Vale Road (B73) and Promised Land Trail. Access to the lower portion of the Project within Kangaroo Valley would be via Moss Vale Road (B73), Bendeela Road, Jacks Corner Road and Lower Bendeela Road. It is noted that there will be increased traffic activity around Bendeela Pondage relating to access to the stockpile area. Management of impacts to facilitate public access in the impacted areas with minimal delay is to be finalised during detailed design and preparation of CTMP. Management measures would include road upgrades to construction site access locations as needed.

5.3 Construction traffic generation and distribution

The main traffic generating activities associated with the construction of the Project include the transportation of staff, haulage of spoil and delivery of construction materials and other specialist equipment. Further details on these traffic generating activities are provided in the sections below.

5.3.1 Construction staff

All temporary work facilities associated with the construction of the Project would be limited to areas of previous disturbance to the extent possible. As such, limited parking would be made available to construction workers due to space constraints. Shuttle buses are therefore proposed to transport the majority construction workers to and from the Project. The shuttle buses would likely service local townships with reasonable availability of rental accommodation including Moss Vale, Nowra and Bomaderry. A small number of senior Project personnel (e.g. site supervisors and Project managers) are anticipated to travel to and from the Project using a mix of light vehicles including sedans, four-wheel drives, light utility trucks and vans.

The morning peak hour of traffic generation associated with the transport of construction workers would be 6:30 am to 7:30 am on weekdays and 7:00 am to 8:00 am on Saturdays. Shuttle buses are expected to arrive within the 30-minute period prior to shift commencement to allow adequate time for construction workers to egress the bus and prepare for the shift (e.g. check-in and change clothing), as well as transfer between the upper and lower schemes, if required. The shuttle buses would remain on site to transport the departing workers from the overnight shift concluding at 7:00 am.

The afternoon peak hour of traffic generation associated with the transport of construction workers would be 6:00 pm to 7:00 pm on weekdays and 1:00 pm to 2:00 pm on Saturdays. During this peak period, shuttle buses would arrive to pick up construction workers concluding their shift at 6:00 pm (weekdays) or 1:00 pm (Saturdays). During the weekday afternoon period, buses would also be arriving during this period to drop off the overnight shift workers commencing at 7:00 pm.

About 16 shuttle buses and 30 light vehicles are expected to facilitate the transportation of a workforce of 370 personnel to the Project during each morning and afternoon peak. These numbers have been rounded up for the purposes of the assessment. Shuttle buses are assumed to have a capacity of 28 passengers and would be evenly distributed between the upper and lower schemes of the Project. A number of shuttle buses and cars may transport construction workers between the upper and lower schemes of the Project.

5.3.2 Spoil haulage

The bulk of tunnel, cavern, headrace and vertical shaft excavation spoil is proposed to be transported out of the underground tunnels via haul trucks and transported (approximately 1,500 m) to a dedicated spoil disposal location adjacent to Bendeela Pondage via public access roads, where it will be treated and managed to acceptable environmental standards. Up to 160 maximum daily heavy vehicles movements during the peak construction stage may be generated by the internal spoil transportation requirements during the Lower Scheme tunnel works element. A single vehicle 'movement' is assumed to consist of two one-way trips (one inbound trip and one outbound trip). The daily average over the spoil haulage period (about 36 months) is expected to be less than 30 spoil truck movements. It is expected that about 10 total trucks would be required to accommodate expected peak spoil haulage. It is assumed that site arrival of these trucks would be dispersed outside of peak traffic periods around the commencement of the excavation works and therefore are included in forecast peak hour construction traffic volumes. It is assumed that the haulage trucks would remain on site during the works period and demobilised at the end of their requirement.

The WaterNSW bridge across the outfall of the Kangaroo Valley Power Station will be used in the spoil haulage route from the Main Access Tunnel Portal to the spoil stockpile area. As part of the early Project development, the bridge is currently under preliminary assessment to check that it has sufficient capacity to support the spoil haulage trucks which are expected to be 20T or 25T rigid body tipper trucks. The detailed assessment of this bridge will be completed as part of the Contractor's traffic management planning. The most likely mitigation measure if the capacity of the bridge was found to not support the 25T rigid body truck would be for the Contractor to select a multi axle truck of a similar size or to use smaller trucks. The base concept for excavating the vertical shaft is by raise boring. For this method, all spoil from the vertical shaft and headrace excavations, other than minor volumes associated with the pilot hole boring, will be transported via the headrace and access tunnel to the spoil disposal area. Should an alternative method such as shaft sinking be ultimately selected, then the spoil generated would be extracted through the top of the shaft and transported to the spoil storage area adjacent to the Bendeela Pondage with haul trucks.

Minimal spoil is proposed to be generated on the plateau. Some of the spoil generated from the surface pipeline footings, surge tank foundations and trenching along a short section of pipeline immediately north of the surge tank is anticipated to be needed for levelling of construction and laydown areas, and access track

maintenance. Surplus or unsuitable material would be transported via heavy vehicles to the spoil disposal area adjacent to the Bendeela Pondage. The spoil haulage route will generate increase in traffic activity on Promised Land Trail and Nowra Road which could impact road users, pedestrians/ cyclists, WaterNSW/ National Parks and Wildlife Service (NPWS) personnel and contractors. These roads would become a controlled environment during the construction period and management measures would be implemented in consultation with WaterNSW and NPWS.

Up to 20 daily heavy vehicles movements (i.e. 20 trips to the spoil disposal area and 20 return movements to the plateau) may be generated by the transportation of the surplus spoil from the plateau to the spoil disposal area adjacent to the Bendeela Pondage. These heavy vehicle movements would be for a period of up to four months and scheduled to not coincide with construction staff shift movements or peak delivery periods and would be evenly distributed throughout standard working hours.

It is to be noted that spoil truck haulage movements and route will be finalised post approval in concurrence with WaterNSW and other relevant stakeholders.

5.3.3 Concrete

Concrete is used to line tunnels and construct the underground power station caverns in the lower scheme and for foundations for the surge tank and penstock in the upper scheme.

For the lower scheme the concrete batching plant is assumed to be at the portal to the main access tunnel. Tunnel lining is gradual however concrete pours in the underground power station will require a large amount of concrete per day. There will be a small amount of local stockpiling of materials. The materials for the lower scheme will come from Nowra and be transported in 20t tipper trucks.

There will be an average of four daily heavy vehicle movements (four inbound and four outbound) of aggregate or cement for the period of 18 months to feed the concrete batching plant for the tunnel lining.

During peak times there may be up to ten hourly heavy vehicle movements (ten inbound and ten outbound) to the lower scheme for trucks carrying materials for concrete.

As the concrete batching is at the main access tunnel portal, the movement of the concrete agitator trucks to the tunnels and caverns are not counted in traffic movements as they are within the site. Should the batching plant not be able to be located at the main access tunnel portal then further heavy vehicle movements would be generated between the batching plant and the main access tunnel portal.

For the upper scheme, during peak times there may be up to ten hourly heavy vehicle movements (ten inbound and ten outbound) to the Promise Land Trail for concrete agitator trucks coming from Moss Vale.

5.3.4 Delivery of materials and equipment

Principal materials and components required to construct the Project are expected to originate primarily from Port Kembla and would be transported to the Project via the Princes Highway (A1) and Moss Vale Road (B73). General construction equipment (e.g. mobile cranes and pumps) would be transported from Sydney via major roads including the Hume Motorway (M31). Premixed concrete is likely to be sourced locally from Moss Vale and concrete subcomponents including sand, gravel and cement would likely be sourced from Nowra.

The following heavy vehicle movements are indicative of what is expected to be generated during construction:

- Semi-trailer (2 and 3-axle): delivery of structural, mechanical, electrical equipment (other than those requiring oversize transport) and other miscellaneous equipment (e.g. prefabricated site offices, gates, fencing, portaloos and tanks)
- Heavy rigid: transport of raw construction materials including gravel, premixed concrete (or alternatively subcomponents including sand, gravel and cement), fuel for onsite machinery and/or water
- Heavy machinery (e.g. earthmoving equipment and cranes): sourced from Sydney and transported via low-loader. Assumed to remain onsite for the duration required for the construction works (e.g. earthmoving equipment and cranes)
- OSOM: delivery of major loads, transformers, pipeline, etc.

A single vehicle 'movement' is assumed to consist of two trips (one inbound trip and one outbound trip). During peak construction periods, an hourly peak of 30 heavy vehicle movements (i.e. 30 inbound trips and 30 outbound trips) are expected to occur at the upper scheme and a peak of ten heavy vehicle movements (i.e. ten inbound trips and ten outbound trips) are expected at the lower scheme. The majority of heavy vehicle movements are expected to occur between 10:00 am and 3:00 pm on weekdays or between 10:00 am to 1:00 pm on Saturdays and would be scheduled to not coincide with peak periods of general background traffic or with peak periods of construction staff shift movements.

OSOM vehicle movements would occur during off peak periods and are further detailed in **Section 5.9**.

The WaterNSW bridge across the outfall of the Kangaroo Valley Power Station will be used in the transport route for deliveries of materials and equipment to the Main Access Tunnel Portal. The detailed assessment of this bridge will be completed as part of the Contractor's traffic management planning. In the event that the heaviest loads exceed the capacity of the bridge, an alternative may be to transport those loads through the Kangaroo Valley Power Station. This alternative would be assessed as part of the Contractor's traffic management planning.

5.3.5 Summary of construction traffic generation and distribution

The anticipated distribution of movements on the local and State road network during the morning and afternoon hours of peak construction traffic generation is shown in **Figure 5-1** and **Figure 5-2**, respectively. **Figure 5-3** shows the distribution of construction traffic movements during the peak hour of heavy vehicle deliveries to the Project (within the proposed 10:00 am and 3:00 pm delivery window on weekdays).

The following additional movements have been assumed during the morning and afternoon peak period in order to provide a conservative assessment:

- Up to 20 light vehicle and 30 heavy vehicle (including shuttle bus) trips in each direction between the upper and lower schemes of the Project
- Up to four miscellaneous heavy vehicle arrivals and four miscellaneous departures at each of the upper and lower schemes of the Project
- Up to three light vehicle and seven heavy vehicles trips in each direction between the Kangaroo Valley Power Station and Bendeela Power Station
- Up to four bus trips from the Kangaroo Valley Power Station to Bendeela Power Station and four returning bus trips from Bendeela Power Station to Kangaroo Valley Power Station.

A summary of all construction traffic is provided in **Table 5-1**. Anticipated construction traffic volumes will be updated as the Project progresses, and the design is refined.

OSOM vehicle movements are mostly anticipated to occur at night and/or during off peak periods. OSOM traffic generated during construction is further detailed in **Section 5.9**.

Table 5-1. Summary of construction traffic

Measure	Summary of indicative traffic movements
Total vehicle movements	The following vehicle movements are required to facilitate construction: ▪ Approximately 3,700 truck movements including 550 oversize / over mass vehicles ▪ Approximately 36,000 truck movements associated with spoil haulage ▪ Approximately 13,700 bus movements associated with workforce transport ▪ Approximately 41,000 light vehicle movements associated with workforce transport. These movements would be spread over the duration of the Project resulting in typical daily movements as follows: ▪ 2 – 100 heavy vehicle movements associated with deliveries ▪ 20 – 60 spoil truck movements ▪ 7 - 16 bus movements associated with workforce transport ▪ 20 light vehicle movements associated with workforce transport. On the basis of an indicative construction sequencing it is likely that spoil haulage, deliveries and workers transport would be compressed over a period during peak tunnelling works. Peak daily traffic movements for intersection performance modelling purposes is summarised below.
Modelled peak daily traffic volumes (workforce and deliveries)	The following traffic movements have been considered associated with the Upper Scheme: ▪ Eight shuttle buses, 12 light vehicles and 6 heavy vehicles per hour during modelled peaks associated with shift start / end times ▪ Fifteen heavy vehicles and 2 light vehicles per hour outside of shift start / end peaks ▪ Approximately 400 out of hours delivery of oversize and over mass components at approximately four per hour over multiple nights. The following traffic movements have been considered associated with the Lower Scheme: ▪ Eight shuttle buses, 12 light vehicles and 6 heavy vehicles per hour during modelled peaks associated with shift start / end times ▪ Fourteen heavy vehicles and 6 light vehicles per hour outside of shift start / end peaks ▪ Approximately 150 out of hours delivery of oversize and over mass components. Where a vehicle movement is defined as one vehicle entering and leaving.
Spoil haulage	Estimated bulked spoil generation of 420,000m^3 involving the following haulage movements: ▪ Approximate peak of 62 haulage movements per day from access and multipurpose tunnel to spoil emplacement targeting use of internal access tracks ▪ Approximate peak of 14 haulage vehicles per day from Tailrace tunnel portal to spoil emplacement via Lower Bendeela Road ▪ Approximate peak of 19 haulage movements per day from Promised Land Trail to spoil emplacement via Moss Vale Road, Bendeela Road, Jacks Corner Road and internal access track (scheduled so as not to exceed heavy vehicle daily traffic volumes considered above).

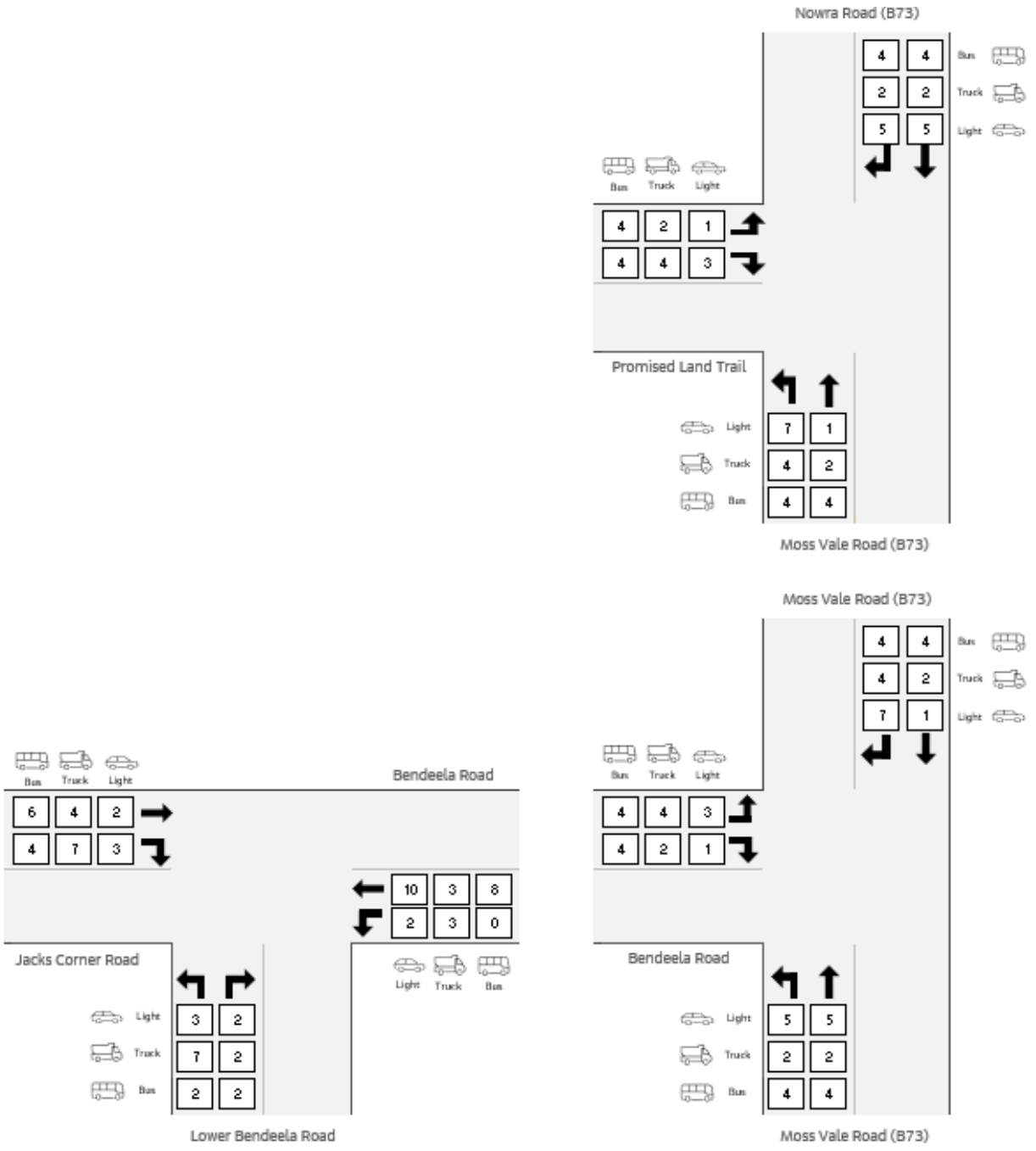


Figure 5-1. Indicative construction traffic trips during the morning peak period (6:30 am to 7:30 am on weekdays and 7:00 am to 8:00 am on Saturdays)

Note: All movements have been rounded up to the nearest whole number

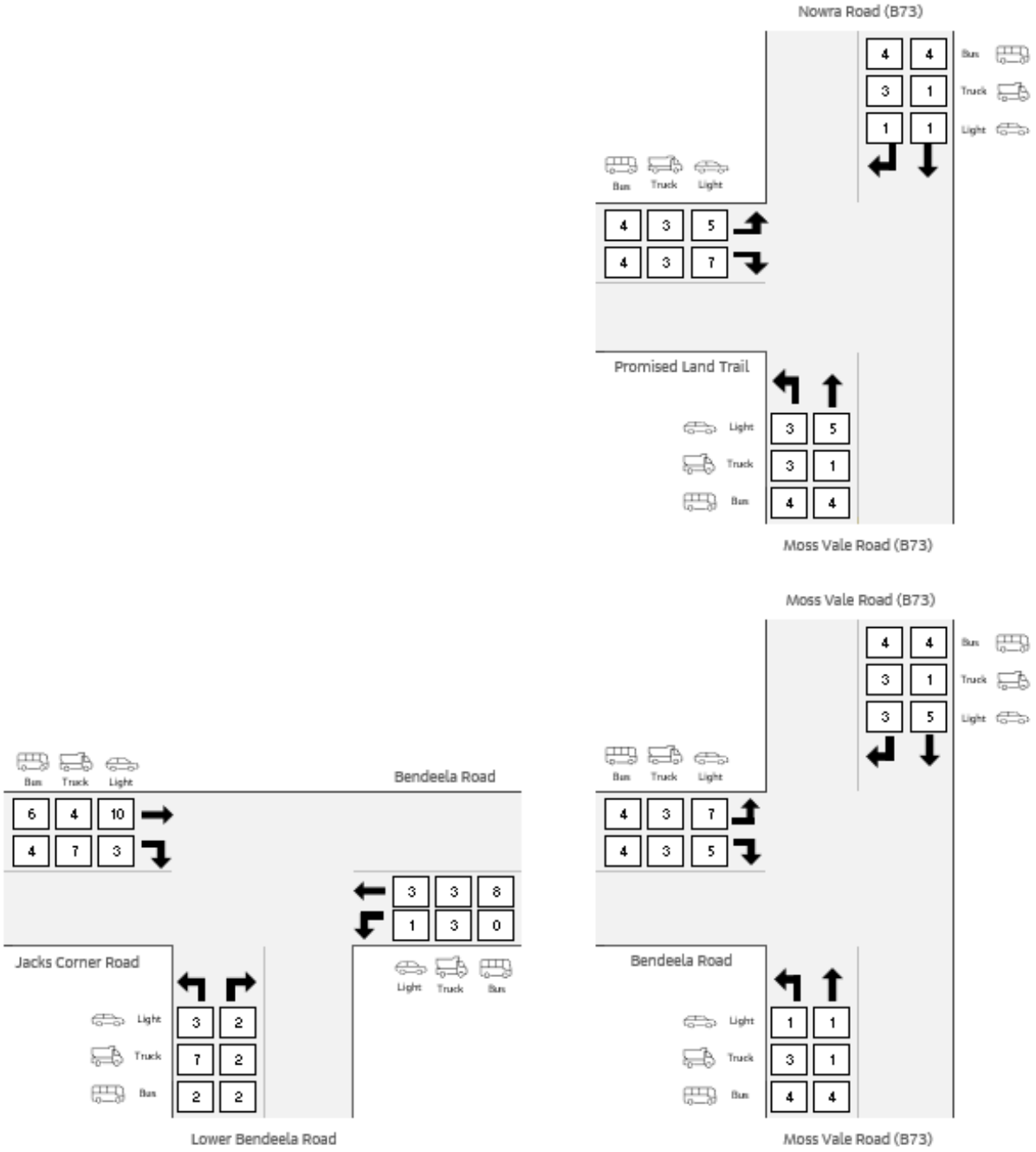


Figure 5-2. Indicative construction traffic trips during the afternoon peak period (6:00 pm to 7:00 pm on weekdays and 1:00 pm to 2:00 pm on Saturdays)

Note: All movements have been rounded up to the nearest whole number

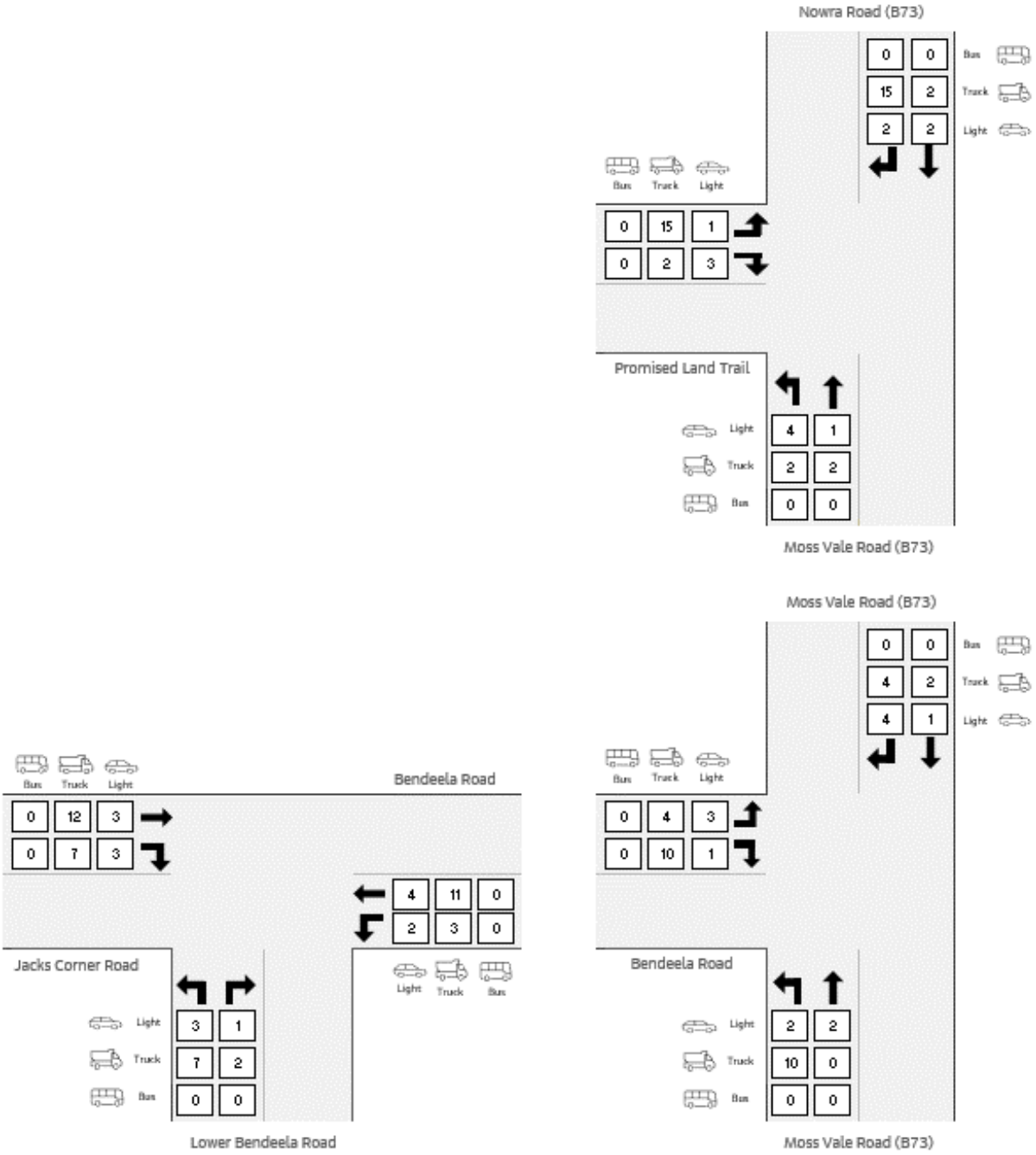


Figure 5-3. Indicative construction traffic trips during the peak hour of heavy vehicle deliveries (10:00 am to 3:00 pm on weekdays and 10:00 am to 1:00 pm on Saturdays)

Note: All movements have been rounded up to the nearest whole number

5.4 Impacts on road network capacity and performance

Traffic modelling using SIDRA Intersection 9 was undertaken to assess the construction traffic impacts of the Project on road capacity and performance. The traffic modelling was performed for the following weekday peak periods:

- Weekday AM peak - 6:30 am to 7:30 am
- Weekday HV peak - 2:00 pm to 3:00 pm
- Weekday PM peak - 6:00 pm to 7:00 pm.

Due to the relatively high Saturday traffic volumes experienced by the local road network, traffic modelling was also performed for the following Saturday peak periods:

- Saturday morning (AM) peak - 7:30 am to 8:30 am
- Saturday heavy vehicle (HV) peak - 11:45 pm to 12:45 pm
- Saturday afternoon (PM) peak - 1:00 pm to 2:00 pm.

The AM and PM peak periods represent the hours when the traffic generated by the construction of the Project is greatest (due to the transportation of the workforce to and from the Project). The heavy vehicle (HV) peak period represents the peak hour of heavy vehicle deliveries and has been modelled to occur concurrently to the peak hour of background traffic volumes within the proposed delivery window (10:00 am to 3:00 pm on weekdays and 10:00 am to 1:00 pm on Saturdays). As such, this scenario represents a worst-case as the available spare capacity of the road network is at its most limited.

It is noted that construction activity associated with the upper scheme of the Project is likely to be complete by 2027 while the lower scheme may occur up until the year 2028. For the purpose of this traffic and transport assessment, it has been assumed that peak construction would occur in year 2025. To account for potential traffic growth in the area, the background traffic volumes have been scaled using a 3.0 % annual growth rate.

5.4.1 Intersection performance results

Traffic modelling has assumed year 2025 as peak construction year. SIDRA Intersection 9 was used to model the performance of key intersections in the study area. Intersection performance results under the 'without Project' (background traffic only; without vehicles associated with construction of the Project) and the 'with Project' (background traffic and with vehicles associated with construction of the Project) scenarios are presented in Table 5-2.

Modelled intersection performance indicates that all intersections in the study area would operate at a LoS A without the Project in 2027. Minimal queue lengths are observed for all intersections and the results show the maximum average delay any intersection would experience is approximately 10 seconds or less. These results indicate that all intersections within the study area would operate well within their capacity in 2027 without the Project, which is primarily due to relatively low volumes present.

Under the 'with Project' scenario (with vehicles associated with construction of the Project), all intersections in the study area are expected to continue to perform at a LoS A. The maximum increase in average delay during construction of the Project is anticipated to be up to approximately four seconds. The results indicate that the 95th percentile queue is not expected to exceed five m in length at any intersection. As such, the construction of the Project is expected to have a negligible impact on the performance of local intersections within the study area. Note that the assessment assumes a worst-case scenario and average delays are likely to be lower.

5.4.1.1 Alternative haulage route assessment

A traffic impact assessment of an alternative spoil haulage route along Jacks Corner Road (public road) and then across the Kangaroo Valley power station bridge has been undertaken. The traffic impact assessment results indicate that the alternative route will produce similar intersection performance (LoS A) to the currently assumed spoil haulage route results shown in **Table 5-2**.

Table 5-2. Intersection performance results

Peak period	Intersection	Without construction of Project (2027)				With construction of Project (2027)			
		Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)	Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)
Weekdays									
AM peak (6:30 am to 7:30am)	Moss Vale Road / Nowra Road / Promised Land Trail	0.03	7.8	A	<5	0.04	10.0	A	<5
	Moss Vale Road / Bendeela Road	0.08	6.5	A	<5	0.10	7.7	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.01	8.9	A	<5	0.03	12.9	A	<5
HV peak (2:00 pm to 3:00 pm)	Moss Vale Road / Nowra Road / Promised Land Trail	0.12	7.9	A	<5	0.14	11.1	A	<5
	Moss Vale Road / Bendeela Road	0.13	7.3	A	<5	0.15	8.5	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	9.7	A	<5	0.04	12.3	A	<5
PM peak (6:00 pm to 7:00 pm)	Moss Vale Road / Nowra Road / Promised Land Trail	0.12	7.8	A	<5	0.13	10.6	A	<5
	Moss Vale Road / Bendeela Road	0.13	7.2	A	<5	0.15	8.0	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	10.9	A	<5	0.04	12.5	A	<5
Saturday									
AM peak (7:00 am to 8:00am)	Moss Vale Road / Nowra Road / Promised Land Trail	0.05	7.8	A	<5	0.07	10.5	A	<5
	Moss Vale Road / Bendeela Road	0.08	6.4	A	<5	0.10	7.0	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.01	10.1	A	<5	0.03	12.6	A	<5

Peak period	Intersection	Without construction of Project (2027)				With construction of Project (2027)			
		Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)	Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)
HV peak (11:45 pm to 12:45 pm)	Moss Vale Road / Nowra Road / Promised Land Trail	0.11	8.2	A	<5	0.14	11.4	A	<5
	Moss Vale Road / Bendeela Road	0.13	7.2	A	<5	0.14	8.4	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	8.9	A	<5	0.03	11.2	A	<5
PM peak (1:00 pm to 2:00 pm)	Moss Vale Road / Nowra Road / Promised Land Trail	0.15	8.7	A	<5	0.17	12.8	A	<5
	Moss Vale Road / Bendeela Road	0.19	8.7	A	<5	0.22	9.9	A	<5
	Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.03	9.0	A	<5	0.05	13.1	A	<5

5.5 Impacts on road safety

With school buses and cyclist utilising the local road network, potential for conflict with Project construction vehicles will be managed through appropriate control measures developed during detailed design stage. The below sections investigate sight distance, turn warrants and impact on crash risk including mitigation measures during construction of the Project.

5.5.1 Sight distance assessment

A preliminary sight distance assessment was undertaken to evaluate whether adequate sight distances are available at the Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail intersection to enable road users to safety perceive and react to turning Project traffic. The assessment was conducted in accordance with the Safe Intersection Sight Distance (SISD) requirements set out in Section 3 of Austroads *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (2021). SISD is the minimum sight distance which should be provided on the major road at any intersection. This allows for all drivers to have the maximum ability to slow down, identify any other road users and drive in a safe manner. The application of SISD to major and minor roads is shown in **Figure 5-4**.

It should be noted that the results of this SISD assessment are preliminary only, and that a 3D sight distance check would be required prior to the construction of the Project to confirm the results and ensure the sight lines are not obstructed by vertical crests and other roadside objects. In addition, other key sight distance checks, including Approach Sight Distance (ASD), Minimum Gap Sight Distance (MGSD) and Stopping Sight Distance (SSD) would also need to be evaluated prior to the construction of the Project.

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections sets out the formula for SISD to be:

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

A summary of the parameter definitions and values used for the SISD assessment are provided in **Table 5-3**. The minimum sight distances recommended for the intersection are shown in **Table 5-4** and the results of the SISD assessment are shown in **Table 5-5**.

The preliminary results (pending results of a more detailed 3D sight distance check) indicate that the SISD for vehicles travelling northbound and southbound on Moss Vale Road are currently inadequate for a speed of 100 km/hr due to horizontal curves and roadside vegetation. A reduction in the posted speed limit to 60 km/hr or below would likely increase the SISD and may assist in meeting the requirements set out by Austroads.

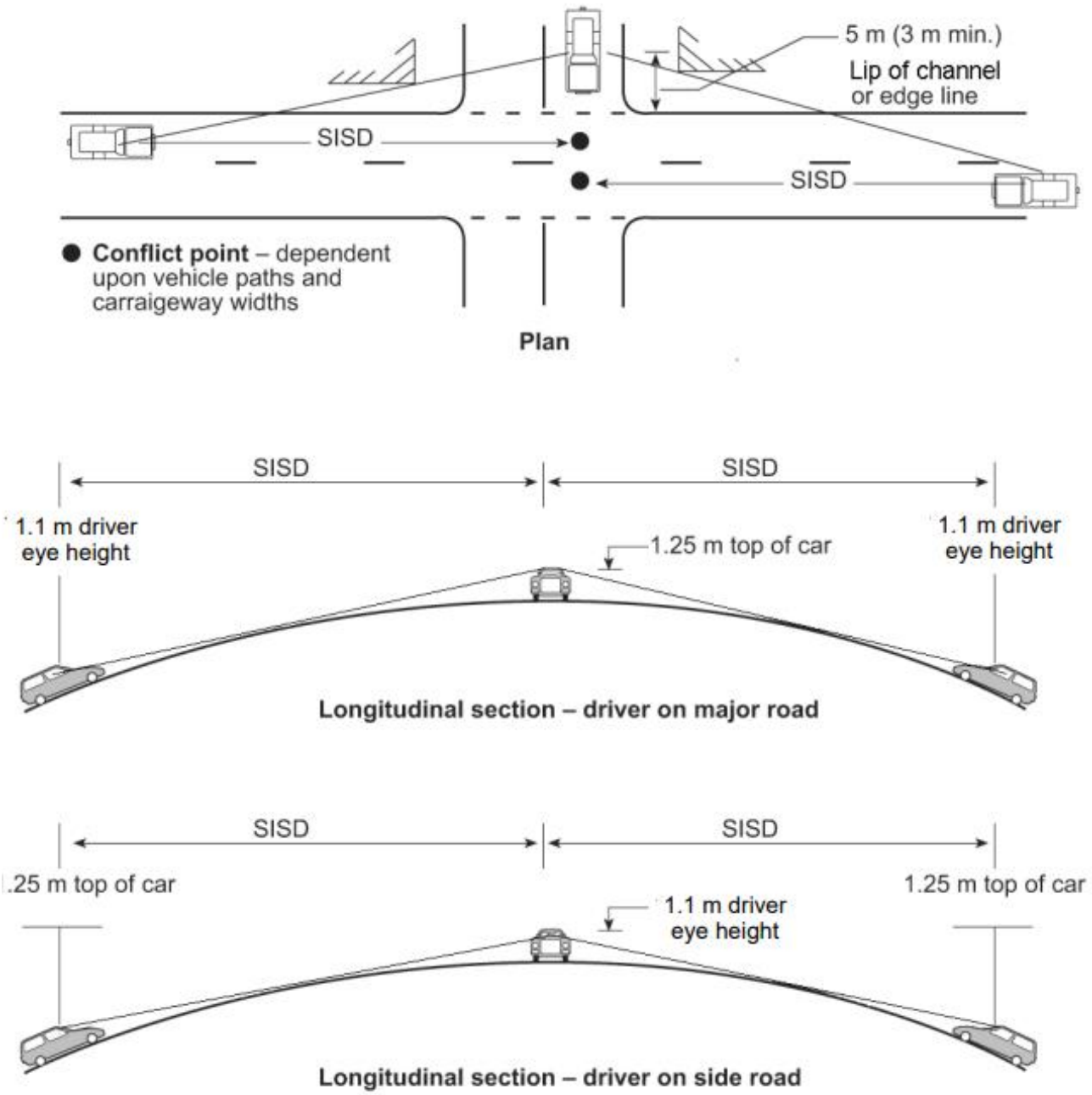


Figure 5-4. Application Safe intersection sight distance (SISD) to major and minor roads
Image source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections

Table 5-3. SISD parameter definitions and adopted values

Parameter	Symbol	Description	Vehicle / direction	Value adopted
Decision time	D_T	Observation time (3 seconds) + reaction time[1]	Light vehicles	5.5 seconds
			Heavy vehicles	5 seconds
Operating speed[2]	v	Operating (85th) percentile speed (km/h)	-	Variable (110 km/h, 60 km/h or 40 km/h)
Coefficient of deceleration	d	Longitudinal deceleration is the measure of the longitudinal friction between the vehicle tyres and the road surface.	Light vehicles	0.36
			Heavy vehicles	0.29
Longitudinal grade[3]	a	In direction of travel – positive for uphill and negative for downhill	Northbound	6 %
			Southbound	-1.5 %

Notes:

[1] Driver reaction time of 2.0 seconds has been adopted for roads with design speed of ≤ 90 km/h and 2.5 seconds has been adopted for road with a design speed of >100 km/h as per Section 5.2.2 of TfNSW's *Supplement to Austroads Guide to Road Design Part 3* (version 2.2, 2016).

[2] Conservatively assumed to be the posted speed limit for. For high-speed rural roads, a design/operating speed of 10 km/h higher than posted speed has been adopted (AGRD3, Clause 3.3).

[3] Calculated using a two-m contour map (NSW Elevation Data Service).

Table 5-4. Indicative SISD requirements for the Moss Vale Road/ Nowra Road / Promised Land Trail intersection

			SISD for light vehicles (m)			SISD for heavy vehicles (m)		
Road	Direction of travel	Grade (%)	40 km/h	60 km/h	100 km/h	40 km/h	60 km/h	100 km/h
Moss Vale Road / Nowra Road	Northbound	6	75	125	250	80	135	275
	Southbound	-1.5	75	125	250	80	135	275

Note: All values have been rounded up to the nearest 5 m

Table 5-5. Preliminary SISD results for the Moss Vale Road / Nowra Road / Promised Land Trail intersection

			SISD met for light vehicles			SISD met for heavy vehicles		
Road	Direction of travel	SISD1	40 km/h	60 km/h	100 km/h	40 km/h	60 km/h	100 km/h
Moss Vale Road / Nowra Road	Northbound	Approximately 150 m^2	Yes	Yes	No	Yes	Yes	No
	Southbound	Approximately 150 m^2	Yes	Yes	No	Yes	Yes	No

[1] Approximate SISD only – a site visit is recommended to confirm these results.

[2] Based on a 5.0 m offset from the conflict point

5.5.2 Turn warrant assessment

A series of turn warrant assessments were undertaken to determine whether higher-order turn treatments at key intersections are required as a result of peak periods of construction traffic generation. The assessment was undertaken for forecast 2027 traffic volumes 'with' and 'without' construction traffic generated from the Project.

5.5.2.1 Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail

As shown in **Table 5-6**, the existing basic left-turn and basic right-turn treatments at the Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail intersection are expected to remain appropriate under the 2027 'without Project' scenarios. However, with HV peak and PM peak Project construction volumes, a higher-order (channelised) right-turn treatment would be warranted. A channelised right-turn with a short or full length turn slot at this intersection would provide greater protection for vehicles waiting to turn right from the centre of the road.

Table 5-6. Turn warrant results for Moss Vale Road / Nowra Road / Promised Land Trail (100 km/h)

		Left turn			Right turn		
Peak period	Scenario	Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
Weekday							
AM peak (6:30 am to 7:30 am)	Without Project	46	0	Basic left	67	0	Basic right
	With Project	52	14	Basic left	98	11	Basic right
HV peak (2:00 pm to 3:00 pm)	Without Project	132	0	Basic left	334	0	Basic right
	With Project	135	6	Basic left	348	17	Channelised right (short)
PM peak (6:00 pm to 7:00 pm)	Without Project	67	0	Basic left	282	0	Basic right
	With Project	77	10	Basic left	307	8	Channelised right (short)
Saturday							
AM peak (7:00 am to 8:00 am)	Without Project	82	0	Basic left	164	0	Basic right
	With Project	88	14	Basic left	195	11	Basic right
HV peak (12:00 pm to 1:00 pm)	Without Project	173	0	Basic left	372	0	Basic right
	With Project	176	6	Basic left	386	17	Channelised right (short)
PM peak (1:00 pm to 2:00 pm)	Without Project	178	0	Basic left	452	0	Basic right
	With Project	187	8	Basic left	477	8	Channelised right (short)

It is noted that a higher-order right-turn treatment would not be warranted under Austroads guidelines if the posted speed limit for Moss Vale Road (B73) is temporarily reduced to 70 km/hr or less during the Project construction period. As shown in **Figure 5-5**, up to 18 right-turn movements can be accommodated (up to 17 movements expected under Project construction conditions) under a peak major road volume (Q_M) of 480 vehicles per hour (up to 477 vehicles expected under Project construction conditions) with a posted speed limit of 70 km/hr or less.

In addition, a higher-order right-turn treatment would not be warranted under Austroads guidelines if the number and / or timing of the right-turn movements are managed in accordance with **Figure 5-6**. As shown in the figure, the intersection can accommodate up to 15 right-turn movements per hour from Moss Vale Road without the requirement for a higher-order turn treatment providing they occur:

- Prior to 6:45 am and after 5:45 pm on weekdays
- Prior to 7:30 am and after 5:30 pm on Saturdays.

Up to 10 right-turn movements can be accommodated during the following times:

- Prior to 10:15 am and after 5:00 pm on weekdays
- Prior to 8:00 am and after 5:15 pm on Saturdays.

Outside of the above hours, the intersection can accommodate up to five right-turn movements from Moss Vale Road without the requirement for a higher-order turn treatment.

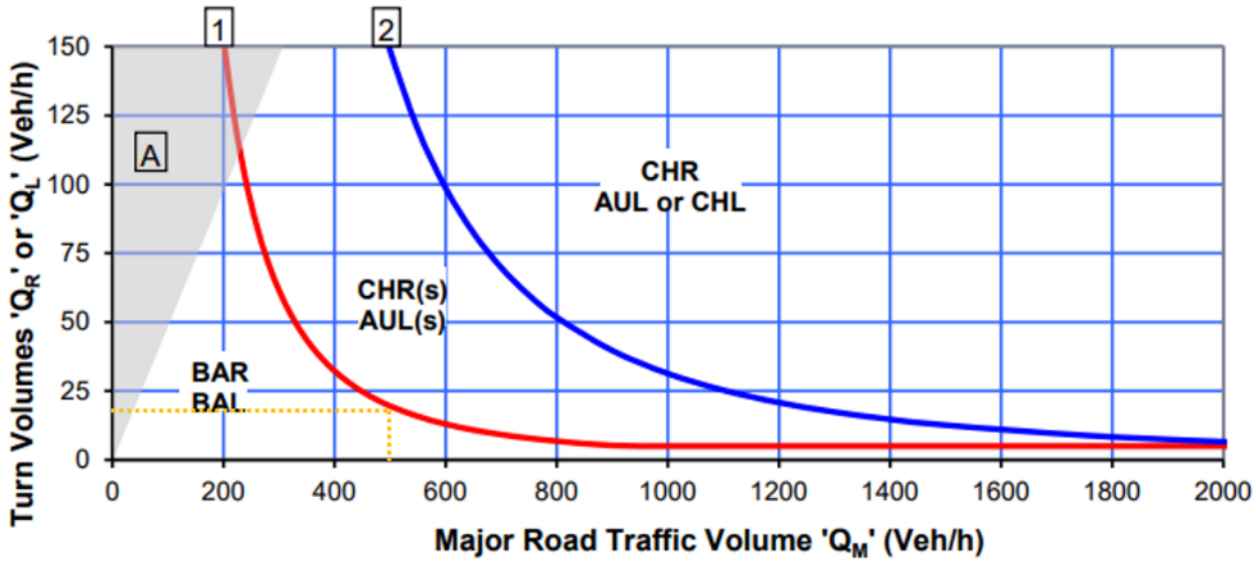


Figure 5-5. Warrants for turn treatments on major roads with a design speed ≤ 70 km/h
Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management

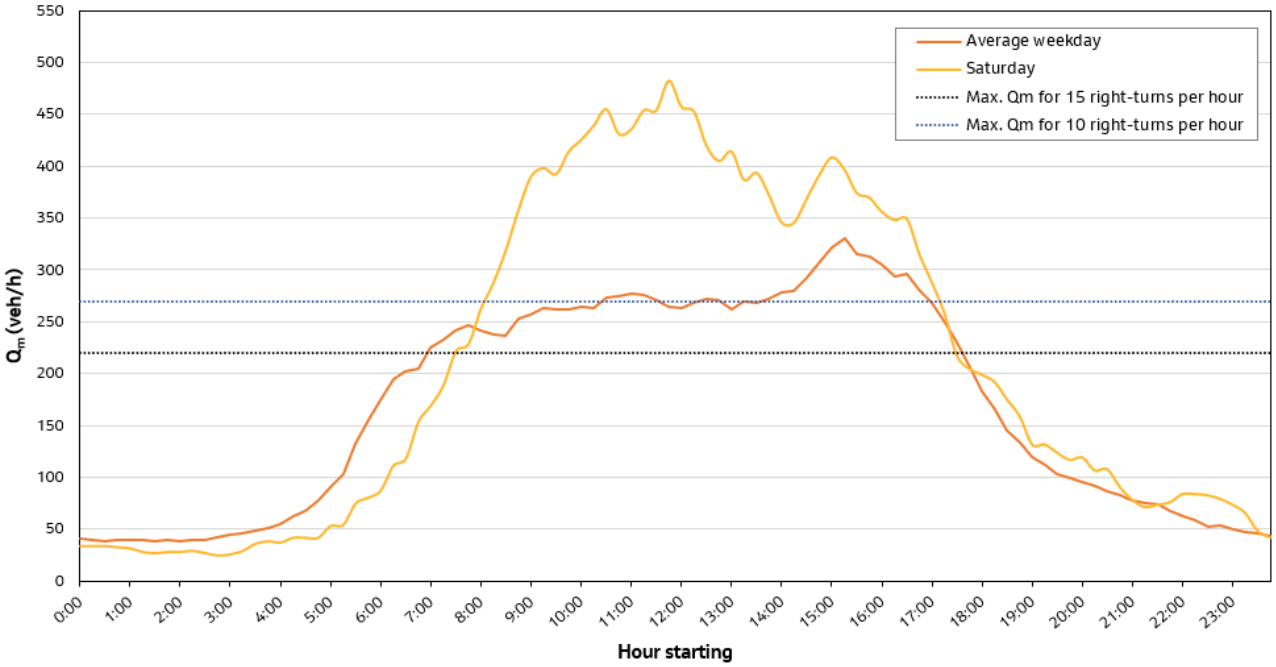


Figure 5-6. Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail
Note: graph assumes a maximum Q_L of 20 vehicle per hour

5.5.2.2 Moss Vale Road (B73) / Bendeela Road

As shown in **Table 5-7**, the current basic left-turn treatment at the Moss Vale Road (B73) / Bendeela Road intersection are expected to remain appropriate under the 2027 weekday and Saturday AM and HV peak 'without Project' scenarios. However, a higher-order (channelised) right-turn is warranted under both the 'without Project' and 'with Project' scenario under Saturday PM peak traffic conditions. As such, expected construction traffic volumes would not trigger a higher-order turn treatment in comparison to the turn treatment required under the forecast background 2027 traffic volumes.

Table 5-7. Turn warrant results for Moss Vale Road (B73) / Bendeela Road (60 km/h)

Peak period	Scenario	Left turn			Right turn		
		Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
Weekday							
AM peak (6:30 am to 7:30 am)	Without Project	110	30	Basic left	193	11	Basic right
	With Project	121	42	Basic left	220	26	Basic right
HV peak (2:00 pm to 3:00 pm)	Without Project	153	24	Basic left	190	13	Basic right
	With Project	155	36	Basic left	417	21	Basic right
PM peak (6:00 pm to 7:00 pm)	Without Project	67	23	Basic left	303	24	Basic right
	With Project	73	31	Basic left	326	34	Basic right
Saturday							
AM peak (7:00 am to 8:00 am)	Without Project	104	32	Basic left	233	8	Basic right
	With Project	114	42	Basic left	261	22	Basic right
HV peak (12:00 pm to 1:00 pm)	Without Project	170	17	Basic left	394	16	Basic right
	With Project	172	28	Basic left	411	24	Basic right
PM peak (1:00 pm to 2:00 pm)	Without Project	255	40	Basic left	610	23	Channelised right (short)
	With Project	261	48	Basic left	634	33	Channelised right (short)

5.5.2.3 Bendeela Road / Jacks Corner Road / Lower Bendeela Road

As shown in **Table 5-8**, the existing basic left-turn and basic right-turn treatments are expected to remain appropriate at Bendeela Road / Jacks Corner Road / Lower Bendeela Road intersection even when expected Project construction traffic volumes are considered.

Table 5-8. Turn warrant results for Bendeela Road / Jacks Corner Road / Lower Bendeela Road (80 km/h)

Peak period	Scenario	Left turn			Right turn		
		Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
Weekday							
AM peak (6:30 am to 7:30 am)	Without Project	15	3	Basic left	20	0	Basic right
	With Project	35	8	Basic left	57	14	Basic right
HV peak (2:00 pm to 3:00 pm)	Without Project	10	13	Basic left	51	4	Basic right
	With Project	26	17	Basic left	86	14	Basic right
PM peak (6:00 pm to 7:00 pm)	Without Project	9	30	Basic left	47	4	Basic right
	With Project	23	34	Basic left	84	18	Basic right
Saturday							
AM peak (7:00 am to 8:00 am)	Without Project	14	1	Basic left	23	1	Basic right
	With Project	34	7	Basic left	60	15	Basic right
HV peak (12:00 pm to 1:00 pm)	Without Project	8	12	Basic left	31	2	Basic right
	With Project	23	16	Basic left	66	12	Basic right
PM peak (1:00 pm to 2:00 pm)	Without Project	52	9	Basic left	92	13	Basic right
	With Project	65	13	Basic left	129	27	Basic right

5.5.3 Crash rates

As outlined in **Section 4.5.1**, 27 % of crashes in the area involved speeding and 5 % involved fatigue as a contributing factor. In addition, 29 % of crashes in the area occurred under wet pavement conditions and 46 % occurred on the section of Moss Vale Road (B73) within Barrengarry Mountain. This high frequency of crash occurrences on Moss Vale Road may be further impacted by the increased traffic resulting from the Project. Typically, a higher level of traffic and congestion results in a reduction in road safety, and therefore the additional traffic volumes may increase the risks to road users. To minimise the risks of speeding and fatigue, as well as other road safety risks and contributing factors, appropriate driver induction, training, safety measures and protocols would be detailed in a Construction Traffic Management Plan (CTMP) and Driver Code of Conduct. An example Driver Code of Conduct is provided in **Appendix A**. All Project personnel, including shuttle bus drivers, would be required to adhere to the CTMP and Driver Code of Conduct. In addition, speed reductions, use of fog lights during periods of low visibility, cessation of works and site shutdowns will be implemented as required during periods of adverse weather.

Providing road safety risks and contributing factors are adequately managed, construction of the Project is not expected to have a significant impact on road safety.

5.6 Impacts on public transport

Impacts to public or school bus services are expected to be negligible given the available spare capacity of the road network. The construction of the Project would have a negligible impact on the operation of bus stops.

5.7 Impacts on pedestrians and cyclists

As discussed in **Section 4.7**, there are limited pedestrian or cycling facilities located near the Project. Impacts to pedestrians and cyclists would therefore be limited to minor amenity impacts at town centres due to the addition of light and heavy construction vehicles on the road network.

5.8 Impacts to parking

Impacts to existing parking are expected to be minimal as parking for construction vehicles would be provided within the Project site, away from public roads. It is expected that the hardstand area in front of Kangaroo Valley Power Station may see an increase in usage by vehicles waiting to access site.

5.9 Oversize/over mass vehicles

OSOM vehicles would be required to transport certain oversized equipment to the Project area during the construction of the Project. Oversized over mass equipment is expected to originate primarily from the Port Kembla region and would generate up to 450 one-way OSOM vehicle trips including:

- Up to 10 two-way OSOM vehicle trips for construction equipment including a tunnel boring machine, road headers, cranes, bulldozers, raise boring machine.
- One one-way OSOM vehicle trip during construction to transport the Generator Step Up Transformer to the lower scheme of the Project
- Up to two one-way oversize vehicle trips to transport the overhead crane beam to and from the lower scheme of the Project
- Up to 50 one-way OSOM vehicle trips during construction to transport main electromechanical equipment and other power station components to the lower scheme of the Project
- Up to 335 one-way oversize vehicle trips during construction to transport pipeline to the upper scheme of the Project
- Up to 60 one-way oversize vehicle trips during construction to transport vertical shaft steel liner to the upper scheme of the Project.

The indicative dimensions and mass of OSOM equipment is provided in **Table 5-9**.

Table 5-9. Indicative dimensions and mass of OSOM equipment to be transport to the Project

Component	Dimensions	Weight (t)
Generator step up transformer	▪ Height: 4.2 m ▪ Width: 4.2 m ▪ Length: 7.0 m	160
Overhead crane beam	▪ Height: 3.0 m ▪ Width: 1.0 m ▪ Length: 23.5 m	N/A
Scroll case section (headrace tunnel and trailrace steel liner)	▪ Height: 2.5 m ▪ Width: 5.5 m ▪ Length: 7.5 m	N/A
Pipeline	▪ Diameter: 3.5 m ▪ Length: 9.0 m	N/A
Vertical shaft steel liner	▪ Diameter: 3.1 m ▪ Length: 9.0 m	N/A

5.9.1 Proposed oversize/over mass haulage route

Figure 5-7 shows the proposed OSOM routes from Port Kembla to the Project. The primary route proposed for OSOM vehicles between Port Kembla and the lower scheme of the Project is approximately 90 km in length and consists of the following roads:

- Port Kembla to Spring Hill Road (B65) at Coniston
- South along route B65 (consisting of Spring Hill Road, Five Island Road, King Street, Primbee Bypass, Windang Road and Shellharbour Road) from Coniston to Shell Cove
- South along Princes Highway (A1) from Shell Cove to Bomaderry
- Northwest along Moss Vale Road (B73) from Bomaderry to the Project.

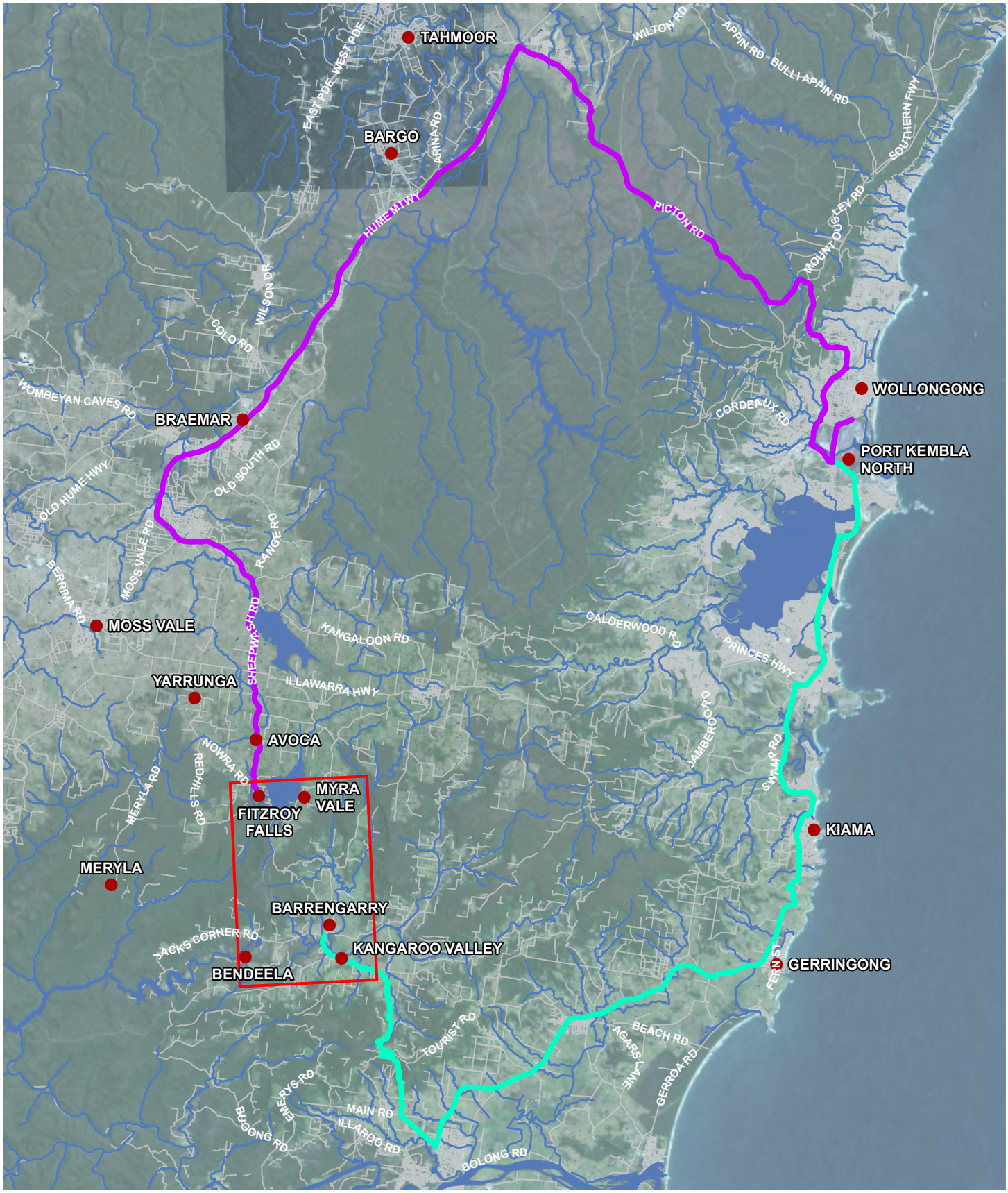
The primary route proposed for OSOM vehicles between Port Kembla and the upper scheme of the Project is approximately 110 km in length and consists of the following roads:

- Port Kembla to Spring Hill Road (B65) at Coniston
- West along Masters Road
- North on Princes Motorway (M1) from Mount St Thomas to Picton Road (B88)
- Northwest on Picton Road (B88) to Wilton
- South on Hume Motorway (M31) from Wilton to Aylmerton
- South on route B73 (consisting of Old Hume Highway and Bowral Road) from Aylmerton to Bowral
- South on Bong Bong Street at Bowral
- South on route B73 (consisting of Kangaloon Road, Sheepwash Road, Nowra Road and Moss Vale Road) to the Project.

The proposed OSOM route via Wilton and Bowral would be required for over mass vehicles due to the 42.5 t vehicle limit at Hampden Bridge and Illawarra Highway dimension limits at Macquarie Pass.

As discussed in **Section 5.3.2**, the WaterNSW bridge at the Kangaroo Valley Power Station outlet over Bendeela Pondage must also be assessed as part of the Contractor's traffic management planning, given its load limits. Road closures may be required to accommodate oversize load haulage down Barrengarry mountain.

The Port of Newcastle may be considered as a secondary or alternative port.



Legend

- Proposed southern route
- Proposed northern route
- Study area
- Road
- Waterways
- Waterbody

0 5 10 km

1:325,000 at A4

GDA2020 MGA Zone 56

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Data sources

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Figure 5-7 Proposed OSOM routes from Port Kembla to the Project

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Created by : JB | QA by : CC

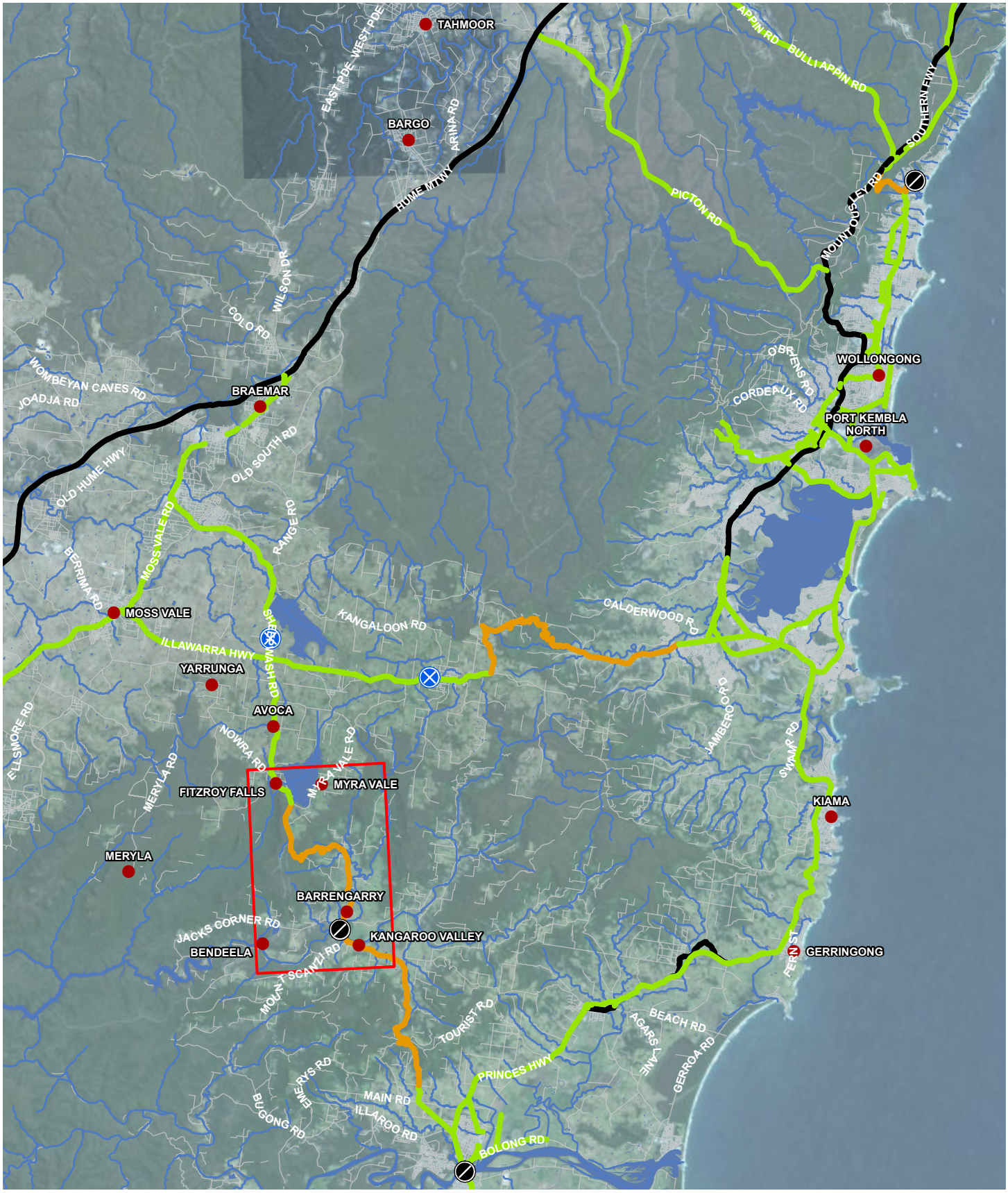
5.9.2 Oversize/ overmass vehicle route restrictions and conditions

The restrictions and conditions of access associated with the proposed OSOM routes from Port Kembla to the Project are described in **Table 5-10** and shown in **Figure 5-8**. It is noted that physical constraints may exist on each route and would be determined via a detailed route survey.

Table 5-10. Limited access locations

Location	Dimension limit (m)			Conditions of access
	Width	Height	Length	
Hampden Bridge (BN875), Kangaroo Valley	2.5	N/A	19.0	▪ An eligible vehicle that exceeds a dimension limit must obtain a Class 1 permit before travel ▪ The bridge has a sign-posted mass limit of 42.5 t. No over mass access is permitted.
Moss Vale Road between Barfield Road Cambewarra to Fitzroy Falls	2.5	N/A	19.0	▪ Police must be contacted prior to travel if wider than 2.5 m ▪ A police escort is required if wider than 3.0 m ▪ A Transport Management Plan (TMP) must be submitted where a Police escort is required ▪ An eligible vehicle that exceeds a dimension limit must obtain a Class 1 permit before travel.
Moss Vale Road at Fitzroy Falls	2.5	4.6	19.0	▪ An eligible vehicle that exceeds a dimension limit must obtain a Class 1 permit before travel.
Kangaroo Valley Road between Berry and Moss Vale Road	2.5	N/A	19.0	▪ Police must be contacted prior to travel if wider than 2.5 m ▪ A police escort is required if wider than 3.0 m ▪ A Transport Management Plan (TMP) must be submitted where a Police escort is required ▪ An eligible vehicle that exceeds a dimension limit must obtain a Class 1 permit before travel.
Princes Motorway	2.5	N/A	25.0	▪ Vehicles or combinations exceeding 3.5 m wide or 25.0 m long are not permitted to travel between 8:00am and sunset on weekends or a state-wide public holiday on the Princes Highway/Motorway between the start of the M1 Motorway at Waterfall and Rose Valley Road at Gerringong and between Woodhill Mountain Road at Berry and Bendalong Road at Conjola ▪ Vehicles or combinations exceeding 3.5 m wide or 25.0 m long are not permitted to travel between sunrise and sunset on weekends or a state-wide public holiday between Rose Valley Road at Gerringong and Woodhill Mountain Road at Berry.
Railway level crossing at Calawalla	N/A	N/A	N/A	▪ Vehicle must approach and traverse the designated level crossings at a speed not less than 35 km/h. If the vehicle cannot comply with this condition, the operator must contact Rail Infrastructure Manager.
Railway level crossing at Robertson	N/A	N/A	N/A	▪ Vehicle must approach and traverse the designated level crossings at a speed not less than 35 km/h. If the vehicle cannot comply with this condition, the operator must contact Rail Infrastructure Manager.
Illawarra Highway between Tullimbar and Robertson	2.5	N/A	19.0	▪ Police must be contacted prior to travel if wider than 2.5 m ▪ A police escort is required if wider than 3.0 m.

Depending on the outcome of the Transport Management Plans for very large loads it may be necessary to close Moss Vale Road in both directions Barfield Road Cambewarra to Fitzroy Falls. These disruptions are expected to occur in the order of 20 times throughout the construction.



Legend

- Restricted Structures - Bridges
- Restricted Structures with Conditional Access - Railway Level Crossings
- NSW Oversize Overmass Load Carrying Vehicles Network Approved Roads
- Approved Routes with Travel Conditions
- Limited Access Locations
- Study area
- Road
- Waterways
- Waterbody

0 5 10 km

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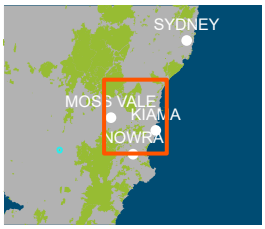
GDA2020 MGA Zone 56



Data sources

Jacobs 2022
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Figure 5-8 Approved and limited access roads for OSOM vehicles

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5.9.3 Impacts of oversize/over mass vehicles

An access permit will be sought from the National Heavy Vehicle Regulator (NHVR) prior to any OSOM movements on the road network. This permit will undergo a separate approval process and a suitable contractor will be engaged for transportation. As part of the permit, a subcontractor will develop a Transport Management Plan and determine the suitable route based on the required OSOM vehicle dimensions and mass in consultation with the Proponent and the NHVR. The Transport Management Plan would detail:

- The proposed OSOM routes
- The maximum dimensions and mass of the materials to be moved
- Potential impacts to the road network including road condition
- Times of transportation to minimise impacts on the road network
- Measures to provide an escort for the loads
- Location of rest areas and require rest stops along the route
- Communication strategy including liaison with emergency services and police
- Any minor temporary civil infrastructure works required to accommodate OSOM movements.

All OSOM movements associated with the construction of the Project would be performed outside of peak traffic periods and in accordance with any OSOM permit conditions to minimise any adverse impacts to the road network.

5.10 Impacts on road condition

The increase in heavy vehicle and OSOM movements has the potential to impact the condition of roads forming part of the proposed haulage routes. Measures to minimise road damage and deterioration during the construction of the Project are provided in **Section 8**. Furthermore, a dilapidation report, in reference to Austroads Design guidelines, will be prepared and submitted with the proposed design during the detailed design stage of the Project.

6 Potential operational impacts

6.1 Operational traffic generation and distribution

Operation of the Project would occur 24 hours per day, 365 days per year. The operational workforce is anticipated to comprise up to five full time employees, generating up to five movements per day (five arrivals to the Project and five departures from the Project per day), as shown in **Table 6-1**. Operational staff are expected to arrive at the Project site at 7:20 am and depart at 4:00 pm on weekdays in line with the existing shift pattern at the Kangaroo Valley Power Station. Operational staff would likely commute to the Project daily from local townships using a mix of light vehicles. Ad-hoc movements throughout the day would also be anticipated but have not been modelled. Inspections of the pipeline and other infrastructure along the alignment are expected to be managed by Water NSW and completed concurrently with the inspections of the existing pipeline assets and are therefore not modelled.

Heavy vehicle traffic generation resulting from operation of the Project during normal operation would be limited to a small number of movements associated with specialist maintenance and facility upkeep activities.

During station outages there would be an increase in heavy vehicle traffic. A typical planned maintenance regime may include a five-day yearly inspection, a one month three-yearly minor outage and a seven yearly major outage for three months. During these outages, up to five heavy vehicles could be expected daily, generating up to five total trips per day (five trips to the Project and five trips from the Project per day).

Approximately 50 % of operational vehicles are expected to access the Project via Bendeela Road from Moss Vale Road from the north and 50 % are expected to access the Project via Bendeela Road from Moss Vale Road from the south.

Table 6-1. Indicative operational traffic generation during normal operation

Vehicle class	Daily trips	Peak hour trips
Light	10	5
Heavy	10	5
OSOM	0	0

6.2 Impacts on road network capacity and performance

Traffic modelling using SIDRA Intersection 9 was undertaken to assess the operational traffic impacts of the Project on road capacity and performance. The traffic modelling was performed for the following weekday peak periods:

- Weekday AM peak – 6:30 am to 7:30 am
- Weekday PM peak – 4:00 pm to 5:00 pm.

It should be noted that the assessment is considered conservative as it assumes that:

- All light vehicle movements associated with the transportation of operational staff to the Project would occur within one hour before shift start (6:30 am to 7:30 am) and one hour after shift end (4:00 pm to 5:00 pm)
- The traffic generation rate in the peak periods would be one light vehicle per worker, generating a maximum of five vehicle movements during each of the peak hour periods
- Heavy vehicle movements associated with specialist maintenance and facility upkeep activities would occur concurrently to the peak periods of operational staff movements (6:30 am to 7:30 am and 4:00 pm to 5:00 pm). The afternoon peak period overlaps with the peak period of background traffic volumes. As such, this scenario represents a worst-case scenario as the available spare capacity of the road network is at its most limited
- The Project would be operational by 2028 and is expected to have a lifespan of approximately 100 years. The years 2028 and 2038 have been selected as the horizon years in order to assess the impacts of the Project on the performance of the road network over the first 10 years of operation.

6.2.1 Intersection performance results

SIDRA Intersection 9 was used to model the performance of key intersections in the study area with operational traffic volumes from the Project. Intersection performance results under the 'without Project' (background traffic growth only; without vehicles associated with operation of the Project) and the 'with Project' (background traffic growth combined with vehicles associated with operation of the Project) scenarios are presented in **Table 6-2**. The results indicate that the operation of the Project would have negligible impacts to the surrounding road network with all roads in the study area expected to continue to perform at a LoS A in 2028 and 2038. Therefore, the road network is expected to have sufficient capacity to accommodate the future traffic demand during the operation of the Project.

6.3 Turn warrant assessment

A series of turn warrant assessments were undertaken to determine whether peak periods of operational traffic generation would require the adoption of a higher-order turn treatment at key intersections in comparison to the forecast 2028 and 2038 background traffic volumes. The results of the turn warrant assessments are shown in **Table 6-3**, **Table 6-4** and **Table 6-5**.

The turn warrant assessment indicates that the current basic left-turn and basic right-turn treatments at the Moss Vale Road (B73) / Promised Land Trail, Moss Vale Road (B73) / Bendeela Road and Bendeela Road / Jacks Corner Road / Lower Bendeela Road intersections are expected to remain appropriate for the 2028 'without Project' and 'with Project' forecast volumes. In addition, all current basic left-turn treatments would remain appropriate in 2038. However, a higher-order (channelised) right-turn is warranted under both the 'without Project' and 'with Project' scenarios for the Moss Vale Road (B73) / Bendeela Road intersection in 2038 under forecast afternoon peak period traffic conditions. As such, operational traffic volumes would not trigger a higher-order turn treatment in comparison to the turn treatment required under the forecast background 2038 traffic volumes.

Table 6-2. Intersection performance results

Year	Peak period	Intersection	Without operation of Project (2028)				With operation of Project (2028)			
			Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)	Degree of Saturation	Intersection delay (seconds)	LoS	95th percentile queue length (metes)
2028	Weekday AM peak (6:30 am to 7:30 am)	Moss Vale Road / Nowra Road / Promised Land Trail	0.05	7.7	A	<5	0.05	7.8	A	<5
		Moss Vale Road / Bendeela Road	0.09	6.4	A	<5	0.09	6.4	A	<5
		Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	9.0	A	<5	0.03	9.0	A	<5
	Weekday PM peak (6:00 pm to 7:00 pm	Moss Vale Road / Nowra Road / Promised Land Trail	0.16	8.6	A	<5	0.16	8.6	A	<5
		Moss Vale Road / Bendeela Road	0.17	8.4	A	<5	0.17	8.7	A	<5
		Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	8.9	A	<5	0.02	8.9	A	<5
2038	Weekday AM peak (6:30 am to 7:30 am)	Moss Vale Road / Nowra Road / Promised Land Trail	0.06	7.8	A	<5	0.06	7.8	A	<5
		Moss Vale Road / Bendeela Road	0.11	6.7	A	<5	0.11	6.7	A	<5
		Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.24	9.0	A	<5	0.03	9.0	A	<5
	Weekday PM peak (6:00 pm to 7:00 pm)	Moss Vale Road / Nowra Road / Promised Land Trail	0.20	9.4	A	<5	0.20	9.4	A	<5
		Moss Vale Road / Bendeela Road	0.22	9.6	A	<5	0.21	9.7	A	<5
		Bendeela Road / Jacks Corner Road / Lower Bendeela Road	0.02	8.9	A	<5	0.02	8.9	A	<5

Table 6-3. Turn warrant results for Moss Vale Road (B73) / Promised Land Trail (100 km/h)

		Left turn			Right turn		
Peak period	Scenario	Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
2028							
AM peak (6:30 am to 7:30 am)	Without Project	84	0	Basic left	144	0	Basic right
	With Project	84	0	Basic left	149	0	Basic right
PM peak (6:00 pm to 7:00 pm)	Without Project	145	0	Basic left	437	0	Basic right
	With Project	150	0	Basic left	422	0	Basic right
2038							
AM peak (7:30 am to 8:30 am)	Without Project	103	0	Basic left	177	0	Basic right
	With Project	103	0	Basic left	182	0	Basic right
PM peak (1:00 pm to 2:00 pm)	Without Project	178	0	Basic left	150	0	Basic right
	With Project	183	0	Basic left	543	0	Basic right

Table 6-4. Turn warrant results for Moss Vale Road (B73) / Bendeela Road (60 km/h)

		Left turn			Right turn		
Peak period	Scenario	Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
2028							
AM peak (6:30 am to 7:30 am)	Without Project	108	37	Basic left	222	9	Basic right
	With Project	108	42	Basic left	227	14	Basic right
PM peak (6:00 pm to 7:00 pm)	Without Project	172	34	Basic left	491	16	Basic right
	With Project	172	34	Basic left	491	16	Basic right
2038							
AM peak (7:30 am to 8:30 am)	Without Project	133	45	Basic left	273	11	Basic right
	With Project	133	50	Basic left	278	16	Basic right
PM peak (1:00 pm to 2:00 pm)	Without Project	212	42	Basic left	603	19	Channelised right (short)
	With Project	212	42	Basic left	603	19	Channelised right (short)

Table 6-5. Turn warrant results for Bendeela Road / Jacks Corner Road / Lower Bendeela Road (80 km/h)

		Left turn			Right turn		
Peak period	Scenario	Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
2028							
AM peak (6:30 am to 7:30 am)	Without Project	31	3	Basic left	43	0	Basic right
	With Project	41	3	Basic left	53	0	Basic right
PM peak (6:00 pm to 7:00 pm)	Without Project	22	12	Basic left	53	3	Basic right
	With Project	22	12	Basic left	63	3	Basic right
2038							
AM peak (7:30 am to 8:30 am)	Without Project	39	3	Basic left	53	0	Basic right
	With Project	49	3	Basic left	63	0	Basic right

Peak period	Scenario	Left turn			Right turn		
		Q_M (veh/h)	Q_L (veh/h)	Recommended treatment	Q_M (veh/h)	Q_R (veh/h)	Recommended treatment
PM peak (1:00 pm to 2:00 pm)	Without Project	27	14	Basic left	66	3	Basic right
	With Project	27	14	Basic left	76	3	Basic right

6.4 Impacts on road safety

Operation of the Project is anticipated to have negligible impacts on road safety due to the low operational traffic volumes expected.

6.5 Impacts on public transport

Impacts to local bus services during the operation of the Project would be negligible due to the low operational traffic volumes anticipated.

6.6 Impacts on pedestrians and cyclists

As discussed in **Section 4.7**, there are no formal pedestrian or cycling facilities near the Project. As such, the Project would have no impact on pedestrians or cyclists. Amenity impacts at town centres due to the addition of operational vehicles on the road network would be negligible given the low operational traffic volumes anticipated.

6.7 Impacts on parking

No impacts to parking are expected as parking for operational vehicles would be provided within or next to the permanent operational and maintenance facility, away from public roads.

6.8 Impacts on road condition

Operation of the Project is anticipated to have negligible impacts on road condition due to the low volume of operational traffic.

7 Cumulative impacts

Cumulative traffic impacts have the potential to occur when the traffic generation of the Project interacts or overlaps with the traffic generation from other projects and can potentially result in an overall larger effect (positive or negative) on the road network and local communities. Cumulative traffic impacts may occur during construction stages when projects are constructed concurrently or consecutively. Projects constructed consecutively (or sequentially) can result in construction activities occurring over an extended period of time with little or no break in construction activities, potentially causing increased impacts and construction fatigue for local communities.

The extent to which traffic generated by another development or activities could interact with the Project generated traffic would depend on its scale, location and/or timing of construction. Generally, cumulative impacts would be expected to occur where multiple long-duration construction activities are undertaken close to, and over a similar timescale to, construction activities for the Project, or where consecutive construction occurs in the same area.

The overall effect of cumulative benefits or impacts could be positive or negative, depending on the nature of the projects and the nearby communities and environment.

7.1 Legislative and policy context

The *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2021) has been used to inform this cumulative traffic assessment. The guidelines indicate the following future projects should be considered in the cumulative impact assessment:

- Changes to existing projects (expansions, modifications, closure)
- Approved projects (approved but construction has not commenced)
- projects under assessment (application of the project has been exhibited and is currently under assessment)
- Related development (development that is required for the project but subject to separate development).

7.2 Assessment methodology

The assessment methodology for the cumulative traffic impact assessment for this Project involved:

- Identification of projects (which have publicly available information) that could be considered for cumulative impacts, using the following initial criteria:
  - Major projects located in the same LGA as the Project which may influence traffic
  - Other energy projects, including wind, solar and battery
  - Local road or infrastructure projects published on the relevant Councils' websites
  - Transport projects published on the TfNSW, Sydney Trains, Australian Rail Track Corporation website or other relevant government agency websites.
- Application of detailed screening criteria to determine which projects should be taken forward to the cumulative impact assessment
- Identification of projects that would be carried through to the cumulative impact assessment.

The assessment methodology is detailed in the sections that follow.

7.3 Screening criteria

Once the initial list of projects was developed using publicly available information, four criteria were applied to identify whether a project should be assessed for cumulative impacts as shown in **Table 7-1**.

Several triggers were developed for each screening criteria to objectively determine whether a project could potentially cause a cumulative impact with this Project and should be considered in the cumulative impact assessment.

Projects that satisfied at least one of the triggers in each of the four criteria were included in the cumulative impact assessment and are described in below.

Table 7-1. Screening criteria for cumulative impact assessment

Screening criteria	Trigger(s)
Location	▪ Direct overlap – Construction footprints of a project intersect with this Project ▪ In the area – Construction footprints are adjacent or in close proximity to this Project.
Timeframe	▪ Concurrent construction program with the Project ▪ Consecutive construction program with the Project.
Status	▪ Changes to existing projects (expansions, modifications, closure) ▪ Approved projects (approved but construction has not commenced) ▪ Projects under assessment (application of the project has been exhibited and is currently under assessment) ▪ Related development (development that is required for the project but subject to separate development).
Scale	▪ A project was considered relevant where it is a large-scale major development or infrastructure project that could cause cumulative impacts with the Project.

7.4 Identification of projects and assessment of cumulative impacts

Projects identified on the initial list that satisfied at least one of the triggers for each of the screening criteria in **Table 7-2** were included in the cumulative impact assessment.

The projects that met the screening criteria for consideration in the cumulative impact assessment area included in **Table 7-2**. Details on the potential cumulative impact of each project are also discussed in **Table 7-2**.

7.5 Mitigation measures

Origin will coordinate and consult with key stakeholders where required to manage the interface of projects under construction at the same time. Co-ordination and consultation with these stakeholders would include:

- Provision of regular updates to the detailed construction program, construction sites and haul routes
- Identification of key potential conflict points with other construction projects
- Developing mitigation strategies in order to manage conflicts. Depending on the nature of the conflict, this could involve the co-ordination of traffic management arrangements between projects.

Table 7-2. Projects considered in the cumulative impact assessment and associated potential cumulative traffic impacts

Project	Status	Brief project description	Potential cumulative impacts
Moss Vale Plastics Recycling Facility SSD-9409987	Response to submissions	Plasrefine Recycling Pty Ltd has proposed to construct and operate a plastics recycling and reprocessing facility located on Beaconsfield Road, Moss Vale. The facility would have capacity to receive up to 120,000 t of mixed plastics per year. Construction and commissioning of the facility is expected to take approximately 15 months. Operation would commence after shortly after commissioning.	The facility would result in increases in heavy and light vehicle traffic movements on the local road network during both construction and operation. The Traffic Impact Assessment indicates a peak of 60 daily light vehicle movements and 40 heavy vehicle daily movements during construction. During operation, up to 100 heavy vehicle movements per day delivering and exporting plastics and up to 280 light vehicle movements associated with the transportation of staff to and from the facility. The majority of vehicles associated with the operation the facility are expected to access the facility from the west via the Hume Highway (Old Hume Highway), Medway Road, Taylors Avenue Douglas Road / Colins Road and Lackey Road. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and Moss Vale Plastics Recycling Facility are expected to be negligible.
Berrima Cement Works Solid Waste Derived Fuels & Delivery Variation Project	Response to submissions	Boral Ltd is seeking approval to increase the waste consumption, storage and operational capabilities of the existing Berrima Cement Works facility. Approval of the modification would increase the permissible delivery times and maximum permitted deliveries to the facility.	The Traffic Impact Assessment indicates all construction materials would arrive to the site from Sydney and the entire construction workforce would reside in hotels located to the north of the subject site (i.e., Bowral, Mittagong, Campbelltown) and therefore will approach to the site via Old Hume Highway. The Traffic Impact Assessment indicates operation of the development will generate an additional 13 trucks per day on the road network. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and Berrima project expected to be negligible.
Moss Vale Road Urban Release Area Maculata Park Taylors Landing	Exhibition	The Moss Vale Road Urban Release Area (URA) is a regionally significant residential development located between Bomaderry and Cambewarra village. The project includes two areas known as Moss Vale Road North and Moss Vale Road South. These two urban release areas have the potential to accommodate around 5,850 residents upon completion.	This report has adopted a conservative annual traffic growth rate based on outputs from the Shoalhaven City Council's strategic (TRACKS) model. This model takes into account the traffic growth that would arise from future land changes and developments in the area. As such, traffic generated by the Moss Vale Road North Urban Release Area is assumed to be adequately captured in the conservative background annual traffic growth rate adopted for this assessment.

Project	Status	Brief project description	Potential cumulative impacts
Shoalhaven Community and Recreational Precinct – Northern Section – Bomaderry Sporting Complex	Design	Shoalhaven City Council has proposed to redevelop the area to the north of Cambewarra Road near the Bomaderry Sporting Complex. New facilities including a new Community Hub, new pools, development of an athletics track and two senior rugby league fields with associated change rooms and amenities would be provided. The process of the development of the design and associated drawings is expected to commence in August 2022 and conclude in September. Construction of the new facilities would commence at the start of 2024.	Access to the redevelopment would likely be via Cambewarra Road. The Princes Highway (A1) is a major road that facilitates access between Cambewarra Road and major regional centres to the north and south including Nowra and Wollongong. As such, limited cumulative traffic volumes are expected to be generated on Moss Vale Road (B73) and the concurrent construction and / or operation of the Project and redevelopment is expected to be minor.
Moss Vale Sewage Treatment Plant Upgrade	Design	Wingecarribee Shire Council has proposed to upgrade the existing sewage treatment plant at Moss Vale. The upgrade would increase treatment capacity from 9,000 to 13,500 people and would cater for the future population growth expected within the catchment area. Design of the plant upgrade is scheduled for completion in 2022.	Access to the sewage plant would likely be via Waite Street and Berrima Road, north of Moss Vale. As such, limited cumulative traffic volumes are expected to be generated on Moss Vale Road (B73) and the concurrent construction and / or operation of the Project and redevelopment is expected to be minor.
Moss Vale Bypass	Design	Wingecarribee Shire Council has proposed to construct the Moss Vale Bypass. The 3-stage project would assist motorists travelling through Moss Vale by providing an alternative to Argyle Street. The Bypass includes an additional crossing of the Main Southern railway and critically, one which is not subject to flooding or height restrictions.	The design of the Moss Vale Bypass is currently in progress, with an anticipated completion date of May 2023. As such, no details are currently available at the time of writing on the construction traffic generating potential of the bypass. However, as the Moss Vale Bypass is located approximately 20 km north of the Project and not on key access routes to the Project (i.e. Moss Vale Road (B73)), any cumulative traffic impacts are expected to be minor.
Ritters Creek, Meryla Road, Meryla – Bridge Replacement	Construction	Wingecarribee Shire Council has proposed to replace the existing Bridge structure over Ritters Creek on Meryla Road. The works would involve the replacement of the single span timber bride with a new, wider bridge crossing. The works are expected to be completed by April 2023.	Traffic generated by the construction of the replacement bridge would be relatively low and within the range of daily variations in traffic volumes on the local network. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and Ritters Creek Bridge Replacement expected to be negligible.
Fitzroy Falls RFS	Detailed design	A new Rural Fire Service (RSF) shed is proposed be built at Fitzroy Falls at the corner of Myra Vale Road and Nowra Road. The shed will replace the RFS shed currently situated at Avoca. The detailed design has been completed and the Development Application is currently being reviewed.	Traffic generated by the construction of the new Rural Fire Service Shed would be relatively low and within the range of daily variations in traffic volumes on the local network. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and new shed are expected to be negligible.

Project	Status	Brief project description	Potential cumulative impacts
West Nowra Resource Recovery Park Stage 2	Approved	Bioelektra Australia Pty Ltd have proposed to construct and operate Stage 2 of the West Nowra Resource Recovery Park. Stage 2 includes a resource recovery facility for the treatment of up to 130,000 t of mixed municipal waste per year. The facility is expected to the operational by 2023.	During operation, approximately 130 vehicles per day would be generated in 2020 and 230 vehicles per day would be generated in 2030. The Traffic Impact Assessment for the facility indicates these traffic movements would predominately occur between the facility and major waste generating centres in (e.g. Nowra and Wollongong) via the Princes Highway. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and facility are expected to be negligible.
Nowra Bridge Project – Princes Highway Upgrade	Construction	The Nowra Bridge project will provide a new four lane bridge over the Shoalhaven River, upgraded intersections and additional lanes on the Princes Highway. The Nowra Bridge project is expected to be complete by mid-2024.	The Traffic and Transport Assessment for the Nowra Bridge project indicates there would be no increase in construction traffic on common access roads such as Moss Vale Road (B73). In addition, access across the Shoalhaven River would be maintained at all times via the existing bridge structure. As such, cumulative traffic impacts resulting from the concurrent construction and / or operation of the Project and Nowra Bridge project are expected to be negligible.

8 Mitigation measures

The following mitigation measures detailed in **Table 8-1** have been developed to specifically manage potential traffic and transport impacts which have been predicted during construction and operation of the Project.

Table 8-1. Traffic and transport environmental management measures

Impact	Reference	Mitigation measure	Timing
Impacts to the local road network	TT1	A CTMP will be prepared in consultation with WaterNSW and implemented by the construction contractor. The CTMP will include: ▪ Confirmation of haulage routes ▪ Access to construction site including entry and exit locations ▪ Times of transporting to minimise impacts on the road network ▪ Measures to minimise the number of workers using private vehicles ▪ Management of oversized vehicles ▪ Identification of the maximum parameters of the materials to be moved ▪ Site specific traffic control measures (including signage) to manage and regulate traffic movement ▪ Relevant traffic safety measures including driver induction, training, safety measures and protocols ▪ Identify requirements for, and placement of, traffic barriers ▪ Requirements and methods to consult and inform the local community of impacts on the local road network due to the development-related activities ▪ Consultation with Transport for NSW, National Heavy Vehicle Regular and Council ▪ Consultation with the emergency services to ensure that procedures are in place to maintain safe, priority access for emergency vehicles ▪ A response plan for any construction related traffic incident ▪ Monitoring, review and amendment mechanisms ▪ Individual traffic management requirements at each phase of construction.	Prior to construction
	TT2	Heavy vehicle movements to and from the Project site will be scheduled to minimise traffic disruption to the surrounding road network. This may include, but is not limited to:	Prior to construction,

Impact	Reference	Mitigation measure	Timing
		▪ Scheduling the movement of construction material, equipment and waste to occur outside of peak traffic periods ▪ Scheduling heavy vehicle deliveries to be evenly dispersed as far as practical to minimise convoying or platoons and queuing outside the Project or on the road network.	construction and operation
	TT3	The loading and unloading of trucks will be planned to ensure each individual truck haulage capacity is fully utilised to reduce the total number of truck movements.	Throughout construction
OSOM vehicles	TT4	An oversized vehicle permit will be sought for all OSOM vehicle movements where required. The OSOM movements will be in accordance with the permit requirements and be outside of peak traffic periods where possible. In addition, a separate OSOM Transport Management Plan will be prepared as part of the CTMP in consultation with WaterNSW and will include: ▪ Identification of routes ▪ Potential impacts to the road network including road condition ▪ Measures to provide an escort for the loads ▪ Times of transporting to minimise impacts on the road network ▪ Location of rest areas and require rest stops along the route ▪ Identification of the maximum parameters of OSOM vehicles ▪ Notification strategy and liaising with emergency services and police ▪ Any minor temporary civil infrastructure works may be required to accommodate OSOM movements.	Prior to construction
Road safety	TT5	A Driver Code of Conduct will be prepared as part of the CTMP in consultation with WaterNSW and will be used to outline the rules and behaviours which drivers associated with the Project will be required to adhere to. The Driver Code of Conduct will outline arrangements for light and heavy vehicle drivers including: ▪ General requirements including site induction requirements ▪ Travelling speeds and safe driving practices, particularly through residential areas and school zones ▪ Fatigue management ▪ Adherence to designated transport routes and heavy vehicle noise ▪ Public complaint resolution.	Prior to construction, construction and operation

Impact	Reference	Mitigation measure	Timing
	TT6	A detailed intersection design will be developed for the upgrade of the Moss Vale Road (B73) / Promised Land Trail intersection. This design will be developed in consultation with and to the satisfaction of TfNSW and Council as appropriate under Section 138 of the NSW *Roads Act 1993*. As the Austroads warrants for turn treatments provides guidance on the preferred minimum turn treatments for major roads based on traffic flows only, the intersection design will also consider geometric minima (e.g. limited sight distance, steep grade). This may result in the adoption of a turn treatment of a higher order than that indicated by the warrants. An indicative design has been included in **Appendix B** as a placeholder for discussion purposes and will be updated as Project progresses.	Prior to construction
	TT7	Vehicles will be required to enter and leave the Project site in a forward direction where possible, to minimise collision and safety risks.	Throughout construction and operation
	TT8	Public roads and Crown roads will not be obstructed by any materials, vehicles, skip bins or the like, under any circumstances. A designated truck parking space for trucks to wait to get confirmation when there is capacity to approach the construction site may need to be implemented to avoid truck queuing on the road to enter the sites at Bendeela and Promise Land Trail. For Bendeela, the laydown area, spoil stockpile area or the hardstand area in front of the Kangaroo Valley Power Station are likely to be suitable. Details such as suitability will be investigated during the detailed design stage of the Project.	Throughout construction and operation
	TT9	'Trucks Turning' warning signs will be installed on both approaches to the intersection of Moss Vale Road (B73) / Promised Land Trail and Moss Vale Road (B73) / Bendeela Road to advise existing road users of the increased heavy vehicle volumes. The signs will be removed upon the completion of the construction works.	Throughout construction
	TT10	Speed reductions, use of fog lights during periods of low visibility, cessation of works and site shutdowns will be implemented as required during periods of adverse weather.	Throughout construction and operation
Access	TT11	Haul trucks accessing the Bendeela construction sites will be carefully managed through construction traffic management measures which will be detailed during preparation of CTMP in the next stage of the Project. Affected parties including emergency services will be notified in advance of any disruptions to traffic and restriction of access impacted by Project activities.	Prior to construction, construction and operation

Impact	Reference	Mitigation measure	Timing
Road condition	TT12	All vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or dirt particles depositing onto the roadway during travel to and from the Project area. Contamination with weeds and mud tracking from trucks leaving the Promised Land Trail, will be managed using standard controls detailed in the **Appendix F** of the EIS (Biodiversity Development Assessment Report) and **Appendix I** of the EIS (Surface Water Quality, Hydrology and Geomorphology Impact Assessment).	Throughout construction
	TT13	All vehicles leaving the site will be cleaned of materials that may fall on the roadway before they are allowed to leave the site.	Throughout construction
	TT14	No tracked vehicles will be permitted on any paved roads.	Throughout construction
	TT15	A Road Dilapidation Report will be prepared prior to and following construction of the Project. Any impacts identified as caused by the Project will be rectified.	Prior to construction, follow construction

9 Conclusion

This report details the traffic and transport impact assessment for the Project and addresses the relevant SEARs for the Project. In addition, this report provides an overview of the existing traffic and transport environment, an assessment of potential traffic and transport impacts of the Project and the required mitigation measures.

The results of the traffic and transport impact assessment indicate that the construction and operation of the Project is expected to have a negligible impact on the performance of key intersections in the study area including Moss Vale Road (B73) / Nowra Road (B73) / Promised Land Trail, Moss Vale Road (B73) / Bendeela Road and Bendeela Road / Jacks Corner Road / Lower Bendeela Road. The potential impacts to public transport, pedestrians and cyclists, road safety and parking during the construction and operation of the Project are also expected to be negligible.

A CTMP developed in consultation with WaterNSW and implemented by the construction contractor would minimise potential impacts of the Project during construction. Relevant traffic safety measures included in the CTMP would be traffic control and signage, driver conduct, safety protocols and management of OSOM vehicles. Furthermore, a separate OSOM Transport Management Plan would be prepared and would include a detailed overview of management measures for the OSOM movements, including identification of route, escort measures, time of transporting and a communications strategy.

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Appendix A Example Driver Code of Conduct

A.1 Driver Code of Conduct

The Driver Code of Conduct is to ensure that light and heavy drivers adhere to safe driving practices. All employees and contractors are to abide by responsible driving and adhering to the Code of Conduct.

A.1.1 General requirements

Light and heavy vehicle drivers hauling to and from the Project site must:

- Have undertaken a site induction carried out by a suitably qualified employee
- Hold a valid driver's licence for the class of vehicle that they are operating and carry a current driver's licence while operating a vehicle
- Operate the vehicle in a safe manner to, from and within the site in accordance with all road rules pertaining to the vehicle, particularly in residential areas or at school zones
- Comply with the direction of authorised site personnel when within the site.

All incidents, hazards and near misses, whether resulting in an injury or not, must be reported to site management immediately. This includes incidents, hazards and near misses which have occurred on or while travelling to and from the site.

Regular toolboxes will be held to outline the potential hazards of travel on the designated routes including locations with increased collision risk, damaged road infrastructure, potential noise impacts and school zones.

A.1.2 Light and heavy vehicle speed

Light and heavy vehicle drivers are to be made aware of two types of speeding:

- Where a vehicle driver travels faster than the posted speed limit
- Where a vehicle driver travels within the posted speed limit but at a speed which is inappropriate for road conditions e.g. rain, fog, unsealed roads.

All vehicle drivers are to observe the posted speed limits to comply with Australian Road Rules. Drivers must adjust their speed appropriately to suit the road environment and weather conditions. Drivers must adjust their speed appropriately through residential areas and school zones.

A.1.3 Light and heavy vehicle driver fatigue

Site personnel fatigue will be managed via the following:

- Unless under exceptional circumstances, work periods shall not exceed 12 hours
- Any extension of this period shall require the approval of site management and where possible alternative transport shall be arranged
- The monitoring of fatigue experienced by employees working extended hours shall rely not only on reporting by employees, but also on observation and assessment by site managers
- Carpooling and bus management will be considered to ensure the drivers are within the 12-hour timeframe to manage fatigue.

Under the *Heavy Vehicle Driver Fatigue Reform* (National Transport Commission 2008), all drivers of trucks and truck combinations over 12 t GMV (except for Ministerial Exemption Notices that may apply) are required to operate under one of three fatigue management schemes:

- Standard Hours of Operation
- Basic Fatigue Management
- Advanced Fatigue Management.

All heavy vehicle operators are to be aware of their adopted fatigue management scheme and operate within its requirements.

A.1.4 Adherence to designated transport routes

Light and heavy drivers must follow the designated transport routes agreed upon with site personnel to and from the Project site. Heavy vehicles must travel only on heavy vehicle-approved roads.

A.1.5 Safety in residential areas and school zones

Drivers are required to be aware and show care when driving through residential areas and near schools, including between the morning (8:00am to 9:30am) and afternoon (2:30pm to 4:00pm) periods. Drivers are to be mindful of children being dropped off and picked up at bus stops and at schools during these periods. Drivers are to comply with 40km/h speed limit for traffic passing a school bus as well as within school zones. Drivers are to give pedestrians a wide berth and be aware of the pedestrians' safety, road users' safety and their own safety at all times.

Construction vehicle movements will be managed to minimise movements during periods of higher traffic volumes and outside of school pick up and drop off periods.

A.1.6 Heavy vehicle noise

If possible, heavy vehicle drivers should not use compression brakes near residential areas as compression brakes can cause excessive noise, especially at night. Compression braking throughout residential areas is only to be used if required for safety reasons. When driving near residential areas, a reduction in speed is recommended to minimise the need to use compression brakes.

All heavy vehicles must be fitted with audible reversing alarms for the safety of all personnel. However, audible reversing alarms can be noisy and heavy vehicle drivers should minimise reversing near residential areas.

A.1.7 Public complaint resolution

To assist in the orderly resolution of complaints, site management will keep a register itemising all reported incidents relating to complaints in regard to heavy vehicle driver conduct external to the site.

The incident register is to include (where possible):

1) Date of the complaint
2) Time of the complaint
3) Name of the complainant (if available)
4) How the complaint was received
5) Detailed description of the complaint (including location, driver/heavy vehicle details)
6) What/when actions were taken to resolve the issue
7) The reply to the person/organisation that made the complaint.

Once site management is satisfied that the complaint is substantiated, an investigation of the location and causes of the complaint will be undertaken. Following investigation of the issue, site management will provide feedback to the complainant that details the investigations undertaken, the result of the investigation and measures implemented to ensure that operations remain compliant. A description of any follow-up investigations and the response provided to the complainant will also be recorded in the Complaints Register upon closure of the issue.

A.1.8 Penalties and disciplinary action

Failure to comply with this Driver Code of Conduct will lead to either the issue of a warning notice or disciplinary action If the offending party represents another company, then disciplinary action may be treated as suspension or cancellation of a service contract or arrangement with that company.

A warning notice may be issued for a number of reasons, which may include (but not limited to):

- Driving at excessive speed
- Abuse of other road users or customers
- Not carrying out instructions as advised
- Not observing the site speed restrictions
- Not reporting incidents, accidents or near misses.

Appendix B Indicative intersection upgrade layout for a channelised right and left turn to the Promised Land Trail

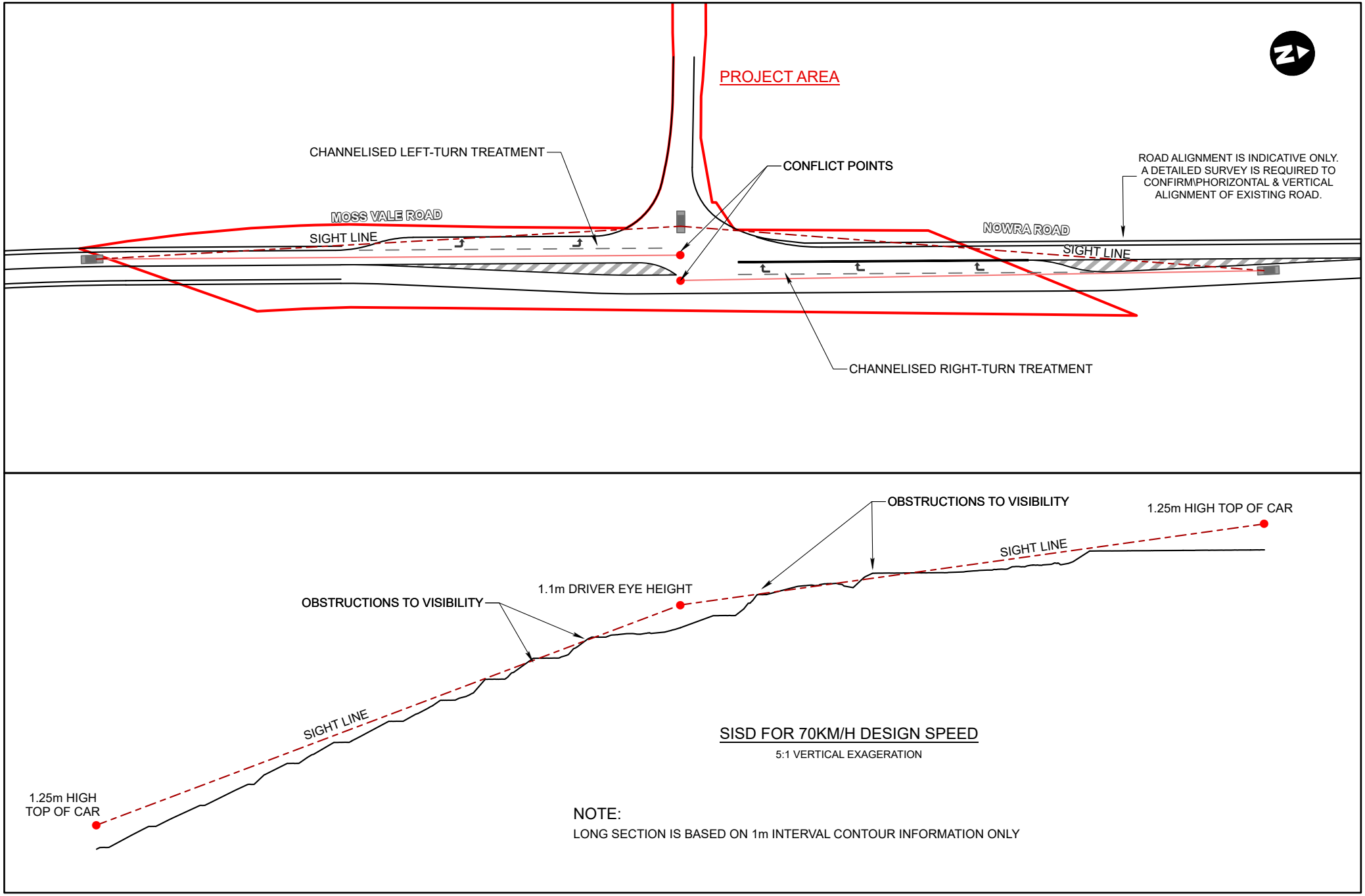

Figure B-1 Indicative intersection upgrade layout

Data sources

Jacobs 2022
NSW Spatial Services 2022

Date: 10/27/2022 Path: \\ausyd0vs01\GISProj\NSW_IS392600_ShoalhavenEIS\Apps\IS392600_EIS.aprx
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