APPENDIX Q

TRAFFIC AND TRANSPORT ASSESSMENT

SCT Consulting

SNOWY 2.0

Exploratory Works Traffic and Transport Assessment

Quality Assurance

Project:	Snowy Hydro 2.0 Traffic and Transport Report		
Project Number:	SCT_00059		
Client:	EMM Consulting	**ABN:**	28 141 736 558
Prepared by:	SCT Consulting PTY. LTD. (SCT Consulting)	**ABN:**	53 612 624 058

Quality Information	
Document name:	Snowy Hydro 2.0 Traffic and Transport Report
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Revision	Revision Date	Details
A	25 May 2018	Draft report for internal review
1	28 May 2018	Draft report for EMM review
2	4 June 2018	Draft report for client review
3	9 July 2018	Final report

Contents

Executive Summary

Snowy 2.0 and its associated Exploratory Works are within the Australian Alps, in southern NSW. The Exploratory Works study area is located within the Snowy Valleys Local Government Area. The majority of Snowy 2.0 and the Exploratory Works are within Kosciuszko National Park (KNP).

Snowy 2.0 is a large scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Scheme. Exploratory Works are required to further understand the viability of the project and comprise:

– the establishment of an exploratory tunnel to the site of the underground power station for Snowy 2.0, portal and construction pad;

– the establishment of a construction compound;

– excavated rock management, including subaqueous disposal within Talbingo Reservoir;

– the establishment of an accommodation camp;

– road establishment and upgrades providing access to the proposed construction areas;

– establishment of barge access infrastructure on Talbingo Reservoir; and

– supporting power and communication.

Construction traffic volumes associated with the above activities will primarily be internal to the site compound due to the self contained nature of the proposal. Mobilisation and delivery heavy vehicles movements will be required to access the site, via Lobs Hole Ravine Road, throughout the construction period. Haulage routes will originate from either Tumut or Cooma and take into consideration the Snowy Mountains Highway and Link Road. Miles Franklin Drive, whilst part of the study extent, will not be used regularly by construction vehicles associated with the proposal.

Peak vehicle movements are expected to occur between 9AM-10AM with a total of 44 movements from 24 vehicles, as shown in **Table ES1**.

Table ES1 Construction Traffic Peak Hour Volume

Movement Type	Number of Movements
	9AM – 10AM
Number of movement to / from site (Mobilisation)	0 / 2
Number of movement to / from site (Deliveries)	20 / 20
Number of light vehicle movements to / from site	0 / 2
Total two-way movements	**44**

Source: EMM, 2018, modified by SCT Consulting; 2018

These movements are outside the network peak of 12PM-1PM and result in minimal impact on the surrounding road network which is characterised by low traffic volumes, large degrees of spare capacity and strong LoS performance results.

The impact of construction traffic on the LoS, capacity, road safety and emergency vehicle usage of these roads was found to be negligible. A sensitivity test was undertaken for the July school holiday period to provide a worst case assumption of the peak construction period extending into school holidays. This assessment indicates no change to the initial findings that no significant impact is expected from a traffic and transport stand point as a result of the proposal.

Mitigation options for the proposal are minor and documented within **Table ES2**.

Table ES2 Mitigation Measures

Mitigation	Overview
Construction traffic management plan	A Construction Traffic Management Plan (CTMP) will be prepared and implemented during construction. The CTMP will set out the strategy and procedures to manage the impacts of the Exploratory Works construction on the local road network and traffic systems, including: - Community and stakeholder notification processes for oversized vehicle movements and any planned disruptions to traffic and restriction of access to areas of Kosciuszko National Park; and - Traffic safety requirements, including appropriate signage, driver conduct and safety protocols.
Oversized vehicle movements	Oversized vehicle movements will occur during off-peak hours and notification will be given to the road authority and local community prior to oversized vehicle movements.
Road Maintenance	Road maintenance will be managed through the following measures: - A Road Dilapidation Report will be prepared and approved prior to and following Exploratory Works; - Routine defect identification and rectification of the internal road network will be managed as part of the project maintenance procedure; and - Internal access roads will be designed in accordance with the relevant vehicle loading requirements.
Signage	Where changes to the traffic conditions are required, appropriate signage will be installed in accordance with the following: - Traffic Control Device for Works on Roads (AS1742.3; 2009); and - Traffic Control at Work Sites (Roads and Maritime Services; 2010).
Time of travel	Standard hours of operation of heavy vehicles on public roads will observe the industry standard hours of 7 am to 6 pm during weekdays, excluding Lobs Hole Ravine Road where no heavy vehicle movements will occur before 8 am.
Traffic control	Where temporary occupation of lanes is required traffic control measures specified in AS1742-2002 will be implemented. Where works require lane occupancy on RMS or council classified roads, a Road Occupancy Licence will be obtained.

Source: SCT Consulting; 2018

1.0 Introduction

1.1 The Project

Snowy Hydro Limited (Snowy Hydro) proposes to develop Snowy 2.0, a large scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). This would be achieved by establishing a new underground hydro-electric power station that would increase the generation capacity of the Snowy Scheme by almost 50%, providing an additional 2,000 megawatts (MW) generating capacity, and providing approximately 350,000 megawatt hours (MWh) of storage available to the National Electricity Market (NEM) at any one time, which is critical to ensuring system security as Australia transitions to a decarbonised NEM. Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and hydro-electric power station.

Snowy 2.0 has been declared to be State significant infrastructure and critical State significant infrastructure (CSSI) by the NSW Minister for Planning under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and is defined in Clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). Separate applications and environmental impact statements (EIS) for different phases of Snowy 2.0 are being submitted under Part 5, Division 5.2 of the EP&A Act. This technical assessment has been prepared to support an EIS for Exploratory Works to undertake investigative works to gather important technical and environmental information for the main Snowy 2.0 project. The main project will be subject of a separate application and EIS next year.

The purpose of Exploratory Works for Snowy 2.0 is primarily to gain a greater understanding of the conditions at the proposed location of the power station, approximately 850 metres (m) below ground level. Understanding factors such as rock conditions (such as stress conditions) and ground temperature is essential to inform decisions about the precise location of the power station cavern and confirm the cavern construction methods.

Exploratory Works comprises:

– an exploratory tunnel to the site of the underground power station for Snowy 2.0;
– horizontal and other test drilling, investigations and analysis in situ at the proposed cavern location and associated areas, and around the portal construction pad, access roads and excavated rock management areas all within the disturbance footprint;
– a portal construction pad for the exploratory tunnel;
– an accommodation camp for the Exploratory Works construction workforce;
– road works and upgrades providing access and haulage routes during Exploratory Works;
– barge access infrastructure, to enable access and transport by barge on Talbingo reservoir;
– excavated rock management, including subaqueous placement within Talbingo Reservoir;
– services infrastructure such as diesel-generated power, water and communications; and
– post-construction revegetation and rehabilitation, management and monitoring.

1.2 Purpose of this report

This traffic and transport assessment supports the EIS for Exploratory Works. It documents the traffic and transport assessment methods and results, the initiatives built into the project design to avoid and minimise associated impacts, to traffic and transport, and the mitigation and management measures proposed to address any residual impacts not able to be avoided.

1.3 Location of Exploratory Works

Snowy 2.0 and Exploratory Works are within the Australian Alps, in southern NSW. The regional location of Exploratory Works is shown on Figure 1.1. Snowy 2.0 is within both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs), however Exploratory Works is entirely within the Snowy Valleys LGA. The majority of Snowy 2.0 and Exploratory Works are within Kosciuszko National Park (KNP). The area in which Exploratory Works

will be undertaken is referred to herein as the project area, and includes all of the surface and subsurface elements further discussed in Section 2.1.

Exploratory Works is predominantly in the Ravine region of the KNP. This region is between Talbingo Reservoir to the north-west and the Snowy Mountains Highway to the east, which connects Adaminaby and Cooma in the south-east to Talbingo and Tumut to the north-west of the KNP. Talbingo Reservoir is an existing reservoir that forms part of the Snowy Scheme. The reservoir, approximately 50 kilometres (km) north-west of Adaminaby and approximately 30 km east-north-east of Tumbarumba, is popular for recreational activities such as boating, fishing, water skiing and canoeing.

The nearest large towns to Exploratory Works are Cooma and Tumut. Cooma is approximately one hour and forty five minutes drive (95 km) south-east of Lobs Hole. Tumut is approximately half an hour (45 km) north of Talbingo. There are several communities and townships near the project area including Talbingo, Tumbarumba, Batlow, Cabramurra and Adaminaby. Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families. Adaminaby was relocated to alongside the Snowy Mountains Highway from its original location (now known as Old Adaminaby) in 1957 due to the construction of Lake Eucumbene. Talbingo and Adaminaby provide a base for users of the Selwyn Snow Resort in winter. Cabramurra was modernised and rebuilt in the early 1970s and is owned and operated by Snowy Hydro. It is still used to accommodate Snowy Scheme employees and contractors. Properties within Talbingo are now predominantly privately owned. Snowy Hydro now only owns 21 properties within the town.

Other attractions and places of interest in the vicinity of the project area include Selwyn Snow Resort, the Yarrangobilly Caves complex and Kiandra. Kiandra has special significance as the first place in Australia where recreational skiing was undertaken and is also an old gold rush town.

The project area is shown on Figure 1.2 and comprises:

– **Lobs Hole:** Lobs Hole will accommodate the excavated rock emplacement areas, an accommodation camp as well as associated infrastructure, roads and laydown areas close to the portal of the exploratory tunnel and portal construction pad at a site east of the Yarrangobilly River;

– **Talbingo Reservoir:** installation of barge access infrastructure near the existing Talbingo Spillway, at the northern end of the Talbingo Reservoir, and also at Middle Bay, at the southern end of the reservoir, near the Lobs Hole facilities, and installation of a submarine cable from the Tumut 3 power station to Middle Bay, providing communications to the portal construction pad and accommodation camp. A program of subaqueous rock placement is also proposed;

– **Mine Trail Road** will be upgraded and extended to allow the transport of excavated rock from the exploratory tunnel to sites at Lobs Hole that will be used to manage excavated material, as well as for the transport of machinery and construction equipment and for the use of general construction traffic; and

– several sections of **Lobs Hole Ravine Road** will be upgraded in a manner that protects the identified environmental constraints present near the current alignment.

The project is described in more detail in Chapter 2.

1.4 Proponent

Snowy Hydro is the proponent for Exploratory Works. Snowy Hydro is an integrated energy business – generating energy, providing price risk management products for wholesale customers and delivering energy to homes and businesses. Snowy Hydro is the fourth largest energy retailer in the NEM and is Australia's leading provider of peak, renewable energy.

1.5 Assessment guidelines and requirements

This traffic and transport assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for Exploratory Works, issued first on 17 May 2018 and revised on 20 June 2018, as well as relevant governmental assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

The SEARs must be addressed in the EIS. **Table 1.1** lists the matters relevant to this assessment and where they are addressed in this report.

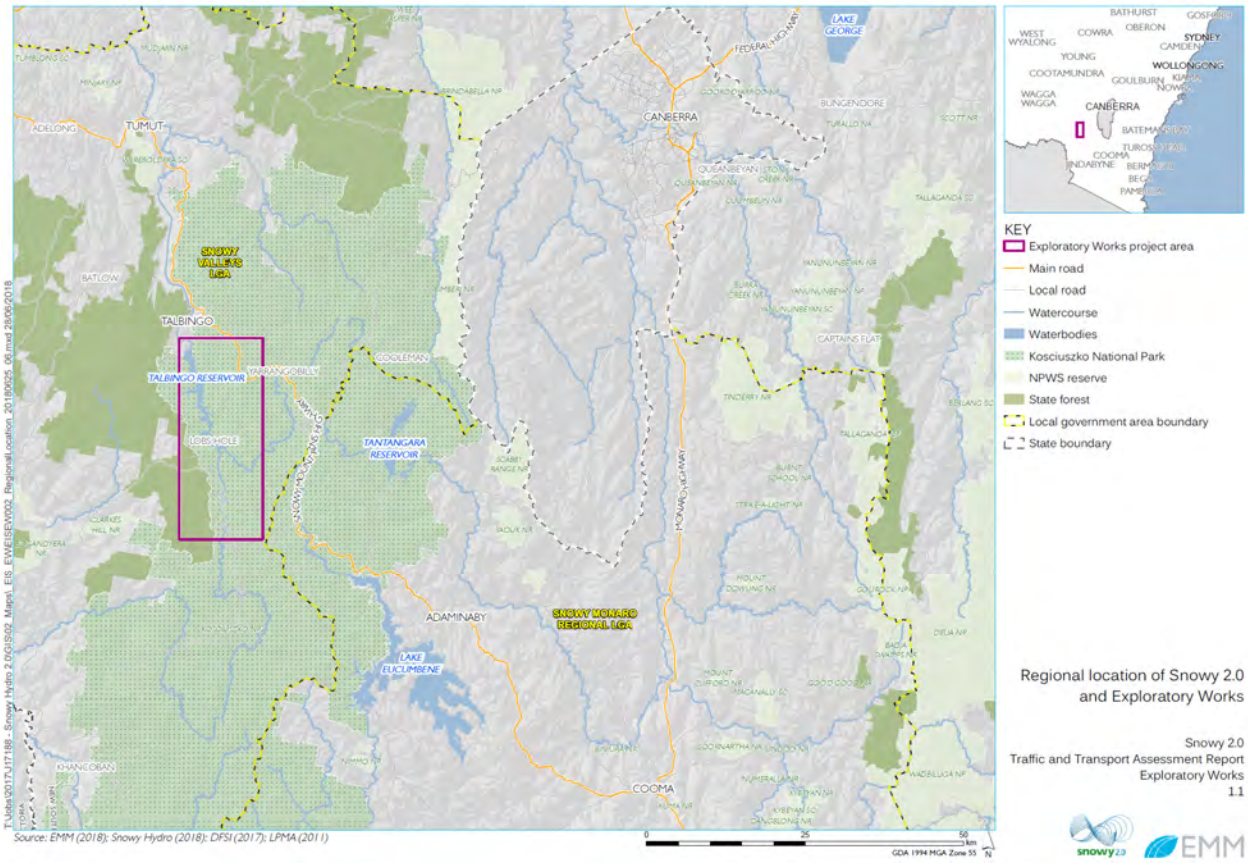
Table 1.1 Relevant Matters Raised in the SEARs

Requirement	Section Assessment
An assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local, national park and State road network (including Upper Lobs Hole Ravine Road, Lower Lobs Hole Ravine Road, Mine Trail Road, Middle Bay Wharf access road, and Talbingo Reservoir access roads); and	Section 4.5.1 | Section 4.5.2 | Section 4.5.3 | Section 4.5.4 | Section 4.8
A strategy for managing these impacts having regard to existing road maintenance agreements	Section 5.2 | Section 5.3 | Section 5.4 | Section 5.5 Section 5.6 | Section 5.7 | Section 5.8 | Section 5.9

Source: SCT Consulting; 2018

To inform preparation of the SEARs, the Department of Planning and Environment (DPE) invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPE when preparing the SEARs.

Figure 1.1 Regional location of Snowy Hydro 2.0 and Exploratory works



Source: EMM Consulting; 2018

Figure 1.2 Exploratory Works project area

Source: EMM Consulting; 2018

1.6 Structure of the document

The report has been structured into the following sections:

– **Section 2** provides an overview of the project.

– **Section 3** provides an overview of the existing traffic and transport conditions, including description of the route, details of public transport, a review of walking and cycling routes and a summary of daily and peak period traffic patterns.

– **Section 4** documents the impact assessment undertaken for the project.

– **Section 5** outlines management measures to be considered to mitigate the traffic impacts of the project.

– **Section 6** provides a summary of the traffic and transport assessment.

2.0 Project Description

2.1 Overview

Exploratory Works comprises construction associated with geotechnical exploration for the underground power station for Snowy 2.0. The Exploratory Works elements are shown on Figure 2.1 and involve:

– establishment of an exploratory tunnel to the site of the underground power station for Snowy 2.0;

– horizontal and other test drilling, investigations and analysis in situ at the proposed cavern location and associated areas, and around the portal construction pad, access roads and excavated rock management areas all within the disturbance footprint;

– establishment of a portal construction pad for the exploratory tunnel;

– establishment of an accommodation camp for the Exploratory Works construction workforce;

– road works and upgrades providing access and haulage routes during Exploratory Works;

– establishment of barge access infrastructure, to enable access and transport by barge on Talbingo reservoir;

– excavated rock management, including subaqueous placement within Talbingo Reservoir;

– establishment of services infrastructure such as diesel-generated power, water and communications; and

– post-construction revegetation and rehabilitation, management and monitoring.

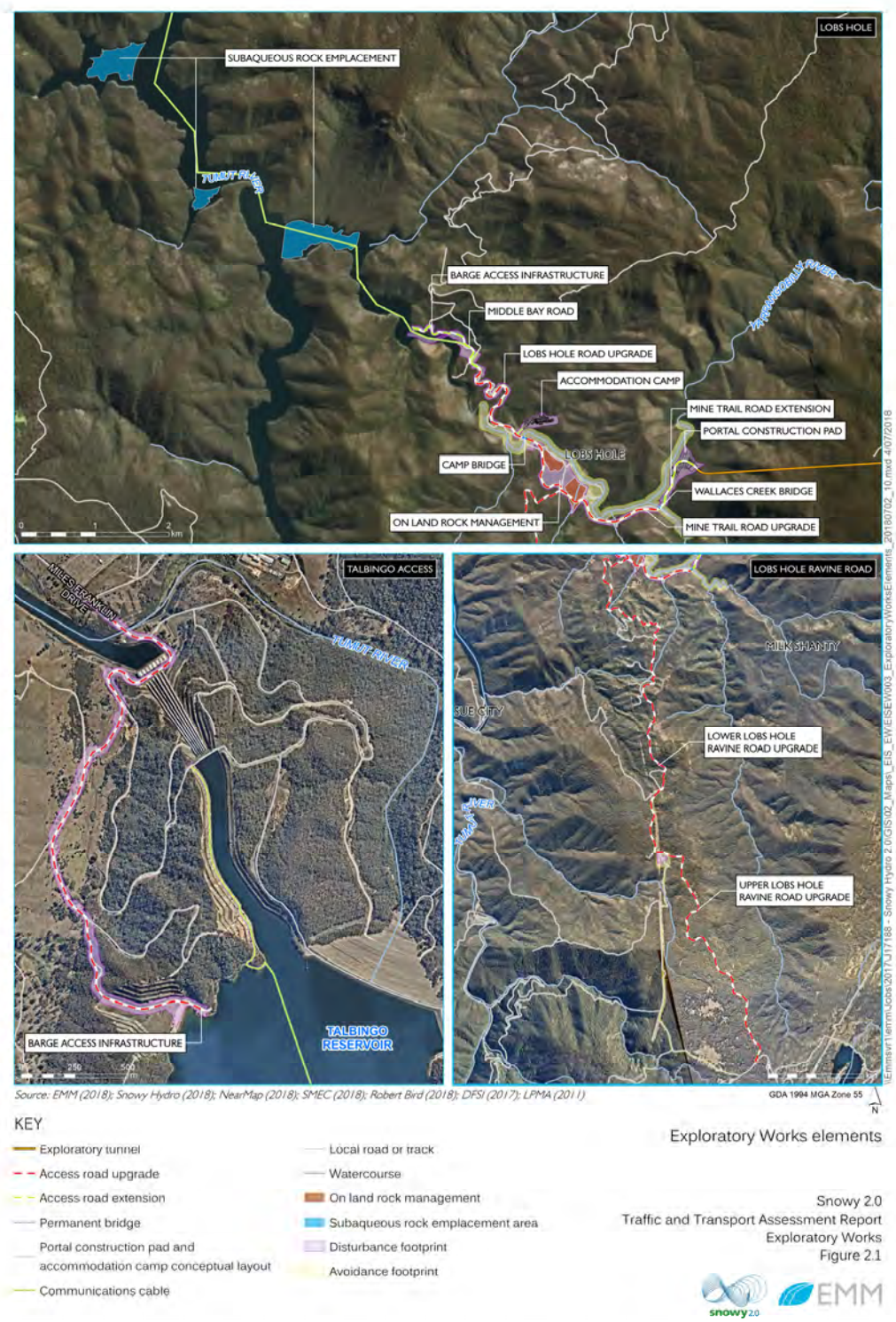
2.2 Exploratory tunnel

An exploratory tunnel of approximately 3.1 km is proposed to provide early access to the location of the largest cavern for the underground power station. This will enable exploratory drilling and help optimise the location of the cavern which, in turn, will optimise the design of Snowy 2.0.

The exploratory tunnel is proposed in the north-east section of Lobs Hole and will extend in an east-west direction with the portal construction pad to be outside the western end of the tunnel at a site east of the Yarrangobilly River, as shown on **Figure 2.2**.

The location of the proposed exploratory tunnel and portal construction pad is shown in Figure 2.2. The exploratory tunnel will be excavated by drill and blast methods and have an 8 x 8 m D-Shaped cross section, as shown on **Figure 2.3.**

Figure 2.1 Exploratory Works elements



Source: EMM Consulting; 2018

The drill and blast excavation process will be repeated cyclically throughout the tunnelling works, involving:

– marking up and drilling blast holes in a predetermined pattern in the working face of the tunnel;

– loading the blast holes with explosives, attaching detonators and connecting the holes into a blast sequence, and detonating the blast;

– ventilating the tunnel to remove blast fumes and dust;

– removing blasted rock;

– scaling and wash down of the tunnel roof and walls to remove loosened pieces of rock;

– geological mapping of the exposed rock faces and classification of the conditions to determine suitable ground support systems for installation;

– installing ground support; and

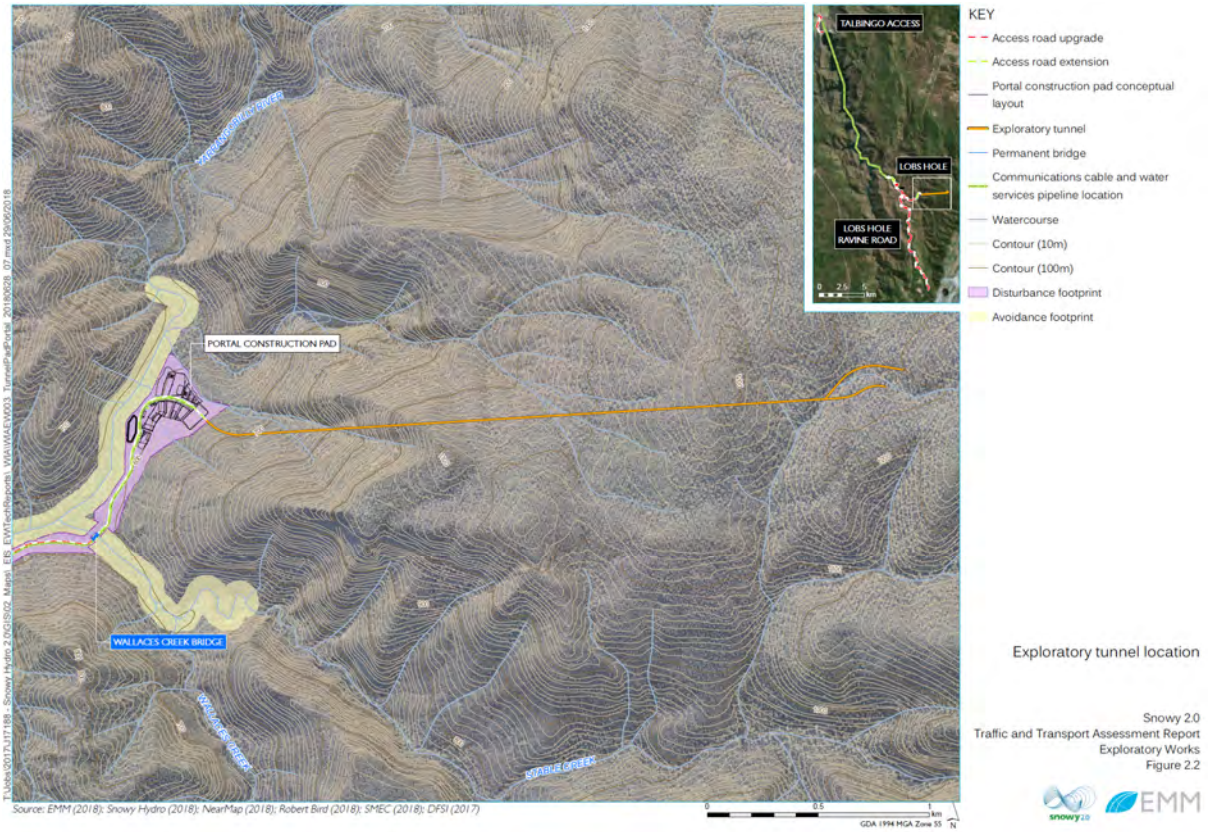
– advancing construction ventilation ducting and other utilities including power, water, compressed air and communications.

The exploratory tunnel will be shotcrete-lined with permanent anchor support and incorporate a groundwater management system. The exploratory tunnel shape and dimensions are designed to allow two-lane traffic for the removal of excavated material, along with additional space for ventilation and drainage of groundwater inflows. Groundwater intersected during tunnelling will be contained and transferred to the portal for treatment and management. Areas identified during forward probing with the potential for high groundwater flows may require management through a detailed grouting program or similar.

The tunnel portal will be established at the western end of the exploratory tunnel and provide access and utilities to the exploratory tunnel during construction. The portal will house power, communications, ventilation and water infrastructure. The portal will also provide a safe and stable entrance to the exploratory tunnel.

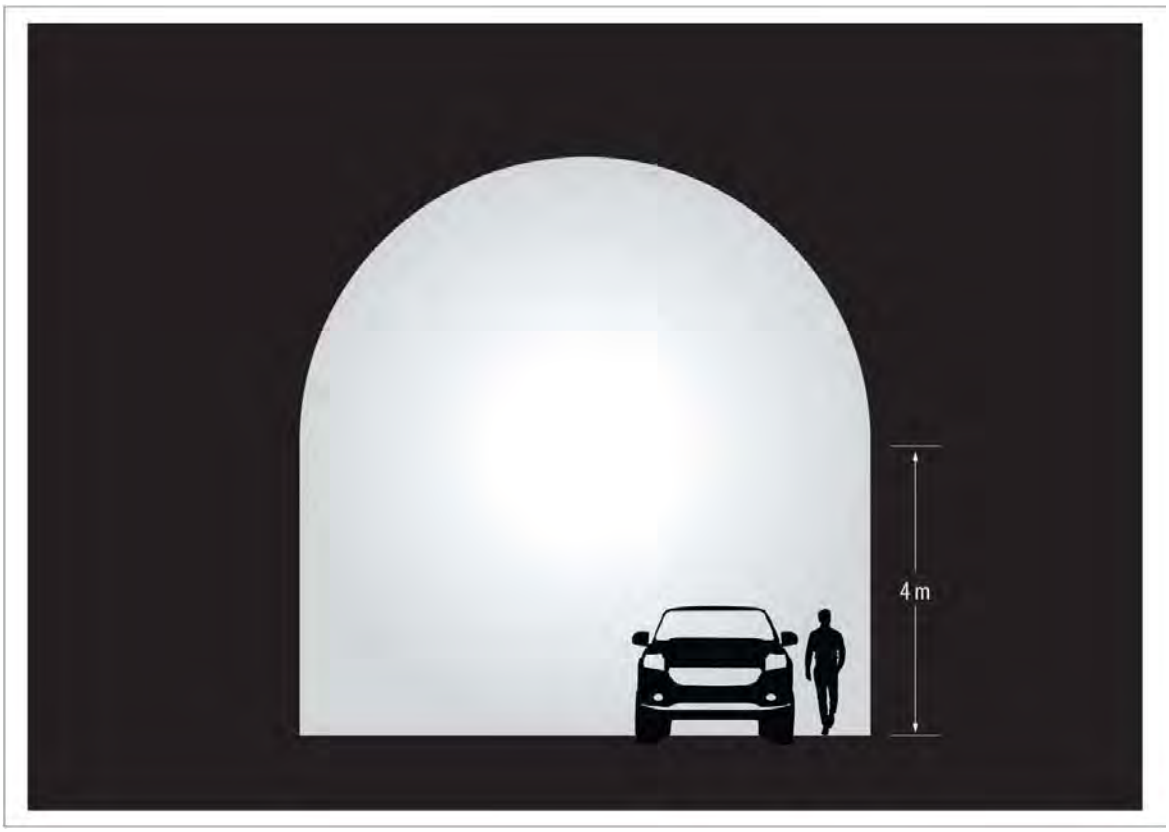
It is anticipated that the exploratory tunnel will be adapted for multiple functions during construction of the subsequent stages of the Snowy 2.0 project. The exploratory tunnel will also eventually be utilized to form the main access tunnel (MAT) to the underground power station during the operational phase of Snowy 2.0, should it proceed.

Figure 2.2 Exploratory tunnel location



Source: EMM Consulting; 2018

Figure 2.3 Exploratory tunnel location



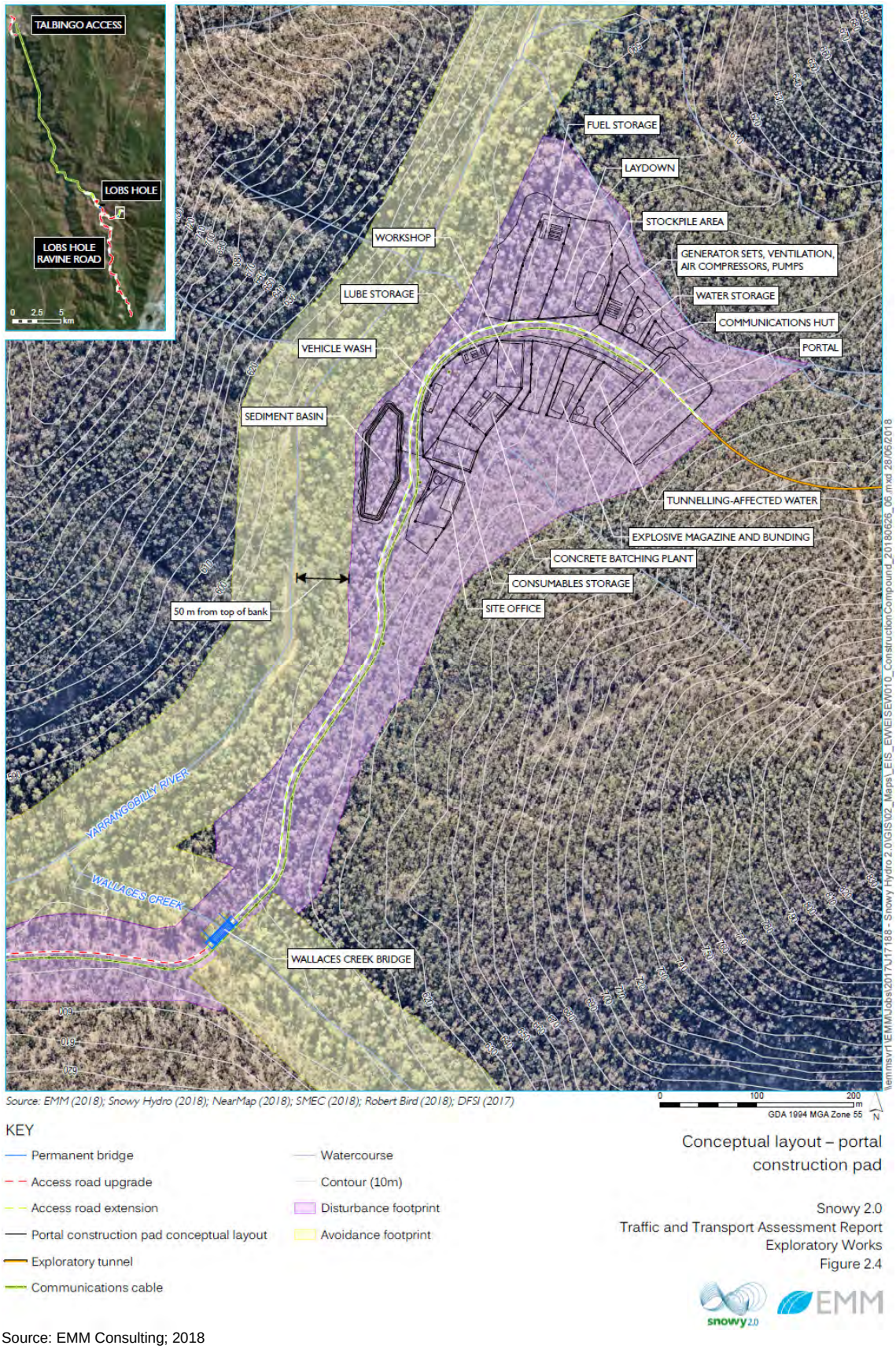
Source: EMM Consulting; 2018

2.3 Portal Construction Pad

A portal construction pad for the exploratory tunnel will provide a secure area for construction activities. Infrastructure at the portal construction pad, shown in **Figure 2.4**, will primarily support tunnelling activities and include a concrete batching plant and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking, equipment laydown areas. Stockpile areas will allow for around two to three months supply of concrete aggregate and sand for the concrete batching plant to ensure that the construction schedule for the proposed access road works do not interfere with the exploratory tunnel excavation schedule. A temporary excavated rock stockpile area is also required to stockpile material excavated during tunnel construction prior to its transfer to the larger excavated material emplacement areas.

The portal construction pad will be at the western end of the exploratory tunnel. The portal construction pad will be excavated to provide a level construction area with a near vertical face for the construction of the portal and tunnelling. The area required for the portal construction pad is approximately 100,000 m2.

Figure 2.4 Conceptual layout – portal construction pad



Source: EMM Consulting; 2018

2.4 Excavated rock management

It is estimated that approximately 750,000 m3 of bulked materials will be excavated, mostly from the exploratory tunnel and portal construction pad with additional quantities from road upgrade works. Subject to geochemical testing of the rock material, excavated rock will be placed either on land or subaqueously within Talbingo Reservoir.

2.4.1 On land placement

Excavated materials will be placed in one of two rock emplacement areas at Lobs Hole as shown on Figure 2.5.

The strategy for excavated rock management is for excavated material to be emplaced at two areas with the final placement of excavated material to be determined at a later date.

Consultation with NPWS throughout the design process has identified an opportunity for the eastern emplacement area to form a permanent landform that enables greater recreational use of Lobs Hole following the completion of Snowy 2.0's construction. It is envisaged that the excavated rock emplacement area will provide, in the long-term, a relatively flat final landform suitable for camping and basic recreational facilities to be confirmed in consultation with NPWS.

The eastern emplacement area has a capacity of up to 600,000 m^3 of material. It will be approximately 25 m maximum depth and will be benched down to the northern edge of the emplacement which is setback 50 m from the Yarrangobilly River.

The western emplacement area will be used to store excavated material should it not be able to be placed within the eastern emplacement area. It is envisaged this emplacement area will be used to store excavated materials suitable for re-use within the construction of Exploratory Works or for use by NPWS in KNP maintenance activities. All remaining material placed in this emplacement area will be removed following the completion of Exploratory Works.

The guiding principles for the design, construction method and management of emplacement areas undertaken for Exploratory Works have been as follows:

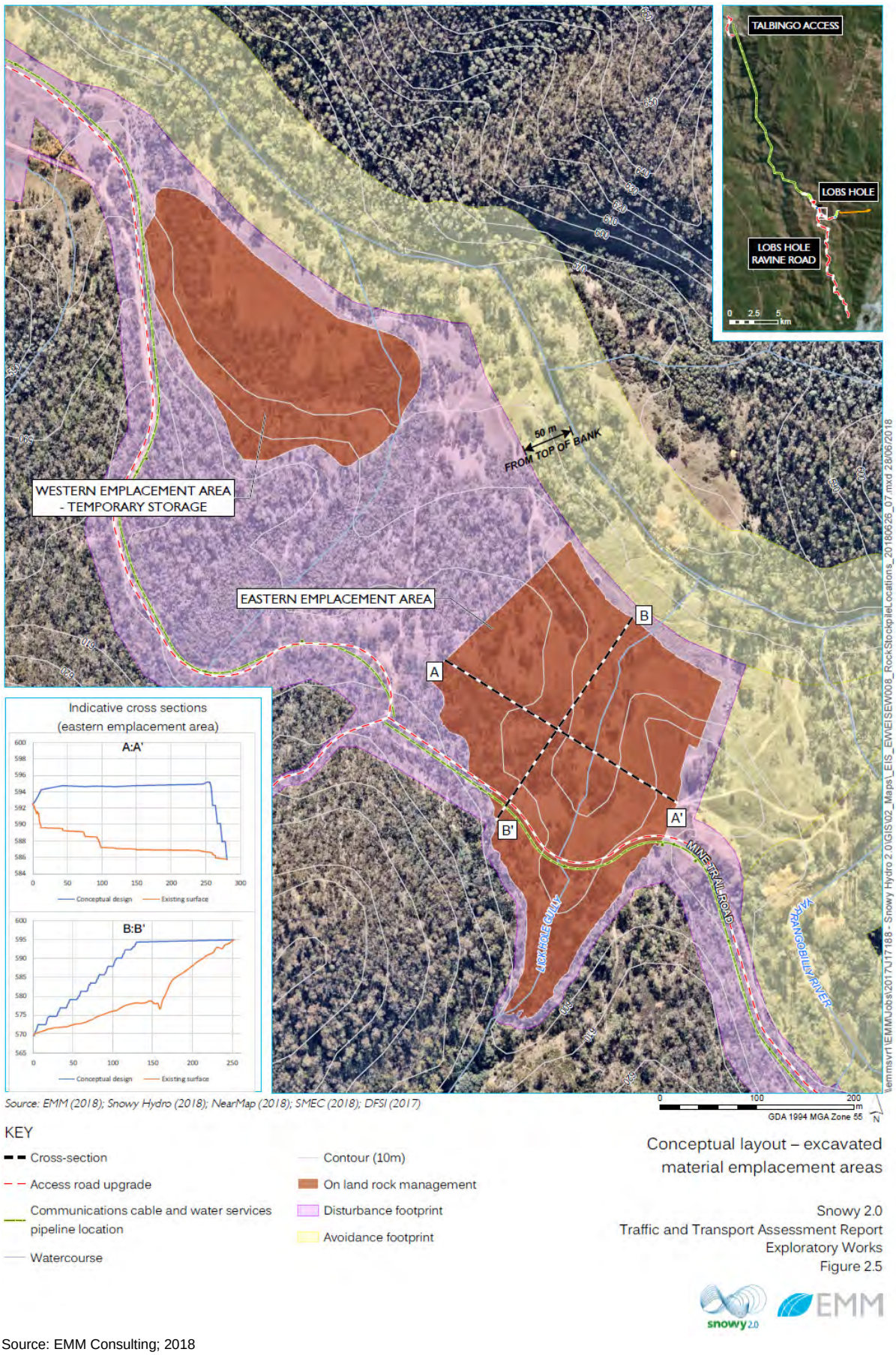
– reducing potential for acid rock drainage from the excavated rock emplacement area entering the Yarrangobilly River or forming groundwater recharge;

– avoid known environmental constraints; and

– manage existing surface water flows from Lick Hole Gully.

The design and management of the emplacement areas have not yet been finalised due to the need for further investigations to determine the likely geochemical characteristics of the excavated material. Following further investigation and prior to construction of Exploratory Works a management plan will be prepared and implemented.

Figure 2.5 Conceptual layout – excavated rock emplacement areas



Source: EMM Consulting; 2018

2.4.2 Subaqueous placement

A initial program for the placement of excavated rock within Talbingo Reservoir also forms part of Exploratory Works. The program will be implemented in an appropriate section of Talbingo Reservoir in accordance with a detailed management plan based on an engineering method informed through the materials' geochemistry and reservoir's characteristics. The purpose of the program is to confirm the suitability of the emplacement method for future excavated rock material from the construction of Snowy 2.0, should it proceed.

The rock for subaqueous placement will be taken from the excavated rock emplacement areas as described above. Testing of the rock would be conducted during excavation to assess geochemical properties. Any rock assessed as unsuitable for subaqueous placement based on the prior geochemical and leachability testing would be separately stockpiled and not used in the program. Suitable (ie non-reactive material) would be transported and loaded to barge, for placement at the deposition area. Suitable placement locations have been identified for Exploratory Works and are shown indicatively on **Figure 2.6**.

All placement within the reservoir would occur within silt curtains and would be subject to a detailed monitoring regime including survey monitoring of pre-placement and post-placement bathymetry, water quality monitoring during placement, and monitoring of aquatic ecology and the recolonisation of benthic species and fish species to the placement area following the placement program. The management, mitigation and monitoring measures would be refined following the ongoing investigations.

2.5 Accommodation Camp

An accommodation camp is proposed to provide accommodation and supporting services for workers in close proximity to the exploratory tunnel. The accommodation camp layout is shown on **Figure 2.7** and includes ensuite rooms surrounding central facilities including a kitchen, tavern, gym, admin office, laundry, maintenance building, sewage and water treatment plants and parking that will service the Exploratory Works workforce. The accommodation camp access road will connect to the north side of Lobs Hole Road at Lobs Hole. The conceptual layout of the accommodation camp is shown on **Figure 2.7**.

2.6 Road and access provisions

Existing road and access will need to be upgraded to a suitable standard to:

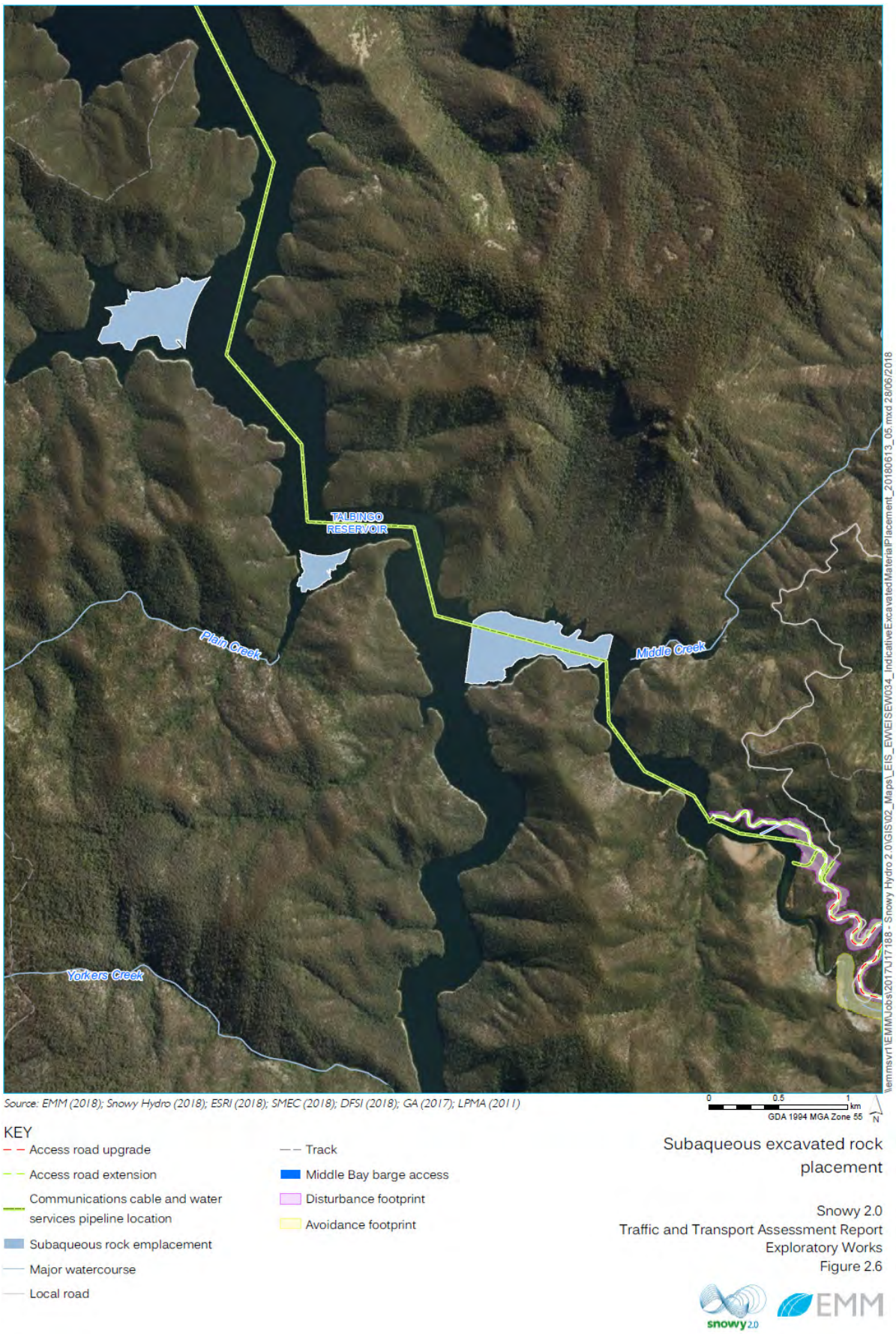
– provide for the transport of excavated rock material between the exploratory tunnel and the excavated rock emplacement areas;

– accommodate the transport of oversized loads as required; and

– facilitate the safe movement of plant, equipment, materials and construction staff to the portal construction pad.

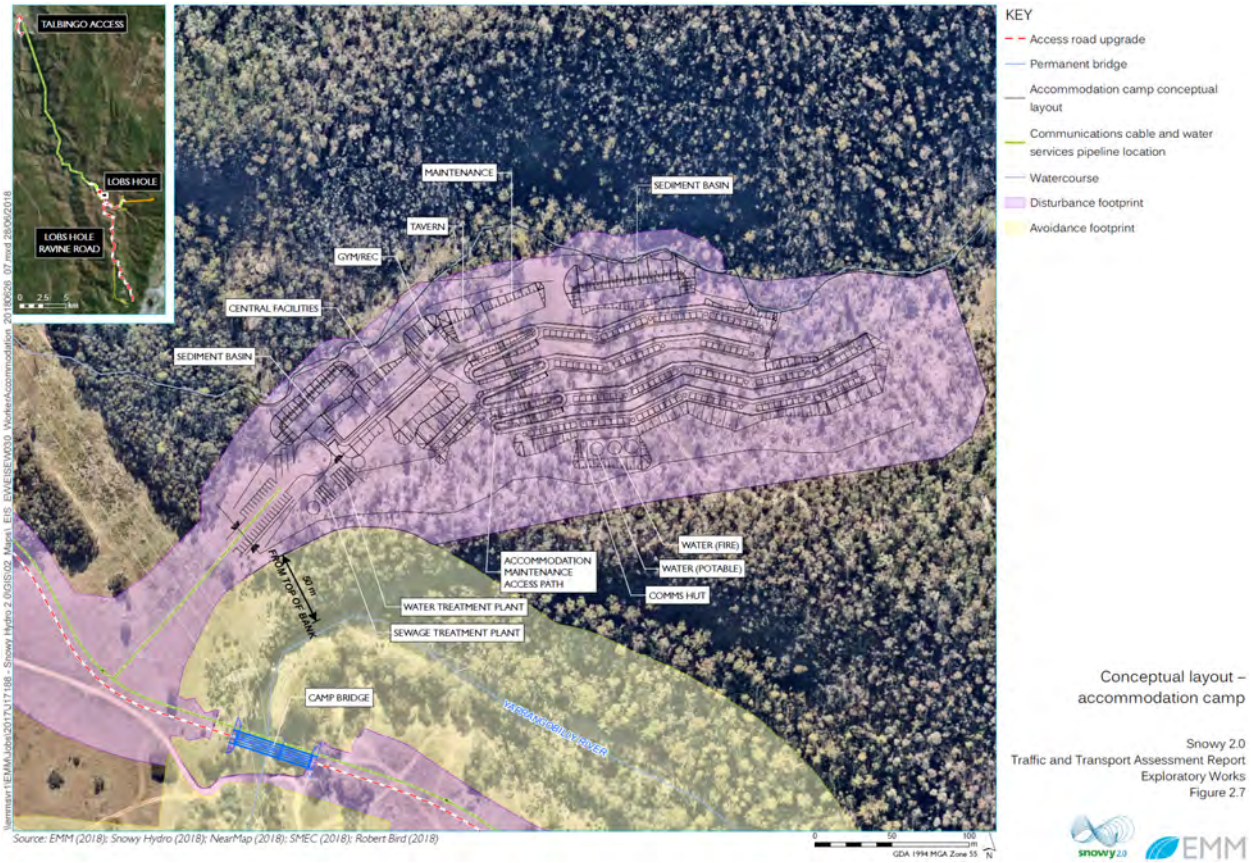
Given the topographic constraints of the area, the standard of the existing roads and the environmental values associated with KNP, the option of barging larger and oversized loads to the site is available. This is discussed further at **Section 2.7**.

Figure 2.6 Indicative location for subaqueous rock placement in Talbingo Reservoir



Source: EMM (2018); Snowy Hydro (2018); ESRI (2018); SMEC (2018); DFSI (2018); GA (2017); LPMA (2011)

Figure 2.7 Conceptual Layout – Accommodation Camp



Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018)

2.6.1 Access road works

The access road upgrades will be designed based on access for a truck and dog trailer. The proposed road works are shown in **Figure 2.8** and described in **Table 2.1**. It is expected that the majority of materials and equipment will travel along the Snowy Mountains Highway, Link Road and Lobs Hole Ravine Road, with some required to travel on Miles Franklin Drive via Talbingo to Talbingo Dam Wall and be transferred via a barge to site. The primary haul routes for construction material on site are provided in **Figure 2.9**. Where existing roads are replaced by new access roads or road upgrades, the existing roads will be removed and rehabilitated in line with the rehabilitation strategy for Exploratory Works.

Table 2.1 Access road upgrades and extensions

Access Road	Proposed upgrades and extensions
Upper Los Hole Ravine Road upgrade	Minor upgrades to 7.5 km section of existing road. Only sinbgle lane access will be provided. No cut and fill earthworks or vegetation clearing will be undertaken.
Lower Lobs Hole Ravine Road upgrade	Upgrades to 6 km section of existing road involving cut and fill earthworks in some sections. Only single lane access will be provided.
Lobs Hole Road upgrade	Upgrade to 7.3 km section of existing road providing two-way access.
Mine Trail Road upgrade	Upgrade to 2.2 km section of existing track to two-way access.
Mine Trail Road extension	Establishment of a new two-way road providing access to the exploratory tunnel portal.
Middle Bay Road	Establishment of a new two-way road to the proposed Middle Bay barge ramp.
Spillway Road	Upgrade of a 3 km section of existing road to provide two-way access to the proposed Spillway barge ramp.

Source: EMM Consulting; 2018

While no cut and fill earthworks or vegetation clearing is proposed along Upper Lobs Hole Ravine Road, a laydown area is proposed within and adjacent to the existing transmission line easement. This area will be used to store materials required for the road works to the lower section of Lobs Hole Ravine Road.

2.6.2 Watercourse crossings

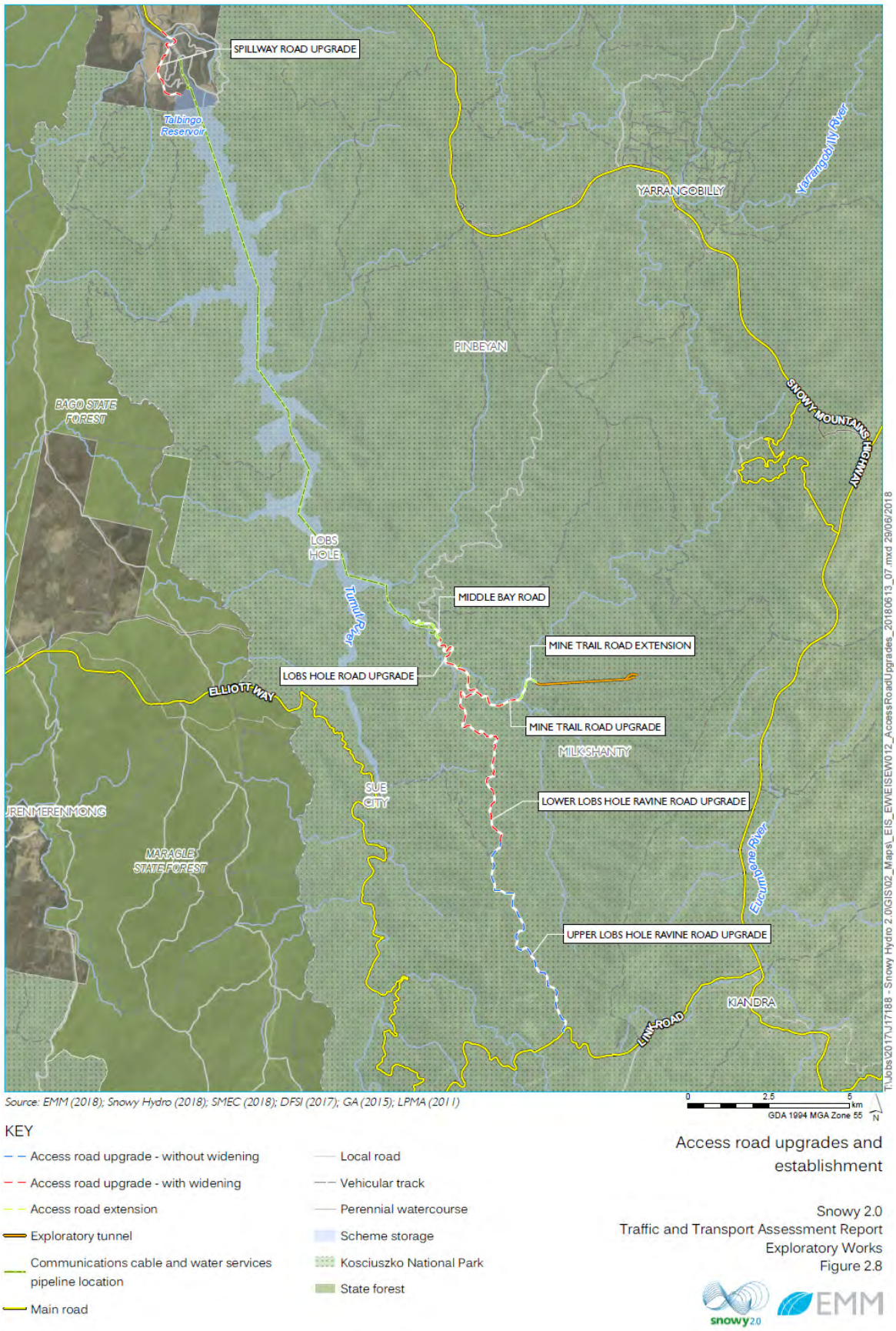
Bridge construction will be required at two locations as described in **Table 2.2**. The locations of these bridge works are shown in **Figure 2.9**.

Table 2.2 Watercourse Crossing Summary

Bridge works area	Overview
Camp bridge	An existing crossing on Yarrangobilly River will be used as a temporary crossing while a new permanent bridge is built as part of Lobs Hole Road upgrade. The existing crossing will require the crossing level to be raised with rocks to facilitate vehicle passage. The rocks used to raise the crossing level will be removed and the crossing no longer used once the permanent bridge has been constructed. The new bridge (Camp Bridge) will be a permanent crossing and used for both Exploratory Works and Snowy 2.0 main works, should it proceed.
Wallaces Creek bridge	Establishment of a new permanent bridge at Wallaces Creek as part of the Mine Trail Road extension. Establishment of this bridge will require an initial temporary pre-fabricated 'Bailey bridge' to be constructed, which will be removed before the end of Exploratory Works.

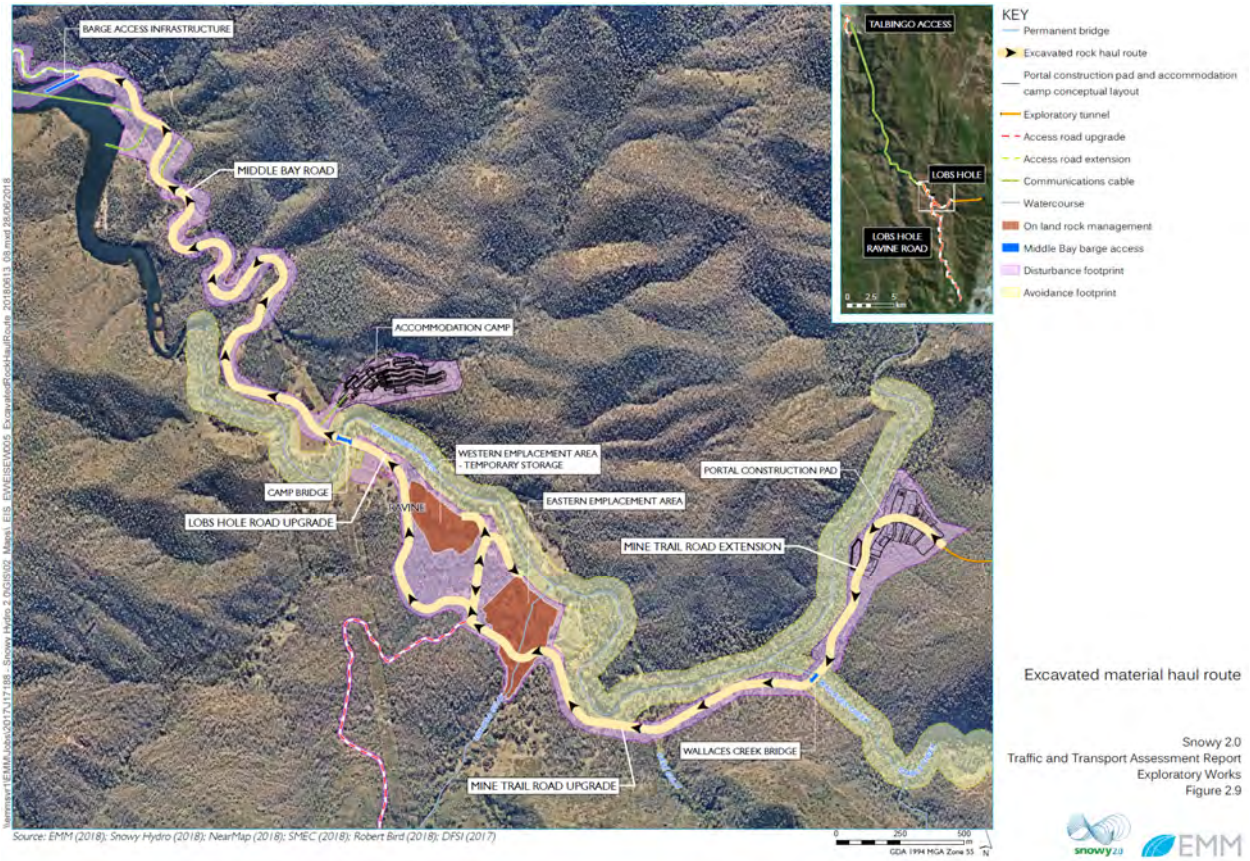
Source: EMM Consulting; 2018

Figure 2.8 Access road upgrades and establishment



Source: EMM (2018); Snowy Hydro (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

Figure 2.9 Excavated material haul route



Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017)

The design for permanent bridges at both crossings will consist of steel girders with a composite deck. This is the most common type of permanent bridge constructed in and around the existing Snowy Scheme. Lightweight steel girders are easy to transport and will therefore allow for efficiencies in the construction schedule and permit the use of smaller-scale lifting equipment at the construction site.

2.7 Barge access infrastructure

To provide an alternative to road access, a barge option is proposed, not only for bulky and heavy equipments but for materials and also in case of emergency. During Exploratory Works, barges will be loaded at the northern barge ramp (Talbingo barge ramp), travel about 18 km along Talbingo Reservoir and be unloaded at the southern barge ramp (Middle Bay barge ramp) before returning to the north. Some loads may also be transported in the reverse direction.

Barge access infrastructure will comprise two dedicated barge ramps at Middle Bay and Talbingo Spillway, with a slope of approximately 1 vertical to 10 horizontal (1V: 10H) at each location. A navigation channel is also required adjacent to the Middle Bay barge ramp. Construction will involve:

- geophysical and geotechnical investigation of the barge access area to inform detailed design;
- site establishment and excavation of barge access area;
- installation of precast concrete panels at the ramp location;
- installation of bollards for mooring lines;
- removal of trees and debris to establish a navigation channel allowing barge access; and
- minor dredging to allow barge access at the reservoir minimum operating level.

To facilitate construction, laydown areas are proposed adjacent to the Middle Bay barge ramp and adjacent to the water inlet pipeline. Laydown will also be used within the footprint of the Talbingo barge ramp.

Dredged material will be placed as part of the subaqueous placement program or within one of the designated on land rock emplacement areas. The infrastructure proposed for the Talbingo Spillway barge ramp and Middle Bay barge ramp is provided in **Figure 2.10**.

2.8 Service and infrastructure

The Exploratory Works will require additional power and communication infrastructure. Water services are also needed and include a water services pipeline and water and waste water (sewage) treatment facilities. A summary of services required is provided at **Table 2.3**.

Figure 2.10 Barge access locations

Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); DFSI (2017); LPMA (2011)

Table 2.3 Service infrastructure requirements

Services Infrastructure	Descriptions
Power	Power will be provided at the portal construction pad and accommodation camp by diesel generators, with fuel storage provided at the portal construction pad.
Communication	Communication will be provided via fibre optic link. the fibre optic service has been designed to incorporate a submarine cable from Tumut 3 power station across Talbingo reservoir to middle bay, and then via a buried conduit within the access roads to the accommodation camp and the portal construction pad.
Water and waste water (sewage)	A water services pipeline is proposed for the supply and discharge of water for the exploratory works which will pump water between Talbingo reservoir and the exploratory tunnel portal, portal construction pad and accommodation camp.
	A package water treatment plant is proposed at the accommodation camp to provide potable water to the accommodation camp and portal construction pad facilities and will be treated to a standard that complies with the Australian drinking water guidelines. the accommodation camp water supply will be pumped via the water pipeline from Talbingo reservoir at middle bay.
	A package waste water (sewage) treatment plant (STP) is proposed at the accommodation camp for the exploratory works waste water. the STP will produce effluent quality comparable to standard for inland treatment facilities in the region (eg Cabramurra). following treatment waste water will be discharged to Talbingo reservoir via the water services pipeline connecting the accommodation camp to Talbingo reservoir. Waste water from the exploratory tunnel and concrete batching plant will be either re-used on site or sent to the waste water treatment plant for treatment prior to discharge.

Source: EMM Consulting; 2018

2.9 Construction and schedule

2.9.1 Geotechnical investigation

To assist the design development for the portal construction pad, accommodation camp, Middle Bay Road, Spillway Road, and Lobs Hole Ravine Road, further survey of ground conditions is required. A program of geotechnical investigations including geophysical survey, construction of test pits, and borehole drilling within the disturbance footprint, will be undertaken as part of construction activities. Excavation of test pits in areas where information on relatively shallow subsurface profiles is required, or where bulk sampling is required for laboratory testing. Borehole drilling is required to facilitate the detailed design of cuttings, bridge foundations, retaining wall foundations, and drainage structures.

2.9.2 Construction activities

A disturbance footprint has been identified for Exploratory Works. The extent of the disturbance footprint is shown on **Figure 2.1** and shows the area required for construction, including the buildings and structures, portal construction pad, road widenings and bridges, laydown areas, and rock emplacement areas. Typical construction activities that will occur within the footprint are summarised in **Table 2.4**.

Table 2.4 Construction Activities

Activity	Descriptions
Geophysical and geotechnical investigation	Geophysical surveys will generally involve: Laying a geophone cable at the required location and establishing seismic holes; Blasting of explosives within seismic holes; and In-reservoir geophysics will use an air gun as the seismic source. Geotechnical surveys will generally involve: Establishing a drill pad including clearing and setup of environmental controls where required; Drilling a borehole to required depth using a tracked or truck mounted drill rig; and Installing piezometers where required for future monitoring program. Geophysical and geotechnical investigation within talbingo reservoir will be carried out using barges and subject to environmental controls.
Site establishment for portal construction pad, accommodation camp, rock placement areas and laydown areas	Site establishment will generally involve: Identifying and flagging areas that are to be avoided during the exploratory works period; Clearing of vegetation within the disturbance footprint, typically using chainsaws, bulldozers and excavators; Civil earthworks to create a stable and level area suitable for establishment. This will involve a cut and fill approach where required to minimise the requirement for imported material; Installing site drainage, soil erosion and other permanent environmental controls where required; Surface finishing, compacting only existing material where possible, or importing additional material. Where suitable, this material will be sourced locally (eg from upgrade works to lobs hole ravine road); and Set up and commissioning of supporting infrastructure, including survey marks.
Road works	Upgrades of existing tracks (no widening) will generally involve: Identifying and flagging areas that are to be avoided during the exploratory works period; and Removing high points, infilling scours, levelling of rutting, and compacting surfaces. Extension or widening of existing tracks will generally involve: Identifying and flagging areas that are to be avoided during the exploratory works period; Installing site drainage, soil erosion and other permanent environmental controls where required; Clearing and earthworks within the disturbance footprint; and Placing road pavement material on the roadway.
Bridge works	Establishment of permanent bridges will generally involve: Installing erosion and sedimentation controls around watercourses and installing scour protection as required; Establishing temporary diversions within the watercourse where required, including work to maintain fish passage; Establishing temporary bridges to facilitate permanent bridge construction; Constructing permanent bridges including piling, establishment of abutments and piers; and Removal and rehabilitation of temporary bridges and diversions.

Activity	Descriptions
Barge access works	Establishment of barge access infrastructure will generally involve: Installing sediment controls; Excavating and dredging of barge ramp area and navigation channel; Installing precast concrete planks and bollards; and Set up and commissioning of supporting infrastructure.
Exploratory tunnel construction	The drill and blast excavation process will be repeated cyclically throughout the tunnelling works, involving: Marking up and drilling blast holes in a predetermined pattern in the working face of the tunnel; Loading the blast holes with explosives, attaching detonators and connecting the holes into a blast sequence, and detonating the blast; Ventilating the tunnel to remove blast fumes and dust; Removing blasted rock; Scaling and wash down of the tunnel roof and walls to remove loosened pieces of rock; Geological mapping of the exposed rock faces and classification of the conditions to determine suitable ground support systems for installation; Installing ground support; and Advancing construction ventilation ducting and other utilities including power, water, compressed air and communications.

Source: EMM Consulting; 2018

2.9.3 Ancillary construction areas

Ancillary facilities and laydown areas have been identified within the conceptual layout for the portal construction pad and accommodation camp. A number of other indicative construction and laydown areas have also been identified to support Exploratory Works. A summary of these sites are:

- Upper Lobs Hole Ravine Road laydown area;
- rock emplacement area laydown, storage and ancillary uses;
- barge access infrastructure laydown areas at Talbingo and Middle Bay; and
- other minor laydown areas as needed during site establishment of watercourse crossings.

All laydown areas are within the disturbance footprint identified for Exploratory Works.

In addition, an area near Camp Bridge has been identified to be used for a plant nursery and organic stockpile area.

2.9.4 Construction workforce requirements

2.9.4.1 Staffing levels

It is currently expected that workforce for Exploratory Works will be approximately 200 people in total at peak construction. Workers are anticipated to work a ‘swing’ shift, for example two weeks on and one week off. These workers will be accommodated within the accommodation camp at Lobs Hole when rostered on.
The majority of the workforce will work on a fly-in fly-out and drive-in drive-out basis. It is expected that the majority of workers will fly in and out of either Cooma Airport or Canberra Airport and then travel to site via bus.
During construction of the accommodation camp, workers will be accommodated at Cabramurra. Some workers may also be accommodated at Snowy Hydro existing accommodation units at Talbingo during construction of the Talbingo barge ramp. No accommodation will be required outside of Cabramurra, the construction accommodation camp or Talbingo for the Exploratory Works workforce.

2.9.4.2 Hours of Operation

It is expected that construction of the exploratory tunnel and haulage of rock material between the tunnel and excavated rock stockpile locations at Lobs Hole will be 24 hours a day, seven days a week for the duration of the tunnel drilling and blasting operation. Other construction activities, including the establishment works, road and infrastructure works, will normally work a 12 hour day, seven days a week.

The transport of materials along the haul route from Snowy Mountains Highway, Link Road and Upper Lobs Hole Ravine Road will only occur during day time hours (except during emergency), to avoid impacts to threatened species (Smoky Mouse). Transport by barge will be 24 hours a day, seven days a week.

2.9.5 Timing and staging

Exploratory Works are expected to take about 34 months, with the exploratory tunnel expected to be completed by late 2021.

It is expected that the construction works will be completed largely in parallel. However, road and access works are expected to be completed within the first six months from commencement. The proposed staging of construction activities are highlighted in **Table 2.5**.

Table 2.5 Indicative staging of construction

Construction works	2018	2019				2020				2021			
Access roads													
Portal construction pad													
Accommodation camp													
Services infrastructure													
Barge access infrastructure													
Tunnelling													
Excavated rock management													

Source: EMM Consulting; 2018

2.10 Site rehabilitation

All Exploratory Works align with components of the main works for Snowy 2.0. However, should Snowy 2.0 not be approved or not progress, the project area will need to be rehabilitated, and project elements decommissioned in consultation with NPWS. Anticipated rehabilitation activities are summarised in **Table 2.6**.

Table 2.6 Planned Exploratory Works rehabilitation activities

Exploratory Works element	
Exploratory tunnel	Tunnel to remain open and allowed to flood in lower portion provided groundwater impacts are negated.
Exploratory tunnel portal area	Permanent portal facade to be constructed, portal to be sealed from entry.
Portal construction pad and associated infrastructure	To be demobilised and all infrastructure removed. Site to be revegetated and returned to “original state”.
Excavated rock emplacement areas	Emplaced excavated rock in the western emplacement area to be removed offsite and area to be revegetated and returned to “original state”. The eastern emplacement area could remain in-situ and the landform rehabilitated as agreed with NPWS.
Accommodation camp	To be demobilised and all infrastructure removed. Site to be revegetated and returned to “original state”.
Road access works	No remediation required as works are to be designed to be permanent.

Exploratory Works element	
Barge access infrastructure	No remediation works required as wharf and loading ramps are designed as permanent. Wharf can be removed if desired.
Services and infrastructure	To be demobilised and all infrastructure removed. Site to be revegetated and returned to “original state”.

Source: EMM Consulting; 2018

2.11 Decommissioning

Should Snowy 2.0 not proceed following the commencement or completion of Exploratory Works, elements constructed are able to be decommissioned and areas rehabilitated. Given works are within KNP, Snow Hydro will liaise closely with NPWS to determine the extent of decommissioning and types of rehabilitation to be undertaken. This approach will be taken to ensure that decommissioning allows for integration with future planned recreational use of these areas and to maintain the values of KNP.

2.12 Key aspects relevant to traffic and transport

Potential traffic and transport issues have been identified from reviewing the proposed Exploratory Works and associated activities. The identification process has considered the proposed project activities and the types of impacts to the traffic and transport environment, and the following aspects are considered relevant to this assessment:

– determine existing traffic and transport conditions and performance;
– determine the peak construction traffic generation;
– identify the volume of heavy vehicle movements;
– identify potential impacts from the generated traffic;
– detail necessary provisions required for specific road users;
– derive measures to minimise impact from staff and heavy vehicle movements;
– detail measures to accommodate and manage the movement of oversized vehicles;
– identify local amenities that may be affected by generated development traffic;
– ensure safety on the surrounding road network; and
– detail necessary traffic control measures that may be implemented.

3.0 Existing traffic and transport environment

This section outlines the existing traffic and transport environment within the study area. Data presented provides an understanding of existing traffic and transport conditions.

3.1 Study Area

The study area of the Snowy 2.0 Exploratory Works, which for the purposes of the traffic and transport assessment extends beyond the construction site itself, lies within the Snowy Valley and Snowy Monaro Regional local government areas (LGAs) as well as encompassing parts of KNP. The project site is between the regional towns of Tumut to the north and Cooma to the south, with Snowy Mountains Highway providing connection to these two centres over approximately 180km.

The study area contains many of the highest mountain peaks in Australia, which during snow season attract an influx of visitors with resulting increases in traffic volumes. Outside of the snow season, recreational visitors access the study area to visit the National Park facilities, but the traffic volumes generated during these periods is nominal and mostly limited to school holiday periods.

Besides the KNP, the majority of the land uses within the study area are rural agricultural with only a few residential townships located within the study with many accommodating personnel associated with the Snowy Scheme.

3.2 Existing Transport Context

3.2.1 Modes of Travel

Based on the 2011 Journey-to-Work data for the LGA of Snowy River, Tumut Shire and Tumbarumba (prior to the formation of existing Snowy Valleys and Snowy Monaro LGA of the 10,340 people who went to work, more than 87 percent of all work trips generated from within the study area were either as drivers and or car passengers, with the remainder walking to work or utilising other modes of transport. Given the limited public transport options within the study area, there were less than one percent of work trips that involved either bus or train as part of their journey.

3.2.2 Public Transport Services

3.2.2.1 Rail

There are no rail services within the study area. The nearest rail stations are located to the east at Canberra and north-west at Wagga Wagga. Both of which are over 100km away by existing roads.

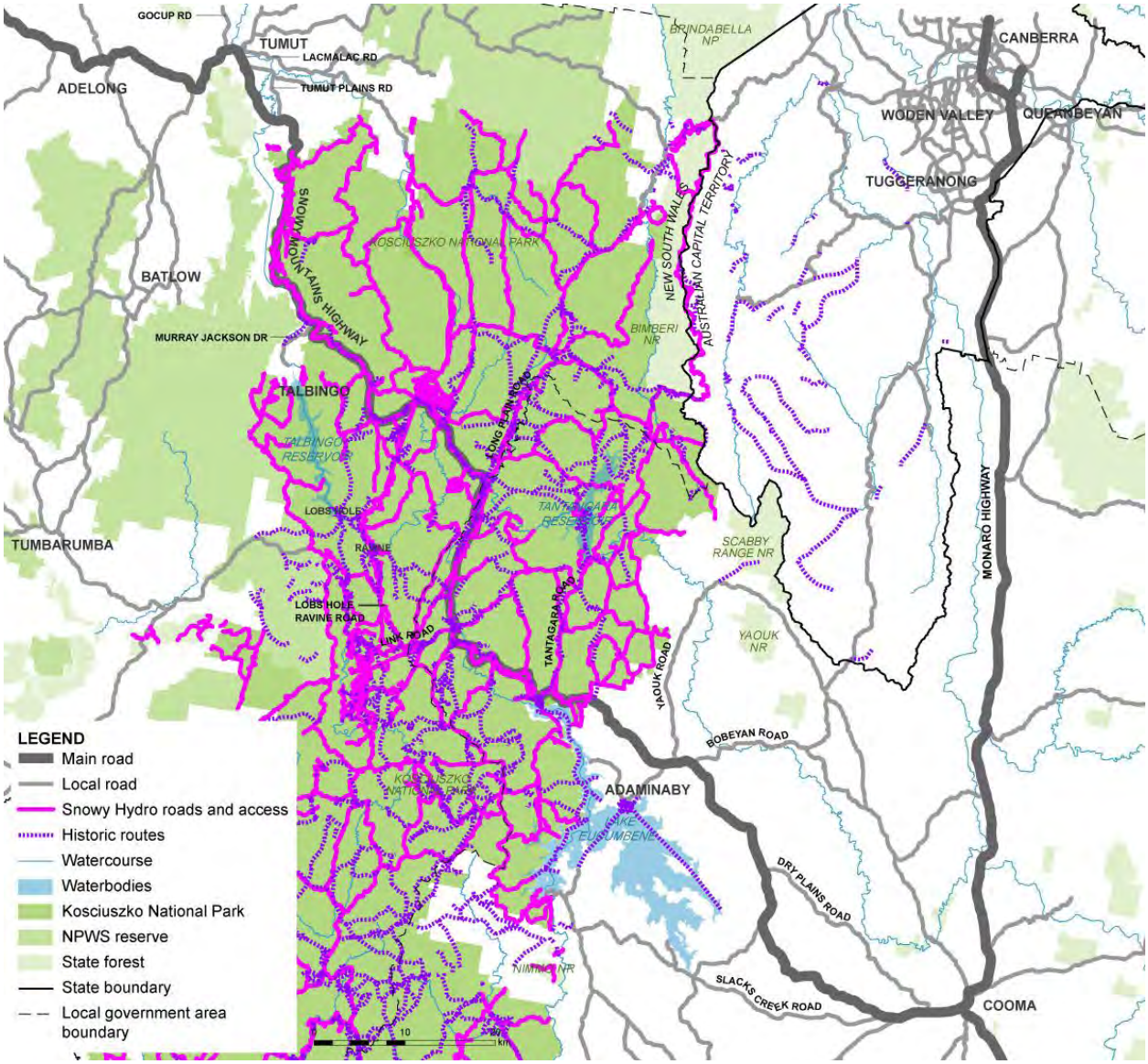
3.2.2.2 Buses / Coaches

There are no direct bus or coaches servicing the study area. There is however, a daily coach service that operates between Wagga Wagga and Tumut as well as between Canberra and Cooma. It is noted that there are no bus or coach operations, besides private tours, that operate along the Snowy Mountains Highway.

3.2.3 Walking and cycling

Figure 3.1 shows the existing walking and cycle tracks within the study area. Although there are no dedicated on-road or off-road walking and cycle facilities along the road network, there are numerous bush walking and mountain biking tracks within KNP. Many of these trails lead to camp sites within KNP that are not accessible by motorised vehicles.

Figure 3.1 Walking and Cycle Tracks



Source: SCT Consulting; 2018

3.3 Existing Traffic Conditions

3.3.1 Overview

To establish the existing traffic conditions adjacent to the area of Exploratory Works, 24-hour traffic surveys were undertaken between January and March of 2018 on the following roads:

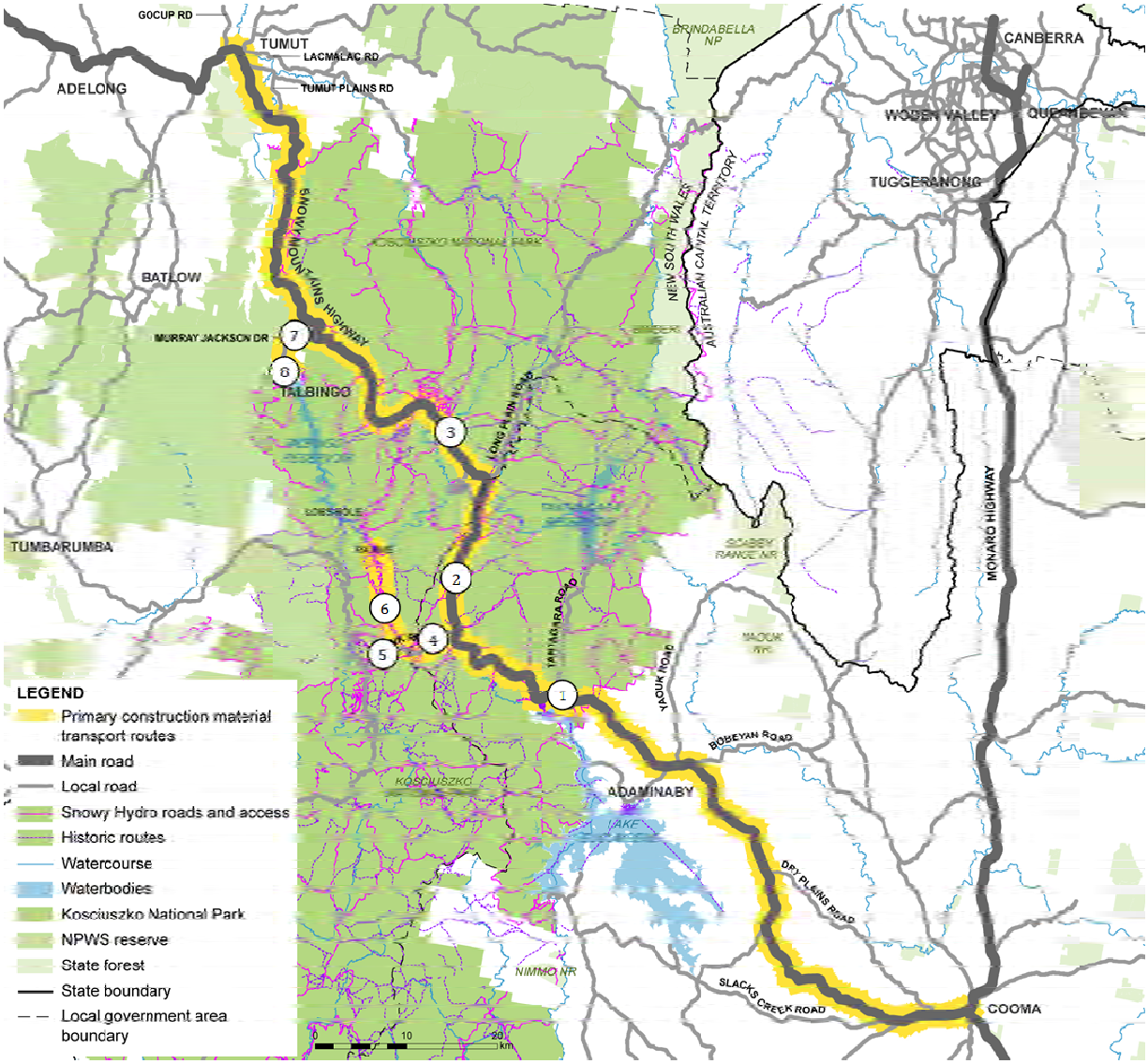
1. Snowy Mountains Highway, south of Link Road
2. Snowy Mountains Highway, north of Link Road
3. Snowy Mountains Highway, north of Yarrangobilly Caves
4. Link Road, between Kings Cross Road and Snowy Mountains Highway
5. Link Road, west of Kings Cross Road
6. Lobs Hole Ravine Road, north of Link Road

In addition, traffic surveys were conducted along the Miles Franklin Drive between 14th March 2018 and 11th April 2018 at the following locations:

1. Miles Franklin Drive, west of Snowy Mountains Highway (currently underway)
2. Miles Franklin Drive, south of Talbingo (currently underway)

The survey locations are shown in **Figure 3.2**.

Figure 3.2 Snowy Mountains Traffic Survey Locations



Source: SCT Consulting; 2018

These eight locations were surveyed to identify the following key traffic measures:

- Hourly traffic volumes, by direction;
- Vehicle classifications; and
- Vehicle speeds.

3.3.1.1 Assessment Criteria

Based on these parameters, the performance of the existing road network can be established to quantify any potential impacts caused as a result of traffic generated by the project.

The abovementioned data aims to ascertain the capacity of the roads based on the existing traffic volumes to compare against relevant AUSTROADS guidelines. However, for locations with low traffic volumes, factors such as road alignment and ability to overtake slower moving vehicles dictate the performance of two-lane highways.

According to AUSTROADS Guide to Traffic Management (Part 3, 2009), the performance of two-lane highways can be classified into six Level of Service (LoS) bands which are defined in **Table 3.1**. The associated LoS can be determined from the speed at which vehicles are travelling.

Table 3.1 AUSTROADS Guide to Traffic Management LoS Definitions for Two-lane Highways

LoS	Definition
A	Motorists experience high operating speeds on Class I highways and little difficulty in passing. Platoons of three or more vehicles are rare. On Class II highways, speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected. On Class III highways, drivers should be able to maintain operating speeds close or equal to the free-flow speed (FFS) of the facility.
B	Passing demand and passing capacity are balanced. On both Class I and Class II highways, the degree of platooning becomes noticeable. Some speed reductions are present on Class I highways. On Class III highways, it becomes difficult to maintain FFS operation, but the speed reduction is still relatively small.
C	Most vehicles are traveling in platoons. Speeds are noticeably curtailed on all three classes of highway.
D	Platooning increases significantly. Passing demand is high on both Class I and II facilities but passing capacity approaches zero. A high percentage of vehicles are now traveling in platoons, and Percent Time Spent Following (PTSF) is quite noticeable. On Class III highways, the fall-off from FFS is now significant.
E	Demand is approaching capacity. Passing on Class I and II highways is virtually impossible, and PTSF is more than 80%. Speeds are seriously curtailed. On Class III highways, speed is less than two-thirds the FFS. The lower limit of this LoS represents capacity.
F	Exists whenever arrival flow in one or both directions exceeds the capacity of the segment. Operating conditions are unstable, and heavy congestion exists on all classes of two-lane highway.

Source: AUSTROADS Guide to Traffic Management, page 46 (2009), modified by SCT Consulting; 2018

AUSTROADS defines the following three classification categories for two-lane highways (**Table 3.2**).

Table 3.2 AUSTROADS Two-lane Highway Categories

Class	Definition
I	These are two-lane highways on which motorists expect to travel at relatively high speeds. Two-lane highways that are major intercity routes, primary arterials connecting major traffic generators, daily commuter routes, or primary links in state or national highway networks generally are assigned to Class I. Class I facilities most often serve long-distance trips or provide connecting links between facilities that serve long-distance trips.
II	These are two-lane highways on which motorists do not necessarily expect to travel at high speeds. Two-lane highways that function as access routes to Class I facilities, serve as scenic or recreational routes that are not primary arterials, or pass through rugged terrain generally are assigned to Class II. Class II facilities most often serve relatively short trips, the beginning and ending portions of longer trips, or trips for which sightseeing plays a significant role.
III	These are two-lane highways serving moderately developed areas. They may be portions of a Class I or Class II highway that pass through small towns or developed recreational areas. On such segments, local traffic often mixes with through traffic, and the density of unsignalised roadside access points is noticeably higher than in a purely rural area. Class III highways may also be longer segments passing through more spread-out recreational areas, also with increased roadside densities. Such segments are often accompanied by reduced speed limits that reflect the higher activity level.

Source: AUSTROADS Guide to Traffic Management, Part 3 page 42 (2009), modified by SCT Consulting; 2018

The methodology for determining the LoS of two-lane highways is defined by Austroads Guide to Traffic Management Part 3 (Table 4.3, page 45) and summarised in **Table 3.3**.

Table 3.3 AUSTROADS LoS of Two-lane Highways

LoS	Class I Highway		Class II Highway	Class III Highway
	Average travel speed ATS (km/h)	Percent time-spent-following PTSF (%)	Percent time-spent-following PTSF (%)	Percent time-spent-following PTSF (%)
A	> 90	≤ 35	< 40	> 91.7
B	> 80 – 90	> 35 – 50	> 40 – 55	> 83.3 – 91.7
C	> 70 – 80	> 50 – 65	> 55 – 70	> 75.0 – 83.3
D	> 60 – 70	> 65 – 80	> 70 – 85	> 66.7 – 75.0
E	≤ 60	> 80	> 85	≤ 66.7

Source: Austroads, modified by SCT Consulting; 2018

In addition to the travel speed criteria, AUSTROADS also identifies that the capacity of a two-lane highway is 1,700 passenger cars per hour for each direction of travel and "is nearly independent of the directional distribution of traffic". Passenger cars is a metric of unit commonly referred as Passenger Car Units (PCU) to account for the different performance and physical characteristics of vehicle types in a network. It does this by assigning a higher conversion factors for larger, slower vehicles to convert to an equivalent car unit. The Roads and Maritime Services (Roads and Maritime) *'Traffic Modelling Guidelines'* (2013) suggest the following values as shown in **Table 3.4** for various vehicle types.

Table 3.4 Suggested PCU values for vehicle classifications

Vehicle Type	PCU Factor
Pedal Cycle	0.2
Motor Cycle	0.4
Car	1
Rigid Truck	1.9
Bus	2.0
Articulated Truck	2.9
Articulated Bus	3.2
B-Double	3.6

Source: Roads and Maritime Traffic Modelling Guidelines (2013; p156), modified by SCT Consulting; 2018

Based on the suggested PCU vales, traffic volumes can be represented in PCUs to determine a volume to capacity ratio (V/C) of a segment of a highway. V/C is a ratio of demand to capacity of a road, whereby a value of 1.0 would represent saturated conditions, or full capacity.

As AUSTROADS does not provide definitive V/C ratios for two lane highway LoS criteria, the following V/C ratios for multi-lane highways are summarised in **Table 3.5** and have been used as a capacity reference point for this assessment.

Table 3.5 LoS Criteria for V/C Ratio of Multi-lane Highways

Free-flow speed	Maximum volume to capacity ratio (V/C): Level of Service				
	A	B	C	D	E
100 km/hr	0.32	0.50	0.72	0.92	1.00
90 km/hr	0.32	0.47	0.68	0.89	1.00
80 km/hr	0.28	0.44	0.64	0.85	1.00
70 km/hr	0.26	0.41	0.59	0.81	1.00

Source: Austroads Guide to Traffic Management Part 3 (Table 4.4, page 48), modified by SCT Consulting; 2018

3.3.2 Snowy Mountains Highway

3.3.2.1 Route Description Cooma - Tumut

Snowy Mountains Highway (B72) is a 333km designated state highway connection between Hume Highway at Mount Adrah and Princes Highway at Stony Creek. It is a two-lane two-way rural highway for the majority of its alignment, with sign posted speed limits ranging between 60km/h to 100km/h.

Passing through the regional towns of Tumut and Cooma, the highway functions as a town centre main road with widened road widths to cater for on-street parking and increased localised traffic volumes with slower traffic speeds. Within the regional towns, there are numerous local collector roads that intersect with the highway which are either priority or roundabout controlled. Outside of these towns, all intersections along the highway are priority controlled.

For the entirety of its alignment, Snowy Mountains Highway is one of two routes within southern NSW approved for heavy vehicle passage between Hume Highway and Pacific Highway by B-Double vehicles of up to 19m in length. The highway traverses the Snowy Mountains with numerous reverse curves as well as several steep segments. Between Talbingo and Link Road, there are approximately 1.3km of southbound overtaking lane and approximately 600m of northbound overtaking lane provided, over a distance of approximately 52km, to allow vehicles to pass slower moving heavy vehicles. All other sections are line marked either with solid or broken centrelines to dictate when drivers are able to safely overtake other vehicles.

3.3.2.2 Existing traffic volumes and patterns

Based on the traffic surveys, the average daily volumes are summarised in the following tables and figures. Note the separation of the summaries of daily traffic profiles during and post-school holiday periods to identify the seasonal variation in traffic volumes.

Table 3.6 and **Table 3.7** provide a summary of the average daily traffic for the three sites along the Snowy Mountains Highway for weekday and weekends. The summary shows that traffic volumes are generally higher during the school holiday periods with greater volumes observed on weekends. Outside of school holiday periods, volumes decrease with weekday volumes representing the higher volumes, except for motorcycles which are observed to increase during weekends. Although the volume of heavy vehicles are not significant, the proportion of these vehicles when compared against the volume of light vehicles is relatively high. This may be reflective of the land uses within the KNP such as forestry and hydro power related vehicles.

Table 3.6 Snowy Mountains Highway Average Weekday Traffic – School Holiday Period

Site	Period	Motorcycles	Light Vehicles	Heavy Vehicles
Site 1 - South of Link Road	Weekday	32	555	86
	Weekend	38	621	45
Site 2 - North of Link Road	Weekday	5	200	20
	Weekend	4	158	15
Site 3 - North of Yarrangobilly Road	Weekday	18	465	102
	Weekend	18	523	66

Source: CFE Information Technologies, modified by SCT Consulting; 2018

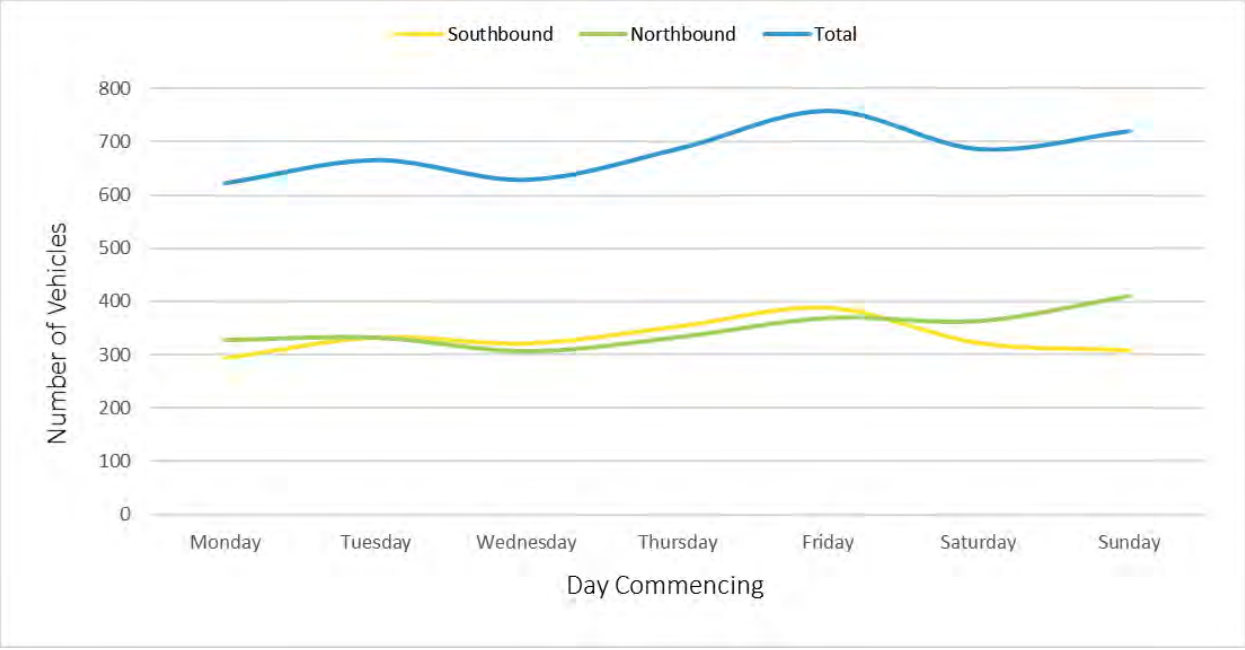
Table 3.7 Snowy Mountains Highway Average Weekday Traffic – Outside of Holiday Period

Site	Period	Motorcycles	Light Vehicles	Heavy Vehicles
Site 1 - South of Link Road	Weekday	31	491	83
	Weekend	82	533	46
Site 2 - North of Link Road	Weekday	17	412	90
	Weekend	48	460	57
Site 3 - North of Yarrangobilly Road	Weekday	15	369	77
	Weekend	39	432	45

Source: CFE Information Technologies, modified by SCT Consulting; 2018

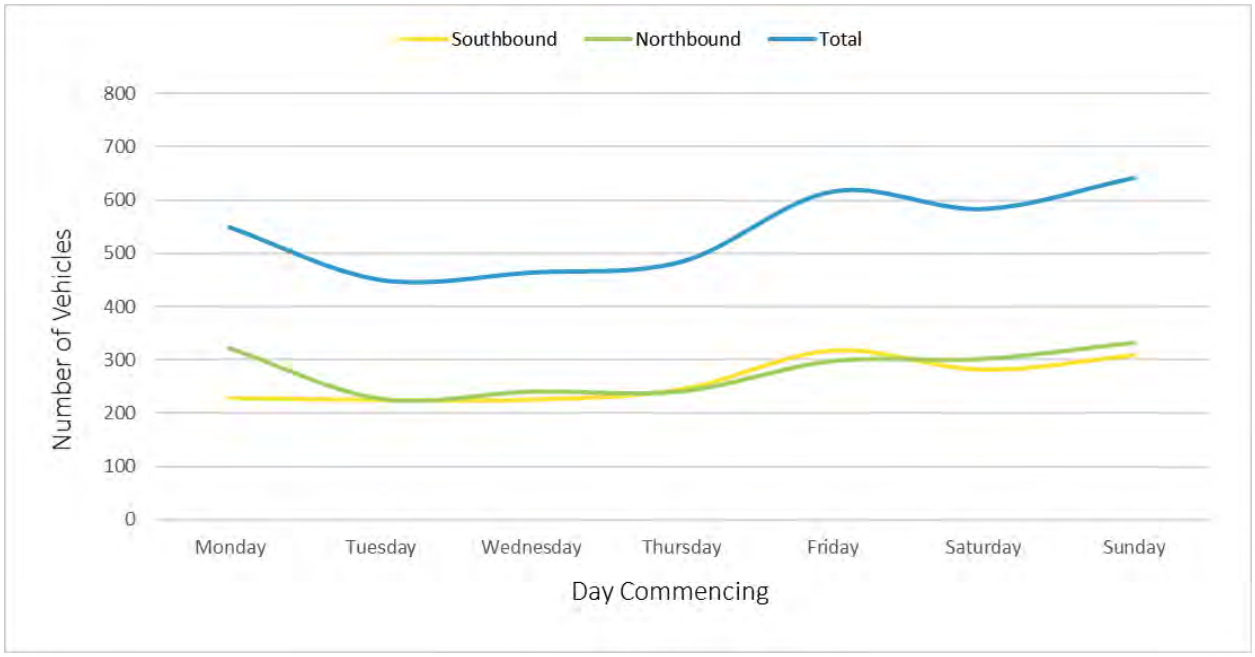
Figure 3.3 to **Figure 3.8** provide a graphical illustration of traffic volumes, within and out of school holidays, across the three survey sites. Analysis indicates that traffic volumes along the Snowy Mountains Highway are highest at Site 1, south of Link Road, and that traffic volumes decline outside of the school holiday period. This suggests that there is a high portion of visitors during the holiday season that access both Snowy Mountains Highway and Link Road. The analysis indicates that the highest peak in traffic volumes occurred on a Friday during the school holiday period, with daily bi-directional traffic volumes approaching 800 vehicles per day south of Link Road.

Figure 3.3 Snowy Mountains Highway, South of Link Road, Site 1 – Average Daily Volume During School Holiday Period



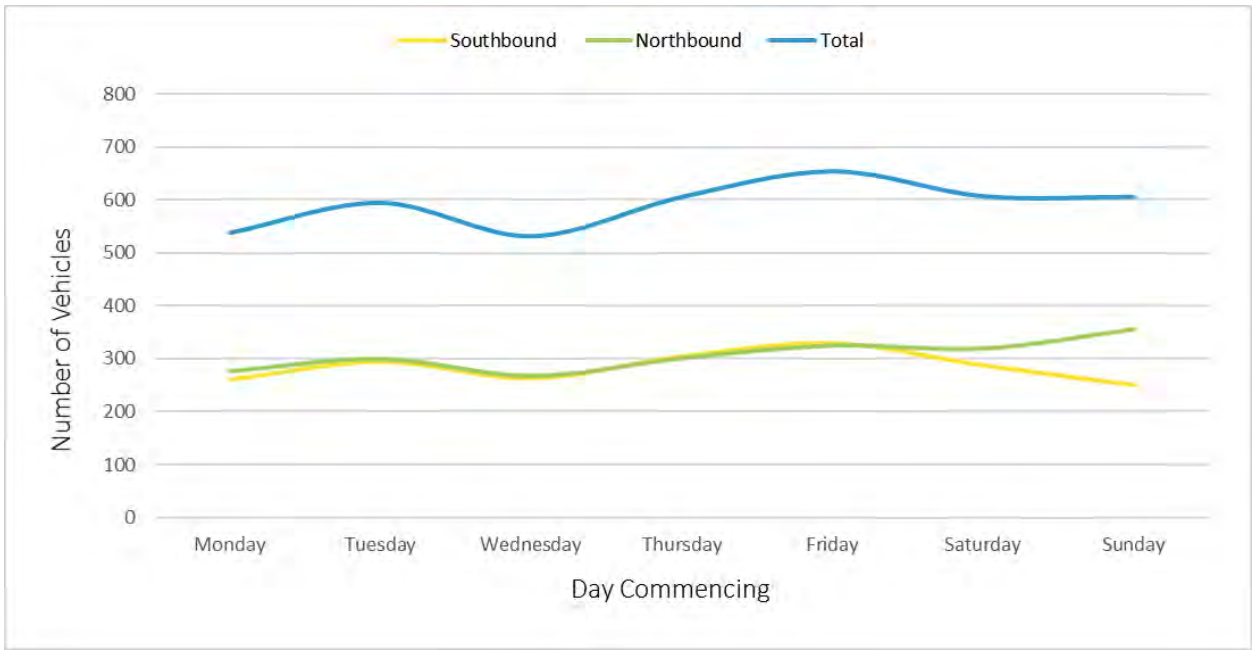
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.4 Snowy Mountains Highway, South of Link Road, Site 1 – Average Daily Volume Post School Holiday Period



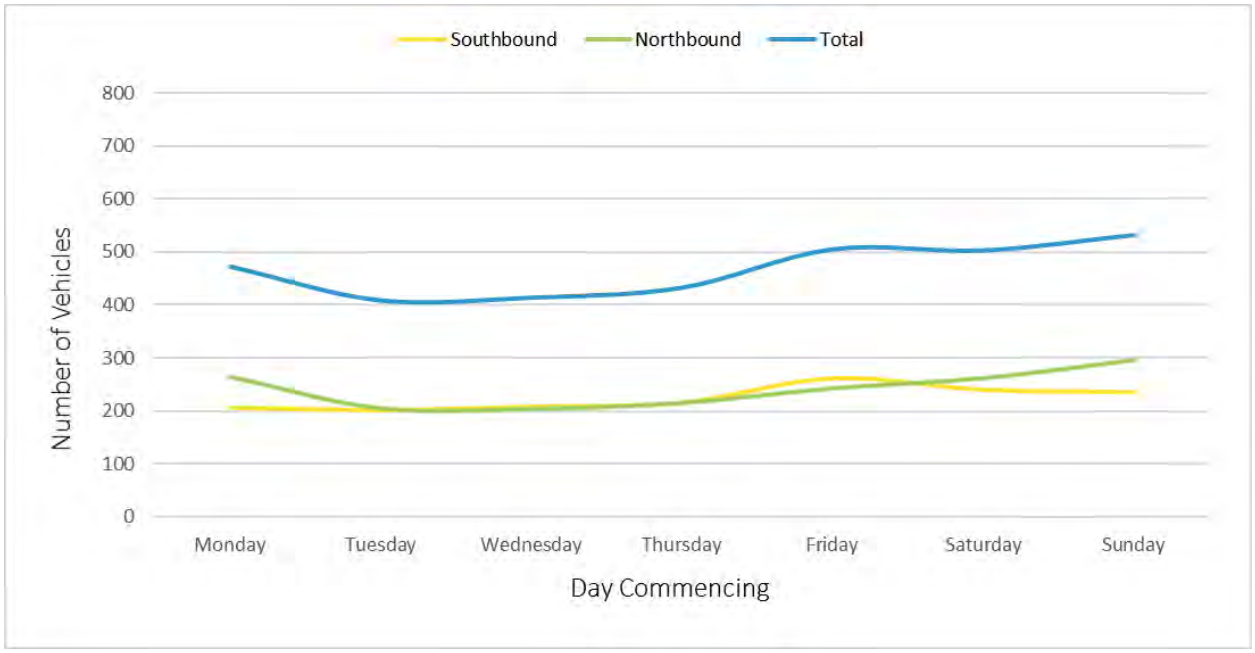
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.5 Snowy Mountains Highway, North of Link Road, Site 2 – Average Daily Volume During School Holiday Period



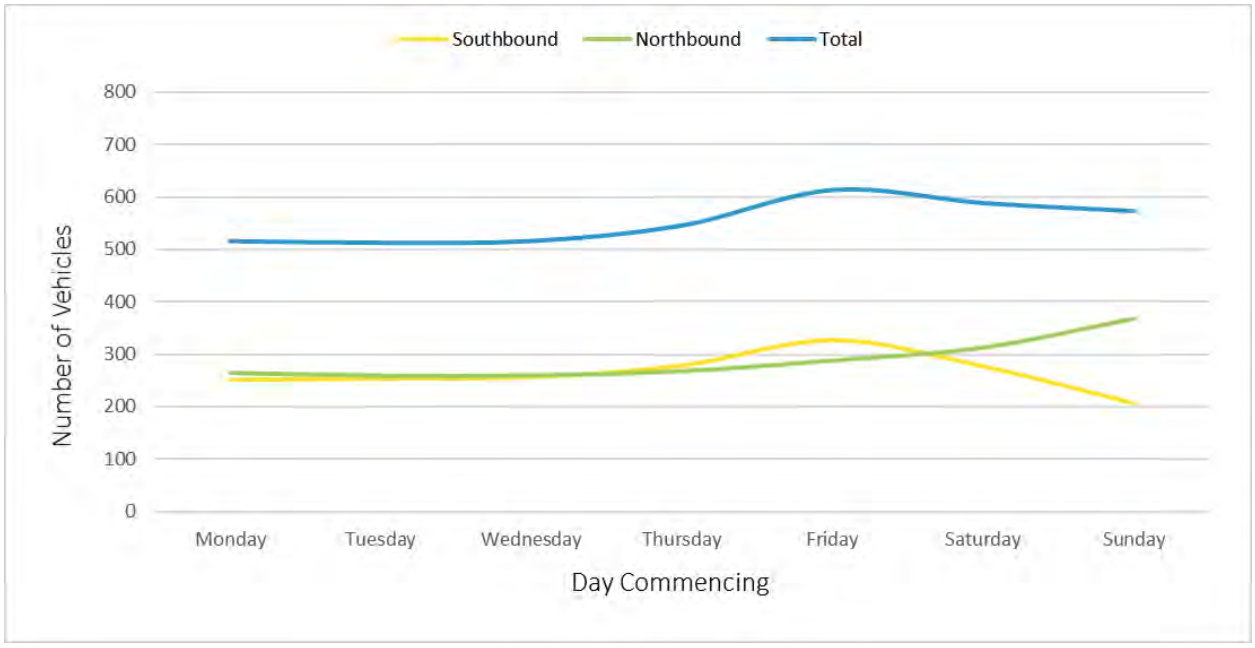
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.6 Snowy Mountains Highway, North of Link Road, Site 2 - Average Daily Volume Post School Holiday Period



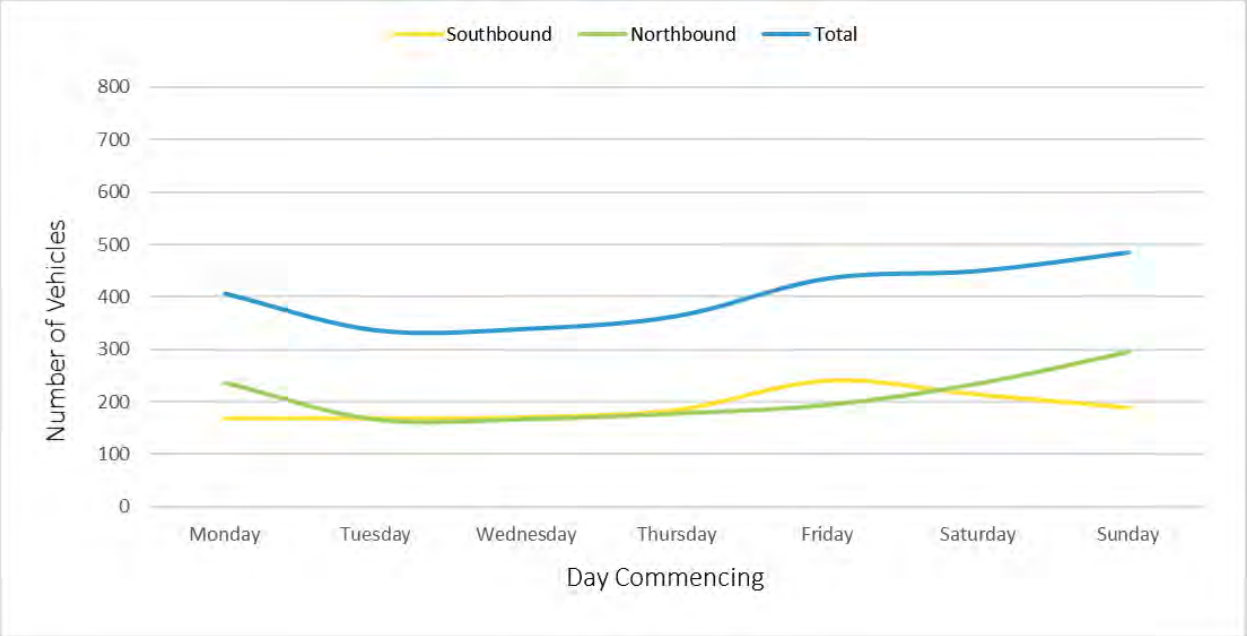
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.7 Snowy Mountains Highway, North of Yarrangobilly Road, Site 3 - Total Daily Volume



Source: CFE Information Technologies, modified by SCT Consulting; 2018

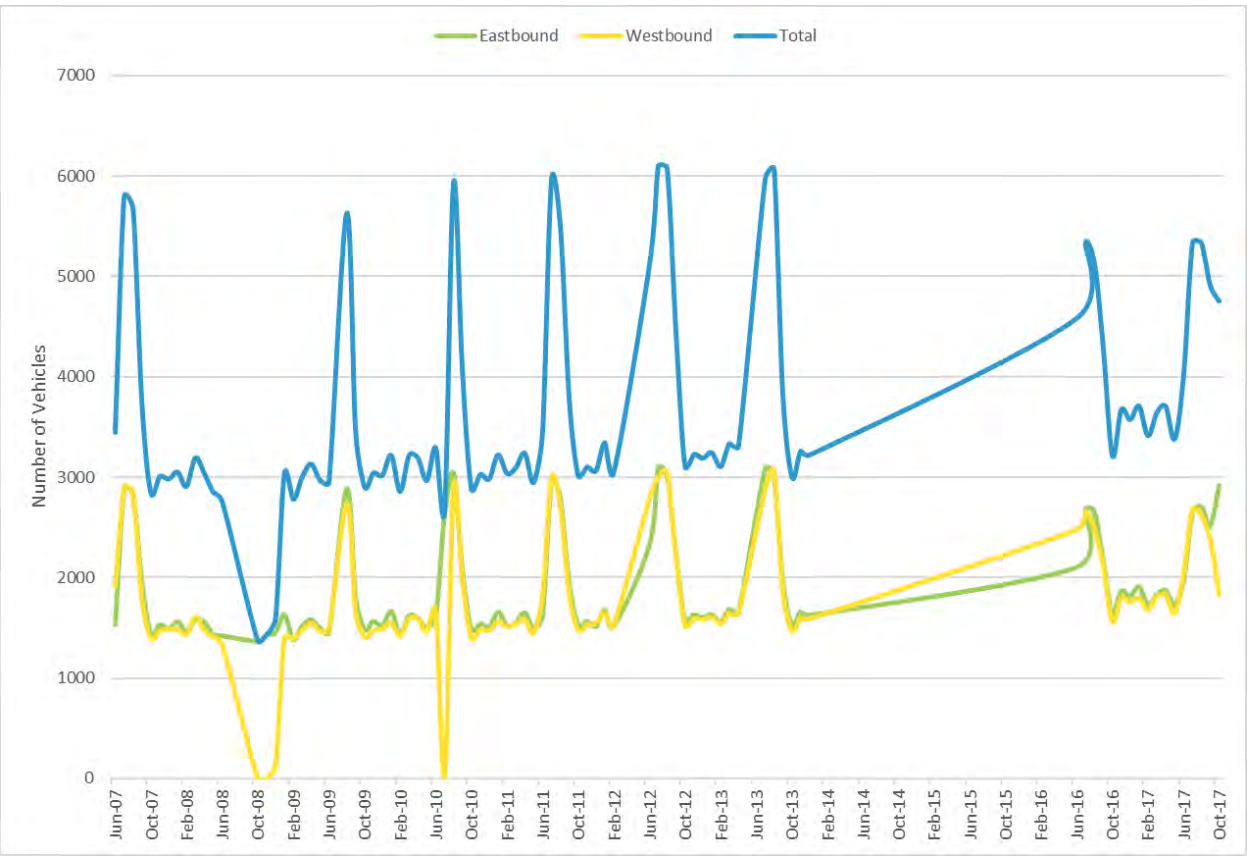
Figure 3.8 Snowy Mountains Highway, North of Yarrangobilly Road, Site 3 - Total Daily Volume



Source: CFE Information Technologies, modified by SCT Consulting; 2018

As the Snowy Mountains region is renowned for its ski fields, traffic along Snowy Mountains Highway is seasonal, with significant fluctuations in traffic volumes. **Figure 3.9** provides the profile of the average daily traffic volumes throughout the year as observed along Snowy Mountains Highway at Cooma, as reported by a Roads and Maritime permanent traffic counter, noting the lack of traffic data between 2014 and 2016.

Figure 3.9 Snowy Mountains Highway, Cooma - Average Daily Volume by Month (2007-2017)

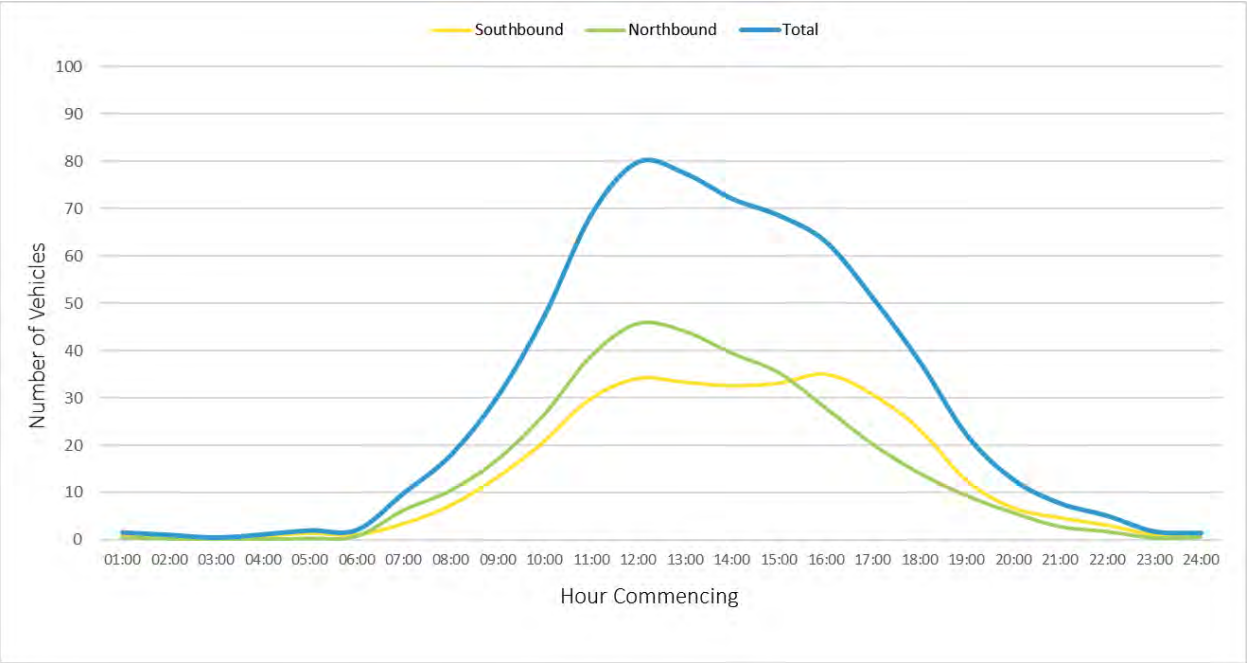


Source: RMS 2018 (http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/), modified by SCT Consulting; 2018

Figure 3.9 shows that peak flows occur between June and September and are most noticeable during the months of July and August. On average across the dataset this period represents an increase in traffic flow over baseline conditions of approximately 1.75. This increase in traffic is attributable to traffic generated by the ski resorts located within the Snowy Mountains region. Outside of these periods, traffic flows along Snowy Mountains Highway are relatively steady with minor fluctuations coinciding with school holiday periods. Outside of the peak snow season, traffic volumes increase on a monthly average of approximately 10 vehicles, which is a negligible increase on a daily basis. During the peak seasons, there are no noticeable increases on an annual basis.

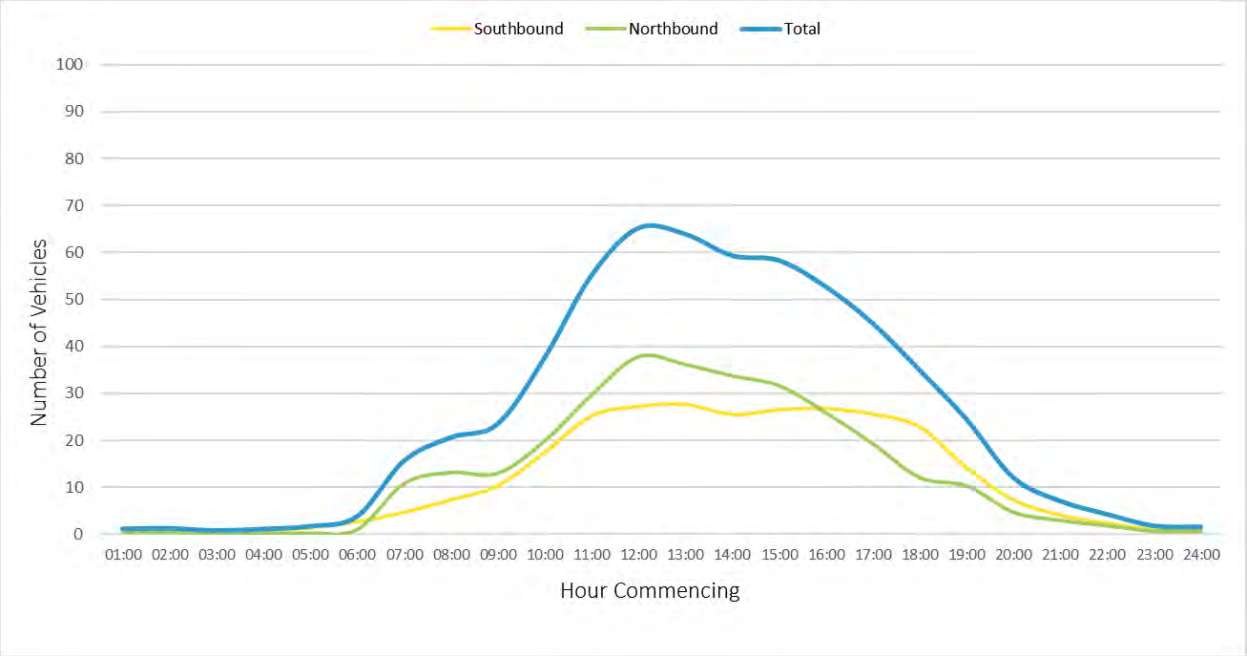
On an hourly flow rate, traffic along Snowy Mountains Highway is typical of regional non-commuter roads with peak flows occurring during the middle of the day. **Figure 3.10** to **Figure 3.12** shows the hourly volume profile during the January holiday period.

Figure 3.10 Snowy Mountains Highway Site 1, Hourly Average South of Link Road, Hourly Profile



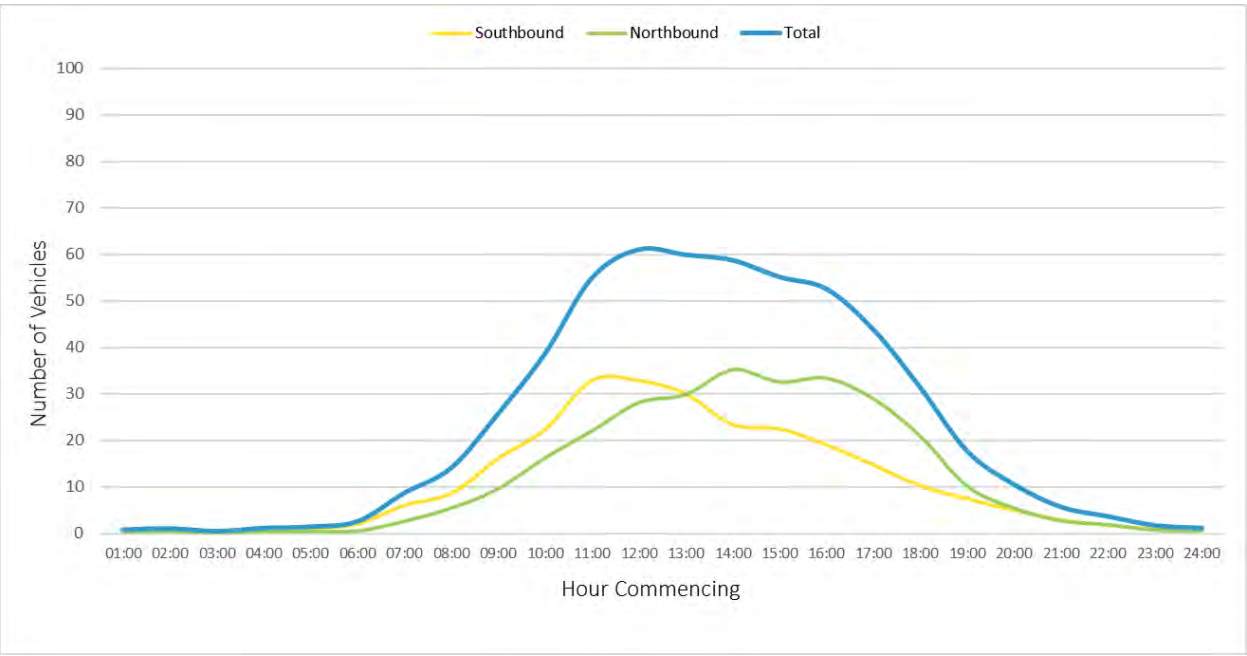
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.11 Snowy Mountains Highway Site 2, Hourly Average North of Link Road, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.12 Snowy Mountains Highway Site 3, Hourly Average North of Yarrangobilly Road, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.10 to **Figure 3.12** show that similar to the daily flow profile the highest hourly flow occurs at Site 1 on the Snowy Mountains Highway south of Link Road. The maximum hourly volume recorded during school holidays between 12PM-1PM does not exceed 80 vehicles. Site 2 and Site 3 recorded approximately 60 vehicles each during the same time period. Outside of the school holiday period these volumes are further reduced.

3.3.2.3 Roadway LoS

Based on the definitions of the two-lane highway categories identified in **Table 3.2**, it is deemed that Snowy Mountains Highway is a Class II rural highway, with segments of Class III adjacent to the townships of Cooma and Tumut.

As identified in **Table 3.3,** LoS of Class II and III highways are to be determined based on the percentage of time spent following a vehicle. However, such a measurement over the Snowy Mountains Highway distance as well as for the duration of the investigation is impractical. Instead a worst case conservative assessment comparison of the surveyed travel speed against the Class I speed criteria has been undertaken to determine LoS.

Table 3.8 provides the observed speeds along Snowy Mountains Highway at Site 1, Site 2 and Site 3 in a southbound (SB) and northbound (NB) direction of travel.

Table 3.8 Snowy Mountains Highway, Average Travel Speeds

Measurement	Site 1		Site 2		Site 3	
	SB	NB	SB	NB	SB	NB
Signposted speed limit (km/hr)	100	100	100	100	100	100
Average Speed	80	75	92	93	99	107
85th Percentile Speed	90	87	101	103	105	112

Source: CFE Information Technologies, modified by SCT Consulting; 2018

As shown in **Table 3.8**, even as a conservative assessment, Snowy Mountains Highway would classify as operating at LoS A, at Sites 2 and 3. It is noted that the survey location of Site 1 was conducted on a bridge with narrowed road width with crash barriers along the road edge. As a result vehicles reduce their travel speed on approach. Even with this adjustment to driving conditions, it is noted that the speed would be equivalent to LoS C of a Class I highway. Based on the above it can be determined that the Snowy Mountains Highway at Site 1, Site 2 and Site 3 is operating within spare capacity at an acceptable level of service.

Figure 3.9 identified that traffic flows can increase significantly during the winter school holidays by a factor of 1.75. Applying the factor of 1.75 to the maximum peak hour flow observed at Site 1, which reported the greatest flows at Snowy Mountains Highway, results in a maximum of 140 vehicles per hour (bi-directional). When compared against the theoretical capacity of 1,700 passenger cars per hour in each direction, as identified by AUSTROADS (Guide to Traffic Management Part 3, page 45, 2009) for two-lane highways, this would indicate a volume capacity (V/C) ratio of less than 0.04. In context, a Class I highway operating at V/C ratio of at or below 0.32, for a 100km/hr speed zone, and 0.28, for an 80km/hr speed zone, is operating a LoS A. As such, it is expected that even during the peak seasons in winter, Snowy Mountains Highway, within the study area, would operate LoS A or similar.

3.3.2.4 Traffic Crashes

Of the 15 crashes reported along Snowy Mountains Highway, adjacent to the study area, six of the crashes occurred south of Miles Franklin Drive, along the winding segment of the highway, with multiple reversing bends over approximately five kilometres. As identified in **Figure 2.7**, this segment of the highway is one of the primary routes identified for the project, where heavy vehicles would need to traverse between the worksite and Cooma.

Typical of rural highways, crashes reported along Snowy Mountains Highway, between 2012 and 2017, involved mainly single vehicles striking an animal or single vehicle running off the roadway. This is especially the case for crashes reported within the study region of Snowy Mountains Highway, where 13 of the 15 crashes recorded were attributable to single vehicles running off the carriageway (12 of which occurred on a curve). Two crashes were reported to have struck wildlife on the roadway.

3.3.3 Link Road

3.3.3.1 Route Description

Link Road is a rural road between Goat Ridge Road to the west and Snowy Mountains Highway (B72) to the east with limited developments adjacent to the road. Link Road also provides the connection between the former residential town of Cabramurra and the Snowy Mountains Highway. During snow season, traffic volumes along the road increase due to the nearby Selwyn Ski Resort, which is accessible via the Link Road and Kings Cross Road intersection. In addition, there are a number of recreational walking, hiking and 4WD trails accessible via Link Road, which are frequented by visitors to the region, especially during holiday periods.

Typical of the region, Link Road is an undulating road with numerous bends along the alignment with reduced speed advisory signs on approaches and tall roadside poles to mark road edges during snowy seasons. In addition, there are crash barriers installed adjacent to steep falls and bends to contain errant vehicles. As such, the speed

environment along Link Road is lower than Snowy Mountains Highway with large sections of the road containing advisory slow speed signs and speed limit signs.

3.3.3.2 Existing traffic volumes and patterns

Table 3.9 and

Table 3.10 provide a summary of the average daily traffic volume for the two sites (Site 4 and Site 5) along Link Road for weekday and weekends. The summary shows that traffic volumes are generally higher during the school holiday periods with greater volumes observed during school holiday weekends. Outside the school holiday period, volumes decrease with weekday volumes greater than weekend volumes, except for motorcycles which increase in number during weekends.

Table 3.9 Link Road Average Weekday Traffic – School Holiday Period

Site	Period	Motorcycles	Light Vehicles	Heavy Vehicles
Site 4 - West of Kings Cross Road	Weekday	25	308	46
	Weekend	32	304	30
Site 5 - East of Kings Cross Road	Weekday	25	199	19
	Weekend	31	206	17

Source: CFE Information Technologies, modified by SCT Consulting; 2018

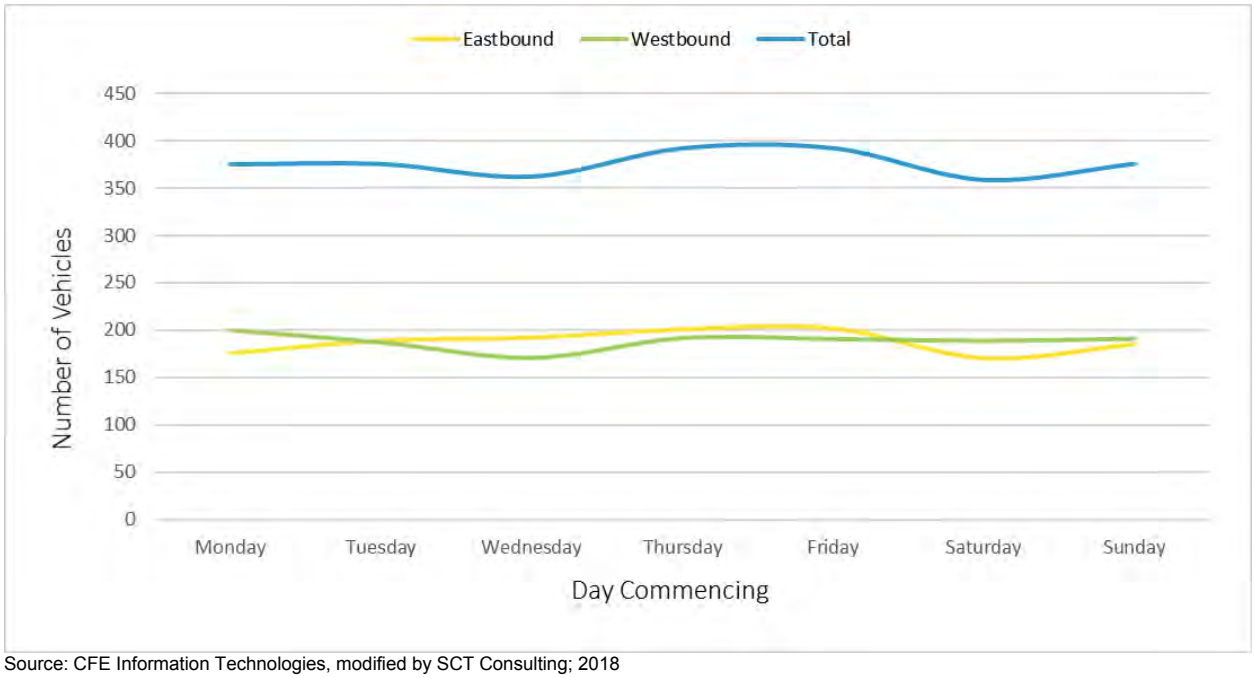
Table 3.10 Link Road Average Weekday Traffic – Outside of Holiday Period

Site	Period	Motorcycles	Light Vehicles	Heavy Vehicles
Site 4 - West of Kings Cross Road	Weekday	27	299	48
	Weekend	66	280	31
Site 5 - East of Kings Cross Road	Weekday	26	185	23
	Weekend	65	178	17

Source: CFE Information Technologies, modified by SCT Consulting; 2018

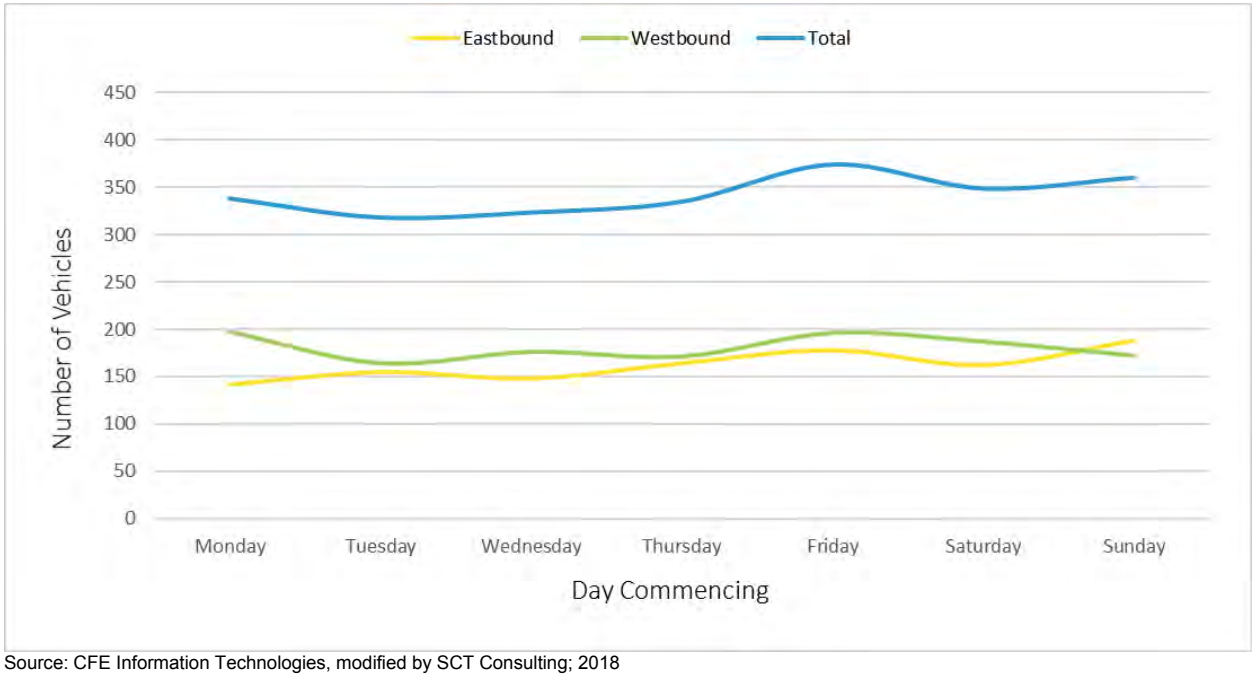
Based on the traffic surveys, detailed average daily volumes are summarised in **Figure 3.13** to **Figure 3.16**, with separate summaries provided during and post-school holiday period.

Figure 3.13 Link Road, west of Kings Cross Road, Site 4 – Average Daily Volume During School Holiday Period



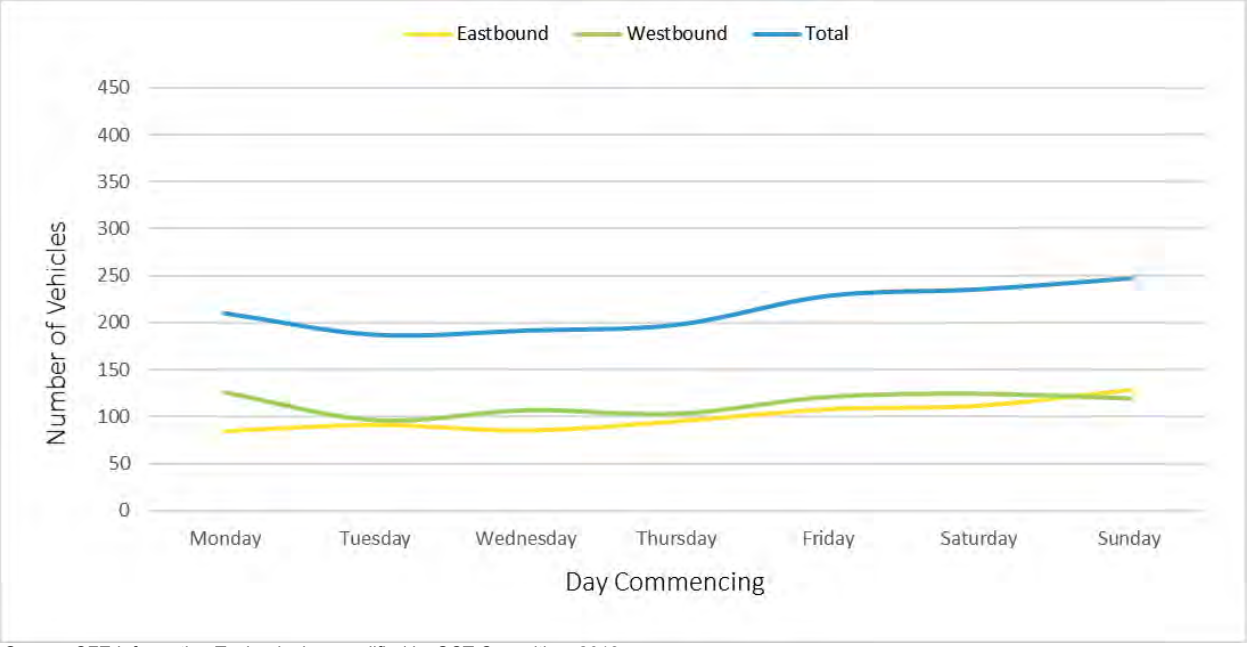
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.14 Link Road, west of Kings Cross Road, Site 4 – Average Daily Volume Post School Holiday Period



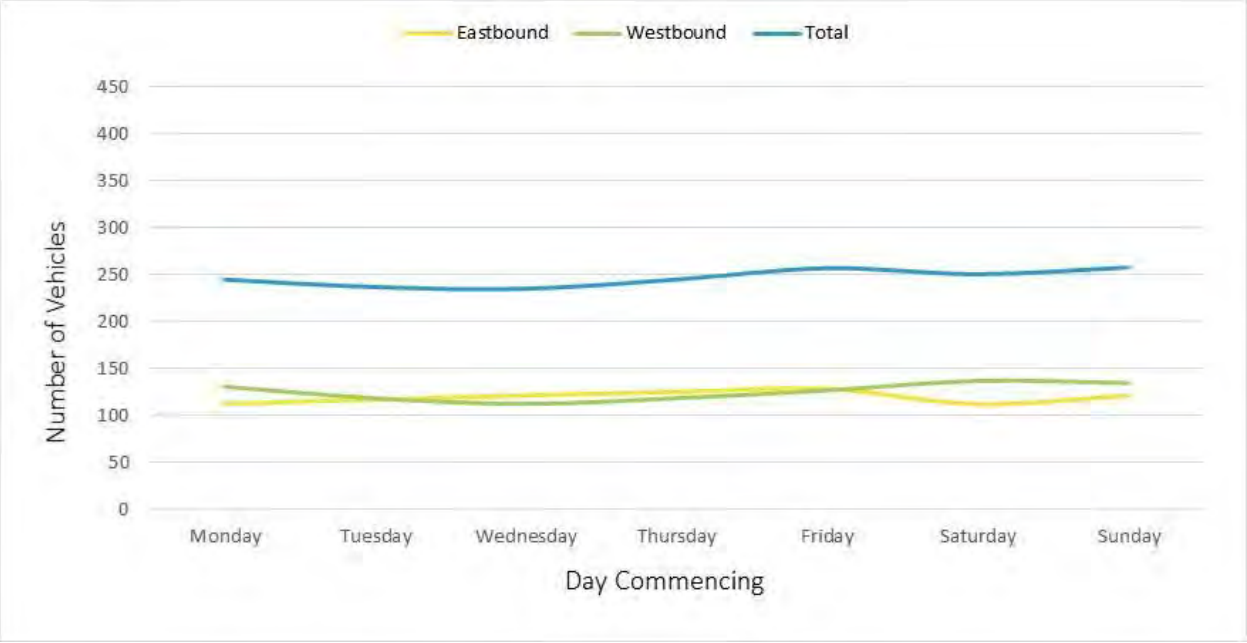
Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.15 Link Road, east of Kings Cross Road, Site 5 – Average Daily Volume During School Holiday Period



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.16 Link Road, east of Kings Cross Road, Site 5 – Average Daily Volume Post School Holiday Period

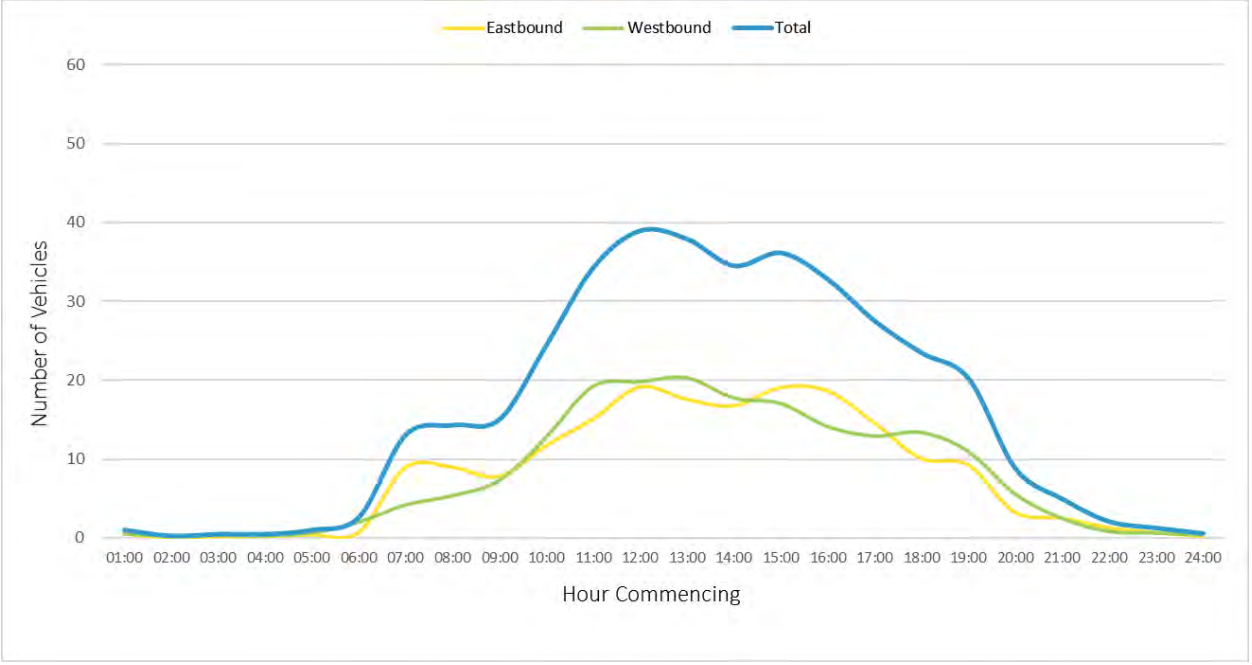


Source: CFE Information Technologies, modified by SCT Consulting; 2018

Comparison of **Figure 3.13** to **Figure 3.16** shows that the traffic volumes along Link Road are highest between Kings Cross Road and Snowy Mountains Highway with a peak flow of approximately 400 vehicles per day. West of Kings Cross Road, Link Road accommodates a peak daily flow of approximately 250 vehicles. This indicates that a large portion of this traffic utilises Link Road to access Kings Cross Road. The analysis also show that traffic flows are marginally higher during the school holiday period, with minimal fluctuations of traffic throughout the week.

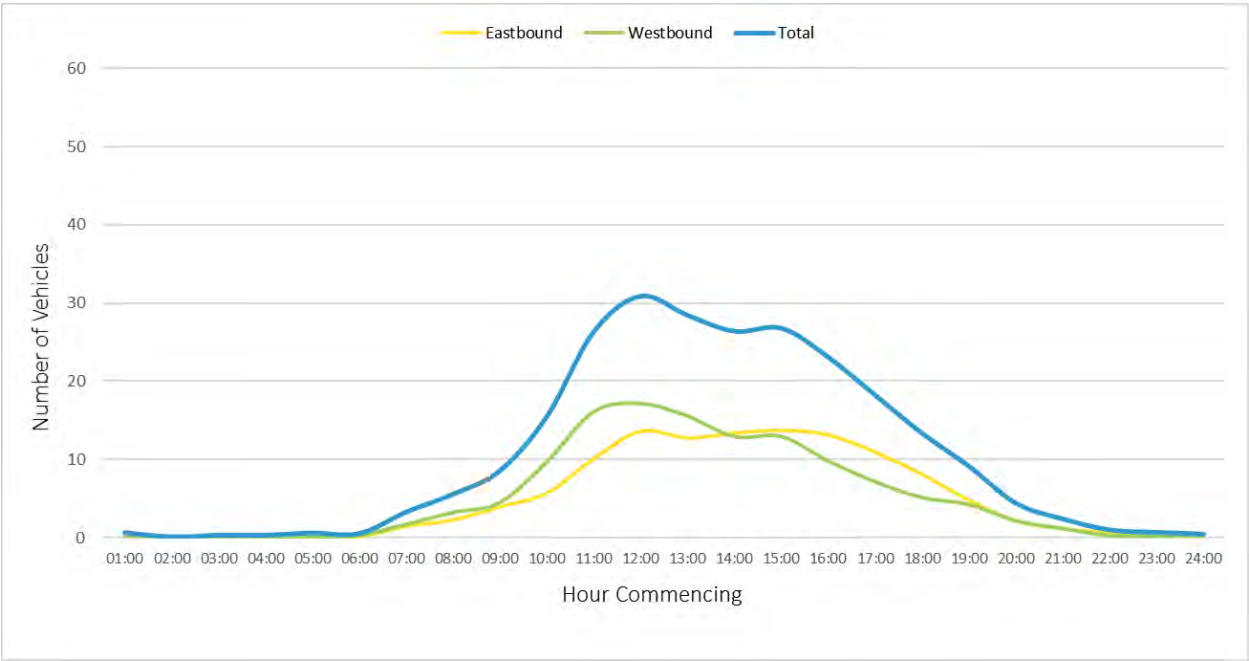
The hourly flow rates along Link Road, during the school holiday period, are shown in **Figure 3.17** and **Figure 3.18.**

Figure 3.17 Link Road, west of Kings Cross Road, Site 4, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.18 Link Road, west of Kings Cross Road, Site 5, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

On an hourly rate, traffic flows along Link Road do not exceed more than 40 vehicles per hour in both directions, a very low volume of traffic. This is expected given the lack of traffic generating development within the region.

3.3.3.3 Roadway LoS

Similar to Snowy Mountains Highway, Link Road is typical of a Class II rural highway that only functions to connect other Class II highways. As identified in **Figure 3.17** and **Figure 3.18**, traffic flows along Link Road are significantly lower than the Snowy Mountains Highway. Applying the previously identified conservative assessment of LoS, based on a Class I highway speed assessment, Link Road performs at LoS C for Site 4 and LoS D at Site 5. This is summarised in **Table 3.11**. It is noted that the survey location Site 5 is adjacent to a bend and as such is not reflective of the free flow speeds along the road.

Table 3.11 Link Road Average Travel Speed

Link Road	Site 4		Site 5	
	SB	NB	SB	NB
Signposted speed limit (km/hr)	80	80	80	80
Average Speed	76	75	62	74
85th Percentile Speed	86	87	72	84

Source: CFE Information Technologies, modified by SCT Consulting; 2018

As noted previously, bi-directional peak hour flows along Link Road is approximately 40 vehicles per hour, with a peak flow of 20 vehicles in each direction. This is considerably less than the theoretical capacity of a two-lane highway of 1,700 passenger cars per hour in each direction and is equivalent to a V/C ratio of 0.01. This would indicate no operational issues with current capacity demands. Traffic along Link Road is highly unlikely to reach the theoretical capacity volume given adjacent land uses, however, the comparison does provide a measurable indication of the current capacity characteristics of the road.

With the Selwyn Ski Resort accessible via Link Road, it is expected that traffic volumes may increase during the snow seasons, especially between Kings Cross Road and Snowy Mountains Highway. Assuming the same rate of increase as per Snowy Mountains Highway, a factor of 1.75, the increase in traffic volumes would not affect the operational LoS of C/D along Link Road.

3.3.3.4 Traffic Crashes

Between 2012 and 2017, there were four crashes reported at various locations along Link Road, all of which only involved a single vehicle. All four of these crashes were reported to have occurred whilst there was ice/snow or water on the road surface with no serious injury for those involved.

3.3.4 Miles Franklin Drive

3.3.4.1 Route Description

Miles Franklin Drive is a two-lane road that provides the main connection to the town of Talbingo, located approximately 2km west of Snowy Mountains Highway. The roadway also provides access to the Tumut 3 Power Station towards the terminus of Miles Franklin Drive. Between Talbingo and the Snowy Mountains Highway Miles Franklin Drive is signposted with a speed limit of 80km/hr, reducing to 60km/hr on approach to the town of Talbingo. Between the Tumut 3 Power Station and Talbingo the signposted speed limit increases to 100km/hr.

3.3.4.2 Existing traffic volumes and patterns

Table 3.12 provides a summary of the average daily traffic volumes for the two sites along Miles Franklin Drive for weekday and weekends. The volumes represented in **Table 3.12** do not include the school holiday period due to a lack of available data for this location. However, given the lack of land uses generating seasonal variations on the corridor this is an acceptable data sample. The location of Site 6 was positioned adjacent to Tumut 3 Power Station and is mainly reflective of associated traffic generation. This represents approximately 50 per cent of traffic surveyed adjacent to Miles Franklin Drive (Site 7). It is recognised that the remainder of the traffic volume is attributable to local traffic generated by Talbingo.

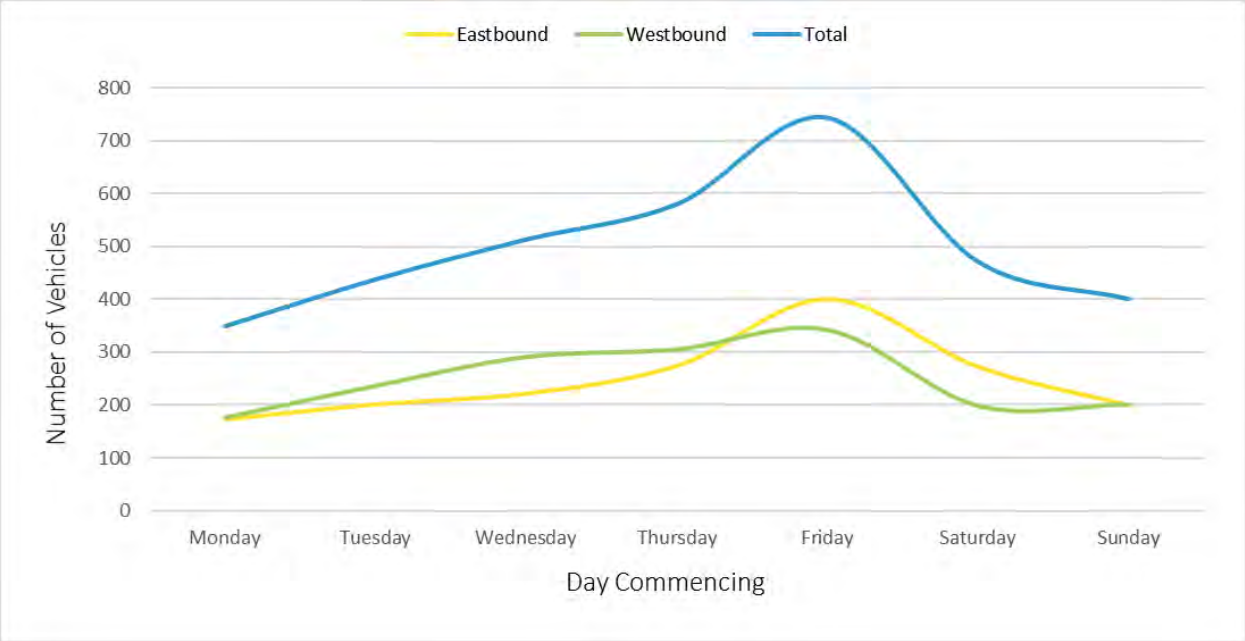
Table 3.12 Miles Franklin Drive Average Weekday Traffic (between March and April 2018)

Site	Period	Motorcycles	Light Vehicles	Heavy Vehicles
Site 6 - 500m West of the Snowy Mountains Highway	Weekday	11	470	44
	Weekend	7	381	47
Site 7 - Northwest of the Tumut 3 Power Station Switchyard	Weekday	5	200	20
	Weekend	4	158	15

Source: CFE Information Technologies, modified by SCT Consulting; 2018

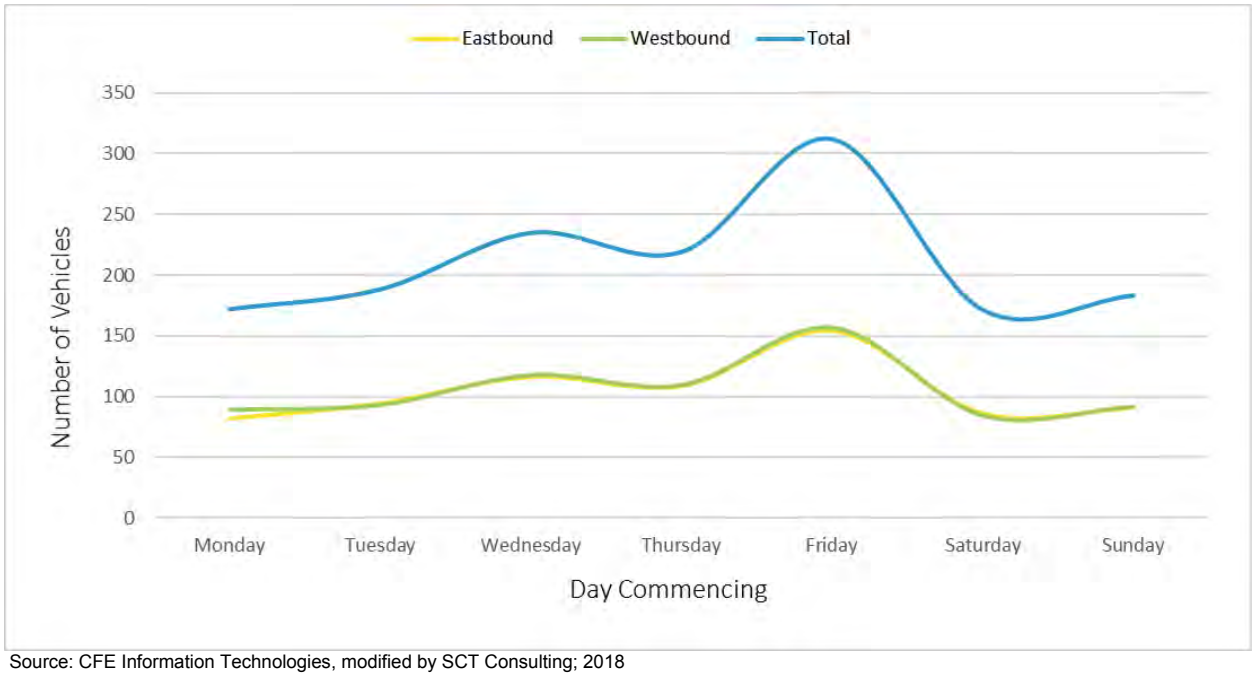
Based on the traffic surveys, detailed average daily volumes are summarised in **Figure 3.19** and **Figure 3.20**.

Figure 3.19 Miles Franklin Drive, 500m West of the Snowy Mountains Highway, Site 6 – Average Daily Volume



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.20 Miles Franklin Drive, 500m Northwest of the Tumut 3 Power Station, Site 7 – Average Daily Volume

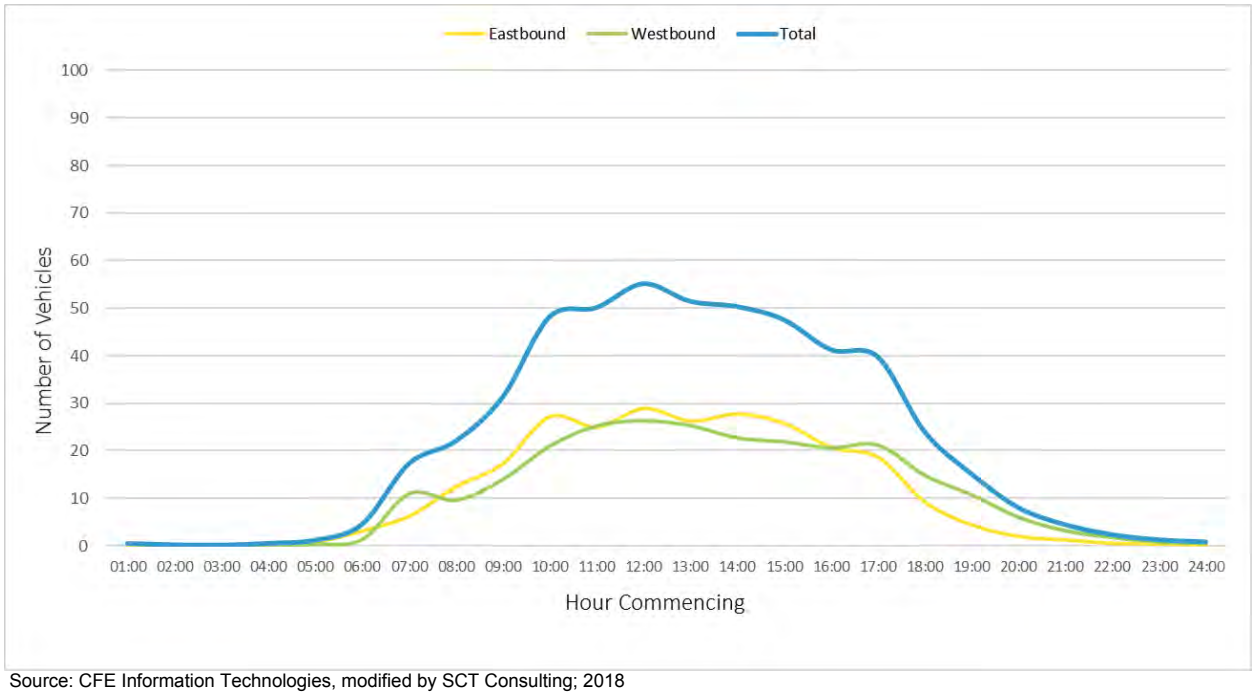


Source: CFE Information Technologies, modified by SCT Consulting; 2018

Based on **Figure 3.19** and **Figure 3.20**, traffic volumes on Miles Franklin Drive are greatest on a Friday, which is primarily driven by the traffic generated by Tumut 3 Power Station. The traffic profile for Site 7 shows an even distribution of daily eastbound and westbound flows, which is indicative of the industrial use of the Power Station.

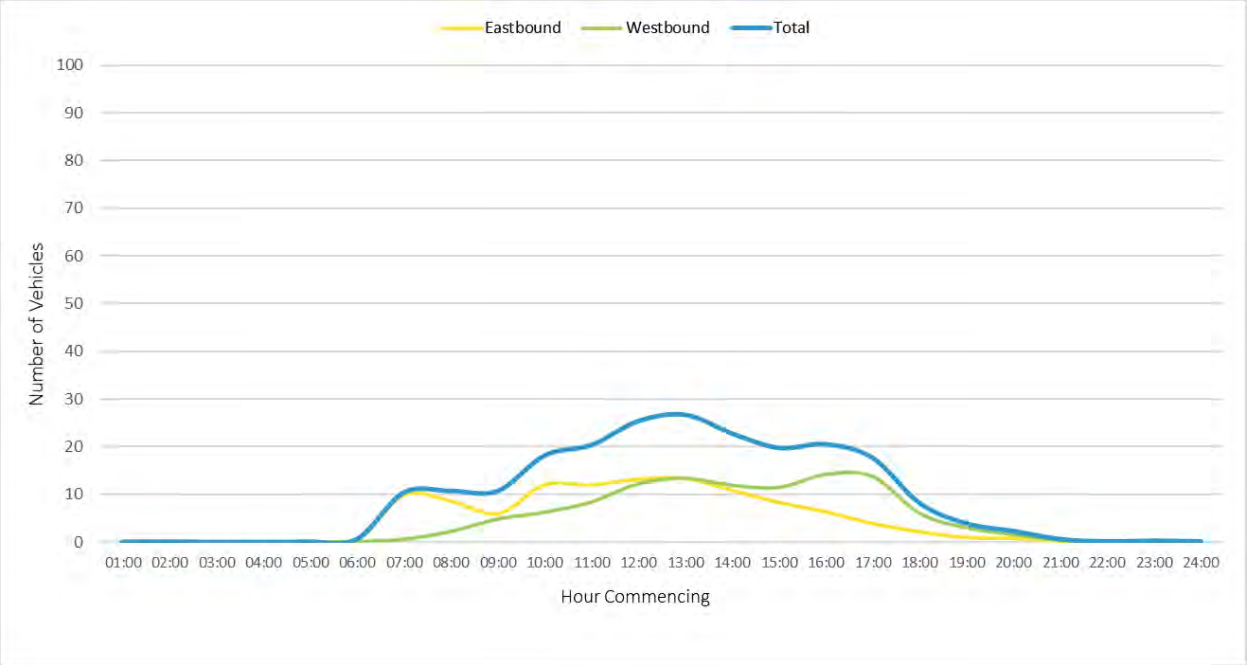
The hourly flow rates along Miles Franklin Drive are shown in **Figure 3.21** and **Figure 3.22**.

Figure 3.21 Miles Franklin Drive, 500m West of the Snowy Mountains Highway, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Figure 3.22 Miles Franklin Drive, 500m Northwest of the Tumut 3 Power Station Switchyard, Hourly Profile



Source: CFE Information Technologies, modified by SCT Consulting; 2018

Similar to the daily profile, the hourly flow rates show that traffic at Site 7 represents approximately 50 per cent of the traffic observed at Site 6. The peak flow does not exceed more than 60 vehicles per hour at both locations.

3.3.4.3 Roadway LoS

AUSTROADS does not provide any commentary on the performance measures of localised traffic corridors, however the Roads and Maritime Guide to Traffic Generating Developments (2002) identifies the environmental capacity performance standards on residential streets as summarised in **Table 3.13**.

Table 3.13 Environmental Capacity Performance Standards on Residential Streets

Road Class	Road Type	Maximum peak hour volume (veh/hr)
Local	Access Way	100
	Street	200 (environmental goal) | 300 maximum
Collector	Street	300 (environmental goal) | 500 maximum

Source: Guide to Traffic Generating Developments, Roads and Maritime Services; 2002

As identified in **Figure 3.21** and **Figure 3.22,** the maximum peak hour volume observed along Miles Franklin Drive was less than 60. This was recorded at Site 6 and is significantly lower than the environmental goal (300) identified for a collector road. As such it can be determined that the road currently functions within capacity at all times.

3.3.4.4 Traffic Crashes

Between 2017 and 2017, there has been two crashes reported on Miles Franklin Drive, both of which were non-casualty single vehicle crashes. One of which involved livestock on the road and other was due to the driver losing control of the vehicle on a bend.

3.3.5 Lobs Hole Ravine Road

3.3.5.1 Route Description

Lobs Hole Ravine Road spans from Snowy Mountains Highway, north of Yarrangobilly Cave, to Link Road to the south. The majority of the road is unpaved and is suitable for four-wheel drive vehicle only. The road provides

connection to many of the walking trails, camp grounds and lookout points within the KNP and functions mainly as a recreational road.

3.3.5.2 Existing traffic volumes and patterns

Table 3.14 provides a summary of the average daily traffic volume for the Lobs Hole Ravine Road for weekday and weekends. The summary shows that the daily traffic volumes for this road were very low throughout the survey period. The survey data is potentially inflated due to access from vehicles associated with the development of the Snowy 2.0 project.

Table 3.14 Lobs Hole Ravine Road Average Weekday Traffic

Site	Period	School Holiday Period (Before January 29th)			Outside of Holiday Period (Post January 29th)		
		Motorcycles	Light Vehicles	Heavy Vehicles	Motorcycles	Light Vehicles	Heavy Vehicles
Site 6	Weekday	0	16	2	1	23	4
	Weekend	1	21	1	3	25	4

Source: CFE Information Technologies, modified by SCT Consulting; 2018

3.3.5.3 Roadway LoS

Given the very limited traffic volume and characteristics of the road, the performance of Lobs Hole Ravine Road is unlikely to be a key factor in the determination of a LoS.

4.0 Potential Impact of Construction Traffic

4.1 Construction Staging

4.1.1 Overview

The Exploratory Works are proposed to be undertaken in multiple stages. The first stage is scheduled to begin in late 2018 with establishment of the site office, followed by:

– establishment of construction compounds

– mobilisation of site equipment

– clearance of tracks

– establishment of site tracks

– temporary creek crossings and

– works to establish the portal works.

The overall duration of all works is proposed to be undertaken over an estimated period of 34 months. During this period, there would be multiple vehicles accessing the site from the adjoining public road network as well circulating within the site boundary. In general, the majority of the traffic generated by the project would be limited to roads within the project site boundary. These do not require assessment as they are closed to the public for the duration of the construction period. However, heavy vehicles would be generated on the surrounding public road network during the mobilisation stages as well as for deliveries to the worksites.

Please refer to **Section 2.0** for a detailed overview of construction related activities.

4.2 Construction Traffic Volumes

The forecast monthly construction vehicle volume profile expected to access the site from the external road network is presented in **Figure 4.1**. **Table 4.1** identifies the peak hourly traffic generation, 44 vehicle movements, as being between 9-10AM.

Figure 4.1 Monthly Heavy Vehicle Traffic Generation

Source: Salini Impregilo, 2018, modified by SCT Consulting; 2018

As shown in **Figure 4.1**, peak heavy vehicle generation is forecast to occur on the sixth month of the project (June 2019). During this month, it is forecast 423 heavy vehicles would access the project site via the adjoining public roads. In order to assess the peak hour traffic generation of the project, the following assumptions are applied to the peak monthly forecast:

– 19 working days in June 2019 (including public holiday);

– All deliveries to / from site during AM period;

– Two light vehicles egress the construction site during peak hour;

– Heavy vehicles would consist of a mixture of rigid and articulated multi-axle types; and

– Lobs Hole Ravine Road will open at 8AM in June 2019 due to the time of sunrise (approx. 7:15AM) and required safety checks.

Based on these assumptions, the 423 heavy vehicles forecast for the peak month is distributed in the following hourly profile.

Table 4.1 Hourly Traffic Profile

Movement Type	Number of Movements
	9AM – 10AM
Number of movement to site (Mobilisation)	0
Number of movement from site (Mobilisation)	2
Number of movement to site (Deliveries)	20
Number of movement from site (Deliveries)	20
Number of light vehicle movements (to site)	0
Number of light vehicle movements (from site)	2
Total two-way movements	44

Source: EMM, 2018, modified by SCT Consulting; 2018

To provide clarity on the overall impact to the road network, an assessment has been undertaken for both outside of school holidays (June 2019) and, as a sensitivity test, the impact of construction in the event it extends beyond it's planned duration into the winter school holiday peak.

4.3 Construction and Staff Accommodation Compounds

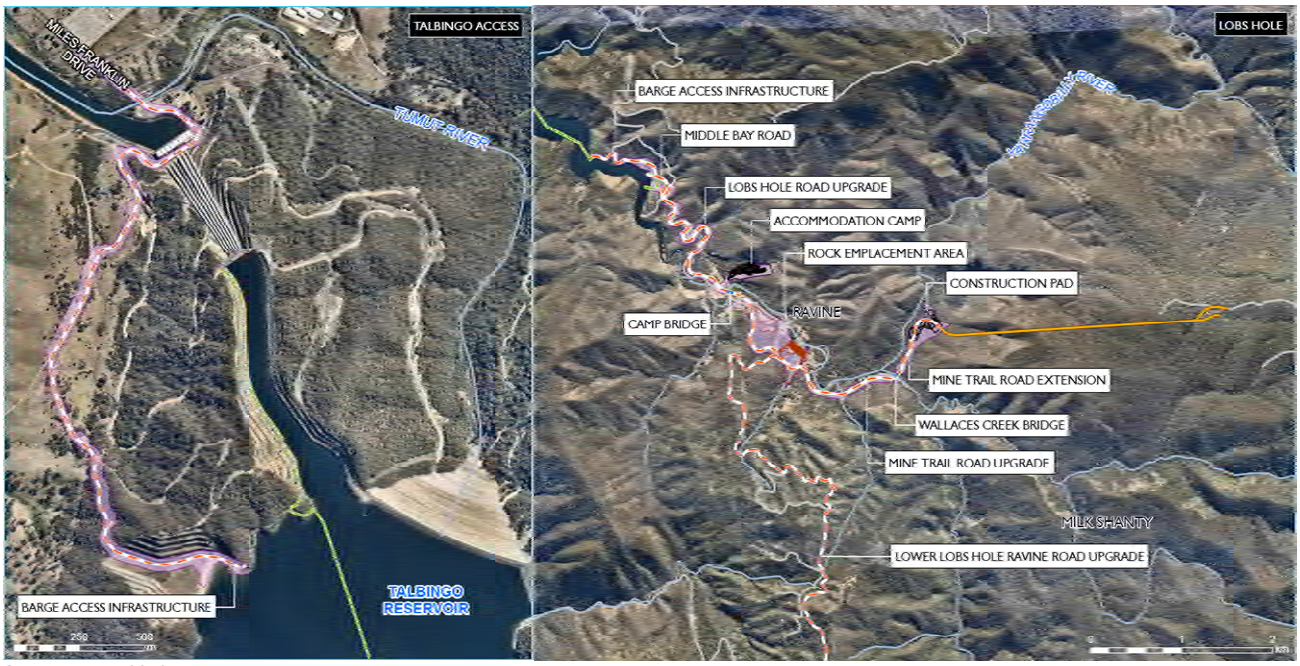
Currently there are no sealed access roads leading to the compounds shown in **Figure 2.4**. As such, as part of this project, numerous access roads, suitable for heavy vehicle access are proposed to be construction during the Site Track Establishment stage, as previously identified in **Section 2.6.1**, which would facilitate passing of two opposing heavy vehicles. During the construction stage, these roads would not be open to the public, and only construction related vehicles would be permitted to access the road between the compounds.

Table 2.1 identifies the proposed road network to be developed as part of the Exploratory Works project.

As shown in **Figure 2.7**, the main access to the construction compounds from the external road network is proposed via the Lobs Hole Ravine alignment joining onto Link Road. Beyond this intersection, all construction vehicles would access the wider road network via Snowy Mountains Highway**.**

A potential supplementary haulage route is also proposed via Talbingo Reservoir at Talbingo as shown in **Figure 4.2**. However, the Talbingo Barge option could be for limited for oversized equipment that are unsuitable for haulage along the Lower Hobs Hole Ravine Road. It is noted that the majority of delivery vehicles will accessLobs Hole via Lobs Hole Ravine Road.

Figure 4.2 Talbingo Reservoir Barge Option



Source: EMM, 2018

4.4 Construction Staff

Figure 4.3 displays the estimated monthly personnel numbers the project is expected generate throughout the 34 month duration of the project. As **Figure 4.3** shows the volume of labourers would peak at approximately 130 people from the tenth month of the project and maintain this level until the completion of the project. Similarly, specialist project staff would peak at approximately 130 people from the tenth month until completion.

Majority of the personnel engaged with the project is proposed to be sourced from outside of the region with approximately 10 per cent of the labour employed from the surrounding localities. It is proposed that all personnel involved with the project would be accommodated within the accommodation compound with transfers between their respective work sites during each shift. As such it is unlikely that construction staff would travel outside of the project sites to the external road network on a daily basis (in between shifts), given the remote remoteness of the location.

Figure 4.3 Project Monthly Personnel

Source: Salini Impregilo, 2018

4.5 Roadway LoS

As identified in **Section 4.1**, the maximum daily vehicle volumes generated on the external network is forecast to be 48 vehicles consisting of 22 heavy vehicles and 2 light vehicles daily, with occasional access by light vehicles from time to time. The impact of these additional traffic volumes on the existing road network are discussed in the following sections.

4.5.1 Snowy Mountains Highway

Deliveries to site along the Snowy Mountains Highway are proposed to occur along both beyond Tumut and Cooma, as identified in **Figure 2.7**, which would allow construction vehicles to access Snowy Mountains Highway both north and south of Link Road. However, to assess a worst-case scenario, it is assumed all construction vehicles would access the highway south of Link Road, which **Section 3.3.3** identified currently accommodates greater volumes. This worst case scenario identified is therefore the highest expected degree of impact for any route.

The resultant traffic volumes on flows along Snowy Mountains Highway for June 2019 are shown in **Table 4.2**.

Table 4.2 Snowy Mountains Highway Road Construction Traffic

Site	Time Period	Traffic Volumes					
		Motorcycles	Light Vehicles	Heavy Vehicles	Total	Total (PCU) (Refer to Table 3.4)	V/C ratio
Existing Conditions							
Site 1	12PM – 1PM*	3 | 2	23 | 29	3 | 2	29 | 33	33 | 36	0.02 | 0.02
	9AM – 10AM^	2 | 2	14 | 21	2 | 2	18 | 25	21 | 27	0.01 | 0.02
	9AM – 10AM# (July school holiday period)	0 | 0##	32 | 39	5 | 4	37 | 43	47 | 51	0.03 | 0.03
Peak Construction Period							
Site 1	9AM – 10AM^	2 | 2	16 | 21	24 | 22	42 | 45	86 | 85	0.05 | 0.05
	9AM – 10AM# (July school holiday period)	0 | 0##	34 | 39	37 | 34	61 | 63	112 | 109	0.07 | 0.06
Difference between existing peak period and construction peak		0 | 0	-7 | -8	21 | 20	13 | 12	54 | 49	0.03 | 0.03

Note: Southbound traffic volume | Northbound traffic volume

* = Network traffic volumes during overall peak period

^ = Network traffic volumes during construction traffic peak period

= Network traffic volumes during construction traffic peak period in July school holidays (estimate)

= Assume no motorcycles during snow season

Source: CFE Information Technologies, modified by SCT Consulting; 2018

Table 4.2 shows that the total traffic volumes, during the peak construction phase between 9-10AM, represent an increase of 25 vehicles (13 southbound and 12 northbound) over the existing network peak hour volumes (12-1PM) along Snowy Mountains Highway. The forecast volumes assume no background traffic growth in the region, given the remote nature of the region and lack of traffic generating land uses.

The majority of construction vehicles will be heavy vehicles and, if an equivalent PCU factor of 2.9 is applied for the heavy vehicles to represent an average articulated heavy vehicle (refer to Table 3.4), this corresponds to an increase of 54 PCUs in the southbound direction of travel and 49 PCUs in the northbound direction. This equates to a V/C ratio increase of 0.05 in both directions of travel, which as identified in **Table 3.5** falls well within the LoS A criteria. Such a nominal increase in PCUs over an hour is unlikely to affect the travel speeds of vehicles along the corridor. There may be occasional access by light vehicles throughout the project duration, however these would not be on a regular basis and would only occur occasionally and would not impact on the forecast V/C ratio.

Between Cooma and Link Road there are numerous reverse bends and gradient changes which could impact travel speeds of heavy vehicles and any following traffic. The potential for reduced areas of travel speed are expected to be limited only these segments, where there are no overtaking lanes and solid divided centre lines. It is, however, highly probable that the average travel speeds along the entirety of Snowy Mountains Highway would remain at existing performance level of LoS A or similar.

It is estimated that during the snow season, the background hourly flows between 9-10AM would increase to 61 vehicles in a southbound direction of travel and 63 in the northbound direction. As identified in **Table 4.2**, the addition of the construction vehicles during this period would not result in any excessive increase of the V/C ratio and is well within the capacity of a two lane highway, as identified in **Section 3.3.2**. This suggests an operating LoS of A will remain, as identified in **Section 3.3.3.3**.

4.5.2 Link Road

All deliveries must travel on Link Road to access Lobs Hole Ravine Road, as identified in **Figure 2.7**. Traffic volumes on Link Road for the peak construction period of June 2019 are summarised in **Table 4.3**. Site 4 is the chosen survey location for Link Road as it accommodates the greatest volumes on the corridor.

Table 4.3 Link Road Construction Traffic

Site	Time Period	Traffic Volumes					
		Motorcycles	Light Vehicles	Heavy Vehicles	Total	Total (PCU) (Refer Table 3.4)	V/C ratio
Existing Conditions							
Site 4	12PM – 1PM*	1 | 2	14 | 16	2 | 2	17 | 20	19 | 22	0.01 | 0.01
	9AM – 10AM^	1 | 2	10 | 9	1 | 2	12 | 13	13 | 15	0.01 | 0.01
	9AM – 10AM# (July school holiday period)	0 | 0##	18 | 16	2 | 4	20 | 20	22 | 24	0.01 | 0.02
Peak Construction Period							
Site 4	9AM – 10AM^	1 | 2	12 | 9	23 | 22	36 | 33	79 | 73	0.05 | 0.04
	9AM – 10AM# (July school holiday period)	0 | 0##	20 | 16	24 | 24	44 | 40	90 | 86	0.05 | 0.05
Difference between existing peak period and construction peak		0 | 0	-2 | -7	21 | 20	19 | 13	59 | 50	0.03 | 0.03

Note: Eastbound traffic volume | Westbound traffic volume

* = Network traffic volumes during overall peak period

^ = Network traffic volumes during construction traffic peak period

= Network traffic volumes during construction traffic peak period in July school holidays (estimate)

= Assume no motorcycles during snow season

Source: CFE Information Technologies, modified by SCT Consulting; 2018

Table 4.3 shows that the traffic volumes during the peak construction movement period between 9-10AM would increase by a total of 32 vehicles (19 eastbound and 13 westbound), along Link Road, when compared to the existing peak period between 12-1PM. Given such low hourly traffic volumes it is highly unlikely travel speeds along Link Road would alter due to the increased construction traffic volumes associated with Exploratory Works. This would result in the existing LoS C performance at Site 4 being retained.

As noted previously the majority of construction vehicles are heavy vehicles. Applying the PCU factor (2.9) for heavy vehicles (refer to **Table 3.4**) would be equivalent to a maximum flow increase of 59 PCUs in the eastbound direction of travel and 50 PCUs in the westbound direction, when compared to existing peak hourly volumes. It is highly unlikely that the average speeds would be affected given the nominal increase in traffic over the hour across the existing low baseline, given that the maximum V/C ratio is 0.05, which is well within the maximum ratios for LoS A identified in **Section 3.3.2**.

It is estimated that during the snow season, the hourly flows between 9-10AM would increase to 90 PCUs eastbound and 86 PCUs westbound. As identified in **Table 4.3**, the addition of construction vehicles during this period does not result in any noticeable increase of the V/C ratio and is well within the capacity of a two lane highway, as identified in **Section 3.3.2**. This suggests an operating LoS of C would remain, as identified in **Section 3.3.4.3**.

4.5.3 Miles Franklin Drive

Construction vehicle movements along Miles Franklin Drive would only deliver oversized equipment and materials. It is not foreseen that this would be a regular hourly occurrence that would impact the operational performance of the road.

Therefore, it is forecast that the existing operational performance of Miles Franklin Drive would be maintained for the duration of the project.

4.5.4 Construction Site Internal Road Network

Traffic access to the following internal construction site access roads are all proposed to be restricted to construction vehicles only for the duration of the project:

– Upper Lobs Hole Ravine Road / Lower Lobs Hole Ravine Road (Lobs Hole Ravine Road;

– Mine Trail Road;

– Middle Bay Wharf access road; and

– Talbingo Reservoir access road.

As described in **Table 2.1**, all these roads are proposed to be upgraded to facilitate the movement of heavy vehicles required for Exploratory Works. As part of the design, the internal road network would be designed to minimise any delays of construction vehicle operations.

Given the remoteness of the remoteness of these from the external public road network, it is highly improbable that the operation of the internal road network would impact the performance of Link Road or Snowy Mountains Highway.

4.6 Public Transport

As identified in **Section 3.2.2**, there are no regular mass transport systems currently in operation within the vicinity of Exploratory Works. No impact will result from construction activities associated with Exploratory Works.

4.7 Walking and Cycling

Throughout the Exploratory Works Lobs Hole Ravine Road will be closed to the public as will Lobs Hole itself. However, some limited access will be available to Talbingo Reservoir to maintain public access to recreational use of the reservoir wherever possible. Access during Exploratory Works is the subject of ongoing consultation with NPWS. The closures will effect existing walking and mountain bike trails adjoining Lobs Hole Ravine Road. Although there is no alternative access proposed for the sites within the project area, there are numerous walking and cycle tracks within the KNP that visitors to the region may continue to access as shown previously in **Figure 3.1**.

4.8 Traffic Crashes

The increase in traffic volumes due to Exploratory Works is unlikely to affect the incidence of traffic crashes observed along Snowy Mountains Highway, Link Road and Miles Franklin Drive. As identified in **Section 3.3**, the majority of crashes observed in the vicinity of the project area were single vehicle accidents resulting from motorists losing control of their vehicle due to the surface conditions or road alignment. These types of crashes result from many factors that can be considered as contributing factors to the crash such as:

– travel speed;

– driver awareness/fatigue;

– familiarity of the road; and

– alcohol/drugs.

4.9 Emergency Vehicles

Access for emergency vehicles will be unaffected as there are no plans to close any of the roads to emergency vehicles. During upgrades of the internal roads, unhindered access will be available and maintained for emergency vehicles at all times. In addition, consultations with emergency service providers would be required as part of the finalisation of the Construction Traffic Management Plan of the project.

5.0 Mitigation Measures

5.1 Oversized Vehicle Movements

There will be instances where oversized deliveries will be necessary, especially in and around the Talbingo barge access. As oversized movements can cause disruptions to the existing traffic, especially within the township of Talbingo, it will be necessary for these movements to occur during the off-peak hours where traffic volumes are typically at their minimum. In addition, notification would be given to the road authority and local community prior to the oversized vehicle movements occurring.

5.2 Road Maintenance

Upon confirmation of the haulage route(s) for construction vehicles associated with Exploratory Works, and prior to construction commencing, an independent and qualified expert should survey and prepare a Road Dilapidation Report. The report would assess the current condition of the road surfaces the construction vehicles would traverse, including the external road network, and describe mechanisms to restore any damage that may result due to its use by traffic and transport related to the project.

The Road Dilapidation Report will be submitted to the relevant road authority for review prior to the commencement of heavy vehicle movements. Following completion of construction, a subsequent survey and report will be prepared to assess any damage to the roads accessed by all Exploratory Works heavy vehicles, that may have resulted from the project. Consideration of damage caused during the Exploratory Works phase by construction vehicles, that requires repairs to ensure network safety and efficiency, should also be addressed by the applicant.

In addition, routine defect identification and rectification of the newly constructed internal road network will be managed as part of the project maintenance procedure. Once appropriate vehicle type and size for construction are determined the internal access roads, including Lobs Hole Ravine Road, will be design in accordance with the relevant vehicle loading requirements to ensure maintenance in accordance with the requirements of the local road authority.

5.3 Signage

During Exploratory Works, if there are changes to the traffic conditions, appropriate signage will be installed in accordance with the following documentation:

– Traffic Control Device for Works on Roads (AS1742.3; 2009)

– Traffic Control at Work Sites (Roads and Maritime Services; 2010)

The aim of the relevant signage is to warn motorists and road users of the presence of construction vehicles as well as changes to normal traffic conditions.

5.4 Time of Travel

Standard hours of operation of heavy vehicles on adjoining public roads will observe the industry standard hours between the hours of 7am to 6pm during weekdays, excluding Lobs Hole Ravine Road where it has been assumed that no heavy vehicle movements will occur before 8AM. The majority of heavy vehicle operations on roads will occur during the standard working hours except for cases where there are oversized transfers or cold concrete pours, in which case movements will occur outside of the hours stated.

5.5 Traffic Control

During the initial stages of the project, where minor works (surface resealing works) may be required at the intersection of Link Road and Lobs Hole Ravine Road, the work may require the temporary occupation of lanes for road opening and resealing. For such cases where lanes may need occupation, traffic control measures specified in AS1742-2002 (e.g. signage, traffic controllers and speed limits) will be adhered to ensure safety and to warn road users in advance of the change in traffic conditions. In such cases, works requiring lane occupancy on Roads and Maritime or council classified roads will be commenced upon receipt of a Road Occupancy Licence.

5.6 Community Consultation

All affected communities, visitors and emergency services must be notified in advance of any disruptions to traffic and restriction of access to areas of KNP impacted by project activities. The methods of notification vary, but may include:

– driver warning signs;

– variable message signs;

– web notifications, such as Mount Kosciuszko visitor and national park websites; and

– public notices in local publications.

Throughout Exploratory Works, project newsletters will be prepared and distributed to residents and business within Talbingo of updates on the project and the current stage of the construction to inform on changes, if any, are expected within the local road network.

In addition, communication strategies will be established to allow communication between the project and community. . A communication strategy is to be developed in conjunction with the Construction Traffic Management Plan to detail the methodology, frequency and response measures in relaying information to the community and ameliorating any community concerns.

5.7 Construction Site Identification

The construction site would be easily identifiable and clearly secured from the public, especially at the Link Road access, with clear warning and advisory in place to warn motorists from entering the site and secure fencing will be erected to prevent unauthorised entry outside of standard working hours.

5.8 Vehicle Movements

All vehicles should exit the site in a forward movement and with heavy vehicle wheels free of soil to prevent soil being dispersed on the roads to minimise road traction loss incidents. Works vehicles entering the public roadway from the site should, at all times, observe the road rules and not place any road users in danger.

In addition, safety measures should be in place within the construction site so that heavy vehicle movements are conducted in a safe manner without any risk to workers on the ground or other machine operators.

All delivery drivers are to be inducted on the safe protocols to be followed within the site as well as on the public roads during deliveries, with reinforcements to observe the road signages including the posted speed limits as well as advisory speed signs along Snowy Mountains Highway, especially south of Miles Franklin Drive where there has been a concentration of sixcrashes reported along the winding section of the highway, as identified in **Section 3.3.3.4**.

5.9 Construction Traffic Management Plan

As part of the conditions of any approvals, a Construction Traffic Management Plan (CTMP) would be prepared as part of the Construction Environmental Management Plan (CEMP). The CTMP would include the guidelines, general requirements and procedures to be used when construction activities would have a potential impact on existing traffic arrangements. Implementation of the measures in the CTMP would ensure that delays and disruptions are managed with appropriate measures and identify / respond to any changes in road safety as a result of construction works.

The CTMP would be submitted in stages to reflect the progress of work and would include:

– signage requirements (e.g. temporary speed restrictions, changes to the road environment, traffic management controls deployed).

– lane possession and approval process during periods of online construction (e.g. linemarking and temporary barriers).

– traffic control devices such as temporary traffic signals.

– a communications strategy which would include methods to provide advanced notice of any major or prolonged impacts (e.g. leaflets and local media), and real-time information regarding current impacts (e.g. variable message signs, radio traffic news).The strategy is to discuss the establishment of a project hotline where the community can query the project or report any traffic or safety concerns and discuss the methodologies of investigating and responding to the queries.

Some of the principles the CTMP would encompass would include:

– to minimise the potential effects of any major sources of delay, any works which would significantly reduce the performance of the road network in the project area would be scheduled for periods of typically lower traffic volumes where possible e.g. avoid peak snow seasons.

– signage would be used to clearly indicate the traffic controls in use; this could also include temporary speed restrictions and passing constraints if required to maintain road safety levels. In some instances, lane closures would be implemented to remove road traffic from construction zones altogether. Where practical, this would occur outside of peak periods to maintain peak period network capacity.

The CTMP would be developed in consultation with the emergency services to ensure that procedures are in place to maintain safe, priority access for emergency vehicles through construction zones. Additionally, the CTMP would be prepared in close consultation with emergency services with a view to planning and executing the works to minimise any impact of the works on their ability to respond to an incident, when possible.

Overall, the CTMP would set out the strategy and procedures to minimise, mitigate and communicate the impacts of the construction of the project on the capacity, performance and safety of the local road network and traffic systems. The CTMP would also address the management of impacts on all existing road users.

6.0 Summary

Snowy 2.0 is a large scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Scheme. Exploratory Works are required to further understand the viability of the project and comprise:

– the establishment of an exploratory tunnel to the site of the underground power station for Snowy 2.0, portal and construction pad;

– the establishment of a construction compound;

– excavated rock management, including subaqueous disposal within Talbingo Reservoir;

– the establishment of an accommodation camp;

– road establishment and upgrades providing access to the proposed construction areas;

– establishment of barge access infrastructure on Talbingo Reservoir; and

– supporting power and communication.

Construction traffic volumes associated with the above activities are centred on the internal operation of the construction site and as such will not impact the surrounding state and local road network, however, mobilisation and delivery heavy vehicles movements will still be required to access the site, via Lobs Hole Ravine Road, throughout the construction period. Analysis indicates that the peak hour for construction vehicle movements is expected to occur between 9AM-10AM. This is outside the network peak of 12PM-1PM and as a result further reduces the impact on the surrounding road network which is characterised by low traffic volumes, large degrees of spare capacity and strong LoS performance results. A total of 44 movements from 24 vehicles is forecast.

Haulage routes will originate from either Tumut or Cooma and take into consideration the Snowy Mountains Highway and Link Road. Miles Franklin Drive, whilst part of the study extent, will not be used regularly by construction vehicles associated with the proposal.

The impact of construction traffic on the LoS, capacity, road safety and emergency vehicle usage of these roads was found to be negligible. A sensitivity test was undertaken for the July school holiday period to provide a worst case assumption of the peak construction period extending into school holidays. This assessment indicates no change to the initial findings that no significant impact is expected.

Mitigation options for the proposal are minor and include:

– community consultation;

– construction site identification and vehicle egress management;

– preparing CTMPs with associated documentation on signage and traffic control;

– road dilapidation and maintenance;

– time of day and oversize vehicle operating restrictions; and

– communication channels to reach individuals impacted by the closure of walking and cycling trails within the site boundary. Many paths remain open for these uses outside of this area.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