APPENDICES

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Traffic impact assessment

OVEN MOUNTAIN PUMPED HYDRO STORAGE

EMM creating opportunities

Oven Mountain Pumped Hydro Energy Storage Project

Traffic Impact Assessment

Prepared for OMPS Pty Ltd

March 2023

Oven Mountain Pumped Hydro Energy Storage Project

Traffic Impact Assessment

OMPS Pty Ltd

J210465 OMPS EIS - TIA

March 2023

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Executive Summary

EMM Consulting (EMM) has been engaged by OMPS Pty Ltd (OMPS) to undertake a Traffic Impact Assessment (TIA) for the proposed Oven Mountain Pumped Hydro Energy Storage Project (the Project) at Carrai, NSW. The Project involves construction of a pumped storage hydropower plant generating and/or consuming 600 to 900 MW of electricity to and from the national grid with a capacity of 8 to 12 hours of storage. The Project will include upper and lower water reservoirs constructed on an ephemeral tributary of the Macleay River, near Georges Junction, and will operate as a closed-loop circuit. An underground tunnel will connect the upper and lower reservoirs via a hydro-electric power station.

A comprehensive traffic assessment was completed for this report which primarily addresses the construction of the Project, to be completed in multiple stages over a period of 5 years (Section 6.1.3). In preparation of this report, stakeholder consultation has been undertaken on a regular basis and stakeholder comments have been addressed (Sections 1.6, 1.7, 1.8 and Chapter 3).

The construction workforce numbers will vary across the multiple construction stages. At its peak, there is expected to be over 600 workers on site undertaking various construction activities (Figure 6.1). Due to the remote location of the site, the majority of the construction workers are expected to live locally within the construction accommodation camps. The workers will be transported primarily by shuttle buses; however, some workers are expected to drive individually. Construction work will occur 24/7.

The construction related traffic generation will also fluctuate at various stages. At its peak, there is expected to be over 200 daily light and heavy vehicles which will access the site via Kempsey Armidale Road. The majority of the construction related vehicles, including Over Size Over Mass (OSOM) vehicles, will be to/from Kempsey. The traffic generation and distribution as part of this Project is depicted in Sections 6.1.5, 6.2 and 6.3. The longest construction related vehicles, apart from OSOM vehicles, are expected to be 19 m semi-trailers.

A separate OSOM vehicle assessment has been undertaken by another consultant. The OSOM report is attached in Attachment D. Furthermore, a Road Safety Audit (RSA) has been conducted by an independent Road Safety Auditor. The RSA report is attached in Attachment C. The key findings of these reports are collated and EMM's recommendations are included in Chapter 8 of this report.

In total three site accesses are proposed as part of the Project, all from Kempsey Armidale Road and located within the Armidale Regional Council area. The site access locations and internal roads are described in Section 2.4.

Kempsey Armidale Road is a council controlled Local Road, which is undergoing reclassification to a Regional Road by the Independent Panel for NSW Road Classification Review and Transfer (February 2021)[1]. There are various sealed and unsealed sections of the road with varying road widths. In many sections there are no specific speed limits but generally in a rural area the default speed limit is 100 km/h, although at some sections (e.g. at the bends) this speed limit is unrealistic.

As part of preparation of this traffic impact assessment report, a site inspection has been conducted by an EMM Traffic Engineer. The site inspection has identified a number of key constraints along Kempsey Armidale Road and the haulage route which are summarised below, and in Chapter 4 of this report.

[1] https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/54d4abb96152c8da8c05020ebede1dc8b4ebf1de/original/1632175001/352f6e379a5aba925819ab5a9ae4a833_Independent_Panel_Road_Classification_Review_and_Transfer_Interim_Report_FINAL_170221.pdf

Key constraints on Kempsey Armidale Road:

- some sections narrow/winding, blind corners, no protection on the downhill side
- environmental constraints – dust, fog, rockfall, sun glare, slippery surface, potholes
- other constraints – unknown bridge/culvert capacities, load limit restrictions, recreational motorbikes, existing concealed driveways.

Key constraints along the haulage routes:

- overgrown vegetation, faded line marking
- three schools from Kempsey (North Street, Willawarrin and Bellbrook)
- one level crossing along the haulage route from Kempsey (Second Lane).

Currently Kempsey Armidale Road is being reinstated under an emergency funding program by both Kempsey Shire Council (KSC) and ARC at various sections due to damage (Section 4.1). The road reinstatement work will be undertaken over a number of years, which may coincide with OMPS construction. As such, necessary coordination and liaison would be required with both KSC and ARC so that the upcoming road works are planned and organised in such a way that it will have minimal impact to general and construction related traffic.

A risk assessment has been undertaken as part of the Road Safety Audit. The relevant traffic and road related risks and its necessary mitigation measures are outlined in Section 7.9 of this report.

For the traffic assessment, tube count data are obtained from both Kempsey Shire Council (KSC) and Armidale Regional Council (ARC). Furthermore, Transport for NSW (TfNSW) traffic volumes have been reviewed. In addition, a total of five intersections which are strategically located have been surveyed and modelled by SIDRA program as part of this Project to determine the capacity of these intersections with the construction related vehicles. The traffic data analysis is presented in Section 5.4 of this report. As the construction of this Project will take place over many years, the traffic assessment has considered the worst case scenario, which is the maximum traffic generated by the site.

Traffic volumes are expected to significantly decrease during operations compared to construction related traffic. The Project life is expected to be in excess of 100 years and may be extended. It is anticipated that the traffic generation during the decommissioning stage will be lower compared to the construction period. Any cumulative traffic impacts in that timeframe is currently unknown. Therefore, a separate traffic assessment for the decommissioning stage is not considered necessary at this stage.

The mitigation measures are described in Chapter 8. A detailed Construction Traffic Management Plan (CTMP) will be prepared by the construction contractor, which would detail mitigation measures required along the Kempsey Armidale Road at sections including Pee Dee Creek, Five Day Creek, McGees Flat and Smiths Bluff. The CTMP will detail the traffic control measures, especially the narrow sections of Kempsey Armidale Road, where two-way traffic will not be feasible. Some localised widening at sections along Kempsey Armidale Road between Pee Dee Creek and Pee Dee Road, O'Sullivan's Gap, Blackbird Flat, McGees Flat, Smiths Bluff may be required. The road widenings, if required, are to be designed and approved for delivery by the relevant councils and funded by the Project.

Some existing road safety hazards are to be investigated and eliminated by the relevant road authorities e.g. roadside vegetation, line marking etc. Before any haulage traffic takes place along Kempsey Armidale Road, the existing bridge and culvert capacities need to be investigated and confirmed by the relevant authorities.

A detailed signage plan needs to be prepared to alert motorists about the potential hazards along Kempsey Armidale Road. The speed limit along some critical sections needs to be investigated and appropriate warning signs need to be installed. Section 8.2 of this report outlines some useful signage which could be used to minimise risks.

Due to the challenging road terrain, it is imperative to implement a 'Drivers Code of Conduct' and enforce some rules and regulations that the construction related drivers must follow. A draft CTMP, along with community complaint procedure, is documented in Chapter 9 of this report.

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Abbreviations

TIA	Traffic Impact Assessment
CTMP	Construction Traffic and Management Plan
ARC	Armidale Regional Council
AS	Australian Standard
CSSI	Critical State Significant Infrastructure
DEL	Average Delay
DOS	Degree of Saturation
DP	Deposited Plan
EAR	Eastern Access Road
KSC	Kempsey Shire Council
LGA	local government area
LOS	Level of Service
Q95	95% queue lengths
LT	Left Turn
RT	Right Turn
TH	Through Movement
m	metres
km	kilometre
NHVR	National Heavy Vehicle Regulator
Project	Oven Mountain Pumped Hydro Energy Storage Project
RMS	NSW Roads and Maritime Services, now TfNSW
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
TCP	Traffic Control Plan
TfNSW	Transport for New South Wales
vph	vehicles per hour
OSOM	Over Size Over Mass

1 Introduction

1.1 The Project

OMPS Pty Ltd (OMPS) is proposing to develop the Oven Mountain Pumped Hydro Energy Storage Project (the Project), an off-river pumped hydro energy storage system (referred to as the 'pumped hydro system') located approximately half-way between Kempsey and Armidale, adjacent to the Macleay River in northern NSW. The Project is located within the New England Renewable Energy Zone (REZ) and the Armidale Regional Local Government Area (LGA), proximate to its border with Kempsey Shire LGA.

Figure 1.1 and Figure 1.2 provide the regional and local context of the Project respectively.

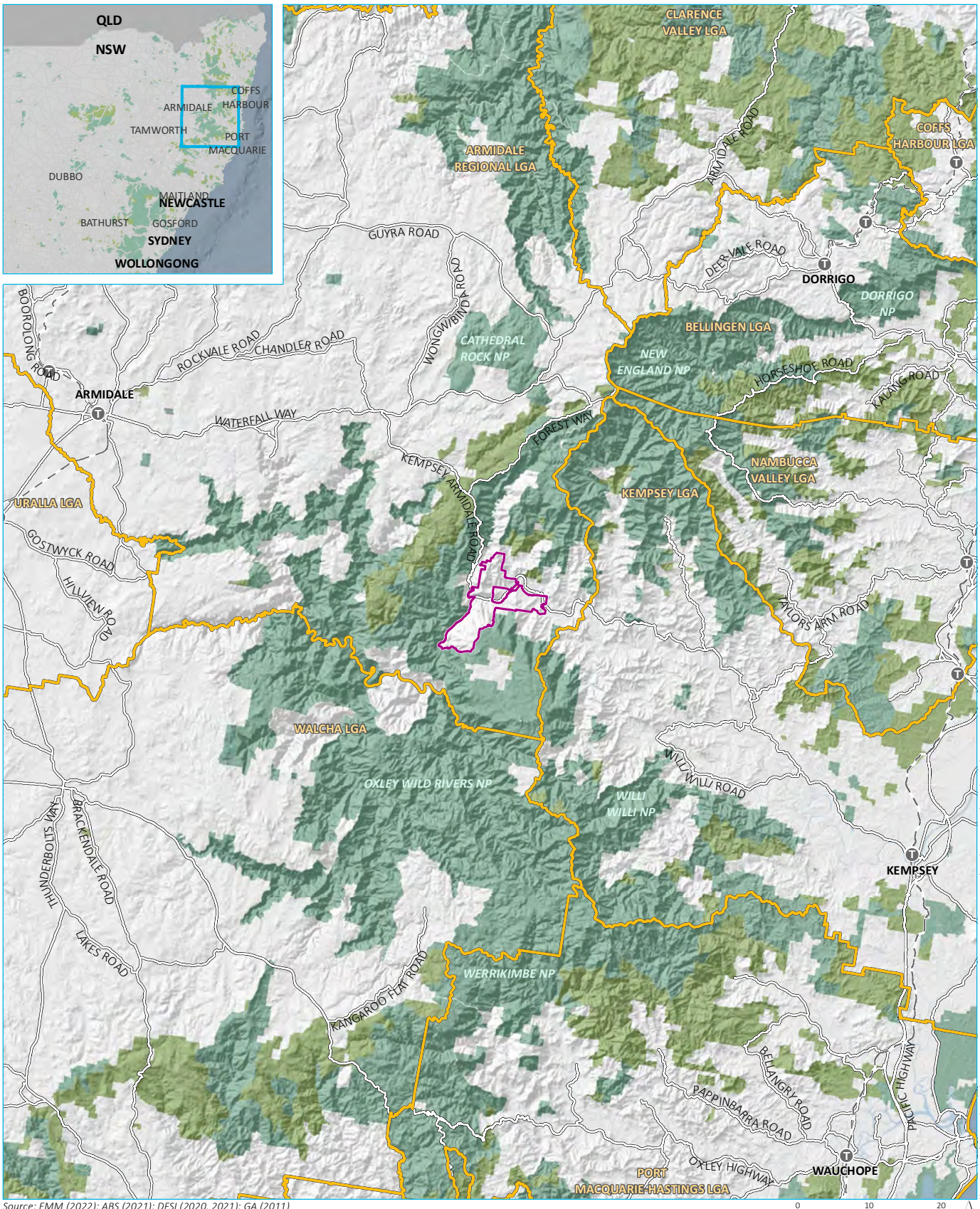
At a basic level, the Project will consist of upper and lower water reservoirs and an underground waterway connecting them via a hydro-electric power station.

The Project has been declared by the New South Wales (NSW) Government to be critical State significant infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Infrastructure Projects are declared to be CSSI if, in the opinion of the NSW Minister for Planning, they are essential to the State for economic, environmental, or social reasons. By providing up to 900 MW of electricity generating capacity, the Project will aid in the transition of the NEM towards cleaner, more reliable and affordable electricity. It will also provide up to between eight and 12 hours of dispatchable energy at full generation to be stored and made available to the National Electricity Market (NEM) through the New England REZ. The expected operational lifespan of the Project is in excess of 100 years.

The Project will utilise the highly favourable natural terrain of the site on which it sits to allow electrical energy from the main grid to be stored by pumping water from the lower reservoir to the upper reservoir. Energy can then be generated when needed by allowing water to flow back down to the lower dam and reservoir via the hydro-electric power station, effectively enabling the Project to act as a large battery.

1.2 Proponent

OMPS (ABN 22 160 259 174) is developing the Project and is located in Kempsey at 2/28 Clyde Street, Kempsey NSW 2440.



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Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011)

0 10 20 km

GDA 1994 MGA Zone 56

N

KEY

- Project area
- Major road
- Train station
- Rail line
- Major road
- Named waterbody
- Local government area
- NPWS reserve
- State forest

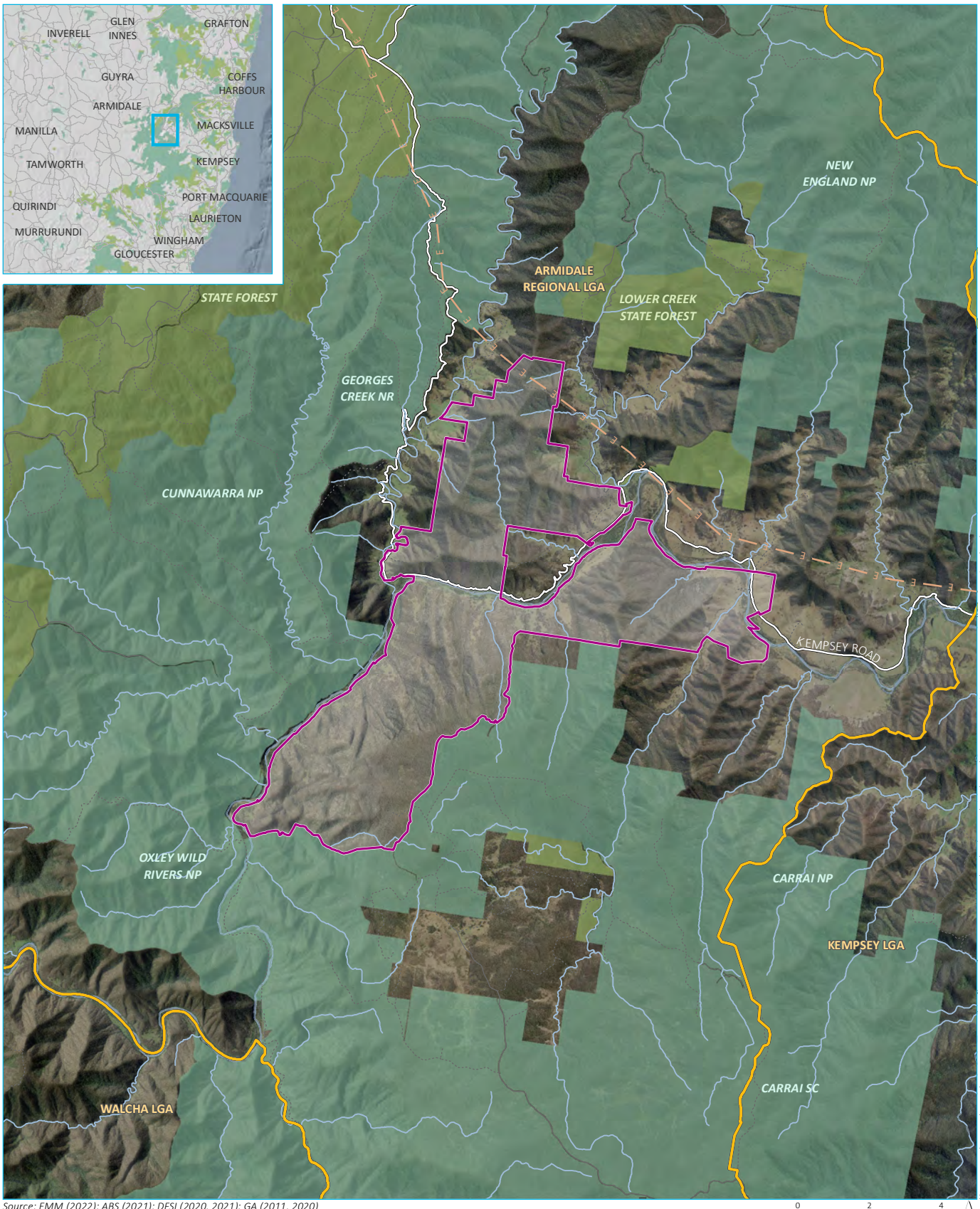
INSET KEY

- Major road
- NPWS reserve
- State forest

Regional context

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 1.1

EMM creating opportunities



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

0 2 4 km

GDA 1994 MGA Zone 56

N

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KEY

- Project area
- Existing transmission line
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- Local government area
- NPWS reserve
- State forest

INSET KEY

- Major road
- NPWS reserve
- State forest

Site context

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 1.2

EMM creating opportunities

1.3 Purpose and scope

This Traffic Impact Assessment (TIA) is an appendix to the Project's environmental impact statement (EIS) and should be read in conjunction with it. The TIA addresses the Secretary's environmental assessment requirements (SEARs) issued for the Project and has been prepared in accordance with the requirements of the Austroads Guide to Traffic Management Part 12, the Roads and Maritime Supplements to Austroads.

This TIA includes:

- determining the Project's existing background traffic conditions (types and number of movements) on the surrounding road network and associated levels of service along road sections and intersections that would be used to facilitate site access for the Project during construction and operation
- determining the Project's likely traffic generation (volumes and scheduling) associated with the construction phase (including transport/movement of excavated materials)
- determining the adequacy of the local road network to accommodate the Project's predicted traffic volume
- considering the availability/adequacy of onsite parking for site personnel
- assessing the potential impacts with construction traffic for the Project, including:
    - an assessment of the existing road network in terms of its safety and capacity
    - an assessment of the vehicular accessibility to the nominated construction sites
    - an assessment of heavy vehicle accessibility to the sites and travel routes
    - identifying the likely road upgrade requirements
    - identifying other traffic management measures that would be required as part of this Project.

The TIA has also considered the following Austroads Guides:

- *Austroads Guide to Road Design Part 3: Geometric Design* (Austroads 2016a)
- *Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development* (Austroads 2016b)
- *Austroads Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads 2017).

1.4 Legislative requirements of this traffic assessment

This report has not been assessed against The *RTA Guide to Traffic Generating Developments* as it has been concluded that this Project is not a traffic generating development.

1.5 Assessment guidelines and requirements

This TIA report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE (now the NSW Department of Planning and Environment (DPE)) on 10 June 2022. This assessment also considers relevant governmental assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

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 SEARs

SEARs requirement	Section addressed
Transport and access:	
an assessment of the impacts of the Project on the:	
• capacity, condition, safety and efficiency of the local and State road network, including a road safety audit of the proposed haulage route	Section 7.1 presents the capacity of key intersections along existing road network. Sections 5.6 and 7.2 present the condition of roads as part of the external road network. Chapter 4 focuses on Kempsey Armidale Road. Section 7.4 presents the road safety assessment at intersections and public roads. Attachment C presents the Road Safety Audit report.
• public access to recreational facilities (including rivers and trails)	Section 5.12 discusses the existing public access to recreational facilities in proximity to the Project (including the National Trail). The access to the existing recreational facilities will be maintained. Access to the national trail and other recreational activities will not be impacted by the Project. Recommendation to improve safety to the recreational user has been described in Table 8.1.
• a strategy to enable regular and emergency management activities to be carried out on site during the Project.	Regular and emergency management activity protocols will be in place. This is outlined in Section 9.8.

1.6 TfNSW

In addition to above SEARs, TfNSW in its letter dated 15 February 2021 has raised comments. TfNSW comments and EMM responses are provided in Table 1.2 below.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
1	Section 3.3.3, the Project proposes to set up an accommodation camp for the staff, due to the remote nature of the project site, however the exact location/s are yet to be determined. Further information will be required to identify the exact location of this camp, the traffic generated by the camp and the distribution of that traffic.	Prior to construction mobilisation, local accommodation facilities would be utilised for the Project's workforce during the construction of the Eastern Access Road (EAR), the main access road and the accommodation camp. The location of the construction accommodation camp is within the Project area and is shown in Figure 2.4. Once constructed, most traffic generated by the accommodation camp will be internal traffic and will only be distributed on the Project's internal road network. The exception will be a transfer service for the workforce, which would involve a coach or shuttle bus transferring the workforce to/from designated pick up and drop off locations (to be determined) at the beginning and end of each shift.
2	Section 3.2.7 addresses that the exact location of the site access/es has yet to be confirmed and investigations are being undertaken to determine the most appropriate location, and that this access road will also include a river crossing. Further information is required – refer to Attachment A.	Location of the site accesses, access roads and river crossing are shown in Figure 2.4.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
3	Section 3.4.1 identifies the Kempsey-Armidale Road as the public road the Project will connect to, [in order] to gain access [to] the greater NSW road network. The primary transportation route however is still yet to be determined, with options being reviewed for both the Armidale or Kempsey directions. A risk assessment should be undertaken for over-size over-mass (OSOM) heavy vehicles along any route being reviewed and consideration should be given to the scheduling of transport movements, with details to be provided for all proposed road upgrades, mitigation measures and temporary controls being proposed, where applicable.	Section 6.5 presents the findings of the OSOM vehicle access route assessment and Attachment D includes the OSOM report. Chapter 8 presents details of road upgrades, mitigation measures and temporary traffic controls along haulage route. The locations of the Kempsey Armidale Road upgrade are outlined in Figure 6.10. These works are to be designed and approved by the councils and funded by OMPS
4	Section 5.6.3 addresses cumulative construction and operational impacts which may occur with other known proposed developments/major projects in the area. Further consultation should also be undertaken with the Department of Planning, Industry and Environment (DPIE) and local councils, to address the location and expected construction/operational timeframes of major projects within the relevant Local Government Areas (LGAs) and along the selected transportation route/s, including but not limited to preliminary, proposed, approved and under construction projects in and out of the New England Renewable Energy Zone (NE REZ).	Section 6.4 presents details of other developments in the region which could have impacts along the secondary haulage route of the Project, noting they are expected to be minimal given the Project's relative location.
5	TfNSW requests that a Traffic Impact Assessment (TIA) be prepared by suitably qualified person/s in accordance with the Austroads Guide to Traffic Management Part 12, the complementary TfNSW Supplement and RTA Guide to Traffic Generating Developments. The TIA should include, but not necessarily be limited to, an assessment of the considerations outlined in Attachment A.	This report is a Traffic Impact Assessment for the Project prepared by Baqir Husain, Abdullah Uddin and Dr. Tim Brooker who have combined traffic engineering experience of up to 35 years for projects in New South Wales. As stated in Section 1.3, this report has been prepared in accordance with relevant guides.
Attachment A		
6	A map of the surrounding road network identifying the Project's site access/s, nearby road and property accesses, intersections and transport related facilities.	Refer to Figure 5.1 and Figure 2.4.
7	A detailed map of the proposed transport route/s from the point of origin to the site, including all public roads proposed to obtain access from the classified (State) road/s to the development site. The map (and associated documentation) should identify any proposed road closures (including any closures, diversions or otherwise reconfigured elements of the road and cycle network) necessary to accommodate the oversize vehicles; any removal or replacement of road infrastructure, or upgrading of road infrastructure.	Refer to Figure 6.5. Details of OSOM routes are present in Attachment D.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
8	The total impact of existing and proposed development on the road network with consideration for a 10 year horizon. This should include:	Section 5.5 presents baseline traffic volumes. Peak construction traffic volumes are expected in 2027, hence a 5 year horizon has been considered. During the operational phase, the traffic generation is expected to be much lower. Therefore, a traffic analysis in a 10 year horizon of the Project opening is unnecessary.
	• Identify Annual Average Daily Traffic (AADT) volumes with percentage heavy vehicles along the transport route/s and diagrammatically demonstrate AM and PM peak hour movements at key intersections.	Section 5.4.3 presents 5 day average daily traffic volumes for the Project generated traffic and estimated AM and PM peak hour volumes at key intersections. The AM and PM volumes are shown in diagrammatically.
	• Background traffic data from published sources and/or recent survey data. The source of data and any assumptions are to be clearly explained and justified, including the growth rate applied to the future horizon. Due to the impact of COVID- 19 on travel patterns, traffic counts undertaken at this time may not be representative of normal volumes. Alternative approaches to understanding the impact of COVID-19 on traffic patterns should be discussed with TfNSW.	Section 5.4 presents traffic data obtained from Councils, TfNSW traffic volume viewer website and intersection count surveys conducted in Kempsey and at Wollomombi near Armidale outside the Covid-19 restriction periods. A 1% linear growth rate has been assumed for the 5 year horizon, which is considered reasonable for regional towns in New South Wales.
	• The cumulative traffic impacts associated with the redevelopment and any other known proposed or approved developments in the area, including all relevant major projects within the relevant Local Government Areas and along the selected transportation route/s.	Construction timelines of other developments identified in the vicinity of the Project in Section 6.4 are unknown at this stage and whether they could trigger cumulative traffic impact is unclear. All developments identified are close to Armidale and if construction timelines overlapped the combined traffic would only affect sections of Waterfall Way closer to Armidale which is on the secondary access route to the Project site. The proposed Project has significantly less traffic volumes travelling to or from Armidale and along Waterfall Way. Therefore, the cumulative traffic of other projects is unlikely to have significant traffic impacts for the traffic operation along the relevant sections of Waterfall Way.
	• The volume and distribution of proposed trips to be generated by the construction, operational and decommission phases of the development. This should identify the maximum daily and hourly demands generated by the development, particularly where they coincide with the network peak hour.	Section 6.1.5 presents average and maximum daily trips to be generated by construction phase of the development. Section 6.2 presents the distribution of trips over the external road network. Sections 8.2 and 8.4 discuss the traffic impact in operation and decommissioning or repowering phases.
	• The volume, type and frequency of all project related design vehicles (workforce, commercial and heavy vehicles, including spoil management movements, OSOM and maintenance) accessing the development site.	Sections 6.1.4 and 6.1.5 include details of vehicle types, volumes, and frequency of all type construction related vehicles. Section 6.5 presents details of OSOM vehicles.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
9	Details of the relevant road geometry and alignment along the identified transport route/s, including existing formations, crossings, intersection treatments and any identified hazards or constraints (such as bridges, narrow pinch points, culverts, etc). This should include:	Section 5.2 presents the details of the road network used as part of the Project haulage routes. Section 5.3 describes the key intersections present along the Project haulage routes.
	• Available sight distances at the site access and intersections along the proposed transport routes and any constraint to achieving the required sight distance for the posted speed limit.	Section 7.4.1 and 7.4.2 provide site distance assessments at site access intersections and Waterfall Way/Kempsey Road intersection
	• An assessment of turn treatment warrants in accordance with the Austroads Guide to Traffic Management Part 6 and Austroads Guide to Road Design Part 4A for intersections along the identified transport route/s, identifying the existence of the minimum basic turn treatments and addressing the need for any warranted higher order treatments.	Section 7.3 presents intersection design details for the proposed site access intersections at Kempsey Armidale Road. Section 7.4.2 presents turn treatment warrants for the existing Waterfall Way/Kempsey Road intersection.
	• Swept path analysis demonstrating the largest design vehicle entering and leaving the development, and moving in each direction through intersections along the proposed transport route/s.	Swept path assessments have been undertaken by LGES as part of preparation of the concept plans of the road upgrade.
	• Details of any stopping bays at distances and dimensions required to accommodate the heavy vehicles proposed.	Chapter 8 presents details of the proposed road improvement works and other traffic control measures to allow two-way movement of heavy vehicles along the Kempsey Armidale Road.
	• Details of any river crossings proposed.	Section 6.7 presents details of river crossing.
10	In addition to the above points, the TIA is to detail any staging of the development; and the time-schedule and sequence of the various vehicle types and volumes associated with any proposed development (temporary or permanent) including construction offices, workers' accommodation, concrete batch plant and operation and maintenance facility.	Section 6.1.3 provides the construction Project stages, phases and sequencing.
11	For offsite sources of materials such as quarries or water sources, inclusion of any proposed material transport activities should form part of the TIA.	The Macleay River pump facility is located on the Project site and will be used for supplying water for use in the construction activities for the Project. On-site quarrying activities will be undertaken within the footprints of the upper and lower reservoirs. Therefore, material transport activities of water and quarried materials will be within the Project internal road network only.
12	Capacity analysis using SIDRA or other relevant application, to identify an acceptable Level of Service (LOS) at intersections with the classified (State) road/s, and where relevant, analysis of any other intersections along the proposed transport route/s.	Section 7.1 presents the assessed intersection capacity and performance using the SIDRA model.
13	A review of crash data along the identified transport route/s for the most recent 5 year reporting period and an assessment of road safety along the proposed transport route/s considering the safe systems principles adopted under Future Transport 2056.	Section 5.7 presents crash data analysis for the most recent 5 year period. Section 5.8 discusses safe systems principles adopted under Future Transport 2056.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
14	Strategic (2D) design drawings of all proposed road works, river crossings and the site access demonstrating scope, estimated cost and constructability of works required to mitigate the impacts of the development on road safety, traffic efficiency and the integrity of transport infrastructure. Works must be appropriately designed for the existing posted speed limit.	Road works on Kempsey Armidale Road will be separately undertaken by KSC and/or ARC and will be funded by the Project. The design drawings for these works will be prepared by Councils. The concept design drawings and costings of the proposed EAR, and bridge over Macleay River as well as the concept design drawings of access roads for the northern powerline have been reviewed by the assessing team as part of this TIA.
15	Site plan demonstrating the locations of the proposed accommodation camp, internal infrastructure and amenities, site access, internal manoeuvring, servicing areas, and parking areas for heavy vehicles and staff, consistent with the relevant parts of AS2890 and Council requirements.	Refer to Figure 2.4.
16	Details of measures to address impacts and/or provide connections for public transport services and active transport modes, such as, public and school bus services, walking and cycling.	Section 8.1 includes mitigation measures to address impacts on public transport services, school buses and active transport modes.
17	Clearly identify the volume and distribution of staff movements, differentiating between staff utilising the accommodation camp and those travelling to private accommodations on a daily basis. Investigate what can be done to consolidate light vehicle movements on the identified route (including car sharing and bus options) to reduce number of movements for offsite staff, including details of Fly-In Fly-Out (FIFO) arrangements for the workforce where applicable.	There will be more than 600 workers at the Project site during peak construction period and the majority of these workers will be residing in the accommodation camp. Section 6.1.5 presents daily light vehicle trips during peak construction period. Coaches and minibuses will be used for transporting workers to/from the Project site. Coach trips are included in heavy vehicle trips and minibus trips are included in light vehicle trips. Staff transfers from the accommodation camp are expected to occur weekly. Weekly rosters are assumed to be happening on multiple days each week (to be confirmed by construction contractor). There will be no Fly-In Fly-Out (FIFO) arrangements for construction workers.
18	Details of measures to ameliorate the impacts of road traffic noise, dust, and/or glare generated by the Project onsite and along the proposed transport route/s.	Impacts of road traffic noise have been addressed in the Noise and Vibration Impact Assessment as part of the EIS (Appendix T). Dust management is detailed in the Air Quality Assessment as part of the EIS (Appendix U). Chapter 8 presents measures to ameliorate dust and sun glare impacts.
19	Details of a Traffic Management Plan (TMP) proposed to address the construction, operation and decommission phases of the proposed development. The TMP may include temporary measures such a Traffic Control Plan (TCP) prepared and implemented by suitably qualified persons in accordance with the current Traffic Control at Work Sites Manual. It is recommended that any TMP adopt a Driver Code of Conduct, including but not necessarily limited to, the following: • A map of the primary transportation route/s highlighting critical locations.	Chapter 9 includes a draft Construction Traffic Management Plan (CTMP). A detailed CTMP will be prepared by the lead construction contractor in consultation with the relevant. The CTMP will accompany the relevant TCP which will be prepared with consultation with the relevant authorities. The Driver Code of Conduct is outlined in Section 9.11. Traffic Management Plans for the operation and decommissioning phases will be prepared prior to commencement of these respective phases.

Table 1.2 TfNSW comments and EMM responses

No.	TfNSW comments in response to scoping report	EMM responses/information location
	• An induction process for vehicle operators and regular toolbox meetings.	
	• Procedures for travel through residential areas, school zones and/or bus route/s.	
	• A complaint resolution and disciplinary procedure.	
	• Community consultation measures proposed for peak periods.	

1.7 Kempsey Shire Council comments

KSC in its letter dated 15 February 2021 raised traffic and transport related comments. KSC comments and EMM responses are provided in Table 1.3.

Table 1.3 KSC comments and EMM responses

Item no.	KSC comments in response to scoping report	EMM responses/information location
1	The volume and make-up of the vehicular traffic generated by the OMPS Projects construction and operation needs to be well understood. Access from the east for most construction and operational needs is envisaged. Road pavements and road alignments from the Pacific Highway to the subject site will therefore be heavily impacted and are not currently designed to cater for the traffic generation, in particular during the construction phase. Upgrade requirements, which are envisaged to be significant, need to be well understood in determining the OMPS projects viability and so as to ensure local and regional traffic and transport is not impacted adversely and that Council does not wear the cost burden (due to premature failure) of the projects impact on local and regional roads used for access. As part of this assessment of cost and road pavement and alignment impacts, overmass and oversize vehicle access needs require consideration.	Sections 6.1.4 and 6.1.5 present volumes and types of vehicles for construction traffic. Section 6.3 presents details of operations traffic. Sections 5.6 and 7.2 discuss conditions of the roads as part of the external road network. Chapter 4 focuses on Kempsey Armidale Road. Section 8.1 includes recommended road upgrades as part of the construction phase. Attachment D includes the OSOM related report. Details of the likely scope and cost of road upgrades and associated road pavement impacts and repair costs for the Kempsey Armidale Road have not been finalised and are under discussion with the two relevant local councils.
2	Access roads to the area are prone to impact from natural disasters, in particular landslide and, as such, the assessment should consider not only geotechnical stability of the subject site but also areas where local road upgrades would be proposed.	Section 8.1 includes mitigation measures for extreme weather events, rock falls and landslides and any associated road upgrades.

1.8 Armidale Regional Council comments

Armidale Regional Council's (ARC) in its email dated 12 February 2021 raised traffic and transport related comments. ARC comments and EMM responses are provided in Table 1.4.

Table 1.4 ARC comments and EMM responses

Item no.	ARC comments in response to scoping report	EMM responses/information location
1	Given the significant number of renewable projects either approved or in the scoping process within the Armidale Regional LGA, the proposal should address all cumulative impacts not only on the immediate locality but also the greater LGA, including but not limited to solar and wind farm developments and all other large scale projects, particularly in regard to visual, traffic, environmental and biodiversity impacts. Additionally, it is recommended that the assessment should also take into consideration other cumulative impacts from other SSD and RSD developments within the LGA in the event that a number of these projects proceed simultaneously.	Construction timelines of nearby developments identified in the vicinity of the Project in Section 6.4 are unknown at this stage and whether they could trigger cumulative traffic impacts is uncertain. Nevertheless, all the other developments identified are closer to Armidale and if construction timelines overlapped the combined traffic would only affect Waterfall Way. The proposed Project has significantly less traffic volumes travelling from Armidale and along Waterfall Way. The cumulative traffic of other projects is unlikely to have significant traffic impacts on the traffic operation along the relevant sections of Waterfall Way.
2	The scoping report identifies Kempsey Road from Armidale to the site as a potential route for construction traffic. Further detail will be supplied in the EIS and detailed traffic report. Council would welcome future access for the development being via Kempsey Road from Armidale due to the potential flow-on effects for the locality and local community from the influx of 600 construction workers for a 2–3 year construction period as well as: • Long term benefit to the community with the upgraded road. • Long term benefit to the economy of the upgraded link for the local community to and from Armidale and Kempsey, as well as to those major centres. • Mutually beneficial outcomes for the development and government with the possibility of shared costs in upgrades. In this regard, Council is looking forward to further reporting on the traffic implications and is keen to discuss all options with the developers on proposed access routes to the site. This will greatly benefit both Council and the surrounding community and assure a good outcome for the development.	The main construction access route for the Project is from Kempsey to the east. As a secondary access route, approximately 15% of construction traffic will access the Project construction areas from Armidale in the west. There will be a series of external road improvement works occurring along Kempsey Armidale Road due to the proposed OSOM vehicle movements accessing the Project from Kempsey. These external road improvements do not form part of this EIS and it is proposed these works will be delivered by local councils. Additionally, there will be three new site access intersections (Sections 2.4 and 7.3) in accordance with Austroads and Council standards along Kempsey Armidale Road. These intersections form part of this EIS and have been the subject of consultation with councils and TfNSW. Existing deficiencies along sections of the Kempsey Armidale Road, where external road improvements are required, such as gaps in road line marking, lack of traffic signage, limited visibility due to vegetation will be mitigated as part of the Project, to improve the safety and driving conditions for existing road users.
3	The proponent must assess construction transport and traffic impacts including but not limited to:	N/A
4	Detailed consideration of transport routes and movements, particularly within the limits that the existing road corridor can accommodate (both from a geometrical and capacity perspective).	Section 6.1 and 6.2 presents details of traffic movements over the external road network.
5	Detailed construction worker movements including construction worker access and parking requirements.	Sections 6.2 and 6.3 discuss construction worker accommodation and travel. Section 7.5 presents parking requirements.

Table 1.4 ARC comments and EMM responses

Item no.	ARC comments in response to scoping report	EMM responses/information location
6	Geometry and capacity constraints of the existing road with regard to the OSOM requirements of the project.	There would be approximately one OSOM vehicle trip (two movements) per day during the construction period. The OSOM vehicle movements to/ from the site from the port, via Kempsey, will be subject to National Heavy Vehicle Regular (NHVR) approval. As part of the approval process, the affected councils will be consulted in regard to routes, and timing. Any potential mitigation measures required to minimise adverse impacts will be confirmed as part of the NHVR application process. Attachment D presents the OSOM report which identifies at a conceptual level, the geometric constraints of the existing road with regard to the proposed OSOM vehicle movements.
7	Detailed consideration of the impact on the project given the vulnerability of the existing road network, particularly with regard to rock fall and landslides.	Sections 7.4.2 and 7.9 identify the locations of hazards from rockfalls and landslides. Chapter 8 addresses the hazards and risks of rock falls and landslides.
8	The cumulative traffic impacts on the community of this project and other major developments commencing construction within the vicinity of the proposal (including road improvement works).	Construction timelines of nearby developments identified in the vicinity of the Project in Section 6.4 are unclear at this stage and whether they could trigger cumulative traffic impacts. However, all developments identified are closer to Armidale and the potential cumulative traffic impacts if construction timelines overlapped would only affect Waterfall Way. The proposed Project has significantly less traffic volumes travelling from Armidale and along Waterfall Way. The cumulative traffic of these Project is unlikely to have significant traffic impacts on the traffic operation along Waterfall Way.
9	Opportunities for the project to improve the resilience of the road network for the benefit of the local community.	Chapter 8 presents the locations of proposed road upgrades along sections of the Kempsey Armidale Road. These road upgrades will improve the general travelling conditions and future road safety for all road users along Kempsey Armidale Road especially around the sharp bends. Other existing deficiencies along sections of the Kempsey Armidale Road such as gaps in road line marking, lack of traffic signage and limited visibility due to vegetation will also be mitigated as part of the Project improving the future safety and driving conditions for all road users.

1.9 Limitations of this report

The primary purpose of this TIA is to highlight the key traffic safety, efficiency and constraints along the Project's proposed transport and haulage routes and the recommended mitigation measures. However, this report does not specify the detailed design requirements for all necessary road upgrade works, including the future road and/or intersection upgrade works which are required as a consequence of this Project.

The estimated traffic volumes and timelines that have been assessed in this report are provided by OMPS in consultation with SMEC. Estimated traffic volumes and timelines may change, following selection of the construction contractor and completion of the detailed design phase. Therefore, the Project schedule and traffic volumes may change over time which may initiate some changes to the recommended mitigation measures outlined in Chapter 8 of this report.

It should be noted that some roads and bridges along the main haulage route from Kempsey have load limit restrictions. Therefore, this is subject to a detailed assessment by a quantified road designer/structural engineer during the detailed design phase.

A detailed Construction Traffic Management Plan (CTMP) will be prepared prior to commencement of works. Once the construction contractor is appointed, it will be their responsibility to undertake a detailed risk assessment and maintain the Project's haulage roads so they are safe for all road users. Any site specific risks that may arise during the construction period are subject to the contractors' discretion (and any associated mitigation measures). EMM does not bear any responsibility on this ground.

Due to the major scale of this Project and its long construction phase, continuous liaison will be required with TfNSW, KSC, ARC and the community in regard to the Project's traffic related road safety risks to ensure a favourable outcome is delivered for all parties. In particular, the timely completion of Kempsey Armidale Road reinstatement works will be subject to TfNSW, KSC and ARC approval and any delays to these works may impact the Project schedule.

2 The Project description

2.1 Project overview

The Project involves building two 'off river' water containment structures to create an upper and a lower reservoir (referred to as 'the upper dam and reservoir' and 'the lower dam and reservoir'), on an ephemeral tributary of the Macleay River. An underground hydro-electric power station complex will be connected to the reservoirs by infrastructure including a power waterway and tunnels. During operation, the water will enable the generation of electricity as it passes through the underground power station while moving from the upper to the lower reservoir, from where it is pumped back up via the same waterway in a 'closed-loop circuit'. The pumped hydro system will be connected to the existing transmission network via new overhead high voltage transmission lines.

A detailed description of the Project and its strategic context is provided in the Project's EIS which should be read in conjunction with this report.

An overview of the key components and elements are provided below.

2.2 Key Project design elements

Broadly, the Project has been categorised into three key components, which are further broken down into the Project's key elements in Table 2.1 and shown in Figure 2.1:

- pumped hydro-electric and generation works (PHGW) – including:
  - new upper and lower water storage dams and reservoirs
  - a new underground pumped hydro-electric power station and transformer hall
  - water tunnels, access tunnels, portals and adits
  - tailrace
  - intake and outlet structures
  - associated gates, shafts and screens
- transmission connection works – including:
  - new electricity transmission lines to connect the PHGW to the existing electricity transmission network (Line 965)
  - new electricity transmission infrastructure
  - a new substation
- ancillary development – including but not limited to:
  - access roads, tracks and bridge
  - on-site quarries and related infrastructure
  - utilities and communications infrastructure
  - construction pads containing assets such as workshops, concrete batching plants (CBPs), and offices

- laydown and storage areas
- construction accommodation
- pumping infrastructure
- operational facilities such as offices, and camps for staff
- construction and operational power supply.

Table 2.1 Key Project elements

Project element	Description
PHGW	
Underground power station complex	An underground pumped hydro-electric power station located below the upstream end of the pumped hydro system to optimise the hydraulic arrangement of the Project. The power station complex consists of: • two main caverns comprising; – the machine hall – the transformer hall • interconnecting tunnels, the transformer hall tunnel and isolated phase busbar (IPB) tunnels.
Dams and reservoirs	Two concrete faced rockfill dams (CFRD) and reservoirs, referred to as the upper dam and reservoir and lower dam and reservoir, with the following specifications:
	Upper dam and reservoir: • CFRD approximately 70 metres (m) high and 780 m long • reservoir covering a total area of approximately 20 hectares (ha) and an inundation extent of approximately 16.7 ha • reservoir height of 881 m Australian Height Datum (AHD) at full supply level (FSL) and 830 m AHD at minimum operating level (MOL) • total reservoir storage capacity of around 5.1 gigalitres (GL) at FSL.
	Lower dam and reservoir: • CFRD approximately 70 m high and 280 m long • reservoir covering a total area of approximately 24.7 ha and an inundation extent of approximately 21.6 ha • reservoir height of 250 m AHD at FSL, 215 m at MOL and 205 m AHD at lowest operating level (LOL) • total reservoir storage capacity of around 6.5 GL at FSL.
Water intake structures	Two intake structures, one at each reservoir, including: • a morning glory, vertical-type intake structure situated at the upper dam and reservoir • a lateral intake structure, with head gates and stoplog slots, and an intake channel, at the lower dam and reservoir.
Spillway	Two concrete lined spillway chutes, one for each of the upper and lower dams and reservoirs. Both spillway crests will comprise of ungated ogee-shaped overflow weirs on the upstream ends of the spillway chutes.
Macleay River pump facility	A pump facility on the Macleay River, which will include duty and standby pumps for the first fill and for ongoing reservoir refills.

Table 2.1 Key Project elements

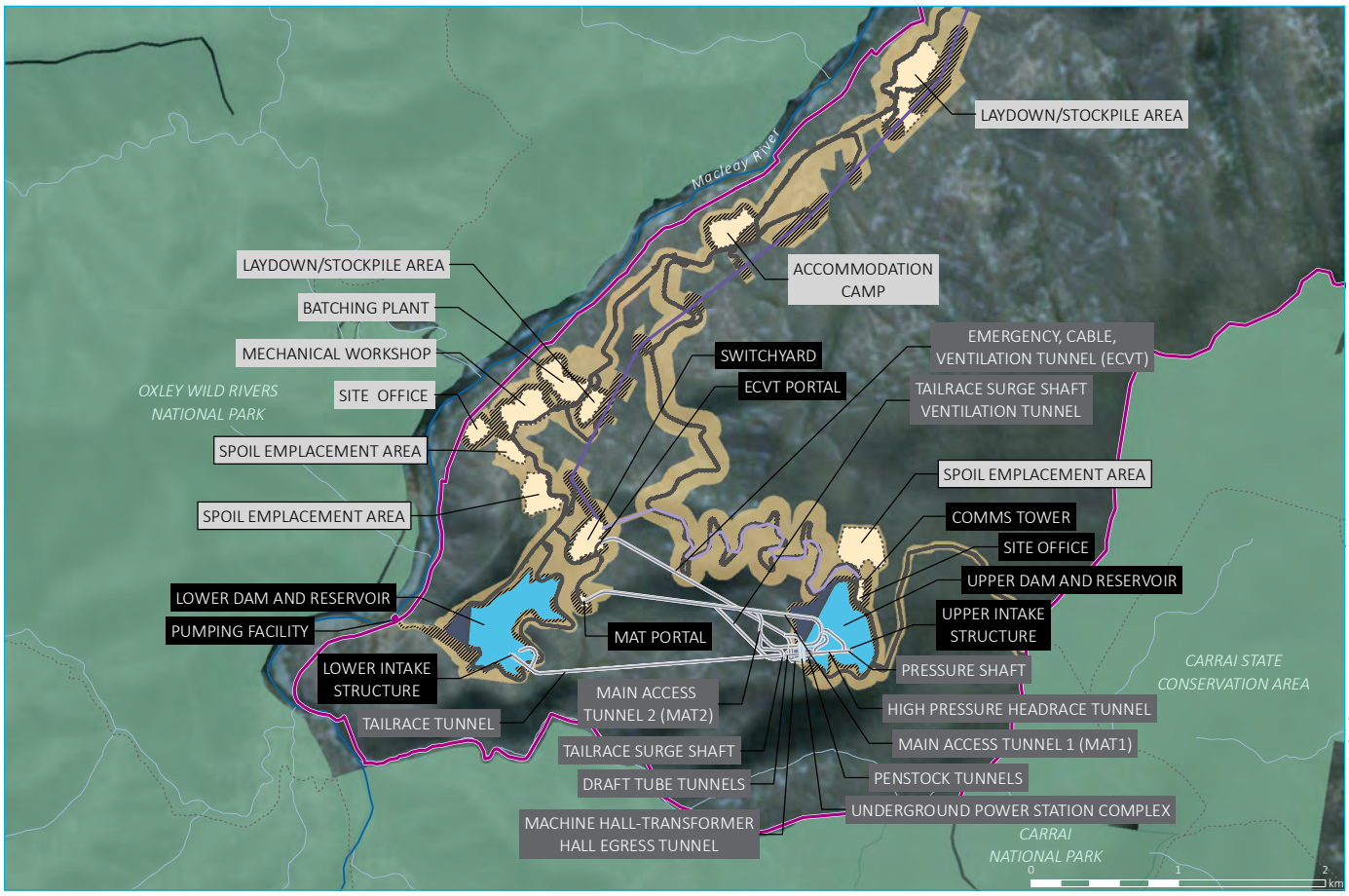
Project element	Description
Tunnels	Three main tunnels comprising of: • two main access tunnels (MAT1 and MAT2) • the emergency, cable, ventilation tunnel (ECVT). The MAT1 and MAT2 will provide loop access to the power station complex from the MAT portal. The ECVT will provide services access and egress between the switchyard portal and the transformer hall. The ECVT portal will contain the station switchyard, control rooms, ventilation and firefighting equipment, with blast walls separating important equipment.
Power waterway	The power waterway will consist of: • a 660 m deep, 5.1 m diameter vertical pressure shaft • 250 m concrete and steel lined high-pressure headrace tunnel • three or more 80 m long penstock tunnels • three or more 120 m long draft tube tunnels • an approximately 1,825 m long concrete lined tailrace tunnel.
Transmission connection works	
Connection works	The connection works will consist of: • An approximately 15km long transmission alignment comprising, at a maximum, double circuit single tower 330 kV overhead infrastructure and single circuit single tower 132 kV overhead infrastructure connecting to TransGrid Line 965. • Up to 25 transmission tower sites (approximately 50 m x 50 m) containing the 132 kV and 330 kV infrastructure. • A transmission easement width of a maximum of approximately 105 m. Note: The upgrade of existing Line 965 will be the subject of a separate application.
Sub-station	Construction of a substation and associated connection infrastructure of up to 330 kV rating.
Switchyard	A high voltage connection linking the connection transmission lines to the cables exiting the underground power station complex. The outdoor air insulated switchyard will likely include: • switchgear and control room • cable potheads • disconnector/earth switches • capacitive voltage transformer (VT) • lightning protection • security fencing, lighting and surveillance • surge arrestor.
Ancillary development (construction and operation)	
Access roads, access tracks and bridge	A variety of external road works to improve existing access, and construction of new permanent roads to enable construction access, temporary establishment and use of construction sites, and general access to the Project area including transmission line infrastructure.
	The proposed main access route will be via Kempsey and involves the construction of a new unsealed two-lane access road located to the east of the site. The main access road will interface with the existing Kempsey-Armidale Road and will require the construction of one new single or two lane low-level bridge crossing over the Macleay River. A temporary bridge may be utilised prior to the construction of the permanent bridge.

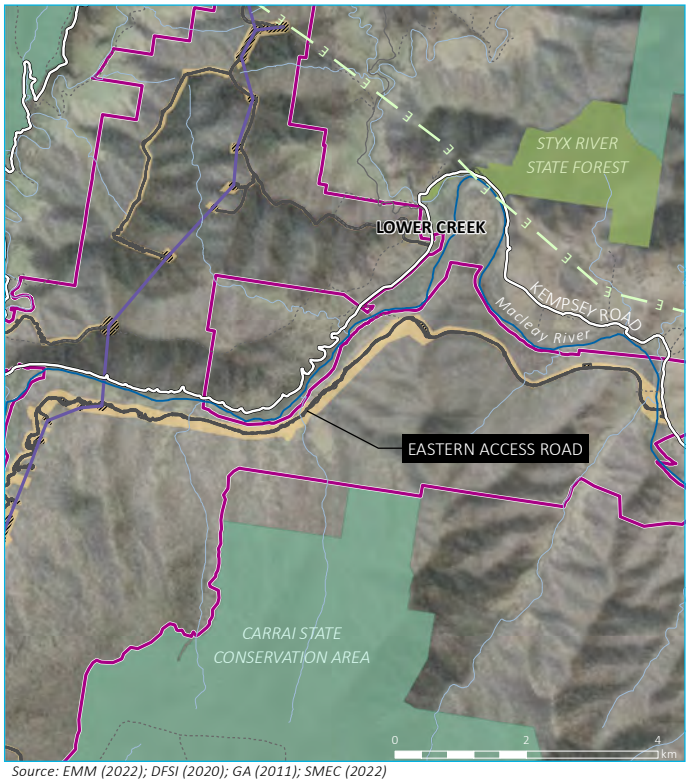
Table 2.1 Key Project elements

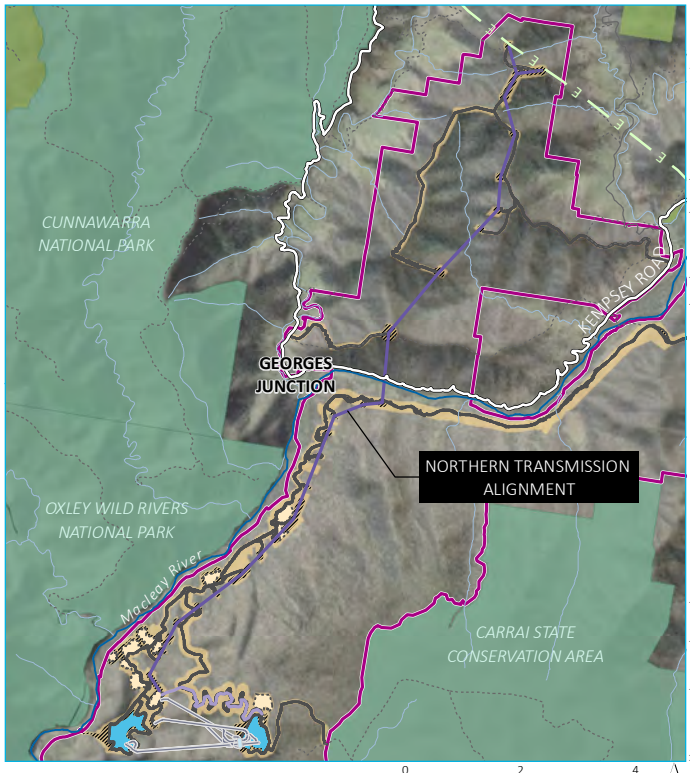
Project element	Description
	There will be approximately 40 km of permanent roads connecting the dams, surface works, portals, transmission assets and spoil sites. Some of these roads are existing roads, however approximately 25 km will be newly constructed roads. The key road components include: • Main Access Road (approximately 4.7 km) • Eastern Access Road (up to approximately 11. 4 km) • Lower Dam Access Road (approximately 3.6 km) • Upper Dam Access Road (approximately 7.1 km) • access to portals and underground works • Upper Dam Emergency Egress Road (approximately 2.2 km). Access to the transmission infrastructure north of the Macleay River will be via two roads accessed from the Kempsey-Armidale Road. These two roads include the: • Northern Transmission Access Road (approximately 15 km) • Southern Transmission Access Road (approximately 2.3 km). To support access along the transmission line easement south of the Macleay River and to each of the tower sites, a network of interconnecting access and maintenance tracks will be constructed, to a large extent utilising existing access tracks.
Surface works pads and facilities	There are four main construction pads in addition to surface portals which will be used temporarily during construction for different services (workers camp, construction site offices, workshop area, and laydown storage).
	Construction works will require the establishment of the following ancillary support infrastructure and areas: • main accommodation camp(s), which will temporarily accommodate the majority of workers as required workers as required throughout the construction period • temporary or fly camps, which will temporarily accommodate the majority of workers as required throughout the construction period • two works areas including Works Area 1 and Works Area 2, which will contain ancillary facilities such as CBPs, mechanical and electrical workshops, a laboratory and various water treatment and wash areas • spoil emplacement areas • staging area • stockpiling areas • temporary site offices to be used during construction.
Communications	Communication infrastructure such as fibre optic cables are required for the operation of the Project and will be located: • on an overhead line linking the upper and lower dams and reservoirs (in conjunction with the electrical line) • buried in road corridors. The communication network will also include a communications tower near the upper dam and reservoir.
Utilities during construction	• Construction water will be supplied either via groundwater bores, or via pumping of water from the Macleay River to support camp operations, the CBP, dust suppressions and other activities across the site. • Construction power will be supplied primarily by use of portable diesel generators and supported where possible by leveraging off existing electricity distribution infrastructure running through the generation site.
Utilities for operation	Alignment and length of utilities (electricity, water, etc.) will be combined into a single corridor (total length of about 5.4 km).

Table 2.1 Key Project elements

Project element	Description
Water diversion and water treatment facilities	• Site drainage will include a combination of cross drainage culverts, drainage pits and pipe, open channels/open drains (vegetated, rock-lined or concrete), levees/bunds, and detention basins. • Various water treatment plants will be used for construction drainage and water treatment facilities – for the main accommodation camp, temporary or fly camps, CBP, tunnel, etc. • Specific discharge locations are planned for stormwater and surface water runoff.
Laydown/stockpile areas	Temporary laydown/stockpile areas will be utilised across the Project area, with a total allocated stockpile area of around 114,000 m^2.
Spoil emplacement areas	To accommodate spoil generated through excavation of the underground caverns and tunnels, three permanent spoil placement locations have been identified with a capacity to store around 2 million cubic metres (Mm^3) of material. Dead storage space within the reservoirs will also be used for spoil placement, with a capacity to store approximately 300,000–400,000 m^3.
Ancillary operational facilities	Primary operation of the Project can be undertaken remotely and will require minimal onsite operational staff, other than for maintenance activities. Operational facilities include maintenance housing, work area, car parking, workshop and storage, control room and switchgear, water treatment plant, office area, heating, ventilation and air conditioning (HVAC), backup generators and Macleay River pump facility.
Other	
Construction	• Construction duration of around four to five years. • Construction workforce of over 600 to approximately 1,000 workers at construction peak.
Rehabilitation	Rehabilitation of areas disturbed during pre-construction and construction will be undertaken progressively during all stages and phases of the Project. Progressive rehabilitation will occur over about 60 ha including spoil emplacement areas and areas used for construction ancillary facilities no longer needed during operation. At the end of the Project's life, 192 ha in total will be rehabilitated to native ecosystem (including native vegetation and rock landscape). Approximately 138 ha will be retained permanently for the water storages and access roads, subject to agreement with relevant landowners/land managers.
Operation	• The Project will provide up to 900 MW of electricity generating capacity and up to eight hours of energy storage at full generating capacity. • Maintenance and operational activities will include power station operations, infrastructure inspections, maintenance to assets, vegetation management, auditing and compliance and other activities. • It is expected that the operation of the new power station will require around 30-50 full-time workers, as well as additional contractors for regular and ad hoc maintenance and repairs.
Hours of operation	• Construction of the Project will be 24/7 and 365 days per year. • Operation of the Project will be 24/7 and 365 days per year.
Project timeline	The Project will involve the construction and operational stages, and numerous phases which are outlined in the Project's EIS.
CIV	Estimated to be about $1.8 billion.







Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

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KEY

- Project area
- Disturbance footprint
- Construction envelope
- Surface works

Project operational elements

- Underground power station complex
- Power and communications lines
- Transmission overhead lines
- Tunnels, portals, intakes, shafts
- Permanent road
- Reservoir
- Dam wall

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Vehicular track
- Existing transmission line
- NPWS reserve

Label format

- SURFACE PERMANENT INFRASTRUCTURE
- UNDERGROUND PERMANENT INFRASTRUCTURE
- TEMPORARY INFRASTRUCTURE
- PERMANENT SPOIL EMPLACEMENT

Key project elements

Oven Mountain Pumped Hydro Energy Storage Project
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OMPS Pty Ltd
Figure 2.1

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2.3 Project area terminology

Approval for the Project is being sought based on feasibility and concept designs as is common for projects of this size and scale. To accommodate minor changes and amendments to the design as it progresses, a 'Project area', 'construction envelope', 'disturbance footprint' and 'operational footprint' approach is being adopted for the Project. This approach is aimed at ensuring environmental impacts are assessed as accurately as possible, whilst accounting for the current level of design and the likelihood of design refinements occurring as the Project progresses towards construction. The terms are explained below.

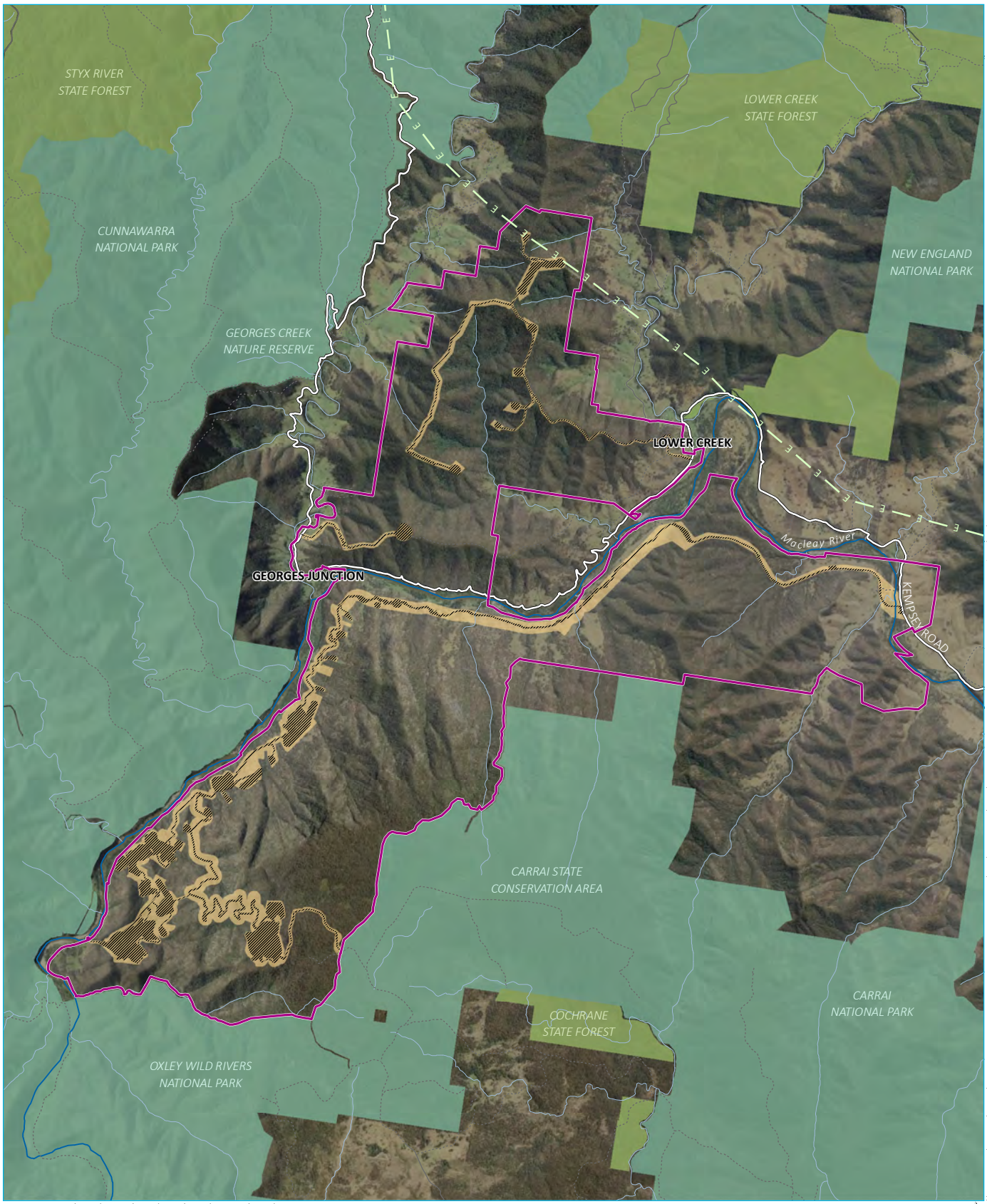
The *Project area* is the broader area within which the Project will be built and operated, and the extent within which direct impacts from the Project are anticipated. Importantly the Project area does not represent a footprint for the construction works, but rather indicates an area that was investigated during environmental assessments. The Project area has been further divided into different areas to facilitate the assessment of direct impacts from the Project.

The *construction envelope* represents the maximum extent of where disturbance may occur during the construction of the Project. In order to derive the construction envelope, buffers have been applied to the key Project elements and infrastructure. The buffers used to derive the final construction envelope area reflect the confidence around the current siting of the asset or infrastructure, and the likelihood that some minor amendments may be required prior to commencing the construction works as a result of the detailed design. The construction envelope for the Project covers an area of around 780 ha.

Located entirely within the bounds of the construction envelope sits the *disturbance footprint*, a smaller area that has been derived directly from the current level of design. The disturbance footprint represents the physical disturbance that can be expected as part of the construction works. As the design is refined, the final siting of the disturbance footprint can move within the construction envelope, subject to the recommended environmental management measures, and provided it does not exceed any limits as defined by the construction envelope. It is proposed that part of the disturbance footprint will be rehabilitated, and land formed at the completion of the Project. However, other parts will be retained after construction which is necessary for the ongoing operation and maintenance of the new power station (operational footprint). The disturbance footprint for the Project covers an area of around 330 ha.

Progressively and at the end of construction, temporary components that are required to support the construction of the Project will be rehabilitated and returned to a state representing their previous use. The exceptions to this are the areas required for the permanent operation of the Project, which would be retained (referred to as the *operational footprint*). The operational footprint of the Project covers an area of around 270 ha. Approximately 60 ha would be progressively rehabilitated during and following the completion of construction.

The Project area, construction envelope and disturbance footprint are shown in Figure 2.2.



Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

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KEY

- Project area
- Disturbance footprint
- Construction envelope

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Minor road
- Vehicular track
- Existing transmission line
- NPWS reserve
- State forest

Project areas overview

Oven Mountain Pumped Hydro Energy Storage Project
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Figure 2.2

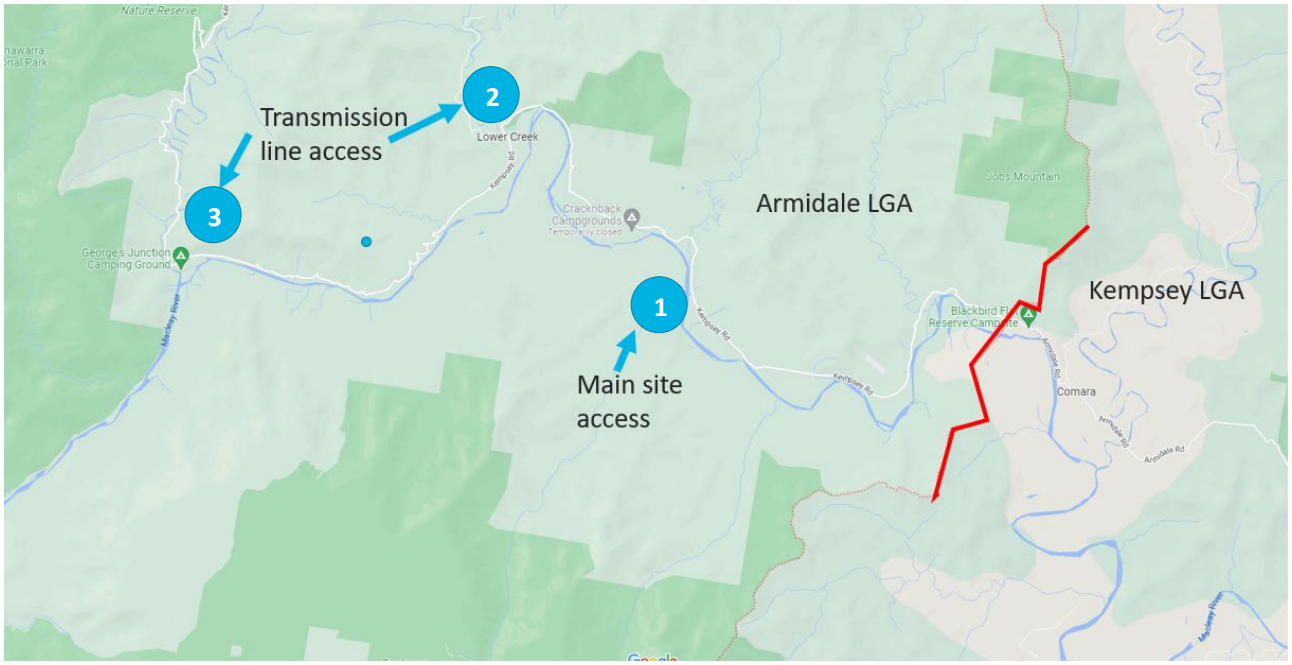
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2.4 Site access and internal roads

In total three site accesses are proposed, two on the northern side of Kempsey Armidale Road and the main access on the southern side of Kempsey Armidale Road which will cross the Macleay River (Figure 2.3). Most Project traffic will utilise the main site access.

It should be noted that Kempsey Road lies within the ARC and Armidale Road lies within the KSC. The road name changes at Blackbird Flat at the LGA boundary, as shown in the red line in Figure 2.4. However, for consistency purposes with the EIS to which this TIA is to be read in conjunction with, this road will be referred to as the Kempsey Armidale Road in this TIA.

The figure shows that all three site accesses will be within Armidale LGA. Further discussion on the site accesses is presented in subsequent sections of this report.



Source: Google Maps

Figure 2.3 Proposed site accesses

The internal road via the new main site access near Smiths Bluff will be named as Eastern Access Road (EAR). It is designed to largely avoid the need for Project use of certain sections of the Kempsey Armidale Road such as the landslip-prone Flying Fox Cutting. The EAR will have two unsealed lanes 3.5 m wide and 1 m unsealed shoulders on each side. The EAR will be designed to have an operating speed of 50 km/h, a minimum curve radius of 140 m and maximum adopted longitudinal grade of 12%.

The EAR will interface with the existing Kempsey Armidale Road via a bridge crossing over the Macleay River near Smith's Bluff. The bridge will have a minimum single lane with 5 m kerb to kerb width.

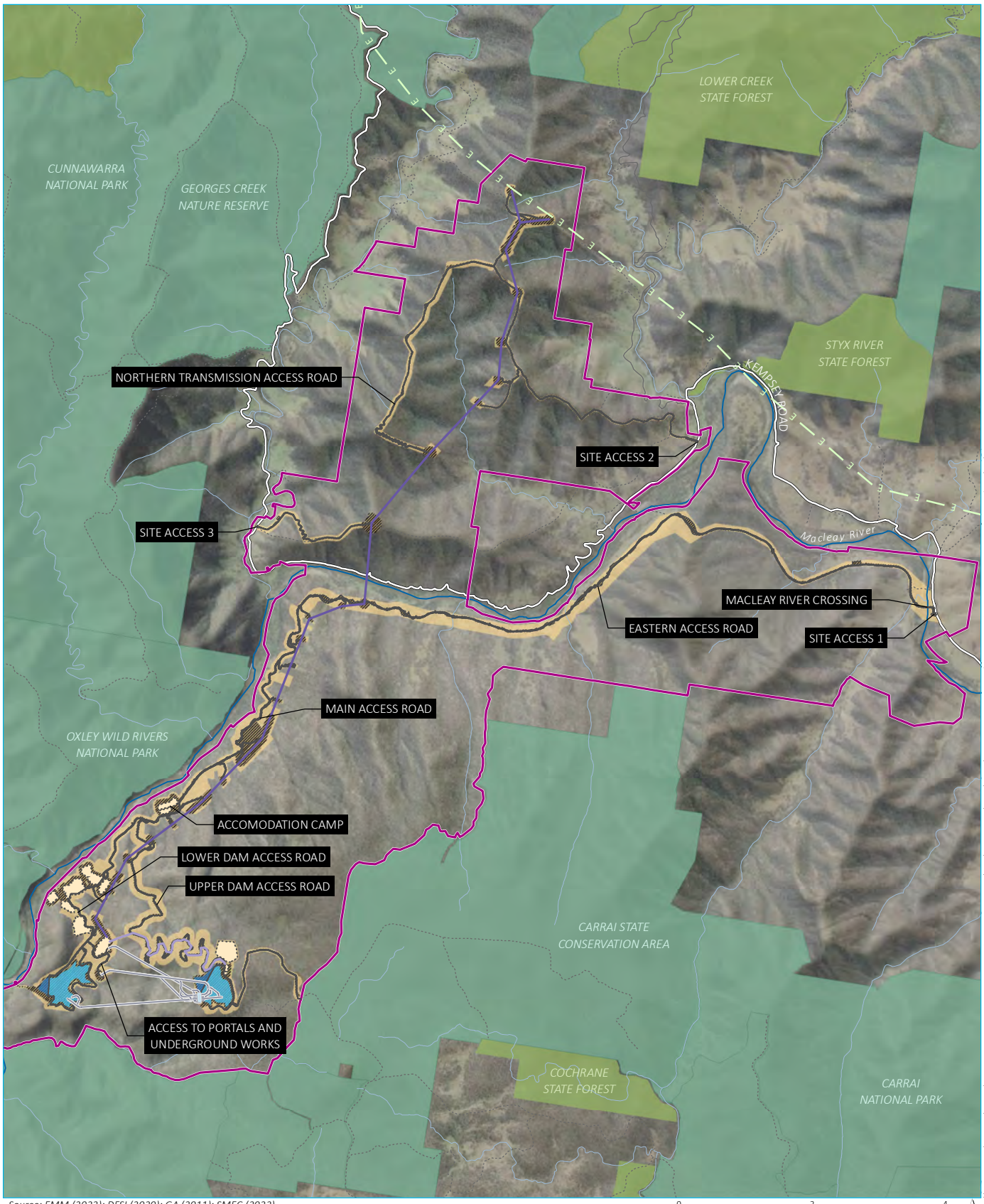
Access to the transmission connection works will be via the Northern Transmission Access Road and will be via two access intersections from the Kempsey Armidale Road. The eastern access intersection is at Lower Creek and the western access intersection is approximately 1 km north of Georges Junction. Northern Transmission Access Road will have one unsealed lane 6 m wide with no shoulders. It will be designed to have an operating speed of 20 km/h, a minimum curve radius of 20 m and maximum adopted longitudinal grade of 25%.

Design of the three access road intersections adjoining Kempsey Armidale Road for the Project have been prepared in consultation with Councils and TfNSW.

All internal roads have been designed in accordance with ARRB Unsealed Roads Best Practice Guide 2 (ARRB, 2020).

All internal roads will be regularly monitored and adequately maintained by the Project.

Site access locations and internal roads are shown in Figure 2.4.



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Source: EMM (2022); DFSI (2020); GA (2011); SMEC (2022)

0 2 4 km

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KEY

- Project area
- Disturbance footprint
- Construction envelope

Project operational elements

- Underground power station complex
- Tunnels, portals, intakes, shafts
- Power and communications lines
- Transmission overhead lines
- Permanent road
- Surface works
- Reservoir
- Dam wall

Existing environment

- Macleay River
- Watercourse/drainage line
- Kempsey-Armidale Road
- Minor road
- Vehicular track
- Existing transmission line
- NPWS reserve
- State forest

Site access locations and internal roads

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Traffic Impact Assessment
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Figure 2.4

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3 Stakeholder consultation

3.1 Consultation with relevant stakeholders

There has been extensive stakeholder consultation and key stakeholders have been consulted regularly for their inputs into the Project's roads and traffic management aspects. Table 3.1 presents the stakeholders, the scope of discussions held and the timings of these discussions.

Table 3.1 Stakeholder consultation relating to roads and traffic for the Project

Stakeholder	Scope	Timing
NSW DPIE	NSW DPIE has been kept informed about the Project and road related issues during most meetings.	Generally every 2–3 months over 2021–22.
TfNSW	TfNSW has been updated about the Project, Kempsey Armidale Road from Kempsey as the main haulage and access routes for the Project and overall road strategy. Discussions have also been held on public sentiment around the local communities' preference to transition the EAR to a public road in the future and to include a Georges Junction river crossing in the EIS as an option.	Generally every 3–4 months over 2021–22.
Kempsey Armidale Road: Project Steering Committee Meetings held by TfNSW, Armidale Regional Council and Kempsey Shire Council	OMPS were invited to attend steering committee meetings to ensure collaboration between the Project team and Kempsey Armidale public works.	Meetings generally held quarterly during 2021–22.
Kempsey Shire Council	Discussed issues relating to Kempsey side of Project as the main access and OSOM route to site including the need for council to undertake external road improvements and manage approval/construction of these works on behalf of the Project. OMPS and Council are working to enter a Voluntary Planning Agreement (VPA) for documenting the external road works necessary for the Project that will sit outside this EIS.	Generally updated every 2–3 months over 2021–22. More regular meetings are planned (probably monthly) to finalise VPA details.
Armidale Regional Council	Council has been kept informed about the Project generally and the decision for minor access route from Armidale side (within design limitations of Kempsey Armidale Road) and the need for collaboration on Kempsey Armidale Road reinstatement works. OMPS and Council are also discussing external road improvements and are working to enter a Voluntary Planning Agreement (VPA) to support the projects external road works that will be delivered outside this EIS on behalf of the project.	Generally every 2–3 months over 2021–22.
Lower Creek Local Area Committee (LAC)	OMPS has attended LAC meetings, responded to questions and consulted closely with LAC members including the provision of maps and copies of documentation.	Maintain regular contact approximately every 1–2 months.
Thunggutti Local Aboriginal Land Council (TLALC)	Project access roads are proposed across sections of TLALC owned land and OMPS has been consulting with TLALC to ensure appropriate placement and design of roads are incorporated to accommodate requirements of the landowner.	Generally maintain regular contact approximately every 2–3 weeks.

Table 3.1 Stakeholder consultation relating to roads and traffic for the Project

Stakeholder	Scope	Timing
Melinda Pavey MP	Discussions relating to public concern for the condition of Kempsey Armidale Road generally and updated road access routes and strategies for the Project. The stakeholder is very supportive of the Project and road strategy.	Periodical updates provided approximately every 2–3 weeks.
Adam Marshall MP	Discussions relating to public concern for Kempsey Armidale Road and updated road access routes and strategies.	Periodical updates provided approximately every 3 months.
OMPS Community Information Hub in Kempsey	Detailed Project information and maps were displayed including information about proposed access roads and required Kempsey Armidale Road improvement works.	Open 3 days per week since June 2022.
Community consultation	Regular meetings are being held with public and local information sessions to answer questions and provide up to date material around access roads.	Ongoing and regular during preparation of this TIA.

3.2 Further consultation with the authorities

Following preparation of the draft traffic report, EMM presented the key findings and recommendations of the report to Kempsey-Armidale Road Steering Committee, held on 21 November 2022. The committee acknowledged the challenging road environment along Kempsey Armidale Road and its recommended mitigation measures outlined in Chapter 8 of this report.

4 Kempsey Armidale Road

A brief description of Kempsey Armidale Road is provided in the table below.

Table 4.1 Kempsey Armidale Road (between Waterfall Way and Comara)

Aspect	Description
Road classification and connectivity	Local road, which is undergoing reclassification to regional road
Alignment	North-west–south-east
Number of lanes	One lane each way
Carriageway type	Combination of sealed and unsealed road
Carriageway width	Varies throughout, generally between 6 m to 7 m but some sections reducing to 4 m wide.
Default speed limit	100 km/h default rural speed limit and default speed limit for non-built-up areas.
Heavy vehicle access	Kempsey Armidale Road, as per NSW Combined Higher Mass Limits (HML) and Restricted Access Vehicle (RAV) Map, is classified as 'Approved Area With Travel Conditions'. The area is approved for B-Double but ARC should be contacted for current travel and route restrictions. Temporary restrictions may apply to impassable routes. Extreme care must be taken on narrow bitumen and gravel roads, especially during school hours, or wet weather. Temporary road closures must be checked with ARC or TfNSW.
Traffic function	Carries regional and local traffic

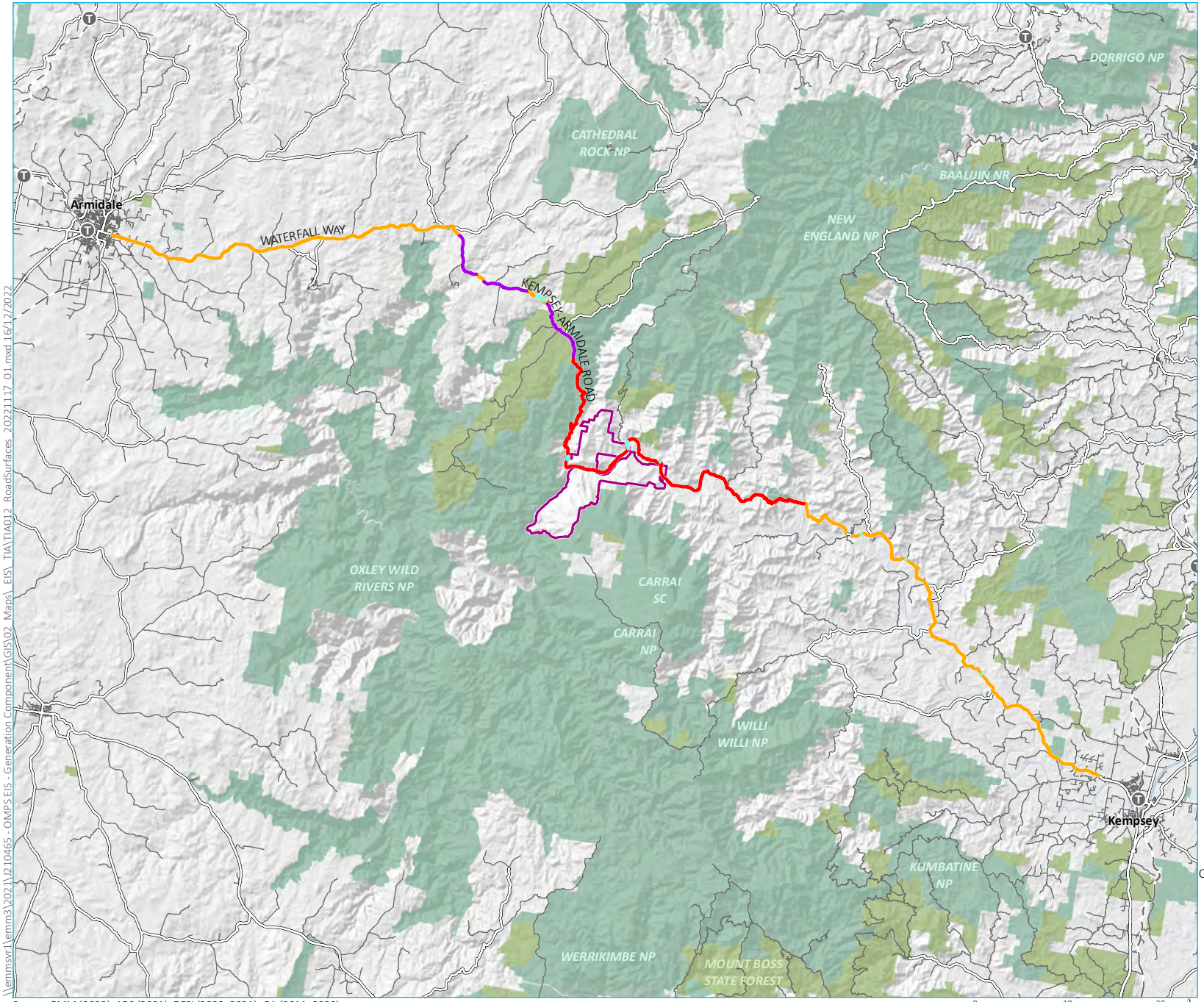
Kempsey Armidale Road has combinations of sealed and unsealed sections from Waterfall Way up to the bridge over Styx River. The unsealed sections are approximately 6 m wide without a road shoulder. The bridge over Oaky River is about 7 m wide, which is suitable for two-way traffic. The bridge over Styx River is a single lane bridge (approximately 5 m wide) accommodating one direction of traffic at any given time.

Kempsey Armidale Road is used by recreational motor bike riders moving in groups and potentially at high speeds. There is existing road signage warning of the presence of cattle in the area. There are a series of narrow and winding sections along Kempsey Armidale Road. As the road progresses towards the mountainous section, there are many narrow and sharp bends with poor sight distances. Some sections have overgrown vegetation, which also restrict sight distances.

At some sections, the road width reduces to approximately 4 m, without protection on the downhill side, which is a serious traffic hazard. Single lane bridges are present near Georges Junction and over Georges Creek, which can only accommodate one direction of traffic at any given time. Fog was observed to occur over Kempsey Armidale Road in the mountainous sections, severely restricting sight distances.

Kempsey Armidale Road has ongoing safety issues due to multiple slips and landslides affecting the road conditions. ARC has a repair program that is currently underway, and the most significant slips are being repaired at Flying Fox cutting and Waterfall corner. ARC has stated that there is significant road damage between Big Hill and Blackbird Flat, with the aim for 10 critical slips to be fully repaired by December 2022. KSC also has a repair program scheduled to fix various minor slips along Kempsey Armidale Road, with Seymour Whyte appointed to complete improvement works projects[2].

[2] https://www.armidaleregional.nsw.gov.au/council/newsroom/works-and-projects/kempsey-road/community-updates



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Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

Details of the Kempsey Armidale Road

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Figure 4.1

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Plate 4.1 **Kempsey Armidale Road (looking south near Wollomombi)**



Plate 4.2 **Kempsey Armidale Road (looking south near Oaky River Dam Road)**



Plate 4.3 **Kempsey Armidale Road (looking south near Oaky River bridge)**



Plate 4.4 **Kempsey Armidale Road (looking south near Raspberry Road)**



Plate 4.5 **Kempsey Armidale Road (looking south near Through Road, Jeogla)**



Plate 4.6 **Kempsey Armidale Road (looking south near National Trail)**



Plate 4.7 **Kempsey Armidale Road (looking south at the river crossing near Pig Paddock Gully)**



Plate 4.8 **Kempsey Armidale Road (Looking east, east of Georges Junction camping ground)**

Table 4.2 **Kempsey Armidale Road (in between Comara and River Street)**

Aspect	Description
Road classification and connectivity	Local road, which is undergoing reclassification to regional road.
Alignment	North-west–south-east.
Number of lanes	One lane each way, narrowing down to one lane carriageway in some sections.
Carriageway type	Sealed from Kempsey to Pee Dee, west of Bellbrook. Mostly unsealed sections after Pee Dee to Comara.
Carriageway width	Approximately 7 m, reducing to 5 m in some sections.
Default speed limit	Mostly 100 km/h, reducing to 50 km/h near urban areas.

Table 4.2 Kempsey Armidale Road (in between Comara and River Street)

Aspect	Description
Heavy vehicle access	Approved access for vehicles up to 26 m B-doubles from River Street near Kempsey to Yarravel. The remaining route is approved for vehicles 19 m long and under 50 t.
Traffic function	Carries regional and local traffic.

The rural section of Kempsey Armidale Road is generally restricted to 100 km/h, but traffic speed limits reduce to as low as 50 km/h in urbanised areas. There are numerous moderate bends along the road where advisory speed reduction signs (in yellow) are provided. Kempsey Armidale Road passes along Willawarrin Public School. There are some concealed driveways along the route which have very limited sight distances. Some sections of Kempsey Armidale Road have narrow road widths that are only one lane due to the risk of falling rocks. There is signage in place to warn motorists about this hazard.

There are several school bus route signs along the approach and departure sections of Kempsey Armidale Road in the vicinity of Bellbrook Public School. There is an existing 40 km/h school zone on Main Street, including a school children's crossing facility. There are some sections where Kempsey Armidale Road narrows down to one lane; give way signs are in place on the approach to these bends. In the mountainous section, plastic guard posts and flags are provided to warn the motorists about the hazard at the road edge. Beyond Comara, the road is currently restricted to a maximum 15 tonne load limit.

Debris from rockfalls was observed during site inspection along some sections of Kempsey Armidale Road. Overgrown vegetation was also observed to restrict sight distances and obscure road signs. The road is currently widened in many sections, with formal passing bays allowing opposing vehicles to pass each other. There are currently numerous potholes and badly damaged sections of Kempsey Armidale Road, possibly worsened by the recent rain this year. Some unsealed sections of the Kempsey Armidale Road can become slippery during rainy days. The same sections of road also create dust during dry days, reducing the safe visibility for following vehicles.

KSC has a repair program to fix various road sections along Kempsey Armidale Road, including slip repairs at Devils Nook and bridge abutment scour repairs at Nulla Creek.



Plate 4.9 Kempsey Armidale Road (looking north near Skillion Flat)



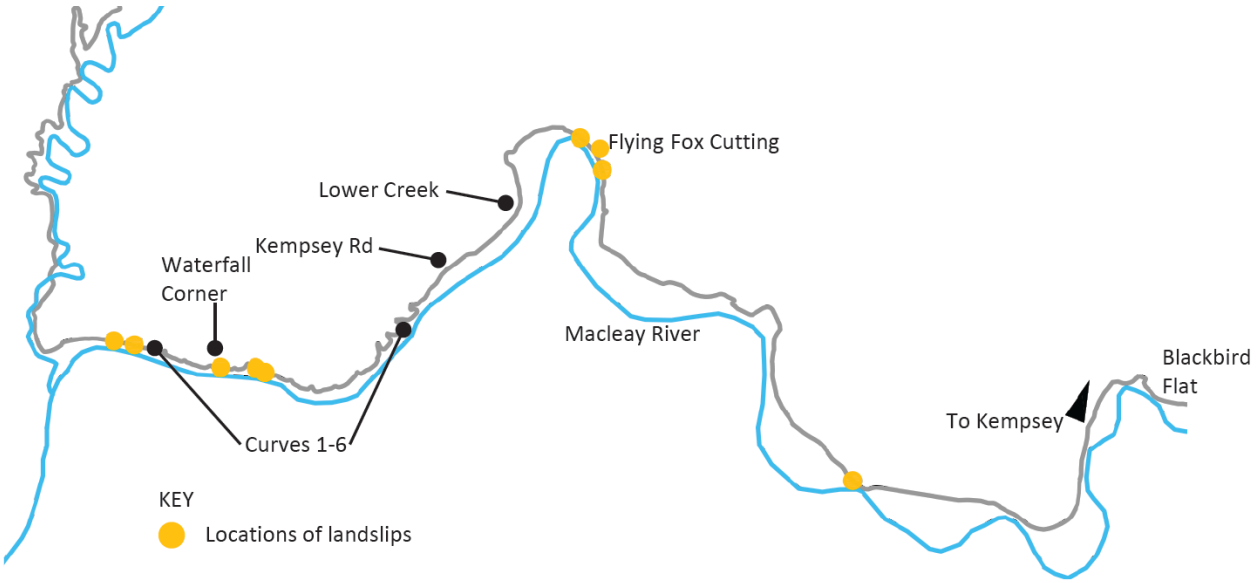
Plate 4.10 Kempsey Armidale Road (looking north near Willawarrin Public School)



Plate 4.11 Kempsey Armidale Road (looking north near Devils Nook Creek)

4.1 Road improvements along Kempsey Armidale Road

On 21 July 2022, NSW Government allocated funding for restoration of the 48 km of Kempsey Armidale Road (43 km Kempsey to Armidale Road and 5 km of Lower Creek Road) to the condition before heavy rainfalls affected the road. According to ARC website, works will include earthworks, roadside drainage, pavements, pavement markings, signage, retaining walls, environmental safeguards, scour protection to existing bridges, roadside furniture including safety barriers, and landscaping as shown in Figure 4.2. More information could be found on the council website (https://www.armidaleregional.nsw.gov.au/council/newsroom/works-and-projects/kempsey-road).



Source: Armidale Regional Council website

Figure 4.2 Kempsey Armidale Road upgrades

Within KSC, road remediation is currently taking place at five landslips on Kempsey Armidale Road near Bellbrook in the Macleay Valley hinterland. Further information could be found on KSC's website (https://www.kempsey.nsw.gov.au/Your-Valley/Ongoing-works-in-the-shire/Major-projects/Armidale-Road-landslip-remediation).

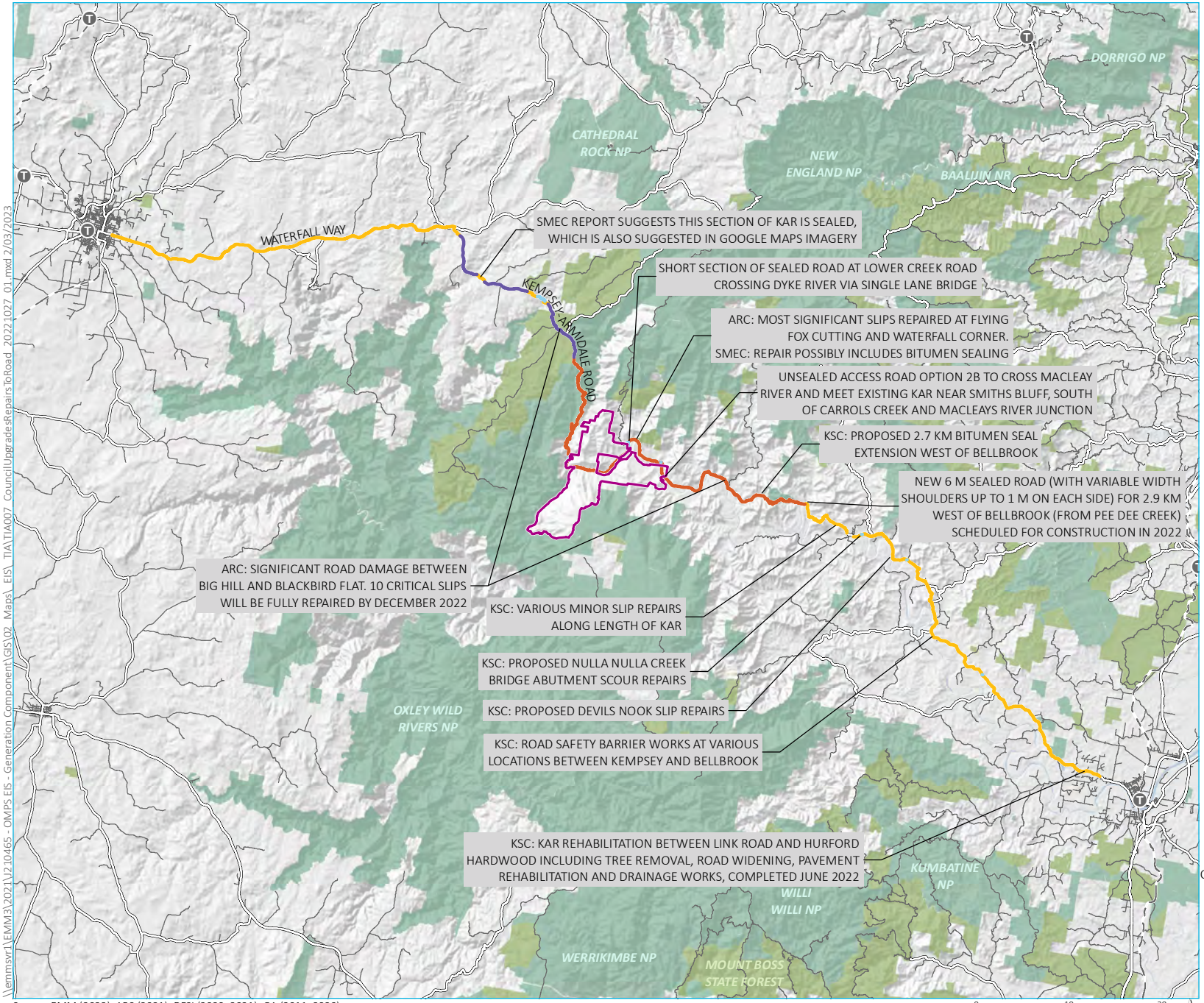
The details of these upgrades and repairs are presented in Table 4.3. Locations of the upgrades and repairs are shown in Figure 4.3.

Table 4.3 Council upgrades and repairs to Kempsey-Armidale Road

LGA	Description	Timing
KSC	The following works are not currently budgeted but identified as priorities for treatment due to alignment or pavement conditions: • 3–3.9 km west of Turners Flat Road • Hickeys Creek bridge to 2 km to the west • 5.2–7.2 km west of Turners Flat Road • North Street to Sherwood Road • Temagog Rd to 2.5 km west • 0.3–1.5 km west of Link Road • 2.5–4.5 km west of Temagog Road • Nulla Creek bridge to West Street, Bellbrook • Pee Dee Hill to Five Day Creek Road (re-sheeting).	-

Table 4.3 Council upgrades and repairs to Kempsey-Armidale Road

LGA	Description	Timing
KSC	There are a range of natural disaster works and safety works in progress between Kempsey and Pee Dee. These works are aimed at maintaining this road to an acceptable standard. The proposed works include: • Works west of Kempsey near Ferrier Drive (widening and pavement rehabilitation). • Bitumen seal extension on gravel length west of Bellbrook for 2.7 km. • Devil's Nook slip repairs. • Nulla Creek bridge abutment scour repairs. • Various minor slip repairs along the length of the road. • Road safety barrier works at various locations between Kempsey and Bellbrook.	In progress
KSC	Upgrade of Kempsey Armidale Road west of Bellbrook to seal a 2.9 km stretch of road from Pee Dee Creek: • The works will provide a two-lane sealed pavement nominally 6 m wide with variable shoulder/verges. Clear width would normally be 8 m. • There are four curves with radius below 30 m in this design that have been flagged for more detailed investigation with KSC.	To commence in 2022/23
ARC	Significant road damage between Big Hill and Blackbird Flat. 10 critical slips will be fully repaired.	To be repaired by approximately December 2022
ARC	Restoration of 43 km Kempsey Armidale Road and 5 km of Lower Creek Road to pre-disaster condition. The works will include earthworks, roadside drainage, pavements, pavement markings, signage, retaining walls, environmental safeguards, scour protection to existing bridges, roadside furniture including safety barriers, and landscaping. Emergency repair works completed at Flying Fox Cutting and Waterfall Corner.	Multi-year program



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Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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Council upgrades and repairs to Kempsey-Armidale Road

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Figure 4.3

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4.2 Road load limit restrictions

Kempsey Armidale Road[3] currently has several load limit restrictions between Wollomombi to Lower Creek and Comara to Lower Creek, which affects the secondary access from Armidale to EAR. The load limit allows a gross weight limit of 15 ton over Kempsey Armidale Road (Plate 4.12 and Plate 4.14) and a gross load limit of 4.3 t (Plate 4.13) over Kempsey Armidale Road. There are further restrictions for heavy vehicles with only one heavy vehicle permitted on the bridge at one time (Plate 4.15). The Project access from Armidale side will only utilise vehicles within the design limitations of the existing road.

During the reinstatement program, temporary load limit restrictions were observed to be in place along localised sections of Kempsey Armidale Road.

The primary access from Kempsey to EAR does not pass through the sections of Kempsey Armidale Road with the previously mentioned load limit restrictions. Despite the lack of signed load limit restrictions, each bridge will still have specific load carrying capacities and structural compositions. A bridge assessment for the access from the Kempsey side will be undertaken during the detailed design phase and prior to access by construction heavy vehicles.

From the main haulage route along Kempsey Armidale Road from Kempsey to EAR, there are bridges and culverts of varying lengths and structural compositions. The bridges and culverts cross:

- Lagoon Creek
- Blackbird Flat Creek
- Five Day Creek
- Pee Dee Creek
- Gap Creek*
- Nulla Nulla Creek
- Fig Tree Gully*
- Midnight Creek
- Schoolhouse Gully*
- Devils Nook Creek
- Lewis Creek
- Long Toms Gully*
- Hickeys Creek
- Mungay Creek
- Woolshed Gully*

[3] Early May 2022 (during the site inspection)

- Deep Creek.

Culverts are marked with an asterisk in the above list.



Plate 4.12 Gross weight limit restriction on Kempsey Armidale Road



Plate 4.13 Gross load limit restriction on Kempsey Armidale Road



Plate 4.14 **Gross weight limit restriction on Kempsey Armidale Road at Comara**



Plate 4.15 **Heavy vehicle restriction on Kempsey Armidale Road**

5 Existing conditions

5.1 Site inspection and observations

A site visit was conducted by Abdullah Uddin, EMM's Associate Traffic Engineer, on the following dates:

- 4 May 2022: between Kempsey to Lower Creek
- 6 May 2022: Wollomombi to Lower Creek.

The site visit observations regarding the existing road conditions have been incorporated throughout this report.

5.2 Road network

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- state roads – freeways and primary arterials (TfNSW managed)
- regional roads – secondary or sub arterials (council managed and part funded by the State)
- local roads – collector and local access roads (council managed).

Key roads considered in this assessment include (listed from west to east) include Waterfall Way, Macleay Valley Way (also known as Lachlan Street, Lord Street and Smith Street), Kempsey Armidale Road, Belgrave Street, Elbow Street, River Street, North Street and Second Lane. These key roads form the external road network of the Project. Key roads are shown in Figure 5.1 and road geometry descriptions are provided in Table 5.1 to Table 5.6.



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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KEY

- Project area
- Key intersections
- Train station
- Rail line
- Major road
- Minor road
- Named waterbody
- Local government area
- NPWS reserve
- State forest

Road network of interest - hierarchy

- State
- Regional
- Local

Road network and key intersections

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Figure 5.1

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Table 5.1 Waterfall Way

Aspect	Description
Road classification and connectivity	State road connecting with the New England Highway at Armidale on the eastern side and joining Pacific Highway at Raleigh towards the west
Local government area	Armidale Regional Council
Alignment	Generally east–west
Number of lanes	One lane in each direction, except at intersections
Carriageway type	Sealed road
Carriageway width	Varies between 8 m to 9.5 m with 3.3 m to 3.5 m lanes in each direction and 0.5 m to 1 m wide sealed shoulders
Default speed limit	100 km/hour (km/h) outside Armidale, reducing to 80 km/h and then 50 km/h within Armidale
Heavy vehicle access	Approved for up to 26 m B-doubles
Traffic function	Primarily carries regional traffic



Source: Google street view

Plate 5.1 Waterfall Way (looking east)

Table 5.2 Macleay Valley Way (north section)

Aspect	Description
Road classification and connectivity	Regional road connecting the towns of Kempsey and Frederickton with Pacific Highway
Alignment	North–south
Number of lanes	One lane in each direction except at intersections.
Carriageway type	Sealed road
Carriageway width	Approximately 10 m which includes two 3.5 m lanes and 1.5 m sealed shoulders
Default speed limit	100 km/h
Heavy vehicle access	Approved for up to 26 m B-doubles
Traffic function	Primarily carries regional traffic



Source: Google street view

Plate 5.2 Macleay Valley Way North (looking north)

Table 5.3 Macleay Valley Way (south section)

Aspect	Description
Road classification and connectivity	Regional road connecting South Kempsey with Pacific Highway
Alignment	North–south
Number of lanes	One lane in each direction except at intersections
Carriageway type	Sealed road
Carriageway width	Approximately 11 m which includes two 3.5 m lanes and 2 m sealed shoulders.
Default speed limit	80 km/h exiting from Pacific Highway, reduced to 50 km/h approaching Kempsey.
Heavy vehicle access	Approved for up to 26 m B-doubles
Traffic function	Primarily carries regional traffic



Source: Google street view

Plate 5.3 Macleay Valley Way South (Looking north)

Macleay Valley Way connects the towns of Kempsey and Frederickton to Pacific Highway. It is also known as Lachlan Street, Lord Street and Smith Street within Kempsey. An approximately 9 km long section of the road will be used by Project traffic to travel towards the Project area. The road has a posted speed limit of 80 km/h on the outskirts of Kempsey and drops to 50 km/h near Kempsey.

Table 5.4 River Street

Aspect	Description
Road classification and connectivity	Regional road connecting to Elbow Street in Kempsey towards the south and Armidale Road towards the north near Yarravel
Alignment	North-west–south-east
Number of lanes	One lane each way
Carriageway type	Sealed road
Carriageway width	Approximately 12 m
Default speed limit	70 km/h in rural sections moving away from Kempsey, 50 km/h near Kempsey
Heavy vehicle access	Approved for vehicles up to 19 m long and under 50 t between Elbow Street and North Street. Approved for vehicles up to 26 m B-doubles and over 50 t between North Street and Kempsey Armidale Road.
Traffic function	Carries regional and local traffic



Plate 5.4 River Street (looking east)

KSC is proposing to make several road safety improvements along River Street, West Kempsey. These will include pedestrian refuge crossings, edge lines for the parking lanes and pedestrian warning signs. Work is expected to begin in late 2022 or early 2023.

Table 5.5 Second Lane

Aspect	Description
Road classification and connectivity	Local road connecting Macleay Valley Way and North Street
Alignment	East–west
Number of lanes	One lane each way
Carriageway type	Sealed road
Carriageway width	Approximately 7 m
Default speed limit	100 km/h, reducing to 60 km/h towards North Street
Heavy vehicle access	Approved access for vehicles up to 26 m B-doubles. Route has travel conditions for B-doubles moving from Second Lane to Saleyards Road.
Traffic function	Carries regional and local traffic



Plate 5.5 Second Lane (looking west)

Table 5.6 North Street

Aspect	Description
Road classification and connectivity	Local road connecting River Street and Second Lane
Alignment	North-east–south-west
Number of lanes	One lane each way
Carriageway type	Sealed road
Carriageway width	Varies between 9 m to 12.5 m. Wider carriageway towards River Street side.
Default speed limit	Different speed limits split approximately halfway along the road, with the western section signposted at 50 km/h and the eastern section signposted at 60 km/h.
Heavy vehicle access	Approved for vehicles up to 26 m B-doubles
Traffic function	Carries regional and local traffic



Plate 5.6 North Street (looking east)

5.3 Key intersections

The key intersections which have been assessed for Project related traffic impacts are described as follows:

- Waterfall Way/Kempsey Armidale Road intersection
- Lord Street/Rudder Street intersection
- Smith Street/Belgrave Street intersection
- River Street/North Street intersection
- North Street/Kemp Street/Saleyards Road intersection
- Second Lane/Griffins Lane intersection
- Macleay Valley Way/Second Lane intersection.

Key intersection locations are shown in Figure 5.1. The intersection geometry details of each intersection are presented in Table 5.7 to Table 5.13.

Table 5.7 Waterfall Way/Kempsey Armidale Road intersection

Aspect	Description
Location from the site	Approximately 40 km north-west of the Project area
Local government area	Armidale Regional Council
Intersection control	Give way controlled
Major road	Waterfall Way
South approach	One lane on approach and departure
East approach	One lane on approach and one lane on departure
West approach	One lane on approach and one lane on departure
Pedestrian connectivity	No pedestrian connectivity on any approach
Traffic function	Predominantly carries regional traffic
Speed limit	100 km/h on east and west approaches and 100 km/h default speed limit on south approach
Additional comments	The intersection is provided with an Auxiliary Left-turn Treatment (AUL) and Auxiliary Right-turn Treatment (AUR). The approach from Kempsey Road to the intersection is on an incline, restricting visibility for northbound vehicles on Kempsey Armidale Road slowing down to turn left or right onto Waterfall Way. Vehicles need to arrive right at the edge of the intersection before obtaining a clear view of any oncoming traffic on Waterfall Way.



Source: Google Maps

Plate 5.7 Waterfall Way/Kempsey Armidale Road intersection

Table 5.8 Lord Street/Rudder Street intersection

Aspect	Description
Location from the site	Approximately 70 km south-east of the Project area
Intersection control	Give way controlled
Major road	Lord Street
North approach	Two lanes on approach and one lane on departure
South approach	One through lane and one left turning short lane on approach, one full and one short lane departure
West approach	One lane on approach and one lane on departure
Pedestrian connectivity	No pedestrian connectivity on any approach
Traffic function	Predominantly carries local traffic
Speed limit	50 km/h on all approaches
Additional comments	Queuing was observed to extend over Macleay River bridge from Smith Street/Belgrave Street intersection during the AM and PM peak hours.



Source: MetroMap

Figure 5.2 Lord Street/Rudder Street intersection

Table 5.9 Smith Street/Belgrave Street intersection

Aspect	Description
Location from the site	Approximately 70 km south-east of the Project area
Intersection control	Give way controlled
Major road	Smith Street
North approach	One through and one right turning short lane on approach, and one lane on departure
East approach	One through lane, one right turning lane and one left turning short lane on approach, and one lane on departure
West approach	One shared through and left turning lane and one right turning lane on approach, and two lanes on departure
Pedestrian connectivity	Signalised pedestrian crossings provided on north, west and (east across Belgrave Street only) approaches
Traffic function	Predominantly carries local traffic
Speed limit	50 km/h on east and west approaches and 40 km/h on north approach
Additional comments	Congestion was observed during the AM and PM peak hours at this intersection.



Source: MetroMap

Figure 5.3 Smith Street/Belgrave Street intersection

Table 5.10 River Street/North Street intersection

Aspect	Description
Location from the site	Approximately 68 km south-east of the Project area
Intersection control	Give way controlled
Major road	River Street
North-east approach	One lane on approach and departure
North-west approach	One lane on approach and departure
South-east approach	One through lane and one right turning short lane on approach and one lane on departure
Pedestrian connectivity	No signalised pedestrian crossings on any approach. There is a pedestrian refuge island on the north-east approach.
Traffic function	Predominantly carries regional and local traffic
Speed limit	50 km/h on north and east approaches and 60 km/h on west approach



Source: MetroMap

Figure 5.4 River Street/North Street intersection

Table 5.11 North Street/Kemp Street/Saleyards Lane/Second Lane intersection

Aspect	Description
Location from the site	Approximately 70 km south-east of the Project area
Intersection control	Give way controlled
Major road	North Street and Second Lane
North approach	One lane on approach and departure
South approach	One lane on approach and departure
West approach	One lane on approach and departure
East approach	One lane on approach and departure
Pedestrian connectivity	No pedestrian connectivity on any approach
Traffic function	Predominantly carries regional traffic
Speed limit	60 km/h on west approach, 100 km/h on east approach, 50 km/h on north and south approaches
Additional comments	There is a railway crossing directly east of this intersection.



Source: MetroMap

Figure 5.5 North Street/Kemp Street/Saleyards Lane/Second Lane intersection

Table 5.12 Second Lane/Griffins Lane intersection

Aspect	Description
Location from the site	Approximately 70 km south-east of the Project area
Intersection control	Give way controlled
Major road	Second Lane
North approach	One lane on approach and departure
West approach	One lane on approach and departure
East approach	One lane on approach and departure
Pedestrian connectivity	No pedestrian connectivity on any approach
Traffic function	Predominantly carries regional traffic
Speed limit	60 km/h on west approach, 100 km/h on east approach, 50 km/h on north approach
Additional comments	There is a railway crossing directly west of this intersection.



Source: MetroMap

Figure 5.6 Second Lane/Griffins Lane intersection

Table 5.13 Macleay Valley Way/Second Lane

Aspect	Description
Location from the site	Approximately 70 km south-east of the Project area
Intersection control	Give way controlled
Major road	Macleay Valley Way
North approach	One right turning lane and one through lane on approach and one lane on departure
South approach	One left turning lane and one through lane on approach and one lane on departure
West approach	One lane on approach and departure
Pedestrian connectivity	No pedestrian connectivity on any approaches
Traffic function	Predominantly carries regional traffic
Speed limit	100 km/h on all approaches
Additional comments	This intersection has a Rural AUL and Rural Channelised Right (CHR) Turn Treatment. There are accelerating lanes for both northbound and southbound traffic.



Source: MetroMap

Figure 5.7 Macleay Valley Way/Second Lane intersection

5.4 Existing traffic volumes

5.4.1 Intersection traffic count surveys

The key intersections providing the main access to the Project have been surveyed between 6:00 am and 9:00 am, as well as between 3:00 pm and 6:00 pm. Waterfall Way/Kempsey Armidale Road intersection is located on the secondary haulage route and was surveyed on 28 June 2022. The remaining key intersections on the main haulage route were surveyed on 29 June 2022. The remaining key intersections that were surveyed are:

- Lord Street/Rudder Street intersection
- Smith Street/Belgrave Street intersection
- River Street/North Street intersection
- North Street/Kemp Street/Saleyards Road intersection
- Second Lane/Griffins Lane intersection
- Macleay Valley Way/Second Lane intersection.

The surveys were performed during a non-school holiday/non-Covid restricted period. The traffic counts survey data is provided in Attachment A.

The survey results indicate that the network peak[4] hours are:

- AM peak hour: 8:00 am to 9:00 am
- PM peak hour: 3:15 pm to 4:15 pm.

The surveyed traffic volumes during the AM and PM peak hours are summarised in Figure 5.9.

5.4.2 TfNSW traffic volume viewer

The 5 day average bi-directional traffic volumes for Macleay Valley Way at South Kempsey and Smith Street at Kempsey are available from TfNSW Traffic Volume Viewer and the data is presented in Table 5.14 for reference purposes.

[4] Network peak – for example, if four intersections are surveyed between 6 am to 9 am, and out of the four intersections three of the intersections have peak hours between 6.45 am to 7.45 am, then this will be the network peak. While this is the peak hour for the road network, this may not necessarily apply to individual sites. For some projects, such as a child care centre or retail shopping centre, the site peak will be considered.

Table 5.14 TfNSW traffic volume viewer daily traffic volumes

Road	Year	Daily volumes [5](5-day AADT)	Eastbound/Southbound		Westbound/Northbound	
			Traffic volume	Heavy vehicle %	Traffic volume	Heavy vehicle %
Macleay Valley Way (450 m South of South Street, South Kempsey)	2021	7,555	3,743	15.07	3,812	15.61
Smith Street, Kempsey	2011	17,832	8,812	-	9,020	-

Source: https://roads-waterways.transport.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6

Table 5.14 shows that Macleay Valley Way carries significant daily traffic volumes, as it provides regional access to the towns of Kempsey and Frederickton. Daily traffic volumes for Smith Street exceeded 17,000 vehicles per day in 2011, as Smith Street was along a former alignment of the Pacific Highway that was bypassed by a newer alignment between 2013 and 2016. As these bypass works are now complete, the current traffic volumes along Smith Street are expected to be much lower than the 2011 survey.

5.4.3 Tube counts traffic volumes from Councils

Traffic volume data collected from tube count surveys has been provided by ARC and KSC. The tube count surveys were conducted on Waterfall Way, Kempsey Armidale Road, and River Street. The survey period for these counts was usually less than a month. Tube count locations are presented in Figure 5.8 and the tube count survey data showing 5-day average bi-directional traffic volumes and heavy vehicle percentages at these locations are presented in Table 5.15.

Table 5.15 Tube counts traffic data from councils

Road section	Survey month/year	Daily volumes (5-day AADT)	Eastbound/Southbound		Westbound/Northbound	
			Traffic volume	Heavy vehicle %	Traffic volume	Heavy vehicle %
1. Waterfall Way (300 m East of Stockton Rd)	March/April 2020	625* (23%)	NA	NA	NA	NA
2. Waterfall Way (East side of Sandy Creek)	March/April 2020	521* (29%)	NA	NA	NA	NA
3. Kempsey Road (40 m south of Lower Creek Road)	June 2021	49	25	6.55	24	7.00
4. Kempsey Road (Blackbird Flat, 20 m west of LGA Boundary)	June 2021	61	30	8.79	31	7.81
5. Armidale Road (west of Five Day Creek Road)	January 2018	76	41	2.74	44	1.36

[5] 5-Day Average Annual Daily Traffic (AADT) = The total volume of traffic passing a roadside observation point over the period of a calendar year, divided by the number of weekdays in that year (eg 366-104=262 working days).

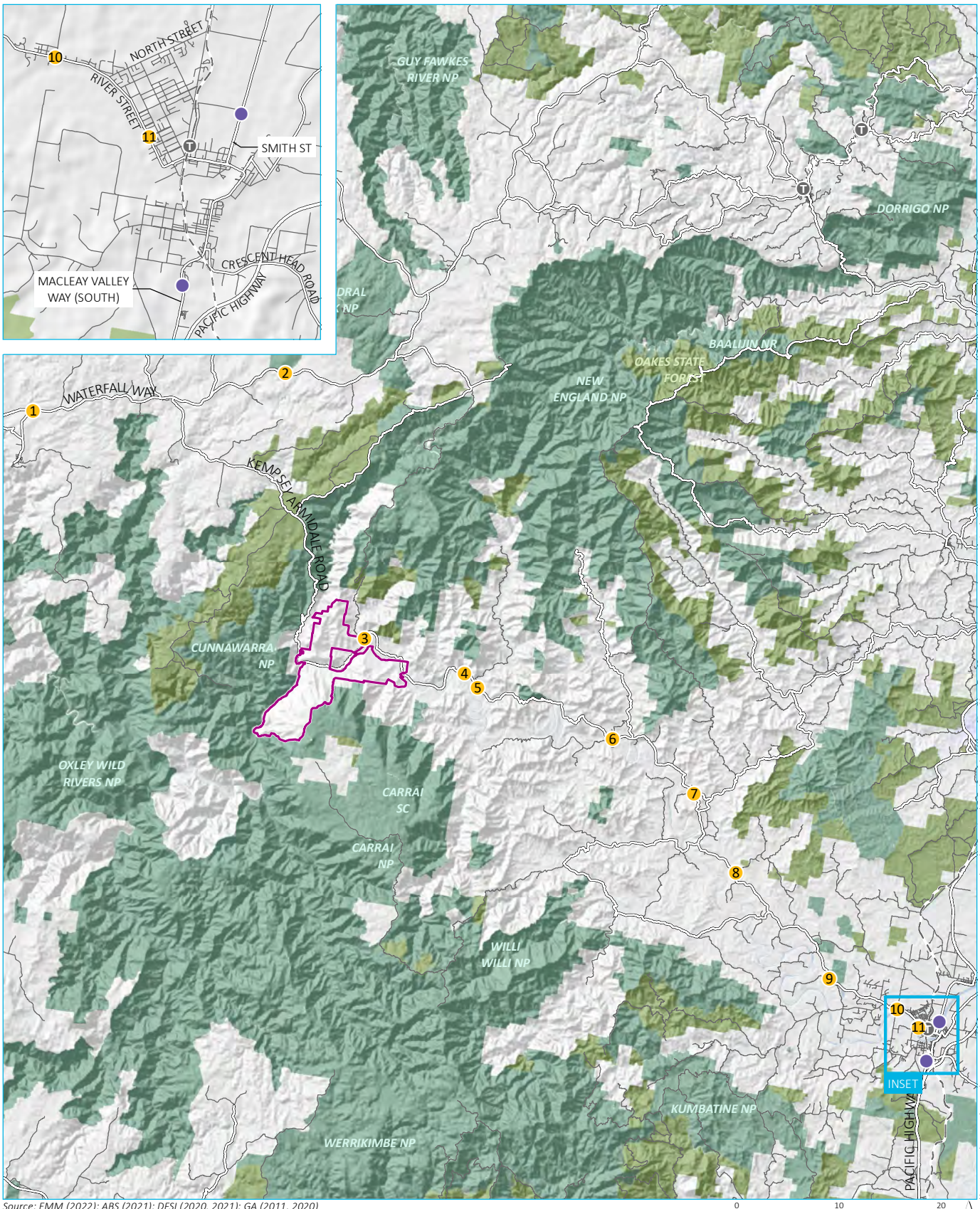
Table 5.15 Tube counts traffic data from councils

Road section	Survey month/year	Daily volumes (5-day AADT)	Eastbound/Southbound		Westbound/Northbound	
			Traffic volume	Heavy vehicle %	Traffic volume	Heavy vehicle %
6. Armidale Road (west of Thungutti Drive)	May 2018	244	127	1.67	119	1.47
7. Armidale Road (south of Tom Gully Road)	April 2021	397	199	1.55	199	1.88
8. Armidale Road (north of Mungay Creek Road)	January/ February 2020	934	464	1.6	468	1.46
9. Armidale Road (south of Mooneba Road)	April/May 2021	1,934	967	1.98	964	3.93
10. River Street (west of Spooners Avenue)	February/ Mar 2020	7,518	3,748	0.88	3,762	0.87
11. River Street (south of Short Street)	October/ November 2018	6,733	3,493	0.8	3,291	0.88

Source: Armidale Regional Council and Kempsey Shire Council.
Note: 1. Values in brackets present heavy vehicle percentages for bi-directional traffic.
*. Traffic volumes for Waterfall Way and Kempsey Road are 7-day average volumes.
NA – Data not available.

As per Table 5.15, the traffic volumes for River Street are the highest as it is one of the major streets in Kempsey, surrounded by urban development land use and population areas. The road becomes part of Kempsey Armidale Road which provides access to localities further west enroute to Armidale. Traffic volumes along Kempsey Armidale Road vary with locations closer to Kempsey having higher traffic volumes. Traffic volumes decrease to less than 100 vehicles per day west of Bellbrook near Comara (Five Day Creek Road). Traffic volumes on Kempsey Armidale Road in the vicinity of the Project area are approximately 50 vehicles per day. This is primarily because of the absence of any major population centres nearby, mountainous terrain and the narrow winding road alignment.

The traffic volumes along Waterfall Way are relatively higher, compared to local roads, as it is a major road corridor connecting the towns of Armidale, Ebor, Dorrigo and Bellingen.



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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KEY

- Project area
- TfNSW traffic volume viewer count locations
- Tube counts traffic data from Councils
- Train station
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

TfNSW and Councils traffic data locations

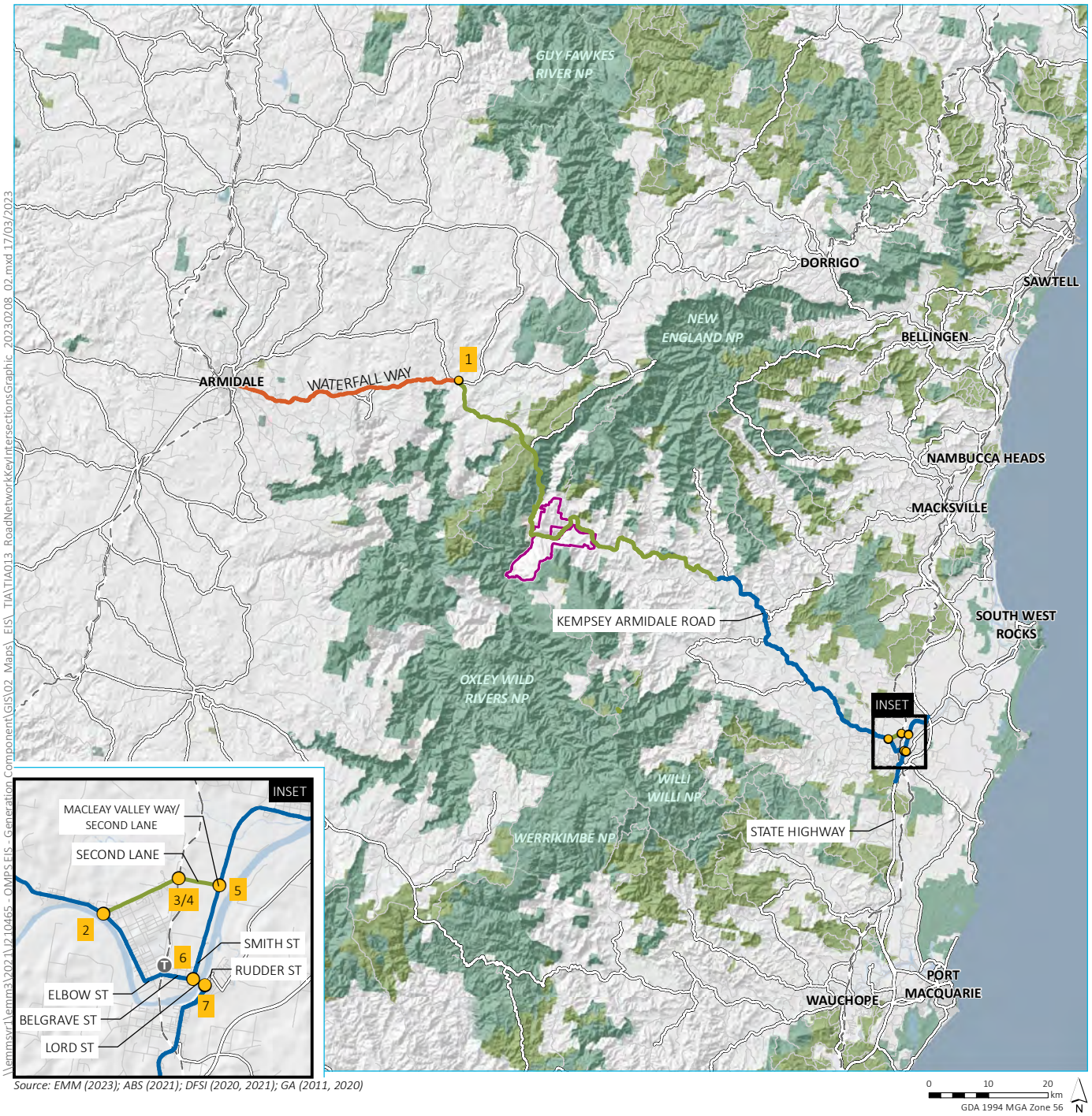
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Figure 5.8

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5.5 Baseline traffic volumes

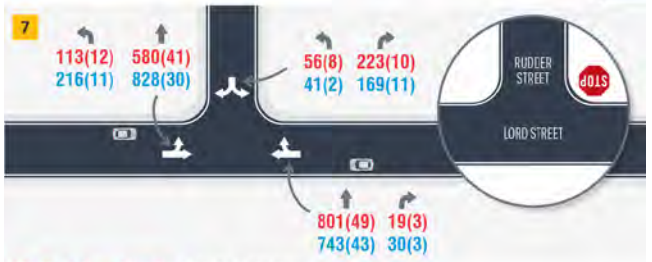
Peak construction traffic volumes are expected to occur in 2027. Therefore, a linear traffic growth rate of one per cent per annum has been applied on the surveyed traffic volumes in 2022 to obtain the baseline traffic volumes in 2027. Baseline traffic volumes are considered to have the same AM and PM peak hour as surveyed traffic volumes.

The surveyed traffic volumes in 2022 for the AM and PM peak hours are presented in Figure 5.9. The baseline traffic volumes in 2027 for the AM and PM peak hours are presented in Figure 5.10.









AM Peak Hour LV(HV) *LV – Light Vehicles*
PM Peak Hour LV(HV) *HV – Heavy Vehicles*

KEY

- Project area
- Key intersections

Road network of interest - hierarchy
- State
- Regional
- Local

Existing environment
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

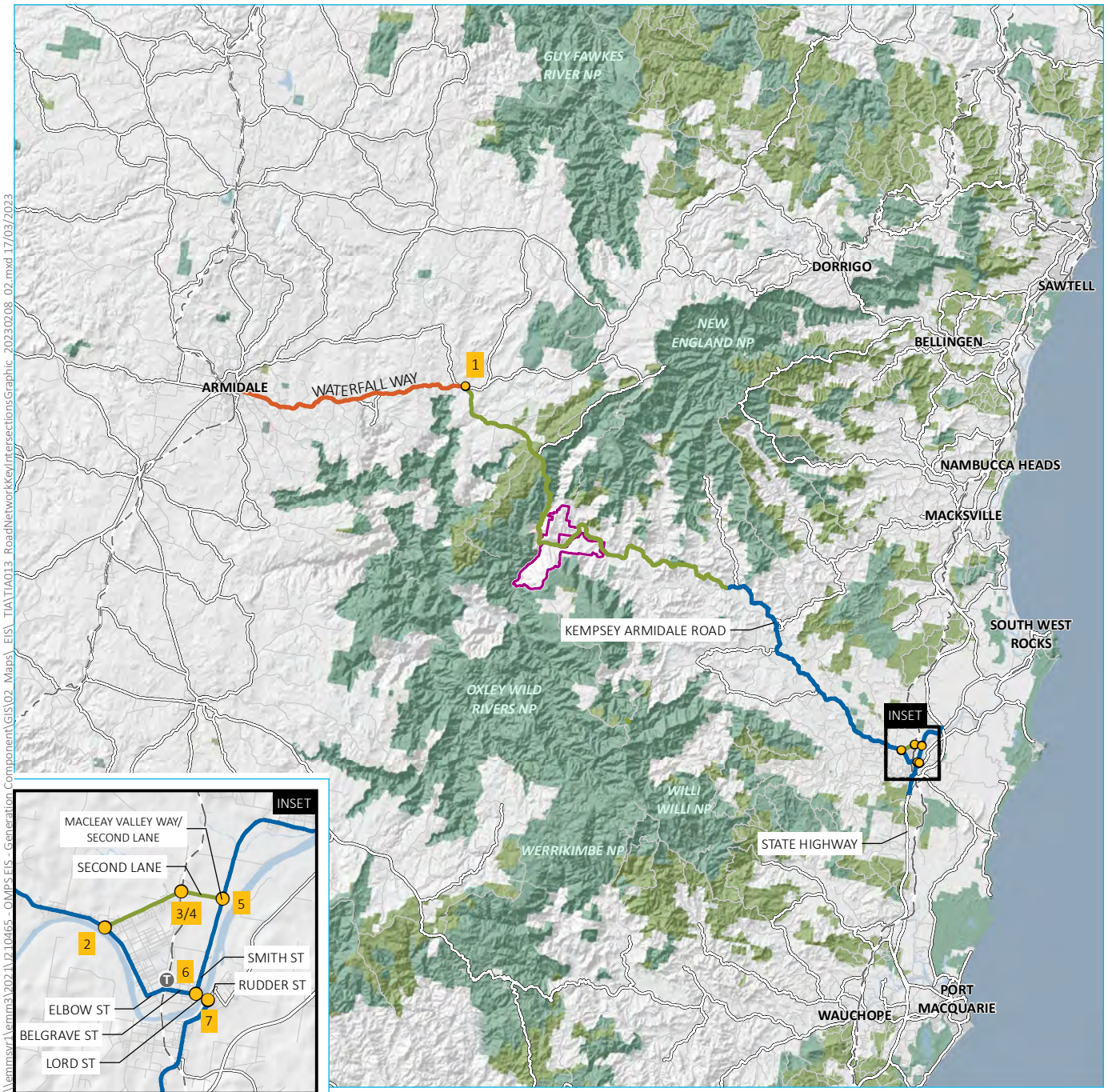
Source: EMM (2023); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

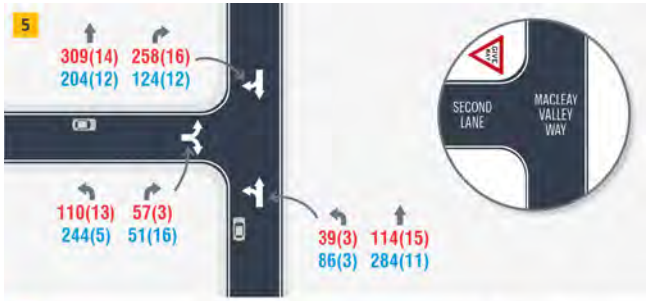
Surveyed AM and PM peak hour traffic volumes in 2022

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Figure 5.9

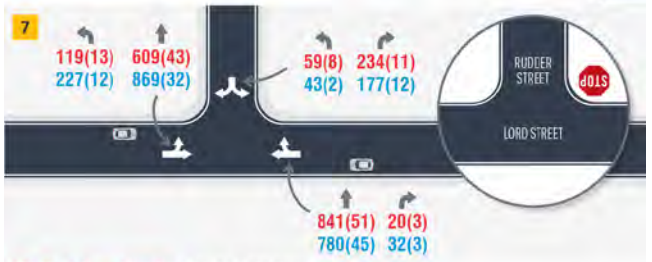
EMM creating opportunities

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AM Peak Hour LV(HV) *LV – Light Vehicles*
PM Peak Hour LV(HV) *HV – Heavy Vehicles*

KEY

- Project area
- Key intersections

Road network of interest - hierarchy
- State
- Regional
- Local

Existing environment
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

Source: EMM (2023); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

Baseline AM and PM peak hour traffic volumes in 2027

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Figure 5.10

EMM creating opportunities

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As per Figure 5.9, the traffic volumes are highest at the Lord Street/Rudder Street and Smith Street/Belgrave Street intersections. These intersections are close to the Kempsey commercial area and also carry traffic which continues on towards Kempsey Armidale Road. There was considerable queuing observed during the peak hours on the Macleay River bridge and along Lord Street. However, it is noted that the preferred route for the Project's traffic is via Macleay Valley Way, Frederickton. Hence, it is unlikely that traffic congestion will increase as a result of the Project's traffic.

Macleay Valley Way/Second Lane intersection and River Street/North Street intersection also carry significant traffic volumes. The two intersections carry significant portion of traffic travelling between River Street and Macleay Valley Way while bypassing Kempsey town centre traffic congestion.

The Waterfall Way/Kempsey Armidale Road has low traffic volumes due to the remote location of the intersection and is on the secondary access route to the Project site.

5.6 Road design standards

Road width design standards for low volume (generally rural) roads are defined by the *Austroads Guide to Road Design Part 3: Geometric Design* (Austroads, 2016) and are based on daily traffic volumes, as shown in Table 5.16.

Table 5.16 Austroads road design for rural road

Threshold band (daily traffic volumes)	Design standard
1–150	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal
150–500	Minimum 7.2 m wide seal
500–1,000	Minimum 7.2 m, up to 8 m wide seal
1,000–3,000	Minimum 9 m wide seal
> 3,000	Minimum 10 m wide seal

Source: Austroads Guide to Road Design Part 3: Geometric Design Table 4.5

The existing road width measurements and daily traffic volumes of roads in the external road network are presented in Table 5.17.

Table 5.17 Baseline daily traffic volumes and corresponding road design standards

Road	Extent of road section	Approximate length of section (km)	Available daily traffic volume (year)	2027 baseline daily traffic volume (without development traffic)	Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Currently meets Austroads design standard?
Waterfall Way	Between Armidale and Wollomombi	40	625 (2020)	669	7.2 m sealed	Minimum 7.2 m, up to 8 m wide seal	Yes
Macleay Valley Way (North)	Between Frederickton and Second Lane at West Kempsey	5.5	8,295	8,710	9–10 m sealed	Minimum 10 m wide seal	Yes
Macleay Valley Way (South)	Between Pacific Highway and Lachlan Street	3.6	7,555 (2021)	8,008	12 m sealed	Minimum 10 m wide seal	Yes
Kempsey Armidale Road	Between Waterfall Way at Wollomombi to Caterpillar Creek	24	49 (2021)	52	6–7 m unsealed*	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	Yes, with exceptions
	Between Caterpillar Creek and Site Access 3	16	49 (2021)	52	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
	Between Site Access 3 and Site Access 2	9.7	49 (2021)	52	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
	Between Site Access 2 and Site Access 1	7.7	61 (2021)	65	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
	Between Site Access 1 to LGA boundary	9	76 (2018)	83	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
	Between LGA boundary to Pee Dee	12.7	76 (2018)	83	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No
	Between Pee Dee to Bellbrook	8.3	244 (2018)	266	9 m sealed	Minimum 7.2 m wide seal	Yes
	Between Bellbrook to Yarravel	45	397 (2021) to 1934 (2021)	2,050	9 m sealed	Minimum 9 m wide seal	Yes

Table 5.17 Baseline daily traffic volumes and corresponding road design standards

Road	Extent of road section	Approximate length of section (km)	Available daily traffic volume (year)	2027 baseline daily traffic volume (without development traffic)	Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Currently meets Austroads design standard?
Lachlan Street/Lord Street	Between Macleay Valley Way (South) and Belgrave Street	2.4	16,385	17,204	10–12 m sealed	Minimum 10 m wide seal (For 2 lane sections)	Yes
Belgrave Street/Elbow Street	Between Lord Street and River Street	1.4	13,755	14,443	Multi-lane road	As this is an urban road section, rural road width standard does not apply	-
Second Lane	Between Macleay Valley Way (North) and North Street	1.2	4,960	5,208	9 m sealed	Minimum 10 m wide seal	Yes, with exceptions
North Street	Between Second Lane and River Street	2.4	4,200	4,410	8.5–9.5 m sealed	Minimum 10 m wide seal	Yes, with exceptions
River Street	Between Elbow Street and Armidale Road	5.1	7,518 (2020)	8,044	12 m sealed	Minimum 10 m wide seal	Yes

Note: Available daily traffic volumes that do not have year of survey mentioned have been determined from intersection traffic count surveys. Peak traffic hour counts are assumed to be 10% of daily volumes.

Baseline daily traffic volumes for the year 2027 have been calculated by applying a 1% linear growth rate over available daily traffic volumes.

* This section of the road is mostly 6 m to 7 m unsealed width but also includes one lane sealed and two lane unsealed sections.

As per Table 5.17, the existing road width measurements for the road network are compliant with Australian Standards except for parts of the Kempsey Armidale Road, North Street and Second Lane.

Kempsey Armidale Road between Wollomombi and Caterpillar Creek has varying sections of sealed and unsealed road, as well as varying road widths. Most of the road section is unsealed and has a road width of approximately 6–7 m. There are sections where the road is sealed for up to two lanes. The existing road standards could still be considered adequate due to the low daily traffic volumes. This section of Kempsey Armidale Road is not the main access route for the Project's traffic, so future traffic volumes will also be expected to remain within the design limitations of the road.

Kempsey Armidale Road between Caterpillar Creek to the proposed EAR (site access 1) is a narrow unsealed road of 3 m to 5 m in width. Although the road is currently non-compliant with Australian Standards, it could still be considered adequate due to very low daily traffic volumes. This section of Kempsey Armidale Road is not the main access route for the Project's traffic, so future traffic volumes will also be expected to remain within the design limitations of the road.

Road sections of Kempsey Armidale Road between the proposed EAR (site access 1) to Pee Dee is generally an unsealed single lane winding road along a mostly mountainous terrain. The traffic volumes are quite low due to few rural settlements in this area.

Road sections along Second Lane and North Street are sealed and have a road width of approximately 8.5–9.5 m. These roads are well maintained. For daily traffic volumes of up to 5,000 vehicles, the road condition can still be considered adequate.

5.7 Crash analysis

Crash data from TfNSW Centre for Road Safety interactive history database for the last five years between 2017 and 2021 has been studied along the road network (Section 5.1) and key intersections (Section 5.3) and are presented in Table 5.18 and shown in Figure 5.11.

The crashes are categorised based on the severity of the crashes, as follows:

- fatal
- serious injury
- moderate injury
- minor/other injury
- non-casualty (e.g. towaway).

Table 5.18 Summary of crashes on external road network within Armidale-Kempsey LGA

LGA	Road section	Degree of crash	Total number of crashes during 2017–21 period
Armidale	Waterfall Way	Serious injury	13
		Moderate injury	9
		Minor/other injury	2
		Non-casualty (e.g. towaway)	3
	Kempsey Road	Serious injury	3

Table 5.18 Summary of crashes on external road network within Armidale-Kempsey LGA

LGA	Road section	Degree of crash	Total number of crashes during 2017–21 period
		Moderate injury	1
		Non-casualty (e.g. towaway)	1
Kempsey	Armidale Road	Fatal	2
		Serious injury	14
		Moderate injury	15
		Minor/other injury	1
		Non-casualty (e.g. towaway)	6
	River Street	Serious injury	3
		Moderate injury	5
	North Street	Serious injury	2
		Moderate injury	2
		Non-casualty (e.g. towaway)	2
	Second Lane	Non-casualty (e.g. towaway)	1
	Elbow Street	Serious injury	2
		Moderate injury	2
		Non-casualty (e.g. towaway)	1
	Belgrave Street	Moderate injury	1
		Minor/other injury	3
		Non-casualty (e.g. towaway)	4
	Smith Street	Serious injury	1
		Moderate injury	4
		Minor/other injury	2
		Non-casualty (e.g. towaway)	1
	Lord Street	Moderate injury	3
		Non-casualty (e.g. towaway)	1
	Lachlan Street	Serious injury	1
		Non-casualty (e.g. towaway)	2
	Macleay Valley Way	Serious injury	3
		Moderate injury	11
		Non-casualty (e.g. towaway)	4

Overall, during the five-year period, there were 131 crashes along the external road network with 32 crashes in Armidale LGA and 99 crashes in Kempsey LGA.

There were 2 fatal crashes, on the Armidale Road section of Kempsey Armidale Road within the Kempsey LGA. Both the crashes were due to a vehicle running off the road carriageway on a bend and running into an object. The crashes resulted in two fatalities. Speeding and fatigue were factors involved in the crashes.

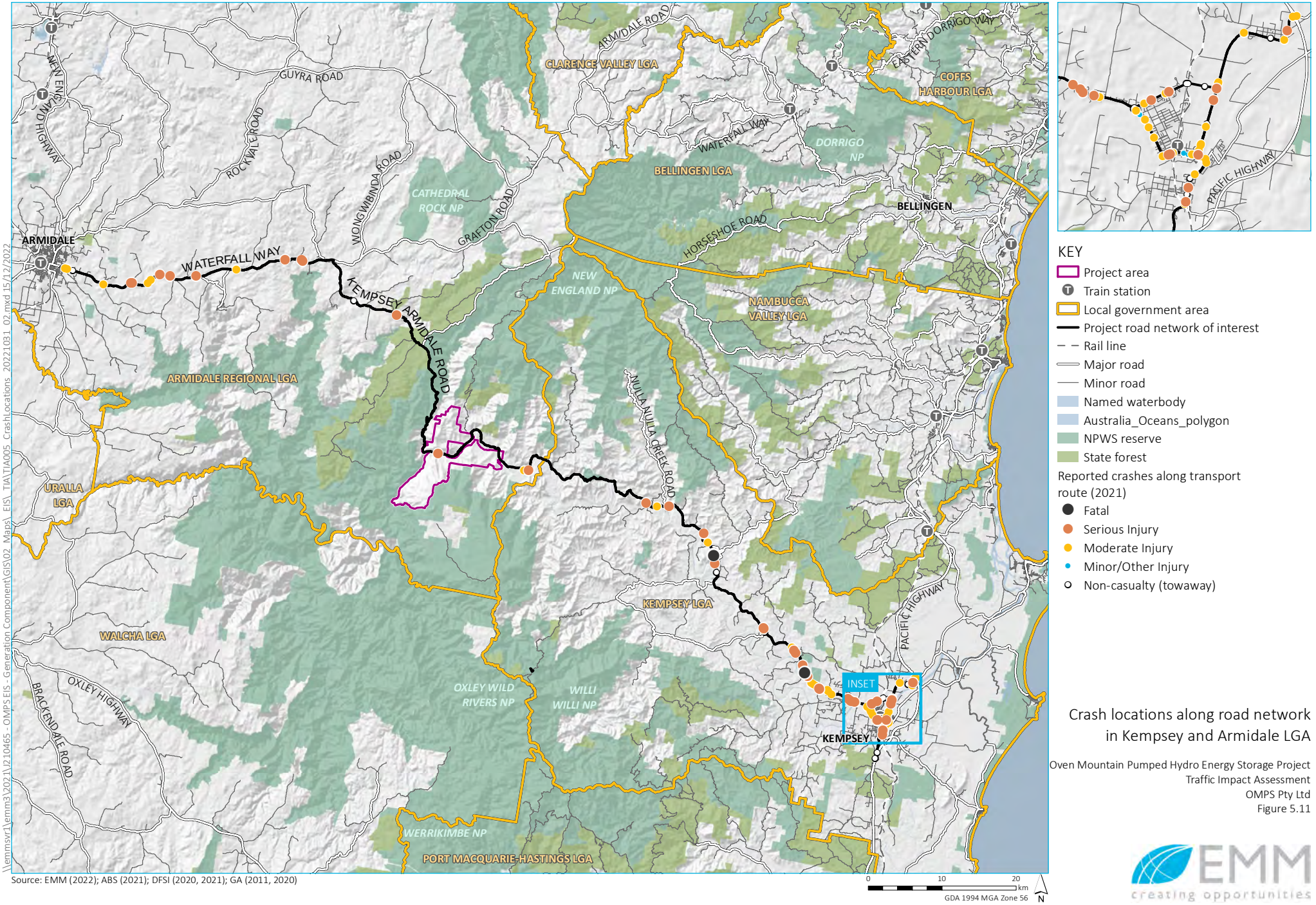
The highest number of serious injury and moderate injury crashes were on the Armidale Road section of Kempsey Armidale Road. The type of crashes included head on, out of control vehicle and vehicle going off right/left/end of the road. This could be partly attributed to the narrow and winding nature of the road with steep slopes.

5.8 2056 Future Transport Strategy

TfNSW 2056 Future Transport Strategy provides a 40 year vision, directions and principles for mobility in NSW. The following key vision is relevant to this TIA:

> The Safe System (otherwise known as Vision Zero, Towards Zero, or Sustainable Safety) views human life and health as paramount to all else and should be the first and foremost consideration when designing a road network.

This TIA has been prepared to identify traffic related risks associated with this Project and outlined the appropriate mitigation measures to minimise those risks for the road users which are aligned with TfNSW 2056 Future Transport Strategy's visions and objectives.



Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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Crash locations along road network in Kempsey and Armidale LGA

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 5.11

EMM
creating opportunities

5.9 Public transport

5.9.1 Trains

The closest train station in context of the Project area is Kempsey station and is serviced by regional trains travelling along the North Coast NSW Line. The trains travel daily to/from Central Station in Sydney to Grafton, Casino and Brisbane (Roma Street). There are six trains arriving at Kempsey station daily with three each in the northbound and southbound directions.

Trains travelling from Sydney (Central) to Casino, Grafton, and Brisbane (Roma Street) arrive at Kempsey train station at 2:25 pm, 7:10 pm, and 9:52 pm respectively. Trains travelling from Grafton, Brisbane (Roma Street) and Casino to Sydney (Central) arrive at Kempsey train station at 8:05 am, 12:43 pm and 11:47 pm respectively. There is only one train arriving during the peak hours identified in Section 5.4. The train station is not expected to be utilised by the Project's workforce during construction and operation due to the remote location of the Project area.

5.9.2 Buses

i Public transport buses

The closest public transport buses in context of the Project area are located in the Kempsey region and are operated by Busways and Cavanagh Bus & Coach Pty Ltd (Cavanagh). Busways operates seven routes in the Kempsey region with routes to Willawarrin and Bellbrook travelling along Kempsey Armidale Road.

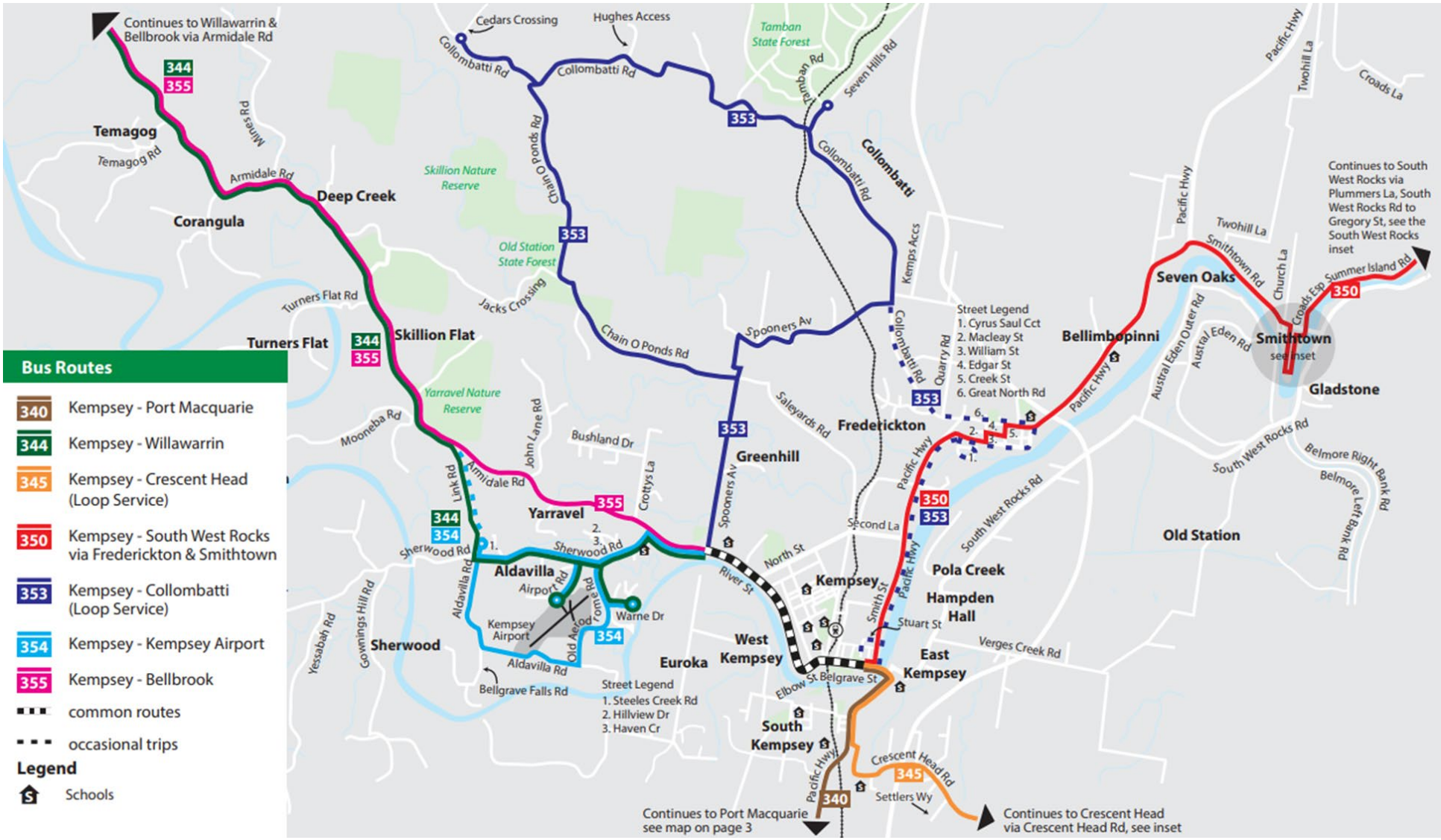
Cavanagh Buses operates five routes within Kempsey with two routes travelling along River Street. Public transport routes and timetables are presented in Table 5.19. Public transport route maps for Busways and Cavanagh buses are shown in Figure 5.12 and Figure 5.13 respectively.

Table 5.19 Public transport bus route summary

Bus route	Coverage (to and from)	Service Frequency
Busways		
340	Kempsey to Port Macquarie	These services operate on public school days only. Their operating frequency is up to three times a day. The operating hours are typical school hours of 7:30 am to 9:30 am and 2:30 pm to 4:30 pm.
344	Kempsey to Willawarrin	
345	Kempsey to Crescent Head (loop service)	
350	South West Rocks to Kempsey via Smithtown & Frederickton	
353	Kempsey to Collombatti (loop service)	
354	Kempsey to Kempsey Airport (loop service)	
355	Bellbrook to Kempsey	
Cavanagh		
341	Kempsey to West Kempsey via Tozer St (loop service)	**Monday–Friday:** 7:40–15:40, every 2 hours
342	Kempsey to East Kempsey (loop service)	**Monday–Friday:** 9:00–17:00, every 2 hours

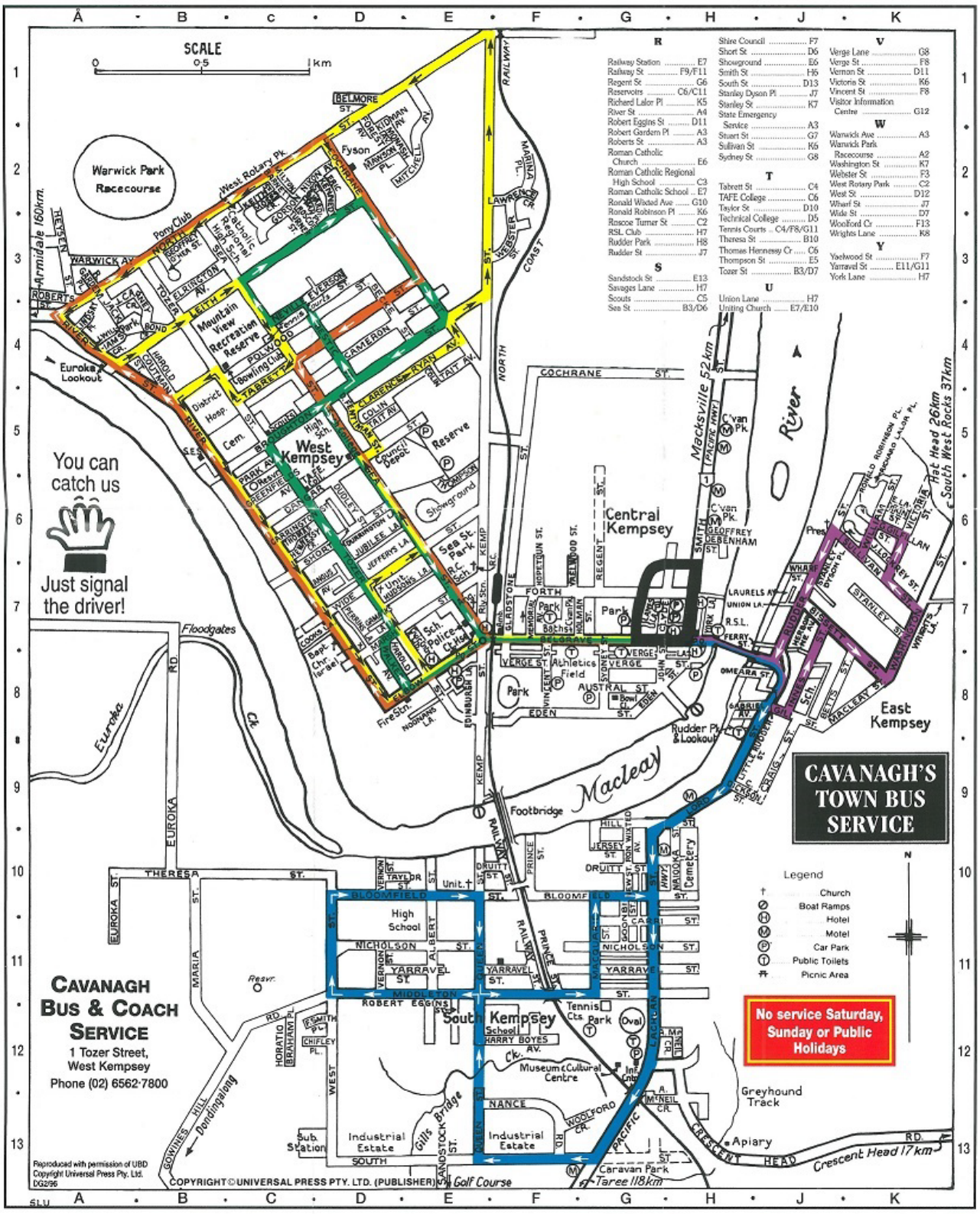
Table 5.19 Public transport bus route summary

Bus route	Coverage (to and from)	Service Frequency
343	Kempsey to South Kempsey (loop service)	**Monday–Friday:** 8:05–16:05, every 2 hours
346	Kempsey to West Kempsey via North St & Kemp St (loop service)	**Monday–Friday:** 8:25–16:25, every 2 hours
349	Kempsey to West Kempsey via North St & Sea St (loop service)	**Monday–Friday:** 9:15–17:15, every 2 hours



Source: https://www.busways.com.au/sites/default/files/network-maps/2021-11-25/Port%20Macquarie%20Network%20Map.pdf

Figure 5.12 Busway bus services route map



Source: http://www.cavanaghbus.com.au/

Figure 5.13 Cavanagh bus services route map

ii School bus services

School bus services in the Kempsey region are operated by Busways. There are over 30 dedicated school bus routes running in the Kempsey region covering Kempsey town and surrounding suburbs and towns. Table 5.20 presents the school bus routes, their coverage, whether they travel along Kempsey Armidale Road, North Street or Second Lane and the times during which they travel along these sections.

Along Kempsey Armidale Road, some bus stops are obvious, associated with Bellbrook Public School. This is the closest of the three schools from the site. The other two schools are located relatively further away from the site, closer to Kempsey. A bus service collects children from the nearby community of Lower Creek to attend school. The service times in Table 5.20 show that school buses are unlikely to coincide with the construction related vehicles, especially in the PM peak.

Table 5.20 School bus route summary

Bus route	Coverage (from and to)	Travelling via Armidale-Kempsey Road (section)	Travelling via North Street and Second Lane	Service time
Edwards Coaches				
S323	Ebor to Armidale Schools	-	-	-
Busways				
S423	Kempsey to Kempsey East PS via West Kempsey	-	North Street	8:55 am to 9:02 am
S474	Toorooka Warbro Brook Rd to Macleay Vocational	River Street to Toorooka Road	North Street	7:46 am to 8:31 am
S475	Moparrabah Willi Rd to Willawarrin PS	Temagog Road to Mines Road Mungay Flat Road to Willawarrin	-	7:51 am to 7:55 am 8:23 am to 8:30 am
S476	South West Rocks to Macleay Vocational	-	-	-
S477	Temagog Rd to Kempsey	Sherwood Road to River Street	North Street	8:15 am to 8:33 am
S478	Millbank Hickeys Creek Rd to Hickeys Creek	-	-	-
S479	Millbank Hickeys Creek Rd to Willawarrin PS	Hickeys Creek Road to Main Street	-	8:40 am to 8:50 am
S480	Wittitrin Dungay Creek Rd to Aldavilla Primary	-	-	-
S482	Mooneba Armidale Rd to Kempsey High	Mooneba Road to River Street	North Street	7:40 am to 8:30 am
S483	Kempsey High to Kempsey East PS via South Kempsey	-	North Street	8:35 am to 8:40 am
S486	Yessabah Clarkes Rd to Kempsey West PS	Sherwood Road to River Street	North Street	8:15 am to 8:29 am
S488	Collombatti Seven Hills Rd to Kempsey West PS	-	North Street and Second Lane	8:26 am to 8:35 am

Table 5.20 School bus route summary

Bus route	Coverage (from and to)	Travelling via Armidale-Kempsey Road (section)	Travelling via North Street and Second Lane	Service time
S489	Bellimbopinni Sutherlands Lane to Kempsey Adventist via Smithtown	-	North Street and Second Lane	8:20 am to 8:30 am
S492	South Kempsey Crescent Head Rd to Kempsey East PS via Crescent Head	-	-	-
S547	Kempsey Belgrave St to Kempsey via West Kempsey	-	North Street	15:36 to 15:40
S605	Willawarrin PS to Moparrabah Willi Rd	Mungay Flat Road to Willawarrin Mines Road to Temagog Road	-	15:18 to 15:22 15:41 to 15:45
S608	Willawarrin PS to Hickeys Creek Rd via Millbank	Willawarrin to Hickeys Creek Road	-	15:08 to 15:18 am
S609	Hickeys Creek to Millbank Hickeys Creek Rd	-	-	-
S611	St Joseph's Primary to Kempsey	-	North Street	15:54 to 15:57
S613	Frederickton PS to Kempsey via Collombatti	River Street	-	16:43 to 16:51
S615	Kempsey West PS to Macleay Vocational via Frederickton	-	North Street and Second Lane	15:39 to 15:43
S618	Aldavilla Primary to Wittitrin Dungay Creek Rd	-	-	-
S619	Kempsey Adventist to Temagog Rd via Turners Flat	Sherwood Road to River Street	North Street	15:46 to 16:04
S620	Kempsey Adventist to Kempsey via Smithtown	-	North Street and Second Lane	15:39 to 15:45
S621	Kempsey East PS to Mooneba Rd	Mooneba Road to River Street	North Street	15:42 to 16:11
S622	Kempsey East PS to Crescent Head	-	-	-
S623	Macleay Vocational to Crescent Head	-	-	-
S624	Kempsey East PS to Kempsey via South Kempsey	-	-	-
S625	Kempsey to Yessabah Clarkes Rd	River Street to Sherwood Road	North Street	15:43 to 15:55

Table 5.20 School bus route summary

Bus route	Coverage (from and to)	Travelling via Armidale-Kempsey Road (section)	Travelling via North Street and Second Lane	Service time
S626	Macleay Vocational to West Kempsey	-	-	-
S627	West Kempsey to Toorooka Warbro Brook Rd	River Street to Mines Road	North Street	15:51 to 16:07
S628	Kempsey East PS to Kempsey	-	-	-
S632	Comara Armidale Rd to Willawarrin PS	Main Street Willawarrin to Five Day Creek Road	-	8:02 to 8:55
S636	Willawarrin PS to Comara Armidale Rd	Main Street Willawarrin to Five Day Creek Road	-	15:00 to 15:55
S659	Yarravel Link Rd to Kempsey East PS	River Street to Sherwood Road	North Street	8:20 to 8:32
S962	Kempsey East PS to Yarravel Link Rd	Sherwood Road to River Street	North Street	15:44 to 15:51

Source: https://transportnsw.info/routes/bus

As per Table 5.20, there are up to 17 school buses each weekday morning and afternoon travelling along Kempsey Armidale Road and 18 school buses along North Street and Second Lane. There is a bus layover area and a school zone along North Street in vicinity of St Paul's College. There is a school zone and bus zone on Kempsey Armidale Road (also known as Main Street at Bellbrook) at the frontage of Bellbrook Public School.

The school bus operating times are from 7:40 am to 9:02 am during the morning hours and 3:00 pm to 4:51 pm in the afternoon hours.

5.10 Active transport

5.10.1 Pedestrian footpath and crossing facilities

Pedestrian footpath and crossing facilities are mostly present within the town of Kempsey. Signalised pedestrian crossing facilities are present at Smith Street/Belgrave Street intersection (Figure 5.3) and along Belgrave Street. Pedestrian crossings along with pedestrian refuge islands are present along Belgrave Street and Elbow Street. Several road safety improvements along River Street, West Kempsey, including pedestrian refuge crossings, have been proposed by Kempsey Shire Council. The road safety works are expected to begin in late 2022 as per council website.

No pedestrian crossings or footpaths were observed along North Street or Second Lane.

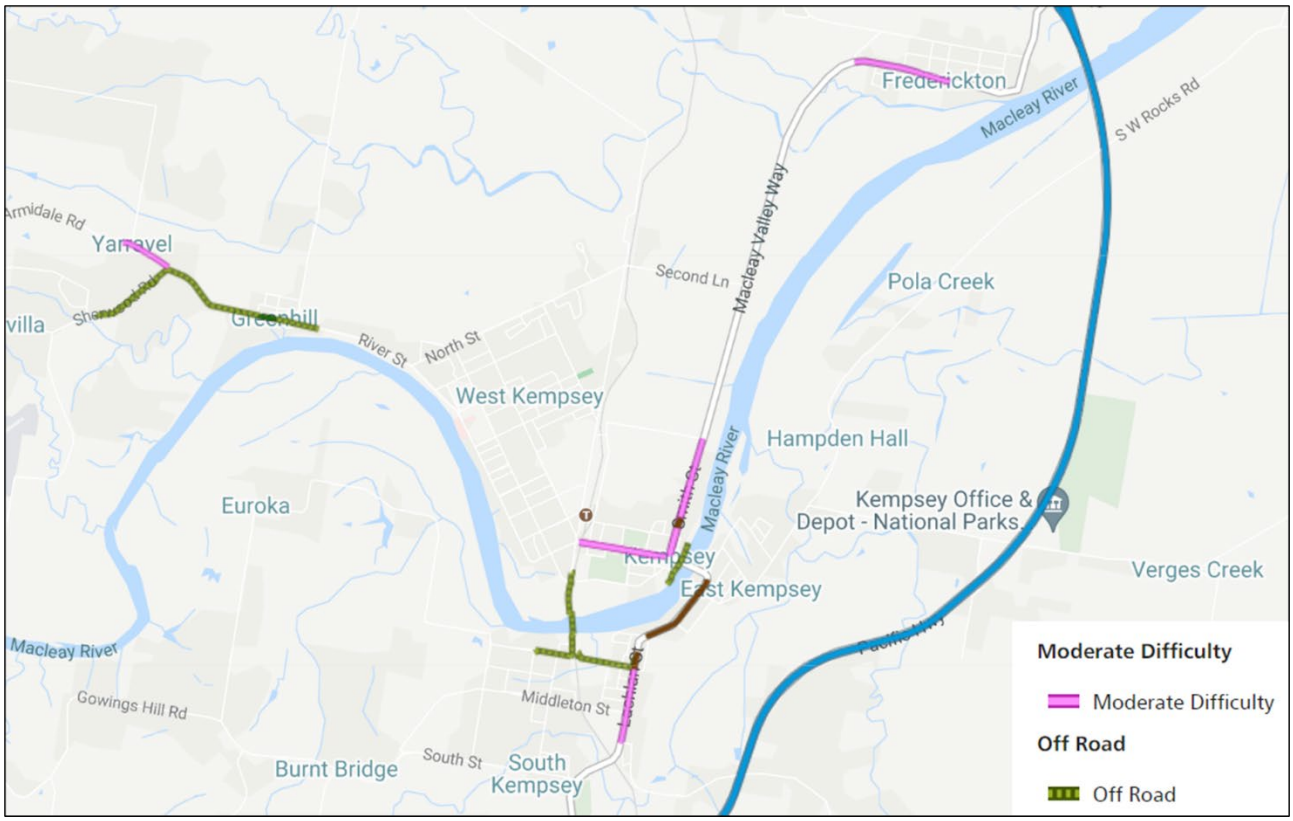
5.10.2 Bicycle network

There are limited existing bicycle infrastructure and bicycle parking facilities within the Kempsey region. There is an off-road bicycle path along River Street between Spooners Avenue and Sherwood Road. The cyclists are mostly expected to use the general road network with vehicular traffic in low traffic volume roads. Existing cycle routes from TfNSW Roads and Maritime Services Cycleway Finder are presented in Figure 5.14.

The Kempsey Shire Bike Plan June 2017 includes the existing bicycle infrastructure and the proposed bicycle network improvements recommended as part of the Kempsey Shire Council Bike Plan. The bike plan also includes a list of infrastructure system improvements ranked in order of priority to establish a complete cycling network and promote cycling across the whole of Kempsey Shire.

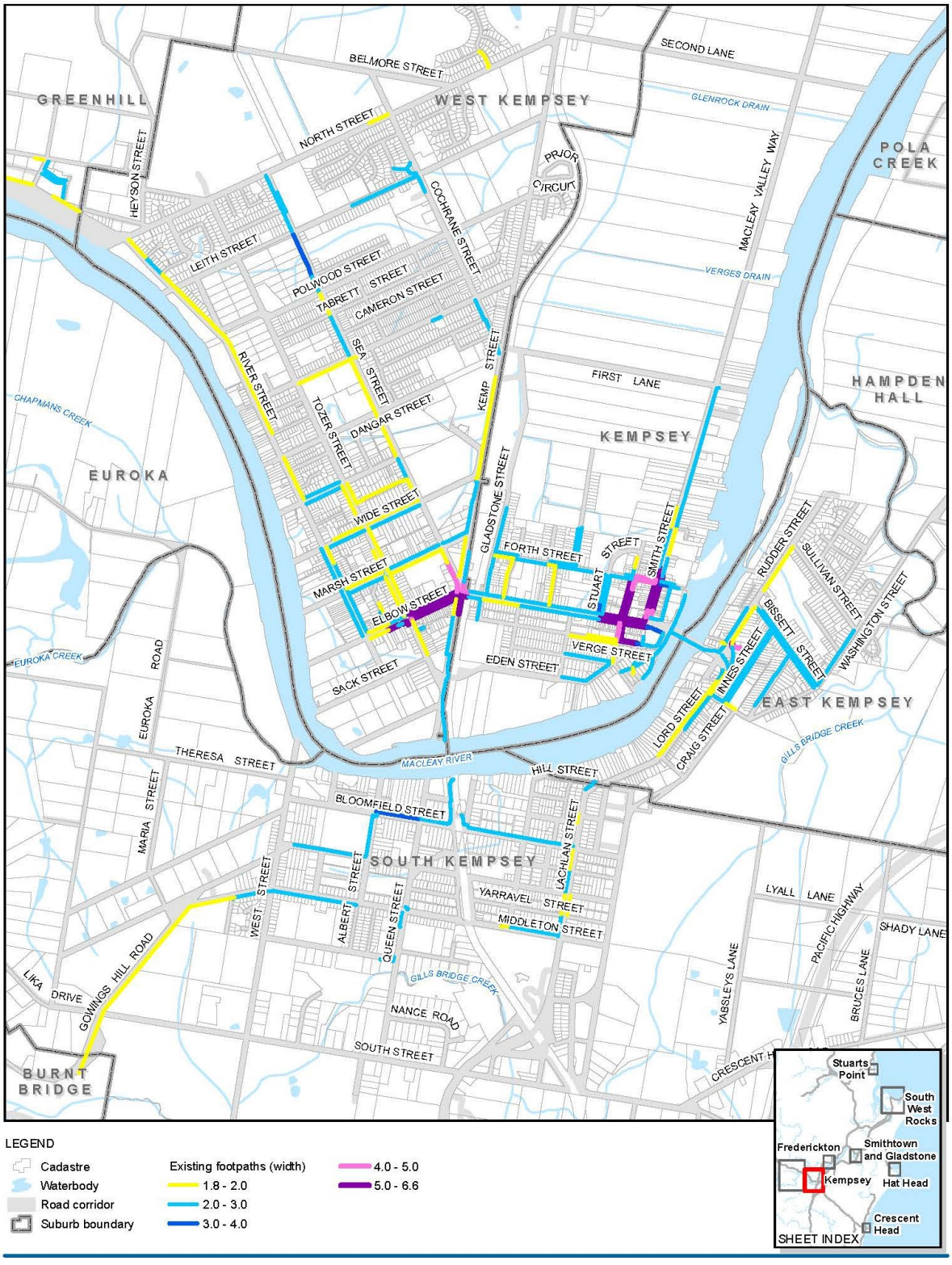
The existing bicycle infrastructure is presented in Figure 5.15 and proposed bicycle network improvements are presented in Figure 5.16.

There are proposed on-road cycleway improvements along Second Lane and North Street and off-road cycleway improvements along Macleay Valley Way. The timing of these improvements is unknown at preparation of this TIA.



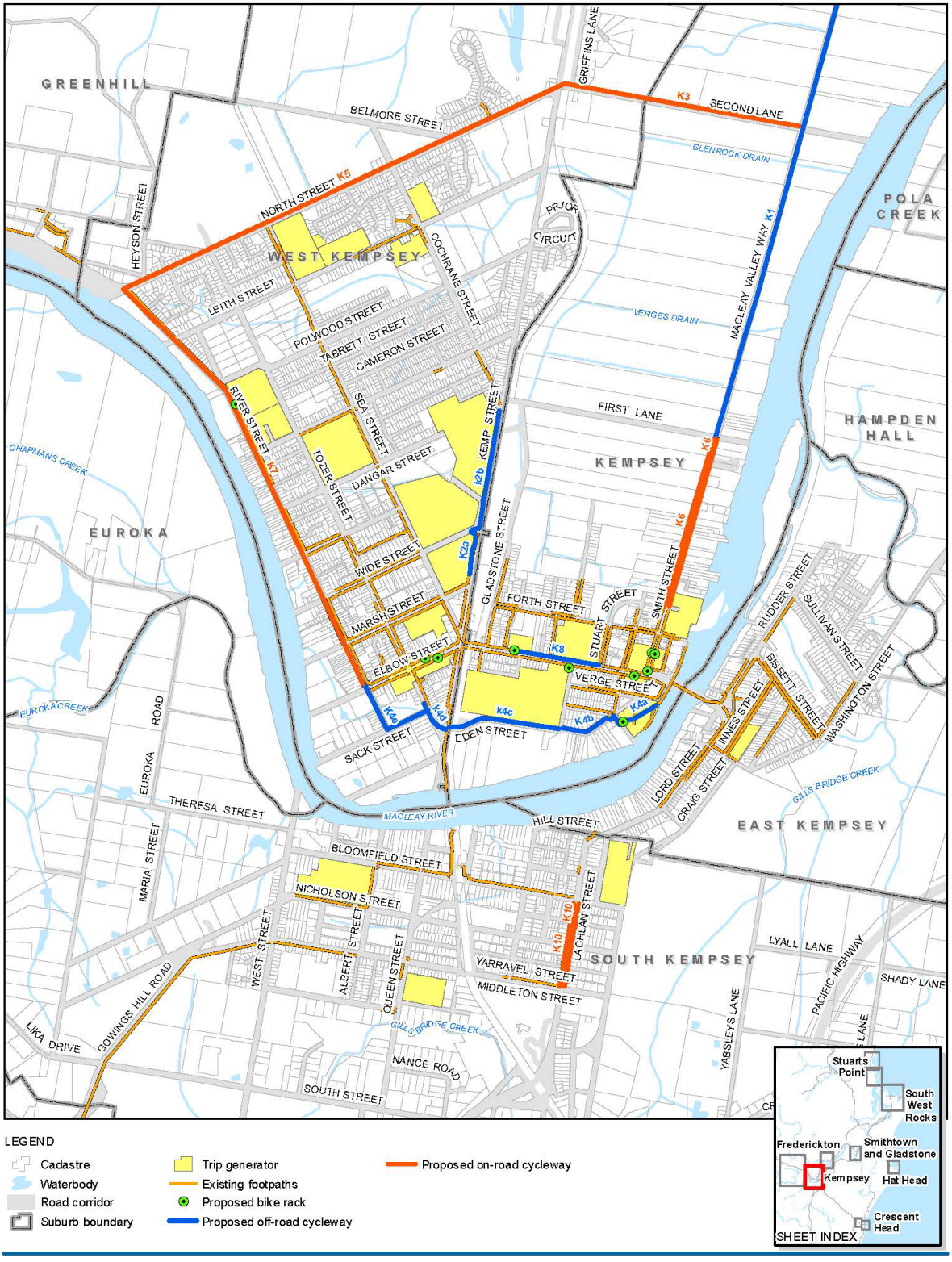
Source: TfNSW Roads & Maritime Services Cycleway Finder

Figure 5.14 Existing cycle routes



Source: Kempsey Shire Bike Plan January 2018

Figure 5.15 Existing bicycle infrastructure



Source: Kempsey Shire Bike Plan January 2018

Figure 5.16 Proposed bicycle network improvements

5.11 Level crossings

There are two railway level crossings present within the Kempsey urban area. There is a railway level crossing across Belgrave Street, approximately 30 m south of Kempsey train station. There is another railway level crossing across Second Lane near the North Street/Kemp Street/Saleyards Road/Second Lane intersection. The two railway level crossings are approximately 3 km apart. There is a passing loop, which is used for freight trains to wait in between the two railway crossings. This allows freight trains to pass each other without blocking the level crossings.

Both the railway level crossings are provided with railway crossing signs, half boom gates, flashing lights and bells for warning motorists of the oncoming trains.

Train timings for Kempsey were retrieved from Australian Rail Track Corporation website and are presented in Table 5.21.

Table 5.21 Details of weekly trains passing through Kempsey

Day	Time	Type	Length (m)	Direction	Day	Time	Type	Length (m)	Direction
Monday	13:44	Steel	900	Northbound	Monday	3:13	Intermodal	1500	Southbound
Monday	14:27	Passenger	205	Northbound	Monday	8:08	Passenger	205	Southbound
Monday	18:48	Intermodal	1500	Northbound	Monday	12:45	Passenger	205	Southbound
Monday	19:13	Passenger	205	Northbound	Monday	23:49	Passenger	205	Southbound
Monday	21:54	Passenger	205	Northbound	Tuesday	1:06	Steel	1200	Southbound
Tuesday	12:50	Steel	1200	Northbound	Tuesday	2:11	Intermodal	1500	Southbound
Tuesday	14:27	Passenger	205	Northbound	Tuesday	3:13	Intermodal	1500	Southbound
Tuesday	15:31	Steel	900	Northbound	Tuesday	5:55	Steel	1200	Southbound
Tuesday	18:23	Intermodal	1500	Northbound	Tuesday	8:08	Passenger	205	Southbound
Tuesday	19:13	Passenger	205	Northbound	Tuesday	10:14	Intermodal	1500	Southbound
Tuesday	19:36	Intermodal	1500	Northbound	Tuesday	12:45	Passenger	205	Southbound
Tuesday	21:54	Passenger	205	Northbound	Tuesday	23:49	Passenger	205	Southbound
Tuesday	22:38	Intermodal	1500	Northbound	Wednesday	3:16	Steel	1200	Southbound
Wednesday	14:27	Passenger	205	Northbound	Wednesday	3:46	Intermodal	1500	Southbound
Wednesday	15:31	Steel	900	Northbound	Wednesday	4:17	Intermodal	1500	Southbound
Wednesday	18:23	Intermodal	1500	Northbound	Wednesday	8:08	Passenger	205	Southbound
Wednesday	19:13	Passenger	205	Northbound	Wednesday	12:45	Passenger	205	Southbound
Wednesday	19:37	Intermodal	1500	Northbound	Wednesday	23:49	Passenger	205	Southbound
Wednesday	21:54	Passenger	205	Northbound	Thursday	2:01	Steel	1200	Southbound
Wednesday	22:43	Intermodal	1500	Northbound	Thursday	3:10	Intermodal	1500	Southbound
Thursday	12:50	Steel	1200	Northbound	Thursday	3:48	Intermodal	1500	Southbound
Thursday	14:27	Passenger	205	Northbound	Thursday	4:21	Intermodal	1500	Southbound

Table 5.21 Details of weekly trains passing through Kempsey

Day	Time	Type	Length (m)	Direction	Day	Time	Type	Length (m)	Direction
Thursday	15:30	Steel	900	Northbound	Thursday	7:07	Steel	1200	Southbound
Thursday	18:28	Intermodal	1500	Northbound	Thursday	8:08	Passenger	205	Southbound
Thursday	19:13	Passenger	205	Northbound	Thursday	12:45	Passenger	205	Southbound
Thursday	19:36	Intermodal	1500	Northbound	Thursday	23:49	Passenger	205	Southbound
Thursday	21:54	Passenger	205	Northbound	Friday	1:58	Steel	1200	Southbound
Thursday	22:42	Intermodal	1500	Northbound	Friday	3:10	Intermodal	1500	Southbound
Friday	14:27	Passenger	205	Northbound	Friday	4:26	Intermodal	1500	Southbound
Friday	18:28	Intermodal	1500	Northbound	Friday	5:05	Intermodal	1500	Southbound
Friday	19:13	Passenger	205	Northbound	Friday	8:08	Passenger	205	Southbound
Friday	20:33	Intermodal	1500	Northbound	Friday	12:45	Passenger	205	Southbound
Friday	21:54	Passenger	205	Northbound	Friday	23:49	Passenger	205	Southbound
Saturday	13:00	General Freight	450	Northbound	Saturday	3:11	Intermodal	1500	Southbound
Saturday	14:27	Passenger	205	Northbound	Saturday	4:09	Steel	1200	Southbound
Saturday	18:18	Intermodal	1500	Northbound	Saturday	5:57	Intermodal	1500	Southbound
Saturday	19:13	Passenger	205	Northbound	Saturday	7:09	Intermodal	1500	Southbound
Saturday	21:54	Passenger	205	Northbound	Saturday	8:08	Passenger	205	Southbound
Saturday	23:57	Intermodal	1500	Northbound	Saturday	9:18	Intermodal	1500	Southbound
Sunday	12:53	Steel	900	Northbound	Saturday	12:45	Passenger	205	Southbound
Sunday	13:42	Intermodal	1500	Northbound	Saturday	23:49	Passenger	205	Southbound
Sunday	14:27	Passenger	205	Northbound	Sunday	3:41	Intermodal	1500	Southbound
Sunday	16:13	Steel	900	Northbound	Sunday	6:35	Steel	1200	Southbound
Sunday	18:18	Intermodal	1500	Northbound	Sunday	8:08	Passenger	205	Southbound
Sunday	19:13	Passenger	205	Northbound	Sunday	8:35	Minerals	450	Southbound
Sunday	21:54	Passenger	205	Northbound	Sunday	12:45	Passenger	205	Southbound
Sunday	22:48	Intermodal	1500	Northbound	Sunday	23:49	Passenger	205	Southbound

Source: https://www.artc.com.au/customers/operations/mtp/2022-10-23/

Table 5.22 presents the daily distribution of the northbound and southbound passenger and freight trains at Kempsey.

Table 5.22 Distribution of northbound and southbound passenger and freight trains at Kempsey

Day	Northbound passenger	Northbound freight	Southbound passenger	Southbound freight	Total
Monday	3	2	3	2	10
Tuesday	3	5	3	5	16
Wednesday	3	4	3	4	14
Thursday	3	5	3	5	16
Friday	3	2	3	2	10
Saturday	3	3	3	3	12
Sunday	3	5	3	5	16
Average	3	4	3	4	13

There are a total of 94 trains passing through Kempsey in a week. There are six passenger trains (three northbound and three southbound) going through Kempsey every day. The passenger trains are 205 m long. There are on average eight freight trains (four northbound and four southbound) every day. The freight trains are up to 1,500 m in length. There are two trains travelling during the peak hours during weekdays, one in the AM peak and one in the PM peak. These trains are a passenger train in the AM peak and a freight train in the PM peak.

5.12 Recreational facilities along the haulage route

There are several camping grounds (Cracknback Campgrounds, Blackbird Flat Reserve Campsite, Blackbird Flat Camping Grounds and Georges Junction Campground) along Kempsey Armidale Road which attract caravan traffic. The caravan traffic is expected to arrive from Kempsey and mostly during holiday periods. During certain period of the year, the road conditions along Kempsey Armidale Road may not be suitable for caravan traffic which has been observed to be signposted by council (Plate 5.8).

There are national parks, forests and reserves in the surrounding areas around the Project. Common recreational activities undertaken in the area include camping, fishing and hiking. There are several residencies, lodges and cabins which are used by campers and hikers.

The National Trail is a trekking route stretching 5,330 km from Cooktown, Queensland to Healesville, Victoria (National Trail 2021). The National Trail is divided into 12 sections and Section 8 *Ebor to Aberdeen* passes adjacent to the Project area (National Trail 2021). The National Trail becomes part of Kempsey Armidale Road (Plate 5.9) for approximately 11 km from Georges Creek to Georges Junction. The trail goes off Kempsey Armidale Road at Georges Junction and becomes Macleay River Trail, continuing along Macleay River. The trail passes adjacent to the Project area up to Rafferty's Crossing.

During the site inspection a group of recreational motor bike riders were observed travelling along Kempsey Armidale Road.

Access for users of the National Trail will not be restricted or impacted as a result of the Project both during construction and operations. Access to other recreational activities will not be impacted by the Project. This includes access to the river from public spaces or reserves, or access to national park estates.



Plate 5.8 **Traffic signage along Kempsey Armidale Road for caravan traffic**



Plate 5.9 **National trail along Kempsey Armidale Road**

6 Assessment method and assumptions

6.1 Construction

6.1.1 Duration and hours

There will be 24/7 construction works throughout the construction period.

6.1.2 Workforce and accommodation

At the peak of construction, the number of workers present in the Project area is expected to be more than 600 persons. The number of construction workers and other Project staff required throughout the Project duration is presented in Figure 6.1.

It is expected that an average worker shift will consist of six days per week (approximately 25 days per month), with two shifts per day for the surface workforce and three per day for underground workers. The shifts will be arranged to accommodate 24/7 construction throughout the construction period.

During the construction peak, there will be approximately 600 workers residing in an on-site accommodation camp. The accommodation camp will be situated on two adjacent platforms, with a combined total area of 35,000 m^2. The primary form of accommodation in the camp will consist of 12 m long and 2.4 m wide containerised accommodation units which can be positioned in a double deck arrangement, if necessary.

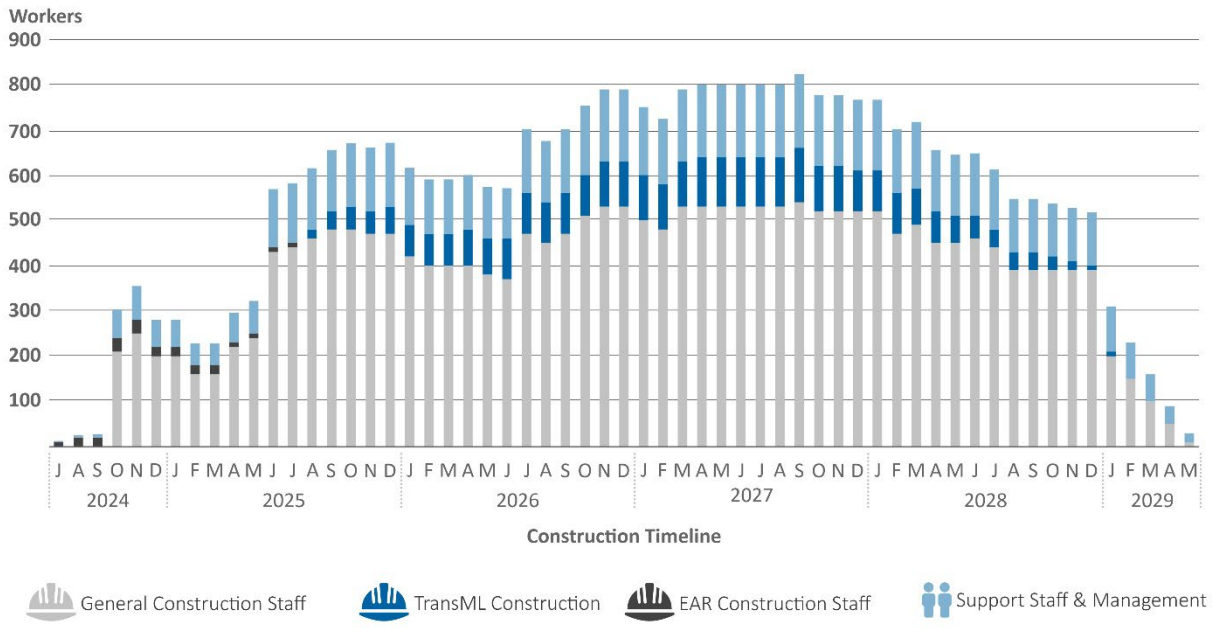


Figure 6.1 Construction worker and other Project staff numbers throughout construction period

Note: Figure 6.1 shows a peak workforce of just over 800 persons.

The above graph shows that within the four to five year construction window the peak construction activities will occur between year two to year four where the maximum number of construction workers will be required. During the last six months of the construction window, the construction will start to ramp down and at the end, there will be less than 100 construction workers on site.

6.1.3 Project stages, phases and sequencing

The construction of the Project has numerous overlapping stages and phases spanning around four to five-year construction period. The planned Project stages and phases are outlined in Table 6.1 and Figure 6.2. These stages and phases are indicative only and are subject to change.

Table 6.1 Overview of Project stages, phases and sequencing

Project stage	Project phase	Sub-stage	Typical activities	Indicative timeline
EIS development, assessment and approval				
Construction	Pre-construction	Investigation and surveying	Prior to the commencement of any construction works, the disturbance footprint will be assessed, surveyed and defined. Ongoing environmental investigations will include archaeological, heritage and ecological surveys of the area, as required.	2023–2024
		Design	This is an approximate two-year phase that involves the detailed design of civil, mechanical and electrical design components. The design phase forms the basis of the Project and detail will increase with each iteration.	2024–2025
		Installation of environmental mitigation measures	Prior to the commencement of construction works, a number of mitigation measures will be installed, including: • erection of site fencing, where required, to delineate the site boundary and provide security and safety • installation of sediment and erosion control measures, and in particular surrounding stockpile and soil emplacement areas. This phase will also involve the establishment of feasible environmental management and monitoring measures as identified throughout the EIS process.	2024–2025
		Pre-clearing works	Vegetation will be cleared only within the disturbance footprint, as outlined in Section 6.1	2024–2026

Table 6.1 Overview of Project stages, phases and sequencing

Project stage	Project phase	Sub-stage	Typical activities	Indicative timeline
Construction	Early works	Site preparation	Once vegetation has been cleared, and appropriate mitigation measures have been installed, site preparation activities will take place. Activities will include, but not be limited to, the following: • clearing and grubbing works • earthworks and levelling • upgrade of existing and establishment of new access roads including the EAR and Main Access Road • installation of water and wastewater facilities • establishment of temporary works areas, stockpile and soil emplacement areas • construction of other ancillary facilities required to commence construction, including power supply, accommodation camp, first aid and medical building, helipad area, bushfire refuge, and garbage areas • mobilisation to site • establishment and filling of construction water stores.	2024–2025
	Staged construction		Once access roads to the Project have been constructed, multiple construction fronts will occur concurrently across the various construction areas throughout the Project area. Construction activities at each construction area will vary depending on the infrastructure and asset being constructed at each location. Extraction of water to fill reservoirs.	2025–2028
	Testing		Testing of operating and protection systems will take place towards the end of the construction period. Once everything has been identified to be in full working order, the new power station will complete its final commissioning.	2028–2029
Operation	Commissioning		Completion of final commission date is planned to occur towards the end of 2028.	2028
	Operation and maintenance		Operation and maintenance will be ongoing for the life of the power station.	2028 and ongoing
	Progressive rehabilitation		Temporary areas of the disturbance footprint, which are not required for operation, will be progressively rehabilitated throughout the construction and operation stages of the Project.	2027–2029

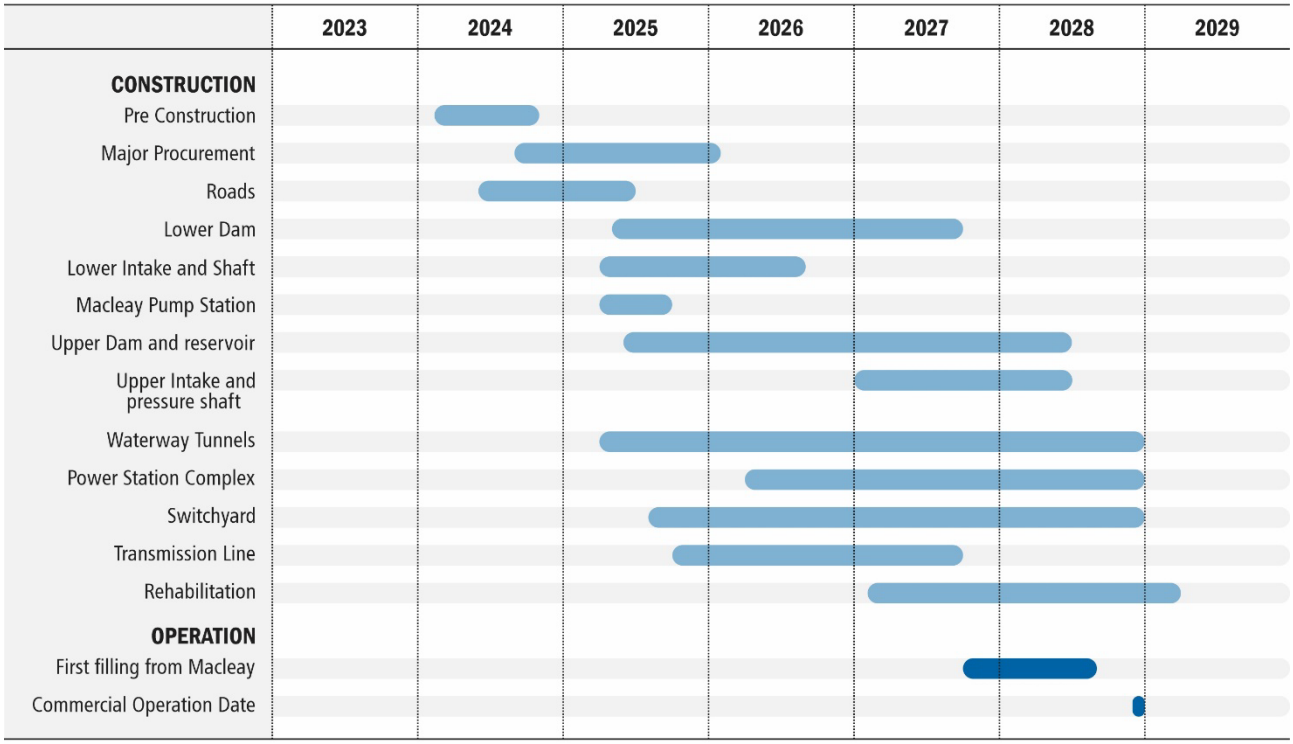


Figure 6.2 Project timing and sequencing

6.1.4 Vehicle types

A wide range of vehicles will be used for construction activities, such as light vehicles, heavy vehicles including buses, helicopters, construction vehicles such as concrete agitators, excavators, cranes, OSOM vehicles (Section 6.5) and a variety of specialised vehicles, such as a tunnel wheel jumbo. The longest size of vehicle accessing the site, apart from OSOM vehicle, will be 19 m long semi-trailer which will travel to the main site access. For the other two site accesses associated to the northern power line development will be served by 12.5 m Heavy Rigid Vehicles (HRV) or smaller in size.

Majority of the workers will be transported to and throughout the site by bus to minimise parking requirements and the number of vehicles present on the external road network. Bus pickup and drop off points will be marked, and sufficient buses will be present to account for the extent of the workforce. The size of the shuttle bus will be determined based on the demand.

Superintendents, engineers, and other employees requiring flexibility of transport for their roles will have access to light vehicles in accordance with their needs.

6.1.5 Traffic generation

Construction traffic for the Project will consist of construction workers' light vehicles and heavy vehicles transporting equipment, building and construction materials, waste, and spoil removal to/from the Project area.

A vehicle trip is defined as one inbound and one outbound movement. One vehicles trip equates to two vehicular movements and incorporates the following assumptions:

- The average daily vehicle trips are based on 25 working days per month which assumes some allowance for lower daily traffic volumes on weekends and public holidays.
- During the peak months of construction, the average and maximum daily vehicle trips will be the same as all Project construction tasks will be working at full capacity during this period.

Average daily vehicle trips per month for the duration of construction of the Project over the external road network (Section 5.2) is presented in Figure 6.3. Average daily vehicle trips per month for the duration of construction of the Project over the internal road network is presented in Figure 6.4.

The external road network includes all roads currently owned and operated by councils or NSW Government. The average and maximum (peak months) light and heavy daily trips for various construction activities for the external roads are shown in Table 6.2.

The internal road network includes roads in the Project area and the Eastern Access Road up to the Eastern Access Road/Kempsey Armidale Road intersection. The average and maximum (peak months) light and heavy daily trips for various construction activities for the internal roads are shown in Table 6.3.

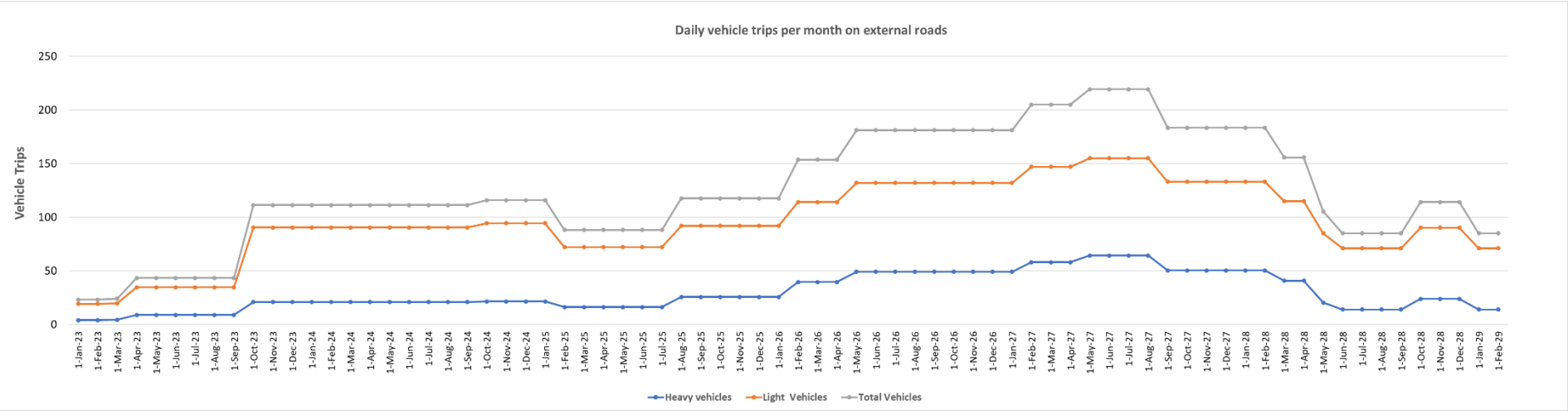


Figure 6.3 Daily vehicle trips during the construction period over the external road network

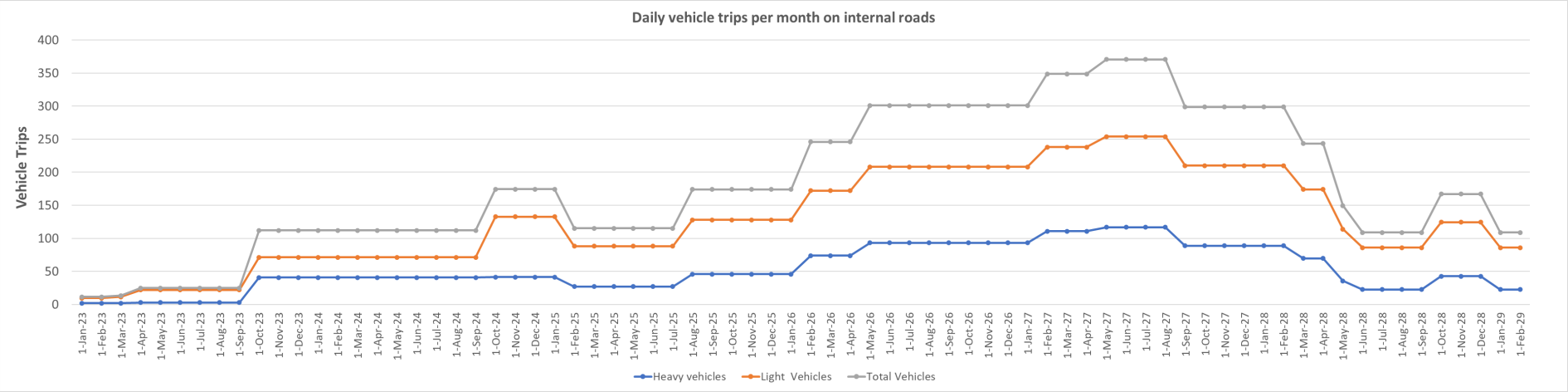


Figure 6.4 Daily vehicle trips during the construction period over the internal road network

Note: One vehicle trip means one inbound and one outbound movement. One vehicles trip equates to two vehicular movements.

The graphs presented in Figure 6.3 and Figure 6.4 present similar trends with average daily vehicle trips rising in steps based on the commencement of various construction stages.

The figures in the above two graphs show the maximum vehicular trip generation is expected to occur during mid 2027 for few months. There would be 64 heavy vehicle trips and 155 light vehicle trips for a total of 219 vehicle trips on the external road network. There would be 117 heavy vehicle trips and 254 light vehicle trips for a total of 371 vehicle trips on the internal road network.

The average daily vehicle trips will then ramp down as the Project reaches its completion in 2029.

Table 6.2 and Table 6.3 present the average and maximum daily vehicle trips for various activities related to construction. For both external and internal road network, the highest trips are generated during mobilisation and construction of roads and dams.

Construction activity relating to travel from local accommodation to the Project area refers to daily movements by specialist contractors, engineers and Project managers who would not be residing in the accommodation camp within the Project area. They would be travelling in their individual cars/utes to/from the Project area. Construction vehicles relating to accommodation village transfers are for the beginning and end of roster movements of surface and underground workers residing in the accommodation camp within the Project area.

These workers would be travelling in minivans (up to 10 seats capacity) and coaches (up to 20 seats capacity). Worker transfers to and from the accommodation camp are expected to occur weekly. Weekly rosters are assumed to be happening on multiple days each week and will be confirmed by construction contractor.

Table 6.2 Daily construction vehicle trips for construction activities over external road network

Vehicle type	Construction activity	Average daily vehicle trips over the construction period	Maximum (peak months) daily vehicle trips over the construction period
Heavy vehicles	EAR/bridge site mobilisation	1	4
	Bridge construction access	1	4
	Bridge construction	1	8
	EAR road construction	3	20
	Mobilisation	1	20
	Roads	1	11
	Lower dam	5	14
	Upper dam	5	14
	Upper intake and tunnel works	3	6
	Power station complex	3	9
	Transformer hall and switchyard	1	6
	Demobilisation	1	10
	Northern powerline	3	10
	General access secondary route (via Armidale)	2	2
	Accommodation village transfers (coach)	2	3

Table 6.2 Daily construction vehicle trips for construction activities over external road network

Vehicle type	Construction activity	Average daily vehicle trips over the construction period	Maximum (peak months) daily vehicle trips over the construction period
Light vehicles	EAR/bridge site mobilisation	1	10
	Bridge construction access	1	10
	Bridge construction	1	14
	EAR road construction	6	38
	Mobilisation	2	38
	Roads	1	16
	Lower dam	7	22
	Upper dam	8	22
	Upper intake and tunnel works	6	14
	Power station complex	5	15
	Transformer hall and switchyard	1	8
	Demobilisation	1	19
	Northern powerline	5	18
	General access secondary route	4	5
	Daily travel from local accommodation to site	44	48
	Accommodation village transfers (minivans)	3	3

Table 6.3 Daily construction vehicle trips for construction activities over internal road network

Vehicle type	Construction activity	Average daily vehicle trips over construction period	Maximum (peak months) daily vehicle trips over construction period
Heavy vehicles	EAR/bridge site mobilisation	0	0
	Bridge construction access	1	2
	Bridge construction	1	2
	EAR road construction	6	40
	Mobilisation	2	40
	Roads	2	22
	Lower dam	9	28
	Upper dam	10	28
	Upper intake and tunnel works	6	13

Table 6.3 Daily construction vehicle trips for construction activities over internal road network

Vehicle type	Construction activity	Average daily vehicle trips over construction period	Maximum (peak months) daily vehicle trips over construction period
	Power station complex	6	18
	Transformer hall and switchyard	1	6
	Demobilisation	1	20
	Northern powerline	6	19
	General vehicle access secondary route	2	2
	Accommodation village transfer (coach)	2	3
Light vehicles	EAR/bridge site mobilisation	0	0
	Bridge construction access	0	2
	Bridge construction	0	2
	EAR road construction	3	19
	Mobilisation	4	77
	Roads	3	32
	Lower dam	15	44
	Upper dam	16	44
	Upper intake and tunnel works	13	28
	Power station complex	10	30
	Transformer hall and switchyard	3	16
	Demobilisation	2	38
	Northern powerline	11	36
	General vehicle access secondary route	4	5
	Travel from local accommodation to site	44	48
	Accommodation village transfer (minivans)	3	3

6.2 Traffic distribution

Construction traffic for all the construction activities will either be from Kempsey or Armidale. Construction traffic from Kempsey is the main access route and construction traffic from Armidale is the secondary access route. Construction vehicular trip distribution for each site access is summarised below:

- Site Access 1 – EAR (near Smiths Bluff): to and from Kempsey – all OSOM vehicles, light and heavy vehicles (excluding heavy vehicles associated with construction of the power lines). This access is expected to have only minor construction related traffic travelling to and from Armidale.

- Site Access 2 (transmission access road, located west of Lower Creek): for the construction of the transmission corridor:
    - heavy vehicles: 80%–90% of the heavy vehicles to/from Armidale
    - light vehicle: 80%–90% of the light vehicles for the construction of the transmission corridor with 50/50 split between Kempsey and Armidale.
- Site Access 3 (transmission access road, north of Georges Junction): for construction of the transmission corridor:
    - heavy vehicles – 10%–20% of the heavy vehicle to/from Armidale
    - light vehicle: 10%–20% of the light vehicles for the construction of the transmission corridor with 50/50 split between Kempsey and Armidale.

The above trip distribution configuration shows that the maximum traffic generation will occur at the Site Access 1 – EAR and the lowest traffic generation will occur at the Site Access 3 – Transmission Line.

Construction traffic from Kempsey is expected to travel in three separate routes:

- Light vehicles: construction related light vehicles are expected to be generated from Kempsey township and likely to pass through the city centre e.g. Lord Street-Smith Street-Macleay Valley Way-Second Lane-North Street-River Street-Kempsey Armidale Road.
- Heavy vehicles: construction related heavy vehicles may originate from the township or further south along Pacific Highway. To minimise traffic impact within the city centre, the designated haulage route will bypass the township, i.e. Pacific Highway-Macleay Valley Way (at Frederickton)-Second Lane-then similar to light vehicle route.
- OSOM vehicles: OSOM vehicles will originate from Port of Newcastle, travel via Pacific Highway to Frederickton, travel along Macleay Valley Way from Frederickton to West Kempsey and join Kempsey Armidale Road via Second Lane, North Street and River Street.

In summary, heavy vehicle traffic arriving via Kempsey is expected to be split 80% via Frederickton and remaining 20% from the city centre. The heavy vehicle traffic that will be passing through the city centre will originate from the local area around Kempsey and expected to be no longer than a 12.5 m Heavy Rigid Vehicle (HRV).

The construction related haulage route, including heavy and OSOM vehicles, has been adopted in such a way to minimise any traffic impact on residential amenities within the town centre and along River Street.

Construction related light vehicles from Kempsey is less predictable. As a conservative approach, it is assumed that 50% of traffic will originate from the city centre while the other 50% of traffic goes via Frederickton.

Any construction traffic from Armidale will travel along Waterfall Way, turn right onto Kempsey Armidale Road and then continue along Kempsey Armidale Road to reach the Project area via site accesses 2 and 3.

Construction related daily vehicle trips on the external road network are presented in Table 6.4 and Figure 5.5.

Table 6.4 Daily vehicle trips and movements on external road network

Vehicle type	External road network	Daily average trips per month over the whole construction period	Daily average trips for peak construction month	Daily average movements for peak construction month
Heavy vehicles	Kempsey Armidale Road (from Georges Junction)	3	7	13
	Kempsey Armidale Road (from Waterfall Way)	3	7	13
	Waterfall Way (East)	0	0	0
	Waterfall Way (West)	3	7	13
	Total from Armidale	**4**	**12**	**23**
	Kempsey Armidale Road (from Bellbrook)	25	53	106
	Kempsey Armidale Road (from River Street)	25	53	106
	River Street/Belgrave Street	5	11	21
	North Street/Second Lane	20	42	84
	Macleay Valley Way (North)	20	42	84
	Macleay Valley Way (South)	5	11	21
	Total from Kempsey	**25**	**53**	**106**
	Total (from Kempsey and Armidale)	**30**	**64**	**129**
Light vehicles	Kempsey Armidale Road (from Georges Junction)	11	19	37
	Kempsey Armidale Road (from Waterfall Way)	7	14	28
	Waterfall Way (East)	0	0	0
	Waterfall Way (West)	7	14	28
	Total from Armidale	**11**	**19**	**37**
	Kempsey Armidale Road (94rom Bellbrook)	85	136	273
	Kempsey Armidale Road (from River Street)	45	93	186
	River Street/Belgrave Street	23	47	93
	North Street/Second Lane	23	47	93

Table 6.4 Daily vehicle trips and movements on external road network

Vehicle type	External road network	Daily average trips per month over the whole construction period	Daily average trips for peak construction month	Daily average movements for peak construction month
	Macleay Valley Way (North)	23	47	93
	Macleay Valley Way (South)	23	47	93
	Total from Kempsey	**85**	**136**	**273**
	Total (from Kempsey and Armidale)	**96**	**155**	**310**
Heavy and light combined	Kempsey Armidale Road (from Georges Junction)	14	25	51
	Kempsey Armidale Road (from Waterfall Way)	10	21	41
	Waterfall Way (East)	0	0	0
	Waterfall Way (West)	10	21	41
	Total from Armidale	**15**	**30**	**60**
	Kempsey Armidale Road (from Bellbrook)	111	189	378
	Kempsey Armidale Road (from River Street)	71	146	292
	River Street/Belgrave Street	28	57	114
	North Street/Second Lane	43	89	178
	Macleay Valley Way (North)	43	89	178
	Macleay Valley Way (South)	28	57	114
	Total From Kempsey	**111**	**189**	**378**
	Total (from Kempsey and Armidale)	**126**	**219**	**439**

Note: One vehicle trip means one inbound and one outbound movement. One vehicles trip equates to two vehicular movements.

Table 6.4 shows that there will be significantly higher traffic volumes travelling to and from Kempsey (main access route) as compared to Armidale (secondary access route). Traffic volumes continuing beyond Kempsey would be split between the Macleay Valley Way (North) and Macleay Valley Way (South) routes to access the main Pacific Highway route. 80% of heavy vehicles will travel via Macleay Valley Way (North).

At the peak of Project construction activity, the average Project related daily traffic movements, including both light and heavy vehicles would be 378 daily vehicle movements, representing return trips by 189 actual vehicles each day assuming one vehicle generates 2 daily vehicle movements.

Of this traffic there would be up to 114 daily vehicle movements (57 return trips by vehicles) per day passing through the Kempsey town centre via the Belgrave Street/River Street route.

On the route to and from Armidale, the average Project related daily traffic movements would be much lower representing a peak of 60 daily vehicle movements (return trips by 30 actual vehicles) per day.

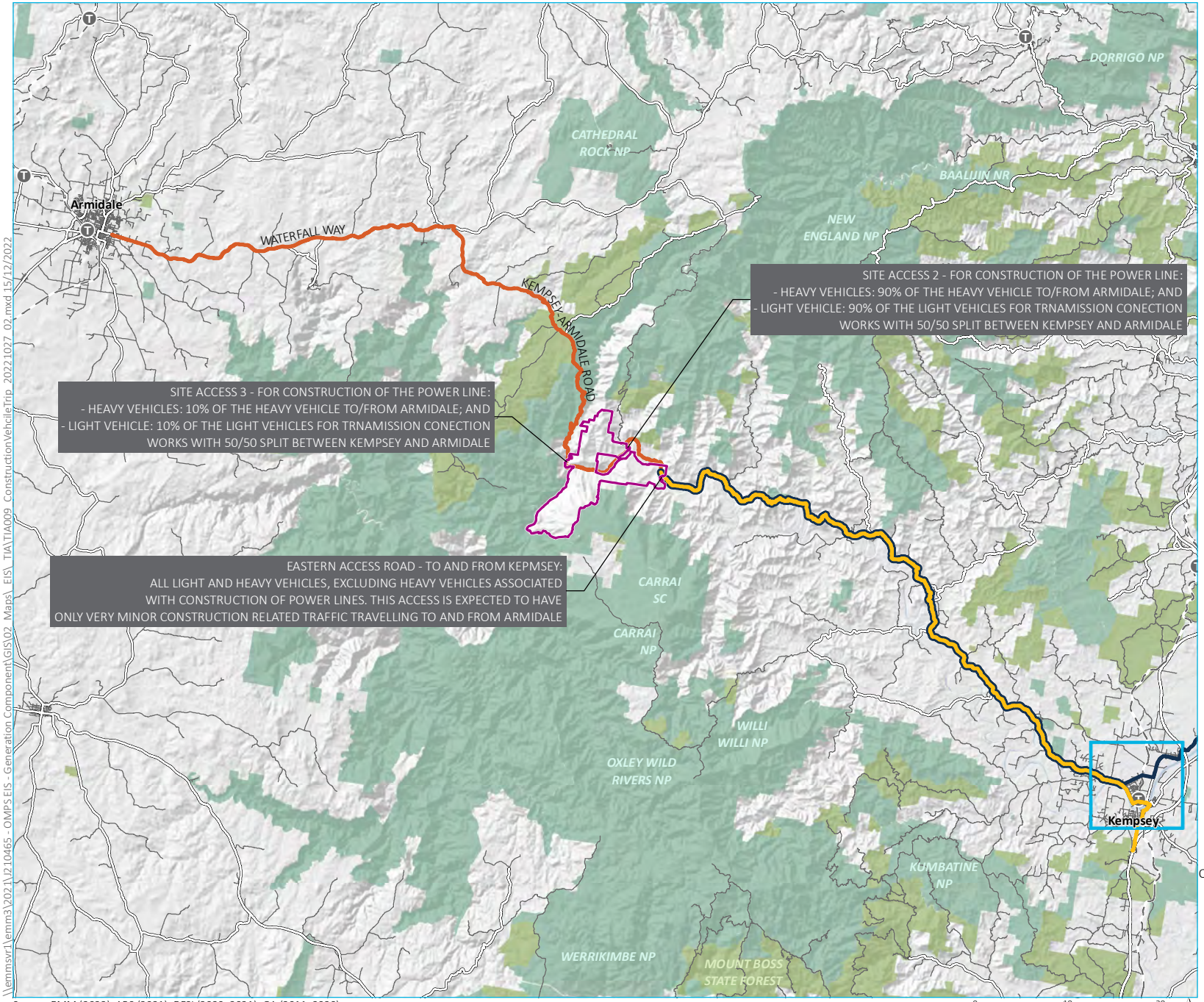
Table 6.5 presents the estimated inbound and outbound light and heavy vehicle traffic distribution by time of the day, during a typical day and night time period (24 hours).

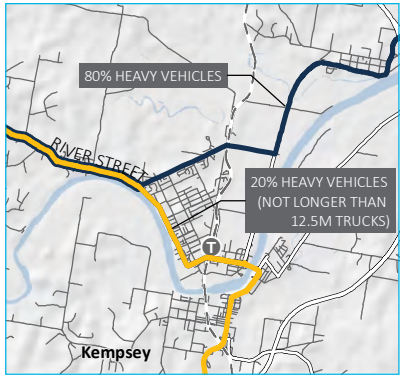
Table 6.5 Construction traffic time distribution – during a typical day and night time period (24 hours)

Time		Inbound LV	Inbound HV	Outbound LV	Outbound HV
5:00 am	6:00 am	15%	10%	2%	-
6:00 am	7:00 am	30%	10%	3%	10%
7:00 am	8:00 am	15%	-	5%	-
8:00 am	9:00 am	10%	-	10%	-
9:00 am	2:00 pm	10%	60%	10%	60%
2:00 pm	3:00 pm	2%	10%	5%	10%
3:00 pm	4:00 pm	2%	-	15%	-
4:00 pm	5:00 pm	2%	-	15%	-
5:00 pm	6:00 pm	2%	10%	20%	10%
6:00 pm	7:00 pm	2%	-	5%	10%
7:00 pm	5:00 am	10%	-	10%	-
Total		**100%**	**100%**	**100%**	**100%**

Table 6.5 presents the construction traffic distribution assumptions during a typical day. It is assumed that majority of the incoming light vehicle traffic would arrive between 5:00 am and 9:00 am and depart between 3:00 pm and 6:00 pm. Inbound heavy vehicle traffic would be approximately evenly distributed between 5:00 am to 6:00 pm and outbound heavy vehicle traffic between 9:00 am to 7:00 pm. There would be no construction heavy vehicle movements in the three school zones on Kempsey Armidale Road during school drop-off/pick up hours (i.e. 7:30 am to 9:30 am and 2:30 pm to 4:30 pm). However, an OSOM vehicle is not defined as a heavy vehicle and is subject to separate conditions. Any OSOM movements will occur outside peak times, as described in Section 6.5.

Based on the peak daily trips for the peak construction month (Table 6.4) and construction traffic time distribution (Table 6.5), the construction traffic volumes during the AM and PM peak hours are summarised in Figure 6.6. The combined baseline + construction traffic volumes are summarised in Figure 6.7.





KEY

- Project area
- Train station
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

Construction vehicle route

- Traffic route coming via Armidale
- Traffic route coming via Kempsey (Macleay Valley Way North)
- Traffic route coming via Kempsey (Macleay Valley Way South)

Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

0 10 20 km

GDA 1994 MGA Zone 56

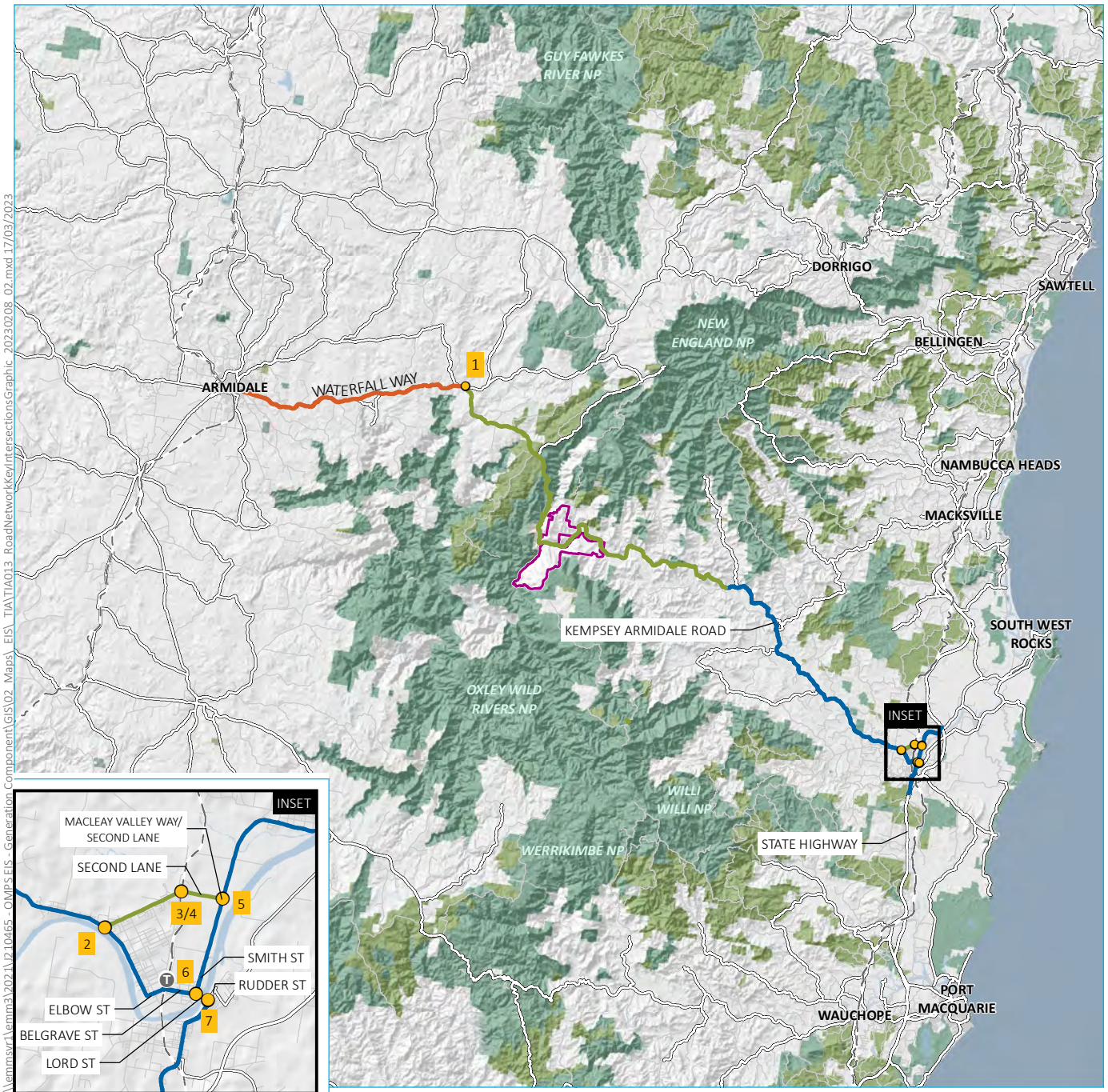
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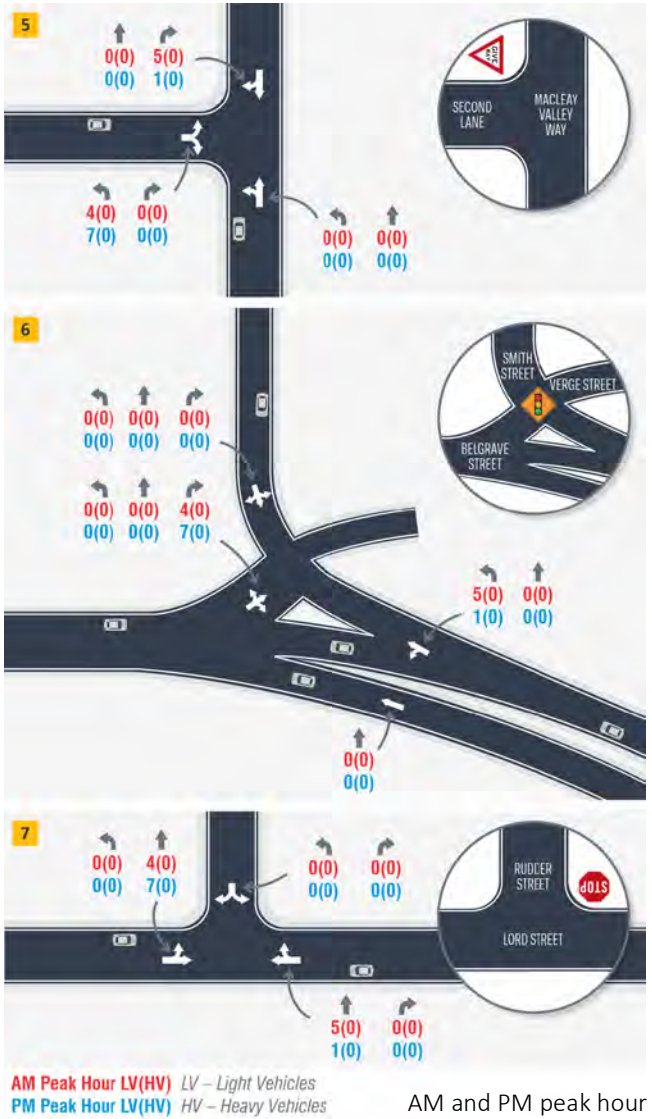
Construction vehicle trip distribution over external road network

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 6.5

EMM creating opportunities

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AM Peak Hour LV(HV) *LV – Light Vehicles*
PM Peak Hour LV(HV) *HV – Heavy Vehicles*

KEY

- Project area
- Key intersections

Road network of interest - hierarchy
- State
- Regional
- Local

Existing environment
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

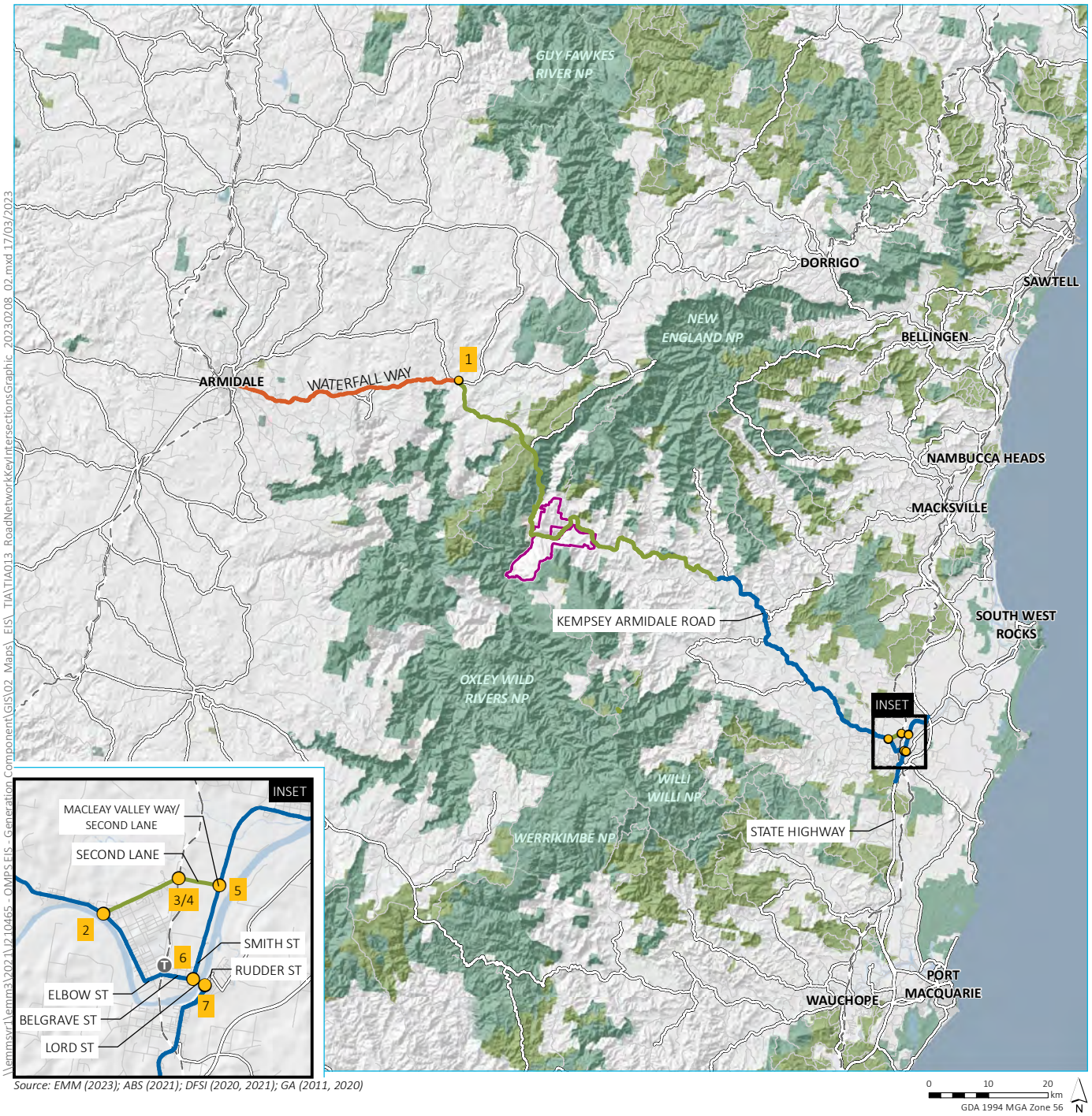
Source: EMM (2023); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

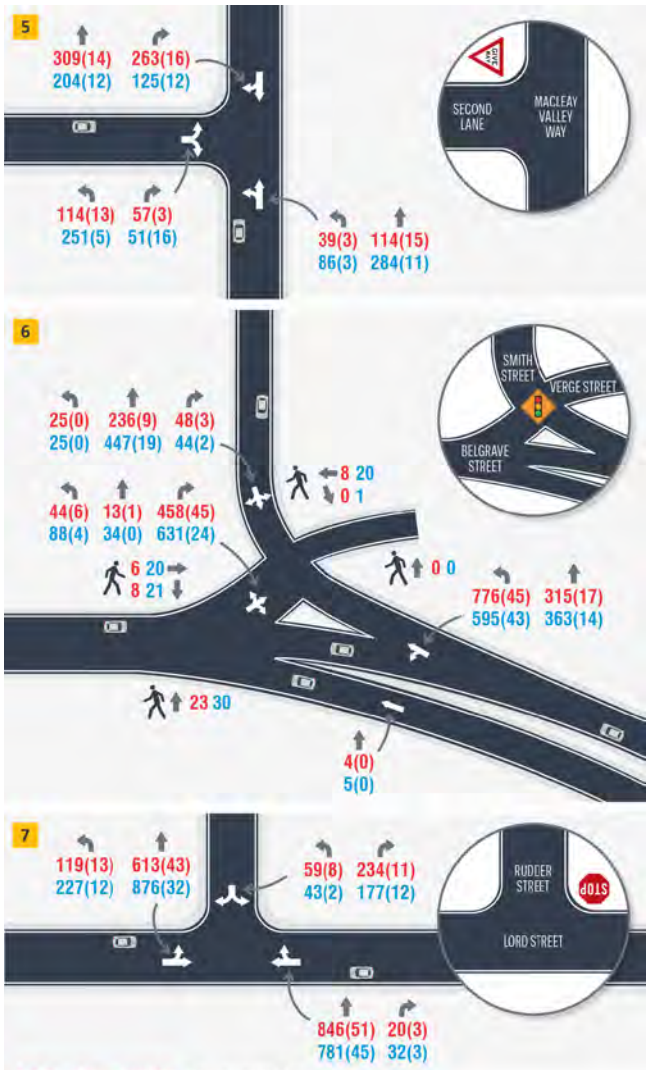
AM and PM peak hour construction traffic volumes

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 6.6

EMM creating opportunities

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AM Peak Hour LV(HV) *LV – Light Vehicles*
PM Peak Hour LV(HV) *HV – Heavy Vehicles*

KEY

- Project area
- Key intersections

Road network of interest - hierarchy
- State
- Regional
- Local

Existing environment
- Rail line
- Major road
- Minor road
- Named waterbody
- NPWS reserve
- State forest

0 10 20 km
GDA 1994 MGA Zone 56

Source: EMM (2023); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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AM and PM peak hour baseline + construction traffic volumes

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 6.7

EMM creating opportunities

6.3 Operational traffic

The Project will operate 24 hours per day, 7 days per week, 365 days per year. The Project will have a full operating life span of 100+ years. It is expected that the operation of the new power station will require around 30–50 full-time workers, as well as additional contractors for regular and ad hoc maintenance and repairs.

It is estimated that the operational traffic will be significantly lower than construction traffic and hence operational traffic impacts have not been considered as part of this TIA report.

6.4 Nearby development traffic

Several developments have been identified along the haulage route in the Armidale LGA which have the potential to generate cumulative traffic impacts with the Project. The estimated cumulative traffic impacts in the Armidale LGA are considered insignificant as use of this route is secondary to the main Project access route from Kempsey. There is no known major development along the haulage route from Kempsey; or indeed along the Kempsey Armidale Road.

The projects identified are in various stages of planning, approval or under construction. Details of construction period, light and heavy vehicle trips and OSOM trips have been retrieved from publicly available scoping or traffic assessment reports and presented in Table 6.6. There is no known major development along the haulage route from Kempsey.

Table 6.6 Nearby development traffic

Development	Road affected as part of Project road network	Construction period	Light vehicles (trips per day)	Heavy vehicles (trips per day)	OSOM vehicles (total trips)
Armidale Battery Energy Storage System	Waterfall Way	9 months	40	5	16
Olive Grove Solar Farm	Waterfall Way	9 months	13	6	-
Stringybark Solar Farm	Waterfall Way	7 months	5	1	-
Oxley Solar Farm	Waterfall Way	12 to 18 months	30	66	5
Doughboy Wind Farm	Waterfall Way	18 months	-	-	-

All the identified developments will have their construction traffic travelling via Waterfall Way which forms part of the Project's external road network. The publicly available reports do not mention the construction start and end months/year of all the identified developments. Based on the limited information available it is not possible to determine the overlap of peak construction period of these developments with the peak construction period of the Project.

Furthermore, Waterfall Way is a state road comprising of a sealed carriageway with two lanes and shoulders on each side and has adequate carriageway to accommodate additional traffic. Most of the cumulative traffic from these developments will only overlap along a short section of Waterfall Way and will not affect Kempsey Armidale Road. Furthermore, the route from Armidale via Waterfall Way is only a secondary access route to the Project area. Therefore, the additional traffic generated by the identified developments is not expected to have significant traffic impacts on the capacity and condition of Waterfall Way.

6.5 Over Size Over Mass vehicles

The Over Size Over Mass (OSOM) deliveries are assumed to incorporate a 250 MVA 3 phase transformer (9.0 L x 4.0 W x 4.0 H 120 T) and a turbine top (6.7 L x 6.7 W x 4.0 H 40 T). The deliveries will be from the Newcastle or Brisbane Port to the Project area via Kempsey. The assumed design vehicles for transporting the deliveries are presented in Figure 6.8 and Figure 6.9.

The design vehicle for the transport of the transformer is a 12 x 8 platform trailer with dimensions measuring 21.6 m in length and 4.2 m in width. The design vehicle for the transport of the turbine top is a 6 x 8 platform trailer with dimensions measuring 10.8 m in length and 4.2 m in width.

There will be several OSOM deliveries to the Project area with a maximum of one OSOM vehicle return trip per day between the Port and the Project area. Due to the high number of local traffic constraints along the Kempsey Armidale Road, OSOM vehicle movements should be conducted outside peak times or during the night time, where possible, between Kempsey and the Project area.

The OSOM vehicle route assessment has been conducted by Rex J Andrews (Rex J Andrews Pty Ltd, 2022) for this Project. The report is attached in Attachment D. The OSOM report identifies the preferred route for access to the Project from port of Newcastle and its necessary upgrades/treatments to the existing Kempsey Armidale Road.

Three treatments options were developed to enable safe and efficient access to the Project. The three options are:

- Treatment option 1: Traffic control.
- Treatment option 2: Traffic control plus pullover bay.
- Treatment option 3: Localised widening at pinch points.

Kempsey Armidale Road was split into 20 sections for separate traffic control treatment locations labelled with 17 sections within the Armidale Regional Council LGA labelled as ARC Section 1 to ARC Section 17, 2 sections within Kempsey Shire Council LGA labelled as KSC Section 1 to KSC Section 3.

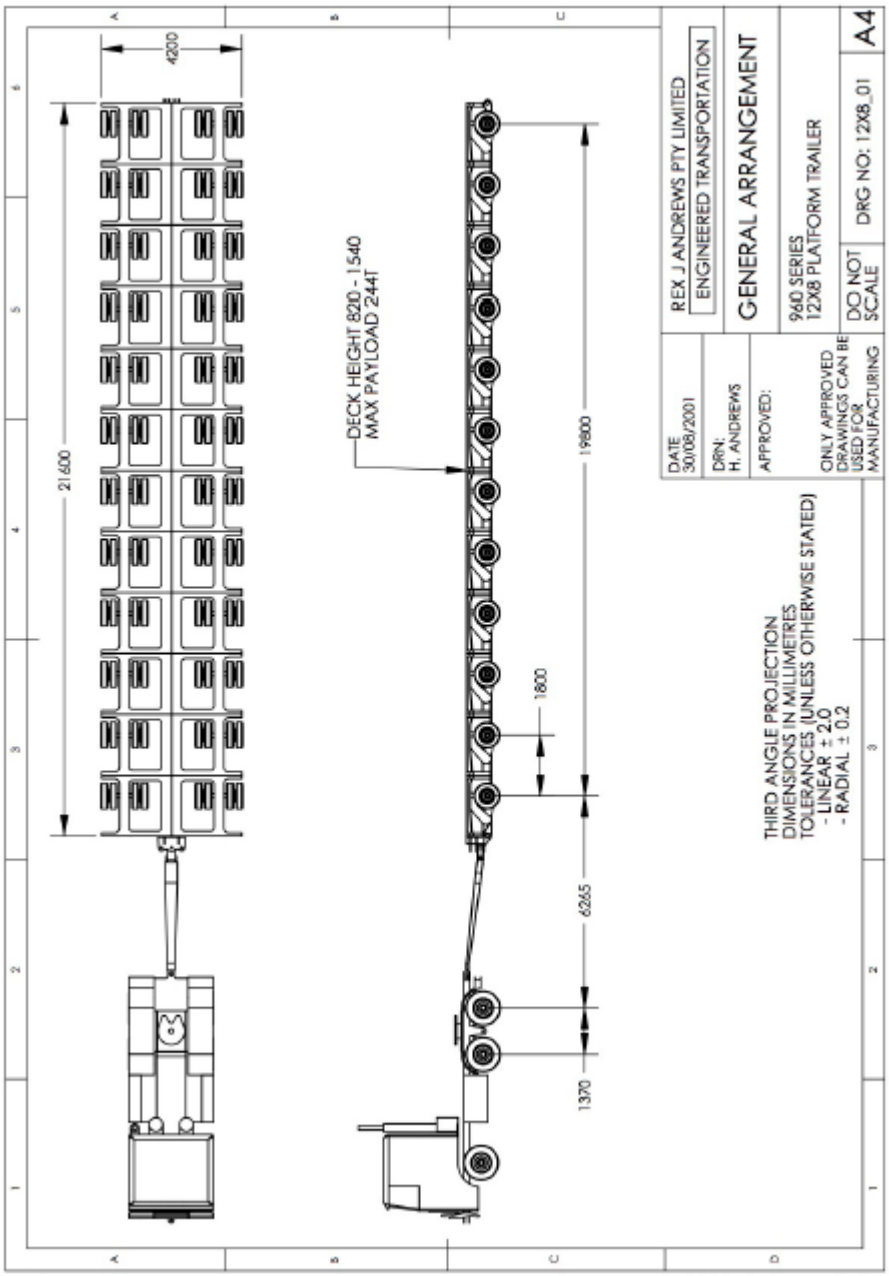
The OSOM report identifies the most suitable route is via Kempsey and identified known constraints along this route. Key findings from the OSOM report are presented in Table 6.7 and include actions for 15 locations/sections (separate to SMEC report) for either minor works/caution or road modifications required. Minor works include requirement of approvals from ARTC for railway crossings, removal of traffic signs/signals for OSOM vehicle movement and spotters to guide certain sections of the route. Road modifications include vegetation trimming/removal and road corridor widening.

Based on the key findings of the Kempsey Armidale Road Strategic Plan report by SMEC (SMEC, 2022) and the Rex J Andrews report (2022), OMPS engaged Local Government Engineering Services Pty Limited (LGES) to prepare a concept design report for the necessary road upgrades to facilitate OSOM vehicles travelling along Kempsey Armidale Road. The report investigates three sections within KSC LGA and six sections within ARC LGA out of the 20 total sections originally highlighted in the SMEC report as these sections are on the preferred route of access to the Project site.

The EAR alignment was further refined and with the selection of Smiths Bluff as the location for the crossing point of EAR with Kempsey Armidale Road, the scope of external road works has been further reduced to three sections within ARC LGA for a combined total of six sections (three in ARC LGA and three in KSC LGA). These six sections are outlined in Table 6.8. There will not be any OSOM vehicle from Armidale (e.g. via Waterfall Way).

4.0 Transport drawings

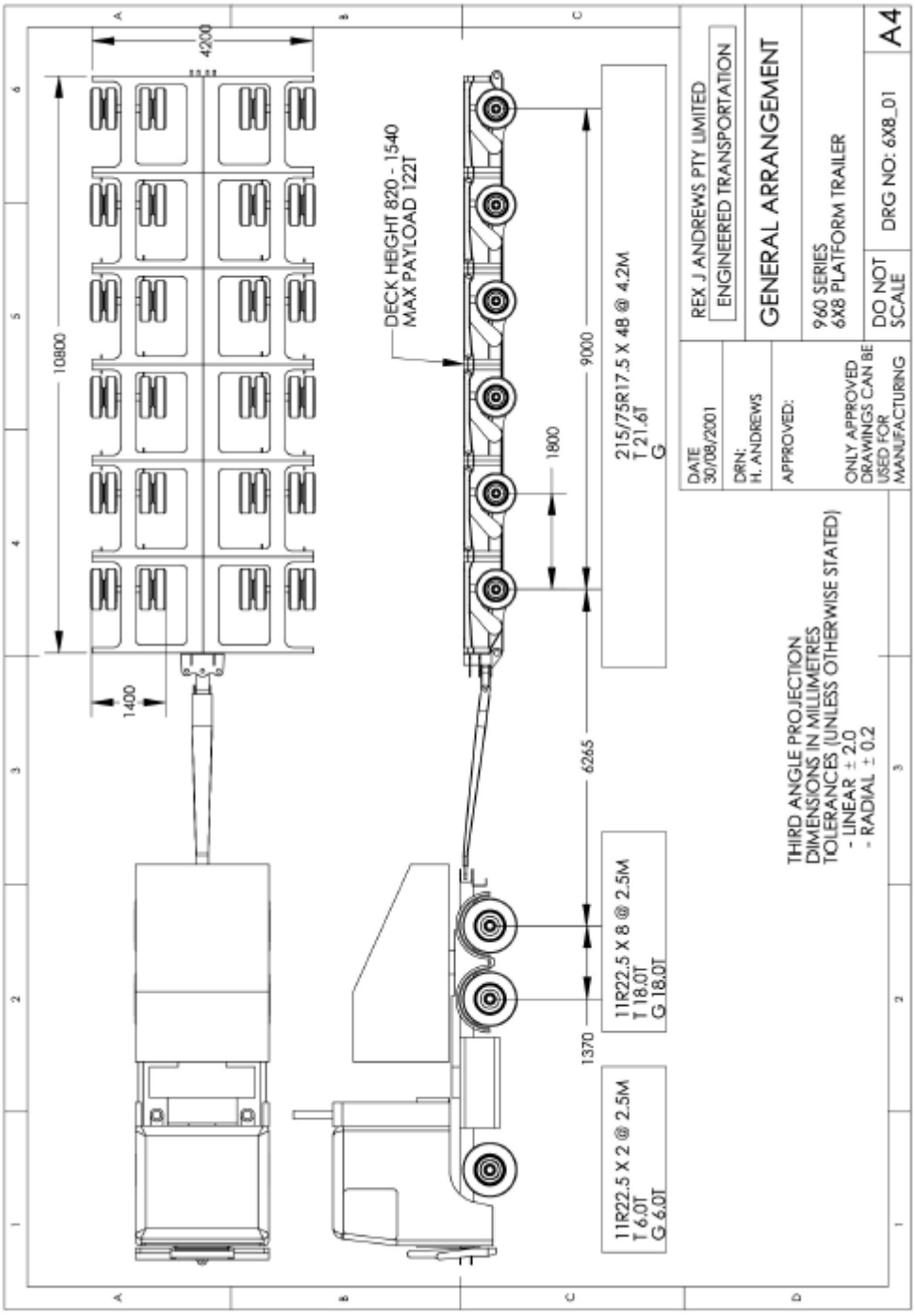
250MVA transformer transporter: 12x8 Platform trailer



Source: Rex J Andrews Route Study Newcastle Port to OMPS report

Figure 6.8 Vehicle specifications transporting 250MVA transformer

Turbine Top transporter: 6x8 platform trailer



Source: Rex J Andrews Route Study Newcastle Port to OMPS report

Figure 6.9 Vehicle specifications transporting turbine top

Table 6.7 Rex J Andrews OSOM route study report findings and recommendations

KM index	Location	Section of road	Current clearance	Procedure	Type of action	Comments
0.4	Mayfield	Selwyn Street rail crossing	Width: 9.0 m	Travel directly ahead	Minor works or caution	Loads to travel over the crossing in the centre of the road. Approval is required crossing this line, likely cross with caution.
1.3	Mayfield	Selwyn Street onto Industrial Drive via George Street	Length: 50.0 m Width: 8.0 m	Right hand turn	Minor works or caution	Trailer will need to be raised to travel over the hump in the road.
4.9	Mayfield	Industrial Drive under traffic signals	Clearance: Height: 5.4m	Travel directly ahead	Minor works or caution	The lowest traffic signal on route is at the intersection of Steel River Blvd. Trucks that exceed 5.3 m will need to travel in the right-hand lane.
20.0	Raymond Terrace	The Pacific Highway through the roundabout at Adelaide Street	Length: 40.0 m Width: 7.0 m	Travel directly ahead	Minor works or caution	Spotter to guide load through this section of road.
283.0	Frederickton	The Pacific Highway onto Macleay Valley Way	7.0 m into 7.0 m	Merge left than left at the roundabout	Minor works or caution	Spotter to guide load through this section of road.
288.9	West Kempsey	Second Lane over rail crossing	Width: 9.0 m	Travel directly ahead over the railway line	Minor works or caution	Loads to travel over the crossing in the centre of the road. Approval is required crossing this line, likely cross with caution.
292.0	West Kempsey	Second Lane onto North Street	Length: 45.0 m Width: 8.0 m	Right hand turn	Minor works or caution	Signs to be made removable and removed and replaced for each load.
295.0 to 339.0	Yarravel to Bellbrook	Kempsey Armidale Road	Length: 30.0 m Width: 6.0 m Height: 4.8 m	Travel directly ahead	Road modifications required	This section of road is sealed and in good condition. It has several bridges, pipes and culverts that would need to be checked for capacity. The road has several tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 m in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 m in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Kempsey and Bellbrook.

Table 6.7 Rex J Andrews OSOM route study report findings and recommendations

KM index	Location	Section of road	Current clearance	Procedure	Type of action	Comments
341.0 to 344.0	Bellbrook to Tynes Gap	Kempsey Armidale Road	Length: 30.0 m Width: 6.0 m Height: 4.8 m	Travel directly ahead	Road modifications required	This section of road is sealed and in good condition up until the east side of Tynes Gap. It has several pipes and culverts that would need to be checked for capacity. If loads exceed 4.8 m in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 m in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Bellbrook and Tynes Gap.
344.0 to 346.0	Tynes Gap	Kempsey Armidale Road	Length: 15.0 m Width: 4.5 m Height: 4.6 m	Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.	Road modifications required	This section of road is sealed and in reasonable condition. It has several pipes and culverts that would need to be checked for capacity. The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site. If loads exceed 4.6 m in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 m in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel over Tynes Gap.
346.0 to 348.0	Tynes Gap to Pee Dee Creek	Kempsey Armidale Road	Length: 30.0 m Width: 5.0 m Height: 4.8 m	Travel directly ahead	Road modifications required	This section of road is sealed and in good condition. It has some pipes and culverts that would need to be checked for capacity. The road has several bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 m in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 m in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Tynes Gap and Pee Dee Creek.

Table 6.7 Rex J Andrews OSOM route study report findings and recommendations

KM index	Location	Section of road	Current clearance	Procedure	Type of action	Comments
348.0 to 350.0	Pee Dee Creek to O'Sullivans Pass	Kempsey Armidale Road	Length: 30.0 m Width: 4.5 m Height: 4.8 m	Travel directly ahead	Road modifications required	This section of road is gravel and in reasonable condition. At some section, the road is narrow and will need some widening, especially in areas where the road steeply falls away. It has a bridge as well as pipes and culverts that would need to be checked for capacity. The road has several tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 m in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 m in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel on the existing road between Pee Dee Creek and O'Sullivans pass.
350.0 to 354.0	O'Sullivans Pass	Kempsey Armidale Road	Length: 15.0 m Width: 4.5 m Height: 4.6 m	Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.	Road modifications required	This section of road is gravel and in average condition. It has several pipes and culverts that would need to be checked for capacity. The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site. If loads exceed 4.6 m in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 m in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel over O'Sullivans Pass.
354.0	O'Sullivan's Pass to Proposed River crossing at Smith Bluff	Kempsey Armidale Road	Length: 30.0 m Width: 4.5 m Height: 4.8 m	Travel directly ahead	Road modifications required	This section of road is gravel and in reasonable condition. At some sections, the road is narrow and will need some widening, especially in areas where the road steeply falls away. It has a bridge and several pipes and culverts that would need to be checked for capacity. The road has multiple tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 m in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 m in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel on the existing road between O'Sullivans pass and Smiths Bluff.

Table 6.7 Rex J Andrews OSOM route study report findings and recommendations

KM index	Location	Section of road	Current clearance	Procedure	Type of action	Comments
370.0	Smith Bluff	Kempsey Armidale Road	Length: N/A Width: N/A Height: N/A	Left hand turn	Road modifications required	Access from Kempsey Armidale Road onto the proposed River crossing route and final access route to the Project area will need to be made suitable for the swept path of the largest load.

Source: Rex J Andrews Route Study Newcastle Port to OMPS

Table 6.8 LGES site access design report for OSOM vehicles

Section	Approximate location	Approximate length (metres)	Comment	Recommendation
KSC Section 1	Extends from Pee Dee Creek to Pee Dee Road	600	This section has a steep cut embankment on the northern side of formation and a steep downslope to the Macleay River on the southern side of formation.	KSC have prepared a design for the reconstruction and sealing of the Kempsey Armidale Road from Pee Dee Creek bridge for a distance of 3 km to the west. A preliminary swept path analysis by LGES on the proposed design showed that with minor modifications to the design, relating to the flattening of batters on several curves and maximising shoulder widths adjacent to proposed safety barriers positions, the nominated design vehicle was able to traverse the road section. A more robust investigation and a concept design of these modifications are underway in consultation with KSC.
KSC Section 2	Extends from Pee Dee Road to Five Day Creek	3,300	This unsealed section starts from Pee Dee Road and traverses in a westerly direction over O'Sullivans Gap. The road ascends from Pee Dee Road to O'Sullivans Gap, typically with a cut slope on the northern side of formation and a steep downslope adjacent to the southern side of formation. From O'Sullivans Gap to the west, the road descends quite steeply over a distance of approximately 2.5 km, with a tight curvilinear alignment. Typically, the road cross-section through the descending alignment consists of a cut slope on the southern side of formation with a steep downslope adjacent to the northern side of formation. Neither of the design vehicles are able to traverse the section of road with the conflict locations summarised below.	Widening of the road formation is required ranging from 0.5 m to 2.5 m horizontally over various lengths on this section. The additional width is obtained by either cutting into the high cut slopes or downslopes. Rock anchors and shotcrete protection is required at some locations.

Table 6.8 LGES site access design report for OSOM vehicles

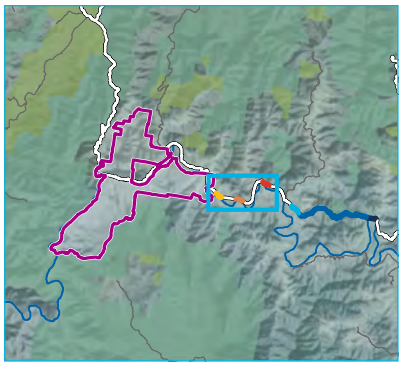
Section	Approximate location	Approximate length (metres)	Comment	Recommendation
KSC Section 3	Cutting between Five Day Creek Road and Schoolhouse Gully	1,000	This partially sealed/unsealed section of the Kempsey Armidale Road traverses generally in a north-south direction with a typical cross-section including a steep (near vertical) cut slope on the eastern side of formation, and a steep downslope to the Macleay River on the western side of formation. Evidence of several landslips within this section on both the upslope cut face and the downslope embankment. Neither of the design vehicles are able to traverse the section of road with the conflict locations summarised below.	An additional formation width of 1 m is required over various lengths on this section. Cutting of upslope batter and/or downslope widening is unlikely due to several constraints hence possible realignment of this section should be investigated.
ARC Section 1	Cutting west of Blackbird Flat Creek	700	This unsealed section of the Kempsey Armidale Road is constrained between the Macleay River on the south-western side of formation and a steep (near vertical) cut slope on the north-eastern side of formation for almost the entire 700 m length. Debris from landslides was observed at the time of inspection at several locations. Neither of the design vehicles are able to traverse the section of road with the conflict locations summarised below.	Widening of the road formation is required ranging from 1.5 m to 3.0 m horizontally over various lengths on this section. Cutting of upslope batter is unlikely, Downslope treatment with shotcrete retaining wall and no-fines concrete may be possible. Overall, possible realignment of this section should be investigated.
ARC Section 2	Cutting 3 km west of Lagoon Creek Bridge	700	This unsealed section of the Kempsey Armidale Road traverses in a general east-west direction, with a downslope on the southern side of formation to the Macleay River and steep upslope on the northern side of formation. Landslides have occurred in the recent past, are evidenced consistently in the downslope embankment over the Project length. These areas are currently protected by either temporary safety barriers or flagging. Neither of the design vehicles are able to traverse the section of road with the conflict locations summarised below.	An additional formation width of 2.0m horizontally is required for 180 m. Cutting of upslope batter unlikely given the extreme height with access not practical. Possible realignment of this section should be investigated. If not possible, downslope treatment with anchors, shotcrete retaining wall and no-fines concrete is preferred.

Table 6.8 LGES site access design report for OSOM vehicles

Section	Approximate location	Approximate length (metres)	Comment	Recommendation
ARC Section 3	Cutting 5 km west of Lagoon Creek Bridge	700	This unsealed section of the Kempsey Armidale Road traverses in a general south-east to north-west direction with a steep downslope to the Macleay River on one side of formation a steep cut slope on the other. Several downslope landslides have occurred in the recent past, and these areas were being protected by temporary barriers or flagging at the time the survey was undertaken in July 2022. At the time of the geotechnical investigation in September 2022, remediation works on the downslope involving the placement of rock anchors were being undertaken by a contractor on behalf of Armidale Regional Council. Neither of the design vehicles are able to traverse the section of road in the state the road was surveyed in (July 2022).	Culvert to be lengthened and road to be widened. An additional formation width of 2.0m horizontally is required for 360 m. Downslope remediation works currently being undertaken. Remediated road to be assessed and if it fails for delivery vehicle swept paths, potential realignment should be investigated.

Source: LGES Oven Mountain Pumped Hydro Storage - Over Size Over Mass Site Access





KEY

- Project area
- Major road
- Macleay River
- Watercourse/drainage line

Upgrade

- ARC Section 1 (700 m)
- ARC Section 2 (700 m)
- ARC Section 3 (700 m)
- KSC Section 1
- KSC Section 2
- KSC Section 3







GDA 1994 MGA Zone 56

Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

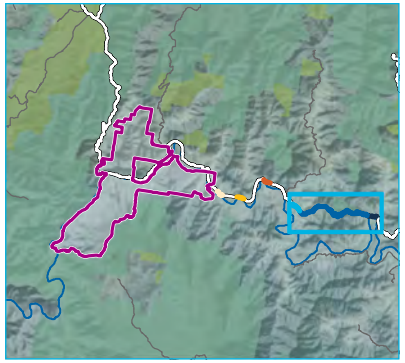
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Council upgrades and repairs to Kempsey-Armidale Road - ARC Section

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 6.10

EMM
creating opportunities





KEY

- Project area
- Major road
- Macleay River
- Watercourse/drainage line
- NPWS reserve

Upgrade

- ARC Section 1
- ARC Section 2
- ARC Section 3
- KSC Section 1 (600 m)
- KSC Section 2 (3300 m)
- KSC Section 3 (1000 m)





0 100 200 m

GDA 1994 MGA Zone 56

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Source: EMM (2022); ABS (2021); DFSI (2020, 2021); GA (2011, 2020)

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Council upgrades and repairs to Kempsey-Armidale Road - KSC Section

Oven Mountain Pumped Hydro Energy Storage Project
Traffic Impact Assessment
OMPS Pty Ltd
Figure 6.10

EMM
creating opportunities

6.6 Parking requirements

The Project has been declared to be a Critical State Significant Infrastructure (CSSI) Project and as such on site parking controls for this type of Project are not provided in either *Kempsey Development Control Plan 2013* or *Armidale Dumaresq Development Control Plan 2012*.

The Project will have ample parking area available to accommodate the Project's parking requirements.

6.7 River crossing

LGES has prepared a concept design options assessment report for the EAR (Local Government Engineering Services, 2022). The report has explored bridge crossings over the Macleay River for three route options of the EAR (these options are presented as Option 2, Option 2A and Option 2B within the LGES report). The Bridge Crossing at location 2B (south of Smiths Bluff) has been selected as the preferred crossing location based on civil design assessment, smaller bridge length and hydraulic modelling results.

The proposed bridge would be approximately 100 m long with a cross section of 5 m. The bridge will have low performance level high strength barriers on each side.

7 Impact assessment

7.1 Intersection performance

The key intersections have been modelled with the SIDRA Intersection 9.0 software; a micro-analytical tool for individual intersections and linked intersection-network modelling. The modelling is based on the traffic survey data detailed in Figure 5.10 (baseline traffic) and Figure 6.7 (baseline + construction traffic). SIDRA provides the following performance indicators:

- Degree of saturation (DOS) – the total usage of the intersection expressed as a factor of 1 with 1 representing 100% use/saturation (e.g. 0.8 = 80% saturation). In practice the target degrees of saturation are 0.90 for signals, 0.85 for roundabouts and 0.80 for unsignalized intersections. These are usually called 'practical degrees of saturation'.
- Average delay (DEL) – the average delay in seconds encountered by all vehicles passing through the intersection. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major traffic will provide an overall low average delay.
- Level of service (LOS) – this is a categorisation of average delay, intended for simple reference.
- 95% queue lengths (Q95) – is defined to be the queue length in metres that has only a 5% probability of being exceeded during the analysed time period. It transforms the average delay into measurable distance units.

The LOS is a good indicator of overall performance for individual intersections, with each level summarised in Table 7.1.

Table 7.1 Intersection LOS standards

Level of service	Average delay (seconds per vehicle)	Traffic signals, roundabout	Priority intersection ('Stop' and 'Give Way')
A	<14	Good operation	Good operations
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity. At traffic signals, incidents will cause extensive delays. Roundabouts require other control mode.	At capacity; required other control mode
F	>71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; required other control mode

Source: *RTA Guide to Traffic Generating Development* (RTA 2002)

SIDRA modelling for the key intersections (Section 5.3) has been conducted for the following scenarios:

1. Baseline – includes baseline 2027 traffic volumes, with growth of background traffic only.
2. Baseline + construction – includes baseline 2027 traffic combined with construction traffic volumes.

The SIDRA modelling results are shown in Table 7.2 to Table 7.8. Overall, the model shows that all intersections have spare capacity to accommodate additional traffic, except for Smith Street/Belgrave Street intersection, Kempsey (Table 7.4), which already accommodates significant traffic volumes and is expected to reach capacity in the AM and PM peak hours. Construction traffic is not anticipated to affect the performance of the intersections significantly.

Table 7.2 2027 SIDRA modelling result for Waterfall Way/Kempsey Armidale Road intersection, Wollomombi

Control/ scenarios	AM Peak					PM Peak				
Give way controlled	Intersection volume	DEL(s)	LOS	DOS	Max Q in m (approach)	Intersection volume	DEL(s)	LOS	DOS	Max Q (approach)
1. Baseline	85	8.3	A	0.025	0.2 (south)	92	8.7	A	0.023	0.3 (south)
2. Baseline + construction	89	8.3	A	0.025	0.2 (south)	95	8.6	A	0.023	0.4 (south)

Key findings:

- the intersection has less than 100 vehicles passing during the peak hour and operates at LOS A in baseline and baseline + construction scenarios
- the longest delay would occur on the south approach (Kempsey Armidale Road) during AM and PM peak
- there is negligible queuing during the peak hours
- the intersection has ample capacity to accommodate additional traffic.

Table 7.3 2027 SIDRA modelling result for Lord Street/Rudder Street intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Stop controlled	Intersection volume	DEL(s)	LOS	DOS	Max Q in m (approach)	Intersection volume	DEL(s)	LOS	DOS	Max Q (approach)
1. Baseline	2,011	16.2	B	0.502	7.6 (north-east)	2,234	23.1	B	0.565	8.5 (north-east)
2. Baseline + construction	2,020	16.2	B	0.505	7.6 (north-east)	2,242	25.4	B	0.592	9.3 (north-east)

Key findings:

- the intersection has less than 100 vehicles passing during the peak hour and operates at LOS B in baseline and baseline + construction scenarios
- the longest delay would occur on the north-east approach (Rudder Street) during AM and PM peak
- there is negligible queuing during the peak hours
- the intersection has approximately 50% capacity to accommodate additional traffic.

Table 7.4 2027 SIDRA modelling result for Smith Street/Belgrave Street intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Signalised	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q (approach)**
1. Baseline	2,036	54.1	D	1.239	256.5 (west)	2,331	64.8	E	1.256	566.3 (west)
2. Baseline + construction	2,045	55.3	D	1.248	261.5 (west)	2,338	66.4	E	1.268	578.7 (west)

Key findings:

- the intersection operates at LOS D in AM peak and LOS E in PM Peak in baseline and baseline + construction scenarios
- the longest delay would occur on the west approach (Belgrave Street) during AM and PM peak
- queuing on Belgrave Street will be just over 250 m in AM Peak and over 500 m during the PM peak at west approach
- the intersection is at capacity during both the AM and PM peaks in baseline scenarios.

Despite the minor deterioration of the model parameters at this intersection (e.g. delay and capacity), the net impact at the intersection due to additional construction related vehicles will be relatively minor.

Table 7.5 2027 SIDRA modelling result for River Street/North Street intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Give way controlled	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q (approach)**
1. Baseline	993	16.3	B	0.379	11.3 (north-east)	1,065	19.1	B	0.509	20.4 (north-east)
2. Baseline + construction	1,007	16.8	B	0.381	12.1 (north-east)	1,073	19.5	B	0.516	20.7 (north-east)

Key findings:

- the intersection will operate at LOS B in baseline and baseline + construction scenarios
- the longest delay would occur on the north-east approach (North Street) during AM and PM peak
- the intersection will still have approximately 50% spare capacity during the PM peak to accommodate additional traffic.

Table 7.6 2027 SIDRA modelling result for North Street/Kemp Street/Saleyards Road intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Stop controlled	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q (approach)**
1. Baseline	598	13.6	A	0.189	3.1 (south)	651	16.6	B	0.197	5.2 (south)
2. Baseline + construction	607	13.7	A	0.191	3.1 (south)	659	16.8	B	0.199	5.3 (south)

Key findings:

- the intersection would operate at LOS B or better in baseline and baseline + construction scenarios
- the longest queue would occur on the south approach (Kemp Street) during AM and PM peak
- the intersection will still have approximately 80% spare capacity to accommodate additional traffic.

Table 7.7 2027 SIDRA modelling result for Second Lane/Griffins Lane intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Give way controlled	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q (approach)**
1. Baseline	519	7.5	A	0.178	0.5 (north)	564	8.2	A	0.183	0.6 (north)
2. Baseline + construction	528	7.6	A	0.181	0.5 (north)	572	8.3	A	0.187	0.6 (north)

Key findings:

- the intersection will operate at LOS A in baseline and baseline + construction scenarios
- the longest delay would occur on the north approach (Griffins Lane) during AM and PM peak
- the intersection will have over 80% spare capacity to accommodate additional traffic.

Table 7.8 2027 SIDRA modelling result for Macleay Valley Way/Second Lane intersection, Kempsey

Control/ scenarios	AM Peak					PM Peak				
Give way controlled	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q in m (approach)**	**Intersection volume**	**DEL(s)**	**LOS**	**DOS**	**Max Q (approach)**
1. Baseline	951	20.1	B	0.306	9.8 (west)	1,052	25.1	B	0.502	24.7 (west)
2. Baseline + construction	960	20.3	B	0.311	10.0 (west)	1,060	25.3	B	0.510	25.5 (west)

Key findings:

- the intersection will operate at LOS B in baseline and baseline + construction scenarios
- the longest delay would occur on the west approach (Second Lane) during AM and PM peak
- the intersection will have approximately 50% capacity during the PM peak hour.

The details of the intersection results are attached in Attachment B.

7.2 Need for rural road upgrades

Austroads Guide to Road Design Part 3: Geometric Design (Austroads, 2016), refers to a range of daily traffic volume thresholds for the design of single carriageway in rural areas, which are shown in Table 5.16 of this report.

The existing road width measurements and conditions with respect to existing daily traffic volumes for each road section considered as part of this TIA are shown in Table 5.17.

An assessment of the external road network due to the construction traffic is undertaken in Table 7.9.

Table 7.9 2027 Baseline + construction daily traffic volumes and corresponding road design standards

Road	Extent of road section	Approximate length of section (km)	Daily traffic volume			Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Will meet Austroads design standard?	Proposed mitigation measures
			Existing	Construction	Combined				
Waterfall Way	Between Armidale and Wollomombi	40	669	60	729	7.2 m sealed	Minimum 7.2 m – 8 m wide seal	Yes	
Macleay Valley Way (North)	Between Frederickton and Second Lane at West Kempsey	5.5	8,710	178	8,888	9–10 m sealed	Minimum 10 m wide seal	Yes	
Macleay Valley Way (South)	Between Pacific Highway and Lachlan Street	3.6	8,008	114	8,122	12 m sealed	Minimum 10 m wide seal	Yes	
Kempsey Armidale Road	Between Waterfall Way at Wollomombi to Caterpillar Creek	24	52	41	93	6–7 m unsealed*	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	Yes, with exceptions	
	Between Caterpillar Creek and Site Access 1	16	52	41	93	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No	Recommend traffic control measures at critical locations.
	Between Site Access 1 and Site Access 2	9.7	52	54	106	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No	Recommend traffic control measures at critical locations.

Table 7.9 2027 Baseline + construction daily traffic volumes and corresponding road design standards

Road	Extent of road section	Approximate length of section (km)	Daily traffic volume			Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Will meet Austroads design standard?	Proposed mitigation measures
			Existing	Construction	Combined				
	Between Site Access 2 and Site Access 3	7.7	65	4	69	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No	Recommend traffic control measures at critical locations.
Kempsey Armidale Road	Between Yarravel to Bellbrook (Accommodation Camp)	45	2,050	292	2,342	9 m sealed	Minimum 9 m wide seal	Yes	
	Between Bellbrook to Pee Dee	8.3	266`	378	644	9 m sealed	Minimum 7.2 m wide seal	Yes	
	Between Pee Dee to Site Access 3	21.7	83	378	461	3–5 m unsealed	8.7 m wide total carriage (if unsealed); or minimum 3.7 m wide seal	No	Recommend widening to 7.2 m sealed width.
Lachlan Street/Lord Street	Between Macleay Valley Way (South) and Belgrave Street	2.4	17,204	114	17,318	10–12 m sealed	Minimum 10 m wide seal	Yes	
Second Lane	Between Macleay Valley Way (North) and North Street	1.2	5,208	178	5,386	9 m sealed	Minimum 10 m wide seal	Yes, with exceptions	

Table 7.9 2027 Baseline + construction daily traffic volumes and corresponding road design standards

Road	Extent of road section	Approximate length of section (km)	Daily traffic volume			Existing road width (approximate)	Austroads Guide to Road Design standard in accordance with daily traffic volume	Will meet Austroads design standard?	Proposed mitigation measures
			Existing	Construction	Combined				
North Street	Between Second Lane and River Street	2.4	4,410	178	4,588	8.5-9.5 m sealed	Minimum 10 m wide seal	Yes, with exceptions	
River Street	Between Elbow Street and Armidale Road	5.1	8,044	114	8,158	12 m sealed	Minimum 10 m wide seal	Yes	

Note: * This section of the road is mostly 6 m to 7 m unsealed width but also includes one lane sealed and two lane unsealed sections.

Table 7.9 shows that Austroads design standards are met for majority of the roads along the main haulage route from Kempsey. Road sections with exceptions could still be considered adequate due to low traffic volumes.

Road sections that have not met Austroads design standards are predominantly near the Project area where it is recommended to implement targeted traffic control measures or road improvements such as widening in sections. This has been discussed further in subsequent sections of this TIA.

7.3 Intersection design

As the proposed three intersections for site access off Kempsey Armidale Road will be unsealed, Austroads basic/auxiliary/channelised turn treatment assessments are not required to be undertaken. Instead, the intersection assessment has been undertaken based on ARRB's Unsealed Roads Best Practice Guide (Edition 2 Published October 2020), endorsed by Deputy Prime Minister and Minister for Infrastructure, Transport and Regional Development. The proposed intersection design treatments have been consulted with Councils and TfNSW.

The criteria for intersection design and its assessment are tabulated below. The below table relates to intersections external to the Project area.

Table 7.10 Intersection assessment

Item no.	Item	ARRB guide recommendations	EMM comments
1	Location of the intersection	Intersections should not be located on high embankments, near bridges, culverts, streams, on small radius curves, on steep grades or superelevated curves. Dense vegetation close to the intersection can reduce visibility; it should be cleared well back and prevented from regrowing.	The proposed three access intersections will be located at a straight alignment at a reasonable grade by avoiding any embankments, bridges or culverts etc. All vegetation will be cleared on both approaches, to be shown at the detailed intersection design.
2	Intersection spacing	Ideally the number of intersections should be kept as low as possible, with the spacing between them as large as can be provided. Adequate separation should be provided for successive intersections, with signposts placed as warnings at critical locations.	Due to the scale of the Project and its required infrastructure, a minimum three accesses are needed from Kempsey Armidale Road. Adequate spacing is provided for these three intersections (Figure 2.3).
3	Intersection angle	Road centrelines should be designed to intersect as close to 90º as possible so that driver observation angles to potentially conflicting vehicles are satisfactory. Intersection approaches should be straight wherever possible. If curves cannot be avoided, it is desirable that through movements have a constant radius and tangent points are located a suitable distance from the intersection.	All proposed intersections will be at or close to 90^0 angle with Kempsey Armidale Road.

Table 7.10 Intersection assessment

Item no.	Item	ARRB guide recommendations	EMM comments
4	Sight distance	There are three sight distance criteria applicable to the various aspects of traffic operations at intersections. They are: • Approach sight distance (ASD) – ASD provides a driver with adequate distance to observe and have sufficient time to react and stop, if necessary, before entering a conflict area. • Minimum Gap Sight Distance (MGSD) – MGSD is the distance required for minor road drivers to enter a major road so that the traffic on the major road is unimpeded. • Safe Intersection Sight Distance (SISD) – SISD provides sufficient distance for a driver on a major road to avoid a collision with a vehicle on a minor road. SISD is the minimum for any intersection design.	In the concept plans, EMM is unable to verify whether the minimum sight distance is achieved or not. However, the ASD and SISD should be provided in accordance with the ARRB guide Table C 16: ASD and SISD values for unsealed roads. The sight distance must be achieved based on the speed on Kempsey Armidale Road. It is understood that in the detailed design, sight distance requirements will be assessed and shown in the plans.

7.4 Road safety assessment

7.4.1 Safety assessment at site access intersections

In accordance with *Austroads Guide to Road Design Part 4A* (Unsignalized and Signalised Intersections) (Austroads, 2017), all unsignalized T-intersections need to have clear visibility between the through traffic travelling on the major road and the turning traffic exiting from the minor road, so that the turning traffic can observe gaps to turn safely to merge with the major road traffic. This visibility measurement is called sight distance.

This is assessed in further detail below, in terms of the safe intersection sight distance (SISD) at the intersection, which varies according to the design speed of the road. Normally a design speed 10 km/h higher than the posted speed limit is used to calculate the SISD.

As per the discussion earlier, assuming Kempsey Armidale Road has a speed limit of 80 km/h near the site access intersections, a presumed design speed of 90 km/hr is considered. In accordance with Austroads (2017), for a road with a design speed of 90 km/h, the minimum SISD required for a general minimum two second driver reaction time is 214 m.

It is difficult to conduct a sight distance assessment at the exact location of the site access intersection. However, as per Austroads guidelines, the site access intersections are to have a clear sight distance for up to a height of 1.25 m for 214 m towards the left and right of the intersections. As discussed with Council this work will be undertaken during the detailed design phase.

7.4.2 Safety risks and hazards on public roads along haulage route

The following observations are made in terms of safety risks and hazards on public roads along the haulage routes:

- there is overgrown vegetation including trees and shrubs blocking roadway, limiting sight distances and obscuring road signs at various locations along the haulage route
- line marking (edge and centre lines) on some sections of River Street and Kempsey Armidale Road have completely faded increasing the risk of head-on crashes

- there are several concealed driveways along the haulage route without appropriate signage
- there are bridges along the haulage route with unknown load capacity
- recreational motor bike riders along Kempsey Armidale Road travel in bunches and sometimes arrive at high speeds increasing the risk of head-on crashes
- the characteristics of the haulage route along Kempsey Armidale Road such as challenging terrain, poor pavement condition, reduced sight distances, and weather conditions with the current speed environment pose serious risks and hazards
- in the mountainous sections, dense fog was observed severely restricting sight distances
- there are apparent rockfalls at some sections of Kempsey Armidale Road creating a serious risk for vehicles falling down steep slopes
- Kempsey Armidale Road narrows down to one lane in many sections and two-way movements are not possible
- there are currently numerous potholes and badly damaged sections of Kempsey Armidale Road, likely worsened by the rain this year
- additional truck movements over time will continue to damage all sealed and unsealed sections Kempsey Armidale Road
- on a typical rainy day, the unsealed sections of the Kempsey Armidale Road become slippery
- during the site inspection, it was noted that passing vehicles create dust, which restricts visibility for any vehicles travelling behind on a typical dry day
- as Kempsey Armidale Road progresses towards the site, there are many narrow sharp bends with poor sight distances
- some sections of Kempsey Armidale Road have overgrown vegetation which also restricts the sight distances
- at some sections, the road is approximately 4 m wide with no protection on the downhill side which is a serious traffic safety hazard
- in the east-west section travelling from Kempsey in the afternoon and vice versa in the mornings, sun glare was observed to be an issue.

The Waterfall Way/Kempsey Armidale Road intersection has raised topography on both sides of Kempsey Road (Plate 7.1). There is vegetation and earth banks restricting visibility to the left and right for the northbound vehicles on Kempsey Road. Vehicles need to arrive right at the edge of the intersection before obtaining a clear view of any oncoming traffic on Waterfall Way.

An Auxiliary Left turn (AUL) and an Auxiliary Right Turn (AUR) treatment is provided on Waterfall Way.



To the left



To the right

Plate 7.1 Topography to the left and right of Kempsey Road on approach to Waterfall Way

A warrants assessment for additional intersection turning lanes was conducted as per guidelines presented in Section 7.2. The posted speed limit on Waterfall Way is 100 km/h. The turn treatment assessment is presented in Table 7.11.

Table 7.11 2027 Intersection turns treatment warrant for Waterfall Way/Kempsey Road intersection for baseline + construction scenario

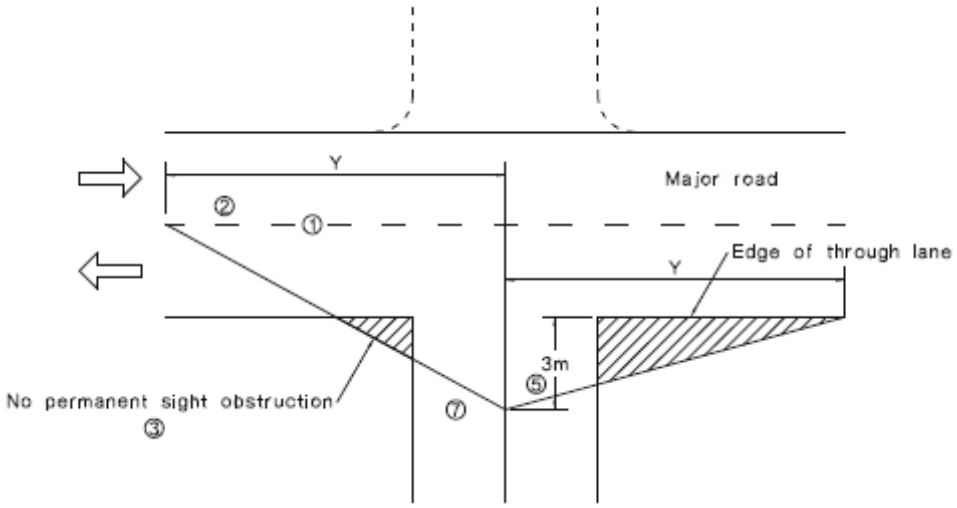
Movement	Peak hour	Major road traffic volume	Turning traffic volume	Turn treatment required
Left turn from major road	AM	3	53	BAL
	PM	3	39	BAL
Right turn from major road	AM	60	4	BAR
	PM	46	2	BAR

The turn treatment assessment results identify a BAL and BAR turn treatment for left and right turning traffic on Waterfall Way. Since the intersection already has AUL and AUR turn treatment, no further intersection turning lanes are required.

A warrant for a Stop sign (R1-1) is also conducted for the Kempsey Armidale Road approach at Waterfall Way/Kempsey Armidale Road intersection. *Australian Standards Manual of uniform traffic control devices Part 2: Traffic control devices for general use* (Australian Standard, 2009) stipules the requirement for 'Stop' or 'Give way' control for unsignalized intersections. The approach control on Kempsey Armidale Road has been determined based on the requirements put forward in *Clause 2.5.4* and *Figure 2.2* of the Australian Standard. Clause 2.5.4 states:

> A STOP sign shall be used when, for minor road traffic, the sight distance, Y, in either direction along the major or uncontrolled road as shown in Figure 2.2 is less than the distance given for the corresponding major road speed. A STOP sign shall NOT be used is the sight distance is equal to or greater than shown in Figure 2.2.

Waterfall Way has a posted speed limit of 100 km/h and a design speed of 110 km/h. As per Figure 7.1 (Australian Standard 1742.2, Figure 2.2), the distance along major road Y for speed of 110 km/h is 115 m. The minimum available sight distance on Waterfall Way towards right is approximately 100 m. Note 3 in Figure 7.1 states that where visibility is limited due to vegetation or earth banks, attempts should be made to remove these rather than installing the Stop sign. Potential mitigation measures regarding clearing vegetation and earth bank near this intersection have been included in Chapter 8 of this report and will be considered further during the detailed design phase.



Major road speed (see Note 4) km/h	Distance along major road: Y, (see Note 6) m
40	20
50	30
60	40
70	55
80	65
90	80
100	95
110	115
120	140

NOTES:

1 Separation line (undivided road), or right hand edge of right hand through lane (divided road).

2 A check to the left is required at a divided road except where the median is wide enough for a crossing or turning manoeuvre to be staged in the median.

3 Where visibility is limited due to some removable obstruction, (e.g. vegetation or earth bank) attempts should be made to remove the obstruction rather than install a STOP sign.

4 The posted or default speed limit is used, unless the 85th percentile speed is significantly higher.

5 Where the minor road approach is an arterial road this dimension should be increased to 4.5 m.

6 When checking sight distance the height of both the observer's eye and the object is 1.05 m.

7 If the safety of the surveyor is likely to be a problem, sighting may be taken from the kerb in the minor road, with appropriate adjustments to the sight triangle.

8 The distances in the Table along both the minor road and the major road are based empirically on the ability of a driver on the minor road approaching the intersection at a speed of 10 km/h or less, being able to stop before reaching a conflict point if there is insufficient gap for crossing or joining the major road stream.

Source: Australian Standard 1742.2

Figure 7.1 Sight distance restrictions requiring use of stop signs

7.5 Parking provision

During the construction period, vehicles are expected to be parked on unsealed areas within the Project area. No vehicles will park on any public road.

7.6 Impact on public transport, school buses, cyclists and pedestrians

To minimise heavy vehicle impact on public transport, cyclists and pedestrians within the Kempsey town centre, the heavy vehicles are proposed to bypass the township (unless originated from Kempsey township). The designated haulage route will be Pacific Highway-Macleay Valley Way (at Frederickton)-Second Lane which will have minimal impact on the existing pedestrian or cyclist infrastructure.

As per information presented in Section 5.9.2, there is one public transport bus route operating along Macleay Valley Way (North section) and two public transport bus routes operating along Kempsey Armidale Road up to Bellbrook. Construction heavy vehicles would be interacting with few public transport buses, hence potential traffic impacts will be minimal.

Construction heavy vehicles will not be operating within school zones on Kempsey Armidale Road between Kempsey and Bellbrook during school bus operating hours i.e. between 7:30 am to 9:30 am and 2:30 pm to 4:30 pm. Additionally, construction heavy vehicles will not be operating on the Kempsey Armidale Road between Bellbrook and the EAR (main access road entry point) during school bus operating hours i.e. between 7:30 am to 9:30 am and 2:30 pm to 4:30 pm. Due to the proposed cease in operation of construction heavy vehicles during the school pick-up and drop-off time (NSW school terms only), traffic impacts on school buses and school zones would be negligible.

Mitigation measures to limit impacts on public transport and cyclists have been presented in Chapter 7 and Table 8.1.

7.7 Swept path assessment

Swept path assessment has been undertaken at the EAR site access intersection as part of the road concept design. The intersection is designed to allow 19 m semi-trailers entering/exiting from north along Kempsey Armidale Road and OSOM vehicles (960 series platform trailers) entering/exiting from south along Kempsey Armidale Road.

7.8 Level crossing assessment

As per the details of trains passing through the level crossing at Kempsey (Table 5.21), there is one passenger train passing the level crossing during the AM peak (8:08 am) and one steel train during the PM peak (3:30 pm) on a typical weekday.

Video footage from the intersection count survey of Second Lane/Griffins Lane showed a freight train going through the level crossing. The total time the level crossing was closed for vehicular traffic was 217 seconds. A queuing assessment has been conducted using equation 3.5 from *Austroads Guide to Traffic Management Part 2: Traffic Theory Concepts* (Austroads, 2020) and based on the traffic volumes presented in Figure 5.10 (baseline traffic volumes) and Figure 6.6 (construction traffic volumes). The queuing assessment is presented in Table 7.12.

Table 7.12 Level crossing queuing assessment for traffic volumes in 2027

Description	Westbound AM peak		Westbound PM peak		Eastbound AM peak		Eastbound PM peak	
	Baseline	Baseline + Construction	Baseline	Baseline + Construction	Baseline	Baseline + Construction	Baseline	Baseline + Construction
Traffic flow rate over level crossing (vph)	329	334	236	237	188	192	322	329
Average flow during 217 seconds	20	20	14	14	11	12	19	20
p(x)	0.018	0.018	0.029	0.029	0.024	0.026	0.025	0.018
P(X)	0.966	0.966	0.952	0.952	0.968	0.963	0.951	0.966
x=queuing vehicles	28	28	20	20	17	18	26	28
Queue (m)	168	168	120	120	102	108	156	168
p(x) is the probability of x occurrences of an event in a situation for which the expected number of occurrences is m.								
P(X) is the probability of x or less occurrences of an event where the expected number of occurrences is m.								

As per Table 7.12, there is an increase of two queuing vehicles between baseline scenario and baseline + construction scenario in the eastbound direction during PM peak. Overall, there is negligible increase in queuing due to additional Project construction traffic.

7.9 Road safety audit findings

A Road Safety Audit (RSA) has been undertaken by SMEC as part of this Project (SMEC, 2021) to identify existing road user risks and hazards, especially along Kempsey Armidale Road. The report assesses the suitability of the Kempsey Armidale Road between the Waterfall Way near Wollomombi and Kempsey to provide access for construction and delivery vehicles. It should be noted that Kempsey has been selected as the main access route to the Project site.

It should be noted that an RSA does not necessarily provide solutions to each of the identified risks or hazards. It generally identifies the risks and hazards predicted to occur relative to the Project and the associated mitigation measures are considered during the detailed design phase by the relevant engineering specialists and implemented where feasible. The RSA findings are based on a Risk Matrix (Table 7.13) and a Treatment Approach (Table 7.14) and presented in Table 7.15.

The proposed mitigation measures to the identified risks have been discussed in Chapter 8 of this report.

Table 7.13 Risk Matrix

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 7.14 Treatment Approach

Risk rating	Suggested treatment approach
Intolerable	Must be corrected.
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
Low	Should be corrected or the risk reduced, if the treatment cost is low.

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
Waterfall Way to Georges Junction					
001	Rear end and side impact	The northbound right turn from Waterfall Way is too short for deceleration and storage due to the close proximity to an existing bridge. This will require vehicles to slow down significantly within the through lane on Waterfall Way which may lead to a rear end collision with a vehicle behind them. The lack of appropriate warning signage will exacerbate the above issue due to driver inattention on a rural highway.	Occasional	Serious	High
002	Rear end/side impact	The approach to Waterfall Way from Kempsey is depressed in side cuts reducing intervisibility between vehicles on Waterfall Way and approaching vehicles from Kempsey. There are no acceleration lanes on Waterfall Way Insufficient acceleration distance: there is a significant speed difference between vehicles travelling at 100 km/h on Waterfall Way and entering vehicles from Kempsey Insufficient sight distance to approaching vehicles: Minimum gap sight distance is not available for an entering vehicle. Safety Risk: Due to the substandard features associated with the intersection there is a risk of rear end or side impact collisions. When considered in combination of all the factors the likelihood of an incident occurring increases.	Occasional	Serious	High
003	Impact with bridge safety rail	Oaky River bridge has substandard concrete parapets and no hazard delineation. Safety Risk: There is a risk a vehicle may impact the bridge parapet due to poor visibility or avoiding an approaching vehicle resulting in bridge damage and a vehicle runoff.	Occasional	Serious	High
004	Impact with road side vegetation	The Armidale-Kempsey Road is a gravel surfaced two-way road on an undulating alignment for the first 20 km to Raspberry Road with property accesses occurring along the alignment except the sealed winding section through the Styx River gorge. Safety risk: The road speed limit is 100 km/h, there is a risk of drivers not familiar to the road running into road side hazards such as vegetation.	Occasional	Serious	High

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
005	Oversized vehicle unable to remain on road	The eastbound approach to the Styx River bridge has a narrow culvert followed by a small radius horizontal curve. Trucks will occupy the full road width and oversize vehicles may have difficulty with the combination of the narrow culvert followed by a tight curve. Safety Risk: There is a risk of an errant vehicle running off the culvert.	Improbable	Minor	Low
006	N/A	The Styx River concrete bridge is a single lane bridge with a small radius horizontal curve on the eastern end of the bridge. Oversized vehicles may not be able to fit around the end barriers. Safety Risk: An oversized vehicle may become stuck blocking the road.	Improbable	Minor	Low
007	N/A	Safety barriers have not been installed for most of the gravel surface alignment leaving road side hazards and steep fill slopes exposed to vehicles. There are no posted speed limits on this section of road. Safety Risk: Errant vehicles may run into hazards such as vegetation or roll down steep side slopes.	Improbable	Serious	Medium
008	Vehicle to vehicle due to road width	East of Raspberry Road the road narrows, remaining on the top of a ridge for 5 km. Vehicles have to move off the road to avoid approaching trucks. Safety Risk: While there is generally adequate verge width to avoid approaching vehicles there is a risk of vehicles colliding.	Improbable	Serious	Medium
009	Collision with approaching vehicle	From Chainage 25 km to Georges Junction the road is narrow with no edge protection to the steep side slope. The road is graded down towards Kempsey at approximately 9%. Safety Risk: There is a risk of an errant vehicle rolling down the slope. From Chainage 25 km to Georges Junction the road is narrow with limited sight distance to approaching vehicles. Safety Risk: There is a risk of vehicles colliding on the blind bends.	Improbable	Serious	Medium
010	Road closure	Georges Creek bridge is narrow and may not provide access for oversized vehicles Safety Risk: There is a risk of an over-width vehicle blocking the road	Improbable	Limited	Low

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
011	N/A	Due to the narrow road width, steep side slopes and small radius horizontal curves the road will require additional passing bays and turn out lanes to allow vehicles to pass safely. Some horizontal curves will require widening to provide adequate width for oversized vehicle swept paths	Occasional	Minor	Medium
Georges Junction to Smiths Creek					
012	Site access blockage due to land slips	The 15 km section of road between Georges Junction and Smiths Creek traverses' areas with extremely steep cut and fill side slopes. The rock cuts are generally unstable while some fill slopes are supported by old dry-stone walls of unknown strength. Safety Risk: During adverse weather event there is a high risk of cut faces collapsing over the road. The bearing strength of the fill slopes to the river are also at risk of collapse under heavy construction vehicle loads.	Probable	Serious	Intolerable
013	Lack of vehicle swept path widths	Small radius horizontal curves will require widening to provide adequate swept paths to provide access for over-width vehicles. Safety Risk: Wheel loads close to the edge of fill slopes may cause the road to collapse resulting in closures and construction delays.	Probable	Minor	High
014	Water over road	Where the road crosses drainage gullies the flood debris has blocked road culverts resulting in stormwater flowing across the road Safety Risk: There is a risk of dangerous flood water depths and road pavement collapse due to pavement saturation.	Probable	Serious	Intolerable
015	Single lane road	There is a length of narrow, single lane sealed road (3.0 m wide) through Lower Creek to the west of Dyke River bridge. 4.2 m wide, the platform trailer wheel path will be outside the bitumen. Safety Risk: The shoulders will not be able to support the wheel loads particularly when saturated resulting in pavement failure and an irregular destabilising heavy vehicle loads resulting in rough pavement surfaces.	Probable	Minor	High

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
016	Vehicle damage	Between Dyke River and Smiths Creek there is a narrow section of road with steep side slopes to the river. The cut slopes are unstable with a high risk of failure and the fill slopes are generally supported by old dry stone walls. Safety Risk: There is a high risk of land slips during adverse weather events and under heavy wheel loads when transporting power generators and turbine components. There is a risk of vehicles being crushed by a land slip.	Probable	Serious	Intolerable
017	Head on crash	There are blind corners around vertical cut faces that restrict sight distance to approaching vehicles. Safety Risk: There is a risk of vehicle collisions resulting in vehicles rolling down fill slopes to the river.	Probable	Serious	Intolerable
018	Head on crash	Smiths Creek bridge is a single lane bridge with limited approach sight distance. Safety Risk: There is a risk of vehicle collisions due to the road width and reduced sight distance available.	Improbable	Serious	High
019	Head on crash	While the general topography east of Smiths Creek is more open, there are constrained sections with steep side slopes and unstable rock cut formations resulting in poor sight distance around curves. Safety Risk: There is a risk of vehicle to vehicle collisions due to narrow road formations and poor sight distance.	Probable	Serious	Intolerable
020	Land slip on road	Lagoon Creek to Blackbird Creek. The terrain is generally open with an undulating alignment except for a short section adjacent to the Macleay River that is a single lane formation with vertical rock faces and steep fill slopes into the Macleay River. Safety Risk: Vehicle collisions on narrow roads and damage to vehicles from falling rocks.	Probable	Serious	Intolerable
021	Land slip on road	Blackbird Creek to Pee Dee Nature Reserve. There are short sections with restricted width due to steep side slopes and the Macleay River. Safety Risk: Vehicle collisions on narrow roads and damage to vehicles from falling rocks.	Probable	Serious	Intolerable

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
022	Vehicle swept path	The Pee Dee Nature Reserve has small radius horizontal curves that may need widening for vehicle swept path requirements. School bus operates via Kempsey Armidale Road. Safety Risk: Long vehicles will use the full road width to negotiate small radius curves and the school bus may stop regularly without a pull off area.	Improbable	Minor	Low
023	Vehicle side swipe	The road is sealed between Pee Dee Creek and Kempsey with 3.5 m lanes and narrow shoulders. Safety Risk: Opposing trucks will have a reduced offset between vehicles with a risk of vehicle side swipes on tight bends.	Improbable	Minor	Low
024	Land slip	East of Devils Nook Creek there is a section of steep side slopes and unstable rock cuts. Safety Risk: There is a risk of damage from falling rocks and road closures due to land slips.	Occasional	Serious	High
Alternate routes through Kempsey					
026	Through traffic interaction with urban activity	At the Kempsey Armidale Road intersection with North Street, access through Kempsey can either continue along River Street into the CBD or turn left into North Street to bypass Kempsey via Second Lane and the Old Pacific Highway to Fredericton to the Pacific Highway. The second photo is a typical pedestrian access across River Street.	Improbable	Serious	Medium
027	Heavy vehicle interaction with CBD activity	River Street, Elbow Street and Belgrave Street into Smith Street (Old Pacific Hwy) runs through the CBD with on street parking and pedestrian movements. There are also two small roundabouts. Safety Risk: Minor accidents with local traffic and pedestrians.	Improbable	Serious	Medium
028	Vehicles and pedestrian	North Street is a narrow urban street with housing on one side of the road. Safety Risk: An increase in heavy vehicle traffic may impact local noise levels and increase the risk of an accident involving a child or a vehicle accessing a driveway.	Improbable	Serious	Medium

Table 7.15 RSA findings

ID	Crash type	Description and safety risk	Frequency	Severity	Risk rating
029	Vehicle over headwall	The Second Lane intersection with the Old Pacific Hwy is restricted by existing pipe culvert headwalls located adjacent to the turn lane. Safety Risk: There is a risk that a heavy vehicle rear axle combination may fall over the headwall when turning left.	Improbable	Minor	Low

* Not a road traffic risk.

8 Mitigation Measures

8.1 Pre-construction phase

As stated in Section 4.1, Kempsey Armidale Road is currently being upgraded. It is understood that the road upgrade program currently behind schedule due to adverse weather. Therefore, OMPS will continue to liaise with both councils with regard to further road upgrades as part of this OMPS Project.

8.2 Construction phase

The mitigation measures for the Project have been provided against the risks/hazards identified in the Road Safety Audit report (SMEC, 2021), OSOM Report (Rex J Andrews Pty Ltd, 2022) and site inspection observations made by EMM's Associate Traffic Engineer, Abdullah Uddin. The bulk of the mitigation measures are proposed on the eastern side along Kempsey Armidale Road as approximately 85% of the Project traffic will approach from Kempsey side as the main construction access route.

The proposed traffic management mitigation measures are presented in Table 8.1.

Table 8.1 Construction phase mitigation measures

Risk/hazard	Mitigation measure	Responsibility	Timing
Narrow section of Kempsey Armidale Road and blind corners	A detailed Construction Traffic Management Plan (CTMP) will be prepared for the Project. The narrow sections of the road and corners where OSOM vehicular traffic would not be possible, appropriate traffic control measures will be implemented. The specific areas include Armidale Road at Pee Dee Creek, Five Day Creek, McGees Flat, Smiths Bluff as depicted in Figure 6.10. A framework of the CTMP is provided in Chapter 9 of the report.	Construction contractor	Prior to construction.
Rockfall, landslips etc at various sections of Kempsey Armidale Road	ARC and KSC current road reinstatement works as described in Section 4.1 of this report.	ARC and KSC	Multi-year program
Narrow road, blind corners along Kempsey Armidale Road	Localised widening at sections along Kempsey Armidale Road between, Pee Dee Creek and Pee Dee Road, O'Sullivan's Gap, Blackbird Flat, McGees Flat, Smiths Bluff as depicted in Figure 6.10.	OMPS, ARC and KSC (works are to be designed and approved by the councils and funded by OMPS)	During construction.

Table 8.1 Construction phase mitigation measures

Risk/hazard	Mitigation measure	Responsibility	Timing
The northbound right turn from Waterfall Way is too short for deceleration and storage due to the close proximity to an existing bridge. The approach to Waterfall Way from Kempsey is depressed in side cuts reducing intervisibility between vehicles on Waterfall Way and approaching vehicles from Kempsey. There are no acceleration lanes on Waterfall Way.	Turn treatment assessment results require BAL/BAR for this intersection. Since the intersection has AUL/AUR turn treatment, which is a higher order turn treatment, additional turning lanes are not required. Stop sign warrant has identified the sight distance to be approximately 100 m which is less than the required 115 m. As per Note 3 in Figure 7.1, rather than installing a 'Stop' sign it is recommended that vegetation and earth bank is cleared on the right side of Kempsey Road approach to increase available sight distances. This will be further considered during the detailed design phase. Nevertheless, given the low volumes of heavy vehicles via Armidale and it is an existing road deficiency with no crash history, a 'Stop' sign should be considered for this intersection control. Furthermore, consideration to be given for temporary reduction of speed limit to 60 km/h on approach to Waterfall Way from Kempsey Road. The above recommended measures should improve safety at this intersection and will be further considered during the detailed design phase.	OMPS/Construction contractor and ARC	During construction.
Bridges along the main haulage route from Kempsey have been identified with the following potential hazards: • bridges with unknown load capacity • substandard concrete parapets and no hazard delineation • narrow culvert followed by a small radius horizontal curve • single lane and narrow section bridges • bridges with limited approach sight distance.	All bridges along the main haulage route from Kempsey to be subject to structural assessment during the detailed design phase. Alternating traffic control along single lane and narrow sections of bridges to be implemented where necessary.	OMPS, ARC and KSC (works are to be designed and approved by the councils and funded by OMPS)	Prior to construction

Table 8.1 Construction phase mitigation measures

Risk/hazard	Mitigation measure	Responsibility	Timing
The following roadside hazards were identified for the secondary haulage route from Armidale side: • road side hazards such as vegetation • hidden property accesses/concealed driveways • road side hazards such as steep fill slopes • absence of posted speed limits • absence of safety barriers along steep slopes • no edge protection to the steep side slope • blind corners around vertical cut faces resulting in limited sight distance to approaching vehicles • apparent rockfalls at some sections of Armidale Road • rock cuts are generally unstable while some fill slopes are supported by old dry-stone walls of unknown strength • flooding of the roads • road maintenance • narrow, single lane sealed road section.	A full review of the roadside vegetation and overgrown vegetation will be assessed during the detailed design phase. Vegetation should be regularly assessed and maintained along the entire haulage route during construction. Drivers to be aware of roadside hazards as per the Driver Code of Conduct. A comprehensive signage plan should be implemented along sections of Kempsey Armidale Road and will be assessed during the detailed design phase. Some suggested signages are presented in Table 8.2. At some sections, guard rail and Road Edge Guide Post with Reflectors may be necessary (see below)  Speed limits along Kempsey Armidale Road should be reviewed and reduced where necessary. Speed limit should be posted along the road at critical points. Alternating traffic control for up to 5 km sections for periods of busy construction traffic, allowing one direction of traffic only. This is a secondary access route with low volumes and is operating within the design limitations of road. During adverse weather condition, an appropriate risk management should be undertaken, subject to the discretion of the contractor. During emergency situations, traffic movements to be assessed and may need to be temporarily ceased during adverse weather condition to avoid rockfalls. Appropriate road management strategy needs to be in place. Any damaged section of the road needs to be repaired quickly, based on maintenance and dilapidation program agreed with council. The bridge parapets should be painted adequately. The bridge capacity is subject to structural engineer's assessments.	OMPS/Construction contractor, ARC, KSC and TfNSW.	Prior to construction

Table 8.1 Construction phase mitigation measures

Risk/hazard	Mitigation measure	Responsibility	Timing
The following roadside hazards were identified for the main haulage route from Kempsey side • line marking (edge and centre lines) on some sections of River Street and Kempsey Armidale Road have completely faded increasing the risk of head-on crashes • constrained sections with steep side slopes and unstable rock cut formations resulting in poor sight distance around curves • single lane formation with vertical rock faces and steep fill slopes into the Macleay River • short sections with restricted width due to steep side slopes and the Macleay River • small radius horizontal curves that may need widening for vehicle swept path requirements • section of steep side slopes and unstable rock cuts.	The existing line marking along the haulage route needs to be reviewed. Faded lines need to be repainted. Proposed minimum 7.2 m sealed width between Pee Dee undertaken by KSC and site access via eastern access road (EAR), subject to local design constraints e.g. minimum shoulder widths and possible need for guardrail. Drivers to be aware of road hazards as per the Driver Code of Conduct. Appropriate risk management should be undertaken on a regular basis, subject to the discretion of the contractor.	OMPS/Construction contractor, TfNSW, ARC and KSC.	Prior to construction
North Street is a narrow urban street with housing on one side of the road. An increase in heavy vehicle traffic may impact local noise levels and increase the risk of an accident involving a child or a vehicle accessing a driveway.	Drivers to take appropriate measure while driving through residential neighbourhoods as per the Driver Code of Conduct. Local noise levels to be managed as per recommendations of Noise and vibrations Impact Assessment. To ensure safety to the school children, truck movements will be restricted during school term in NSW for the AM and PM peak school hours in school zones along the Kempsey Armidale Road.	Construction contractor	During construction
Recreational motor bike riders along Kempsey Road travel in bunches and sometimes arrive at high speeds increasing the risk of head-on crashes.	Motor bike riders to be alerted by appropriate signage of increased heavy vehicle traffic due to OMPS Project (Table 8.2). Construction heavy vehicle drivers to be made aware of motor bike riders as per Drivers Code of Conduct (Section 9.11).	OMPS, Construction contractor ARC and KSC	During construction
In the mountainous sections, dense fog was observed severely restricting sight distances.	Driver's code of conduct to be followed. All vehicles to use headlights and fog lights during fog conditions.	Construction contractor	Prior to construction

Table 8.1 Construction phase mitigation measures

Risk/hazard	Mitigation measure	Responsibility	Timing
In the east-west section travelling from Kempsey in the afternoon and vice versa in the mornings, sun glare was observed to be an issue.	Driver's code of conduct to be followed. Drivers to travel with appropriate caution and awareness of speed during critical morning and afternoon peak periods.	Construction contractor	During construction
On a typical rainy day, the unsealed sections of the Armidale Road become slippery. During the site inspection, it was noted that when a vehicle passes, it creates dust which restricts visibility for any vehicles travelling behind.	Drivers' code of conduct to include driving in rainy weather in the area. Consider watering for dust control without creating other hazards e.g. slippery road surfaces.	Construction contractor	During construction
Existing road geometry and road conditions pose serious risks and hazards for OSOM vehicle movements	A series of road modifications, traffic control measures and traffic sign removal and replacement measures are presented in the OSOM report in Attachment D. The extent of road modifications required will be further detailed in the detailed design stage.	OMPS, Construction Contractor, ARC, KSC and National Heavy Vehicle Regulator (NHVR)	During construction
Impacts on public transport buses, cyclists and pedestrians.	The Project is unlikely to have any significant impact on public transport, cyclists and pedestrians. However, local schools should be informed about the presence of additional trucks in the area.	Construction contractor	During construction
Road signage deficiencies	A comprehensive signage plan should be prepared for Kempsey Armidale Road for consideration of both ARC and KSC respective Local traffic committees.	Construction contractor	During construction

8.3 Recommended signage

A comprehensive signage plan should be prepared for sections of the Kempsey Armidale Road for consideration by the ARC and KSC respective local traffic committees. The following signs could be considered where appropriate.

Table 8.2 Recommended signage

No	Sign name	Sign image	Sign number
1	Curve (left and right)		W1-3_l and W1-3_r

Table 8.2 Recommended signage

No	Sign name	Sign image	Sign number
2	Reverse Curve (left and right)		W1-4_l and W1-4_r
	Chevron alignment marker		D4-6
3	Caution Driveways		w2-206a_n
4	Reduce Speed (left and right)		W2-211-10-1n and w2-211-10n
5	Reduce Speed on Reverse Curve (left and right)		W2-211-11-1n and w2-211-11n
6	Hazardous motorcycle curve (left and right)		W5-230n_l and w5-230n_r

Table 8.2 Recommended signage

No	Sign name	Sign image	Sign number
7	Tilting truck (left and right)		W1-8-1_L and W1-8-1_R
7	Road narrows		w4-3
8	Gravel road		w2-211-5n
9	Changed traffic condition		t1-23
10	Fallen rocks (left and right)		W5-42_l and w5-42_r
11	Crest and Dip		W5-11 and W5-9
12	Loose stones – avoid windscreen damage		T3-9

Table 8.2 Recommended signage

No	Sign name	Sign image	Sign number
13	Warning sign (example from another Project)		NA

8.4 Operation phase

Operational traffic will be significantly lower than during Project construction hence no significant traffic impacts are expected during operation phase. The need for construction heavy vehicles and OSOM vehicles is expected to be limited during the operational phase of the Project.

A detailed Operations Traffic Management Plan (OTMP) will be prepared prior to commencement of operations in consultation with the relevant traffic authorities. The OTMP will have appropriate traffic control measure along sections of Kempsey Armidale Road if required for operational traffic movements.

8.5 Decommissioning or repowering phase

Pumped hydro systems usually function for a very long time and are maintained for decades. Repowering pumped hydro systems is a common practice, extending their useful life.

In the event that the Project needs to be decommissioned or repowered, all decommissioning or repowering activities will be planned in a detailed and dedicated plan at the time.

9 Draft construction traffic management plan

As stated earlier, the detailed Construction Traffic Management Plan (CTMP) will be prepared prior to commencement of works and in consultation with the relevant authorities and the nominated construction contractor. An outline of the draft construction traffic management plan is provided below. Note that it is not a detailed CTMP, rather it provides a framework on what the CTMP should cover when it is prepared and is subject to change during detailed design. The final CTMP will also include haulage routes, Kempsey Armidale Road works, new access roads and bridges.

9.1 Objective

The draft CTMP aims to ensure the safety of all workers and road users within the vicinity of the construction site. It has the following primary objectives:

- to minimise the impact of the construction vehicle traffic on the local and regional road network and with other road users (e.g. school bus operators)
- to ensure continuous, safe and efficient movement of traffic for both the general public and construction workers
- to install appropriate advance warning signs to inform users of the changed traffic conditions
- to provide information regarding the changed access arrangements and a description of the proposed external routes for vehicles, including the construction vehicles accessing the site.

9.2 Hours of work

Construction work is expected to continue 24/7 throughout the four to five year construction period.

9.3 General requirements

In accordance with TfNSW requirements, all vehicles transporting loose materials will have the entire load covered and/or secured to prevent any large items, excess dust or dirt particles depositing onto the roadway during travel to and from the site. All subcontractors will be inducted by the lead contractor to ensure that the procedures are met for all vehicles entering and exiting the construction site. The lead contractors will monitor the roads leading to and from the site and take all necessary steps to rectify any road deposits caused by site vehicles.

Vehicles operating to, from and within the site, will do so in a manner which does not create unreasonable or unnecessary noise or vibration. No tracked vehicles will be permitted or required on any paved roads. Public roads and the access road will not be obstructed by any materials, vehicles refuse skips or the like.

9.4 Construction vehicle types

For OSOM vehicles required to travel to the Project area from Kempsey, a separate application will be lodged to NHVR. As part of the stakeholder consultation associated to this application, ARC, KSC and TfNSW will be consulted as part of the Project approval process.

9.5 Construction vehicle routes

Construction vehicle routes will be as shown in Figure 6.5 and will be provided in the detailed construction traffic management plan.

9.6 Traffic control measures

Traffic Guidance Schemes (TGS) formerly referred to as Traffic Control Plans (TCPs) will be developed in the detailed CTMP in accordance with the Australian Standards and TfNSW Traffic control at work sites technical manual (Transport for NSW, 2022).

9.7 Construction workers parking

The Project has a large footprint and therefore on-site parking is not considered to be a major issue. During the construction period, vehicles are expected to be parked on unsealed areas. No vehicles will park on public roads.

Staff parking will be located in the area near the accommodation camp which is near to the junction between the lower dam access road and the upper dam access road.

9.8 Work site security

Temporary road barriers and fences will be used to secure the road access points to the Project area. All access points are to be securely locked when construction activities are not in progress.

9.9 Emergency activity strategy

The CTMP will include a strategy enable regular and emergency management activities to be carried out on site during the Project. The strategy will draw from:

- Vehicle routes and amendments in the event of an emergency within the site and/or allowing for maintenance of access for emergency services.
- Construction worker parking and no-parking areas to ensure that access for emergency vehicles is maintained.
- Staff inductions to ensure that all employees are briefed on emergency procedures.
- Workplace health and safety and Drivers' Code of Conduct which will ensure inclusion of specific measures to enable emergency management activities and appropriate driver behaviour in the event of an emergency.

9.10 Staff induction

All staff and subcontractors will be required to undergo a site induction upon entry to the Project site. The induction will include permitted access routes to and from the construction site for all vehicles, as well as standard environmental, occupation health and safety, driver protocols, and emergency procedures. Additionally, the lead contractor will discuss traffic management requirements regularly as part of the toolbox talks.

9.11 Workplace health and safety

Any personnel required to undertake works or traffic control within the public domain will be suitably trained and covered by appropriate insurances. All traffic controllers will be TfNSW accredited.

9.12 Drivers' code of conduct

The Driver's Code of Conduct will be provided to all relevant personnel prior to their arrival at site. The Driver's Code of Conduct is to be read and signed by all light and heavy vehicle drivers prior to operation of vehicles. This will be in addition to regular safety briefings and updates. The Driver's Code of Conduct will address all relevant site and locality road safety and traffic management measures including:

- compliance with all road rules and regulations
- driving to local road conditions which includes sections of narrow gravel and unsealed roads, steep side slopes and rock cuts with no edge protection in sections; sharp bends with limited sight distances etc
- driver behaviour near schools and residential areas
- courtesy to other road users
- fatigue management
- checking vehicles and covering loads
- hazards of driving in varying weather conditions including fog and sun glare
- the appropriate use of compression braking
- safety procedures for accidents and breakdowns.

The Driver's Code of Conduct will also include a single page summary detailing the site access, primary and OSOM transport routes and other key aspects of light and heavy vehicle related compliance.

9.13 Complaint management

A complaint management system to enable active community consultation and maintain positive communication with local residents will be implemented for the site. The purpose of this system will be to minimise complaints by providing timely responses to community concerns and monitoring the ongoing environmental performance of the site construction activity.

9.13.1 Registering complaints

A dedicated Community Complaints phone number will be established that is available 24 hours, seven days a week for community members who have enquiries or who wish to lodge complaints in relation to Project construction activities. The Community Complaints phone number allows community members to enquire or lodge complaints about Project related vehicles travelling on the public road system.

9.13.2 Complaint response

An initial response will be provided to the complainant generally within 24 hours using the contact details provided (phone and/or email). Preliminary investigations into each complaint will commence within 48 hours of complaint receipt. Complainants will be advised as soon as possible of the result of the investigation.

10 Conclusion

This report undertakes a traffic impact assessment for the construction of the Project.

Construction of the Project is expected to take approximately four to five years with peak construction period expected in 2027. Construction workforce is expected to be more than 600 workers during peak construction period, with 600 workers staying in an accommodation camp on site.

Construction traffic, apart from OSOM vehicles, is expected to arrive from or via Kempsey as the main access route or Armidale as the secondary access route, with the Kempsey Armidale Road the only road that would facilitate access to the construction site, for light, heavy and OSOM vehicles. OSOM vehicles will only travel to the Project site via Kempsey. There are three proposed site access roads from the Kempsey Armidale Road that then form the Project's internal road network.

Approximately 80% of the Project's traffic will travel via Kempsey along the main access route, as opposed to Armidale along the secondary access route. In order to minimise impacts on the Kempsey city centre, 80% of heavy vehicles will travel via Macleay Valley Way (North) to the Project area. All OSOM vehicles will also travel via Macleay Valley Way (North). Only heavy vehicles with a length less than 12.5 m will travel on Macleay Valley Way (South).

The impact of Project-related vehicles on key intersections along the Project's main haulage route has been assessed. SIDRA modelling results have showed that the Level of Service will remain at B or better for all intersections, except Smith Street/Belgrave Street intersection, Kempsey where the LOS will be E in the PM peak. The poor LOS D and E is primarily attributed to the existing heavy traffic flow and congestion at this intersection. The Project generated traffic is not expected to significantly further impact this intersection.

Austroads design standards for rural roads are met for the majority of road sections along the Project's main haulage route with the exception of some sections in proximity of the Project area along the Kempsey Armidale Road. These road sections will have some road improvement work such as widening and/or traffic control measures implemented to provide for safe access for all road users during the Project construction period which is outlined in Chapter 8 of this report. The road improvement works along Kempsey Armidale Road, undertaken either by respective councils or OMPS, will have some legacy benefits for the local community and other road traffic using the route, after the Project construction work is completed.

The three proposed site access intersection will be unsealed. During the detailed design phase, an intersection safety assessment will be required, as outlined in Section 7.3 of this report.

Construction heavy vehicles would generally be avoiding the Kempsey town centre and interacting with public transport services, hence the potential traffic impacts on existing public transport, cyclist and pedestrian infrastructure services would be limited. There will generally be no construction heavy vehicle movements during 7:30 am to 9:30 am and 2:30 pm to 4:30 pm in school zones on the sections of Kempsey Armidale Road and North Street which are used by school bus services, hence the potential traffic impacts on school buses operations would be limited.

General public road safety risks and hazards have been identified as part of the SMEC Road Safety Audit report, OSOM reports and the EMM traffic engineer's site inspection and will mostly be managed by localised road widening along sections of the Kempsey Armidale Road between Bellbrook and Smiths Bluff and/or traffic control measures implemented along the haulage route throughout the construction period. Roadside vegetation is an existing risk along Kempsey Armidale Road which should be cleared or trimmed as required prior to commencement of the construction and will be further assessed during the detailed design phase. Similarly, some pavement markings are found to be faded along TfNSW road and need to be repainted in sections.

A comprehensive signage plan needs to be developed in due course to minimise risks to motorists who are unfamiliar with the challenging topography of ARC and KSC. Some suggested signages are outlined in Section 8.2 of this report.

Car parking areas will be provided within the Project disturbance footprint and will generally be unsealed. There will be no parking for Project related light or heavy vehicle traffic allowed on public roads.

A detailed CTMP needs to be development as part of the Project approval conditions, along with necessary TCP at each section of Kempsey Armidale Road where traffic control is required.

In accordance with these conclusions and assuming the Project related traffic management recommendations outlined in Chapter 8 are implemented, the proposed development is not expected to have significant adverse impacts to the regional or local traffic operations on their respective road networks.

11 References

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Attachment A

Traffic survey data

EMM
creating opportunities

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Lord St and Rudder St, Kempsey

GPS *-31.082083, 152.845537*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	Rudder St
East:	Lord St
South:	N/A
West:	Lord St

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:15 PM-4:15 PM

	#DIV/0!	80%	51%	#DIV/0!	75%	91%	#DIV/0!	93%	87%	
	0	180	43	0	33	786	0	858	227	
All Vehicles	0	224	84	0	44	864	0	924	260	

Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
6:00	6:15	0	13	5	0	4	55	0	77	6	716	
6:15	6:30	0	17	4	0	1	54	0	56	6	798	
6:30	6:45	0	20	3	0	4	73	0	90	16	928	
6:45	7:00	0	26	7	0	3	80	0	82	14	1024	
7:00	7:15	0	30	12	0	3	87	0	92	18	1185	
7:15	7:30	0	31	6	0	3	117	0	90	21	1355	
7:30	7:45	0	28	11	0	5	124	0	107	27	1565	
7:45	8:00	0	50	18	0	8	168	0	114	15	1780	
8:00	8:15	0	57	11	0	5	177	0	139	23	1925	Peak
8:15	8:30	0	74	14	0	4	212	0	150	24		
8:30	8:45	0	52	30	0	2	229	0	167	37		
8:45	9:00	0	60	9	0	11	232	0	165	41		
15:00	15:15	0	41	9	0	8	170	0	220	50	2108	
15:15	15:30	0	55	21	0	11	199	0	194	60	2127	Peak
15:30	15:45	0	56	14	0	11	216	0	211	65	2058	
15:45	16:00	0	35	7	0	4	168	0	231	52	1941	
16:00	16:15	0	34	1	0	7	203	0	222	50	1904	
16:15	16:30	0	32	9	0	12	152	0	199	67	1881	
16:30	16:45	0	38	7	0	6	143	0	185	77	1809	
16:45	17:00	0	51	3	0	8	173	0	171	54	1714	
17:00	17:15	0	35	3	0	5	179	0	211	61	1557	
17:15	17:30	0	34	1	0	3	137	0	171	53		
17:30	17:45	0	28	4	0	3	132	0	143	51		
17:45	18:00	0	33	1	0	4	89	0	131	45		

Pedestrians Crossing

Time		North Approach Rudder St		East Approach Lord St		West Approach Lord St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Southbound	Northbound	
6:00	6:15	0	0	0	0	0	0	2
6:15	6:30	0	0	0	0	0	0	2
6:30	6:45	0	0	0	0	0	0	2
6:45	7:00	0	2	0	0	0	0	2
7:00	7:15	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	3
8:00	8:15	0	0	0	0	0	0	3
8:15	8:30	0	0	0	0	0	0	
8:30	8:45	3	0	0	0	0	0	
8:45	9:00	0	0	0	0	0	0	
15:00	15:15	1	0	0	0	0	0	3
15:15	15:30	0	0	0	0	0	0	2
15:30	15:45	0	0	0	0	0	0	2
15:45	16:00	0	2	0	0	0	0	2
16:00	16:15	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	1
17:15	17:30	0	0	0	0	0	0	
17:30	17:45	0	0	0	0	0	0	
17:45	18:00	0	1	0	0	0	0	

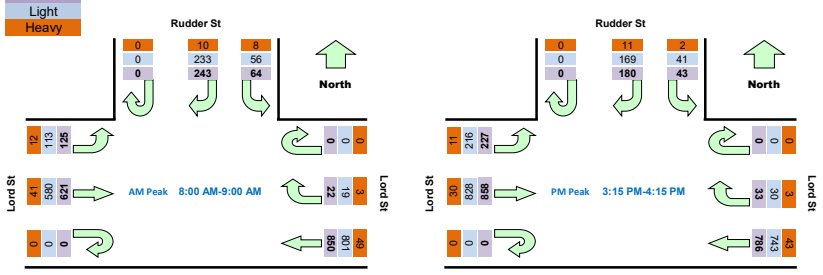
Peak Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	243	64	0	22	850	0	621	125	1925
15:15	16:15	0	180	43	0	33	786	0	858	227	2127

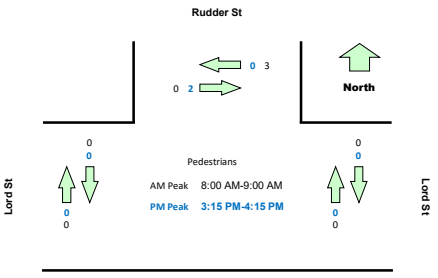
Peak Time		North Approach Rudder St		East Approach Lord St		West Approach Lord St		Peak total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Southbound	Northbound	
8:00	9:00	3	0	0	0	0	0	3
15:15	16:15	0	2	0	0	0	0	2

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy





Light Vehicles

Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	12	5	0	4	47	0	72	6
6:15	6:30	0	14	4	0	1	47	0	50	4
6:30	6:45	0	17	3	0	4	68	0	85	15
6:45	7:00	0	24	4	0	2	75	0	79	11
7:00	7:15	0	29	11	0	3	81	0	82	9
7:15	7:30	0	29	4	0	3	102	0	85	14
7:30	7:45	0	28	10	0	5	109	0	101	23
7:45	8:00	0	49	17	0	8	158	0	106	13
8:00	8:15	0	54	11	0	5	173	0	130	22
8:15	8:30	0	74	12	0	2	201	0	140	19
8:30	8:45	0	46	25	0	2	215	0	158	35
8:45	9:00	0	59	8	0	10	212	0	152	37
15:00	15:15	0	39	9	0	5	160	0	209	48
15:15	15:30	0	51	20	0	9	184	0	182	60
15:30	15:45	0	51	14	0	10	203	0	207	59
15:45	16:00	0	35	6	0	4	160	0	222	49
16:00	16:15	0	32	1	0	7	196	0	217	48
16:15	16:30	0	28	6	0	11	145	0	190	65
16:30	16:45	0	36	6	0	6	137	0	179	76
16:45	17:00	0	45	3	0	8	165	0	165	54
17:00	17:15	0	31	3	0	5	175	0	204	60
17:15	17:30	0	33	1	0	3	136	0	161	51
17:30	17:45	0	27	4	0	3	128	0	139	49
17:45	18:00	0	32	1	0	4	85	0	129	44

Peak Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	233	56	0	19	801	0	580	113	1802
15:15	16:15	0	169	41	0	30	743	0	828	216	2027

Heavy Vehicles

Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	1	0	0	0	8	0	5	0
6:15	6:30	0	3	0	0	0	7	0	6	2
6:30	6:45	0	3	0	0	0	5	0	5	1
6:45	7:00	0	2	3	0	1	5	0	3	3
7:00	7:15	0	1	1	0	0	6	0	10	9
7:15	7:30	0	2	2	0	0	15	0	5	7
7:30	7:45	0	0	1	0	0	15	0	6	4
7:45	8:00	0	1	1	0	0	10	0	8	2
8:00	8:15	0	3	0	0	0	4	0	9	1
8:15	8:30	0	0	2	0	2	11	0	10	5
8:30	8:45	0	6	5	0	0	14	0	9	2
8:45	9:00	0	1	1	0	1	20	0	13	4
15:00	15:15	0	2	0	0	3	10	0	11	2
15:15	15:30	0	4	1	0	2	15	0	12	0
15:30	15:45	0	5	0	0	1	13	0	4	6
15:45	16:00	0	0	1	0	0	8	0	9	3
16:00	16:15	0	2	0	0	0	7	0	5	2
16:15	16:30	0	4	3	0	1	7	0	9	2
16:30	16:45	0	2	1	0	0	6	0	6	1
16:45	17:00	0	6	0	0	0	8	0	6	0
17:00	17:15	0	4	0	0	0	4	0	7	1
17:15	17:30	0	1	0	0	0	1	0	10	2
17:30	17:45	0	1	0	0	0	4	0	4	2
17:45	18:00	0	1	0	0	0	4	0	2	1

Peak Time		North Approach Rudder St			East Approach Lord St			West Approach Lord St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	10	8	0	3	49	0	41	12	123
15:15	16:15	0	11	2	0	3	43	0	30	11	100

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Lord St and Smith St, Kempsey

GPS *-31.080584, 152.841851*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	Smith St
East:	Lord St
South:	N/A
West:	Belgrave St

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:15 PM-4:15 PM

	#DIV/0!	79%	95%	#DIV/0!	90%	88%	#DIV/0!	96%	92%	
	0	44	467	0	359	607	0	618	88	
All Vehicles	0	56	492	0	400	688	0	644	96	

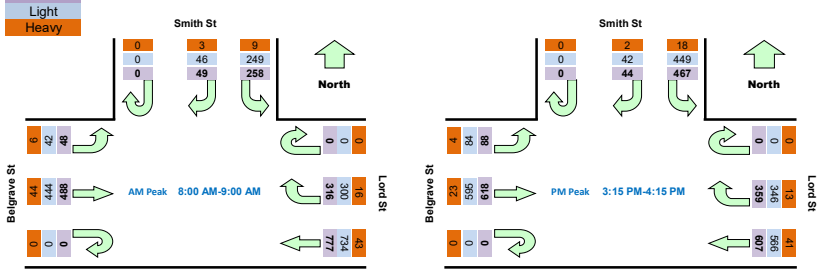
Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
6:00	6:15	0	1	33	0	28	40	0	50	1	708	
6:15	6:30	0	3	26	0	20	51	0	36	3	795	
6:30	6:45	0	4	28	0	32	61	0	78	2	923	
6:45	7:00	0	5	43	0	32	74	0	53	4	1016	
7:00	7:15	0	6	29	0	42	75	0	81	7	1170	
7:15	7:30	0	7	43	0	40	108	0	68	1	1347	
7:30	7:45	0	4	57	0	39	113	0	77	8	1565	
7:45	8:00	0	11	46	0	72	146	0	83	7	1784	
8:00	8:15	0	12	65	0	74	160	0	97	9	1936	Peak
8:15	8:30	0	12	55	0	72	214	0	119	13		
8:30	8:45	0	17	78	0	78	203	0	126	15		
8:45	9:00	0	8	60	0	92	200	0	146	11		
15:00	15:15	0	7	118	0	82	129	0	152	15	2150	
15:15	15:30	0	14	107	0	98	156	0	147	24	2183	Peak
15:30	15:45	0	12	123	0	100	172	0	153	23	2107	
15:45	16:00	0	8	122	0	72	131	0	161	24	1991	
16:00	16:15	0	10	115	0	89	148	0	157	17	1950	
16:15	16:30	0	13	123	0	76	108	0	143	7	1922	
16:30	16:45	0	7	96	0	62	119	0	166	17	1867	
16:45	17:00	0	13	91	0	89	135	0	134	15	1784	
17:00	17:15	0	7	106	0	83	131	0	166	15	1619	
17:15	17:30	0	7	100	0	64	107	0	124	13		
17:30	17:45	0	11	83	0	61	99	0	111	19		
17:45	18:00	0	9	89	0	60	62	0	87	5		

Peak Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	49	258	0	316	777	0	488	48	1936
15:15	16:15	0	44	467	0	359	607	0	618	88	2183

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

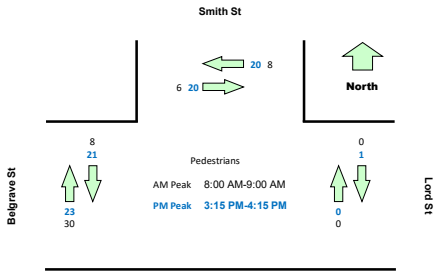
Total
Light
Heavy



Pedestrians Crossing

Time		North Approach Smith St		East Approach Lord St		West Approach Belgrave St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Southbound	Northbound	
6:00	6:15	0	0	0	0	0	0	4
6:15	6:30	1	0	0	0	0	0	5
6:30	6:45	0	3	0	0	0	0	5
6:45	7:00	0	0	0	0	0	0	2
7:00	7:15	1	0	0	0	0	0	6
7:15	7:30	0	0	0	0	0	1	17
7:30	7:45	0	0	0	0	0	0	26
7:45	8:00	0	2	0	0	1	1	41
8:00	8:15	2	2	0	0	0	8	52
8:15	8:30	1	1	0	0	1	7	
8:30	8:45	3	1	0	0	2	9	
8:45	9:00	2	2	0	0	5	6	
15:00	15:15	4	2	0	0	4	4	78
15:15	15:30	6	4	0	0	3	14	85
15:30	15:45	4	3	0	0	6	3	72
15:45	16:00	6	6	0	0	7	2	69
16:00	16:15	4	7	1	0	5	4	57
16:15	16:30	6	3	0	0	4	1	58
16:30	16:45	3	2	0	0	3	5	57
16:45	17:00	4	3	0	0	1	1	52
17:00	17:15	3	1	0	0	13	5	44
17:15	17:30	1	0	0	0	4	8	
17:30	17:45	0	3	0	0	0	5	
17:45	18:00	0	0	0	0	1	0	

Peak Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St			Peak total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Southbound	Northbound				
8:00	9:00	8	6	0	0	8	30	52			
15:15	16:15	20	20	1	0	21	23	85			



Light Vehicles

Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	0	32	0	23	36	0	46	1
6:15	6:30	0	1	21	0	15	46	0	33	3
6:30	6:45	0	3	26	0	29	56	0	74	0
6:45	7:00	0	5	42	0	27	72	0	48	2
7:00	7:15	0	5	25	0	38	72	0	66	5
7:15	7:30	0	7	40	0	32	99	0	59	1
7:30	7:45	0	4	51	0	38	99	0	73	6
7:45	8:00	0	11	44	0	68	139	0	75	7
8:00	8:15	0	11	62	0	72	155	0	90	7
8:15	8:30	0	11	52	0	68	207	0	107	13
8:30	8:45	0	16	78	0	75	186	0	115	11
8:45	9:00	0	8	57	0	85	186	0	132	11
15:00	15:15	0	7	114	0	77	122	0	143	15
15:15	15:30	0	14	98	0	96	139	0	144	24
15:30	15:45	0	11	120	0	96	158	0	146	22
15:45	16:00	0	7	118	0	68	127	0	153	21
16:00	16:15	0	10	113	0	86	142	0	152	17
16:15	16:30	0	13	117	0	70	103	0	138	7
16:30	16:45	0	7	94	0	61	112	0	161	16
16:45	17:00	0	12	90	0	83	127	0	129	15
17:00	17:15	0	7	102	0	78	128	0	162	15
17:15	17:30	0	7	95	0	64	105	0	117	12
17:30	17:45	0	11	80	0	59	96	0	108	18
17:45	18:00	0	9	87	0	56	61	0	86	5

Peak Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	46	249	0	300	734	0	444	42	1815
15:15	16:15	0	42	449	0	346	566	0	595	84	2082

Heavy Vehicles

Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	1	1	0	5	4	0	4	0
6:15	6:30	0	2	5	0	5	5	0	3	0
6:30	6:45	0	1	2	0	3	5	0	4	2
6:45	7:00	0	0	1	0	5	2	0	5	2
7:00	7:15	0	1	4	0	4	3	0	15	2
7:15	7:30	0	0	3	0	8	9	0	9	0
7:30	7:45	0	0	6	0	1	14	0	4	2
7:45	8:00	0	0	2	0	4	7	0	8	0
8:00	8:15	0	1	3	0	2	5	0	7	2
8:15	8:30	0	1	3	0	4	7	0	12	0
8:30	8:45	0	1	0	0	3	17	0	11	4
8:45	9:00	0	0	3	0	7	14	0	14	0
15:00	15:15	0	0	4	0	5	7	0	9	0
15:15	15:30	0	0	9	0	2	17	0	3	0
15:30	15:45	0	1	3	0	4	14	0	7	1
15:45	16:00	0	1	4	0	4	4	0	8	3
16:00	16:15	0	0	2	0	3	6	0	5	0
16:15	16:30	0	0	6	0	6	5	0	5	0
16:30	16:45	0	0	2	0	1	7	0	5	1
16:45	17:00	0	1	1	0	6	8	0	5	0
17:00	17:15	0	0	4	0	5	3	0	4	0
17:15	17:30	0	0	5	0	0	2	0	7	1
17:30	17:45	0	0	3	0	2	3	0	3	1
17:45	18:00	0	0	2	0	4	1	0	1	0

Peak Time		North Approach Smith St			East Approach Lord St			West Approach Belgrave St			Peak total
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	
8:00	9:00	0	3	9	0	16	43	0	44	6	121
15:15	16:15	0	2	18	0	13	41	0	23	4	101

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of River St and North St, Kempsey

GPS *-31.063000, 152.814001*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	River St
East:	North St
South:	River St
West:	N/A

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:00 PM-4:00 PM

All Vehicles

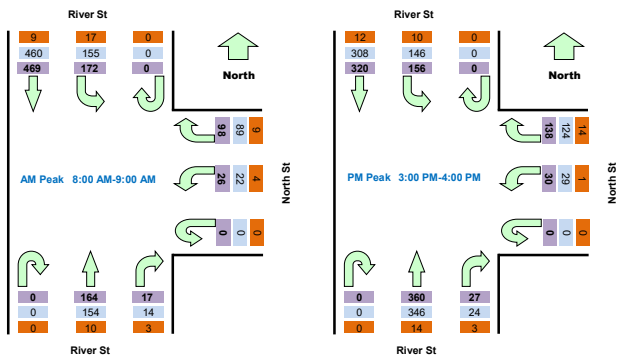
Time		North Approach River St			East Approach North St			South Approach River St			Hourly Total	
Period Start	**Period End**	**U**	**SB**	**L**	**U**	**R**	**L**	**U**	**R**	**NB**	**Hour**	**Peak**
6:00	6:15	0	34	16	0	8	0	0	1	12	399	
6:15	6:30	0	40	24	0	10	2	0	0	28	445	
6:30	6:45	0	48	8	0	21	2	0	0	21	471	
6:45	7:00	0	61	16	0	10	6	0	1	30	536	
7:00	7:15	0	45	26	0	16	3	0	2	25	601	
7:15	7:30	0	51	14	0	18	1	0	1	45	672	
7:30	7:45	0	67	15	0	28	4	0	4	47	802	
7:45	8:00	0	79	24	0	19	11	0	3	53	884	
8:00	8:15	0	99	27	0	24	5	0	6	27	946	Peak
8:15	8:30	0	136	52	0	24	6	0	2	40		
8:30	8:45	0	119	46	0	24	8	0	5	45		
8:45	9:00	0	115	47	0	26	7	0	4	52		
15:00	15:15	0	94	41	0	18	11	0	4	68	1031	Peak
15:15	15:30	0	65	42	0	34	2	0	11	89	1014	
15:30	15:45	0	77	34	0	50	9	0	8	106	991	
15:45	16:00	0	84	39	0	36	8	0	4	97	931	
16:00	16:15	0	62	26	0	34	5	0	8	84	869	
16:15	16:30	0	51	17	0	39	7	0	9	97	850	
16:30	16:45	0	63	20	0	52	6	0	4	79	835	
16:45	17:00	0	60	23	0	32	7	0	1	83	803	
17:00	17:15	0	51	19	0	31	3	0	7	89	720	
17:15	17:30	0	48	21	0	37	4	0	4	91		
17:30	17:45	0	51	17	0	37	3	0	4	80		
17:45	18:00	0	33	12	0	23	1	0	5	49		

Peak Time		North Approach River St			East Approach North St			South Approach River St			Peak
Period Start	**Period End**	U	SB	L	U	R	L	U	R	NB	**total**
8:00	9:00	0	469	172	0	98	26	0	17	164	946
15:00	16:00	0	320	156	0	138	30	0	27	360	1031

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach River St			East Approach North St			South Approach River St		
Period Start	**Period End**	U	SB	L	U	R	L	U	R	NB
6:00	6:15	0	34	16	0	7	0	0	1	12
6:15	6:30	0	39	23	0	9	2	0	0	25
6:30	6:45	0	46	8	0	19	2	0	0	15
6:45	7:00	0	57	14	0	8	5	0	1	28
7:00	7:15	0	42	26	0	15	3	0	2	23
7:15	7:30	0	49	13	0	17	1	0	1	41
7:30	7:45	0	64	14	0	24	4	0	4	42
7:45	8:00	0	78	22	0	19	10	0	2	44
8:00	8:15	0	98	27	0	24	5	0	5	25
8:15	8:30	0	134	44	0	23	5	0	2	39
8:30	8:45	0	117	44	0	22	5	0	4	40
8:45	9:00	0	111	40	0	20	7	0	3	50
15:00	15:15	0	91	38	0	16	11	0	4	62
15:15	15:30	0	61	40	0	33	2	0	10	84
15:30	15:45	0	73	33	0	43	9	0	7	103
15:45	16:00	0	83	35	0	32	7	0	3	97
16:00	16:15	0	59	26	0	31	5	0	8	80
16:15	16:30	0	45	16	0	37	7	0	9	96
16:30	16:45	0	59	19	0	52	5	0	4	77
16:45	17:00	0	58	20	0	31	7	0	1	81
17:00	17:15	0	50	18	0	30	3	0	7	88
17:15	17:30	0	44	21	0	36	4	0	4	91
17:30	17:45	0	49	16	0	37	3	0	4	77
17:45	18:00	0	32	12	0	23	1	0	5	49

Peak Time		North Approach River St			East Approach North St			South Approach River St			Peak
Period Start	**Period End**	U	SB	L	U	R	L	U	R	NB	**total**
8:00	9:00	0	460	155	0	89	22	0	14	154	894
15:00	16:00	0	308	146	0	124	29	0	24	346	977

Heavy Vehicles

Time		North Approach River St			East Approach North St			South Approach River St		
Period Start	**Period End**	U	SB	L	U	R	L	U	R	NB
6:00	6:15	0	0	0	0	1	0	0	0	0
6:15	6:30	0	1	1	0	1	0	0	0	3
6:30	6:45	0	2	0	0	2	0	0	0	6
6:45	7:00	0	4	2	0	2	1	0	0	2
7:00	7:15	0	3	0	0	1	0	0	0	2
7:15	7:30	0	2	1	0	1	0	0	0	4
7:30	7:45	0	3	1	0	4	0	0	0	5
7:45	8:00	0	1	2	0	0	1	0	1	9
8:00	8:15	0	1	0	0	0	0	0	1	2
8:15	8:30	0	2	8	0	1	1	0	0	1
8:30	8:45	0	2	2	0	2	3	0	1	5
8:45	9:00	0	4	7	0	6	0	0	1	2
15:00	15:15	0	3	3	0	2	0	0	0	6
15:15	15:30	0	4	2	0	1	0	0	1	5
15:30	15:45	0	4	1	0	7	0	0	1	3
15:45	16:00	0	1	4	0	4	1	0	1	0
16:00	16:15	0	3	0	0	3	0	0	0	4
16:15	16:30	0	6	1	0	2	0	0	0	1
16:30	16:45	0	4	1	0	0	1	0	0	2
16:45	17:00	0	2	3	0	1	0	0	0	2
17:00	17:15	0	1	1	0	1	0	0	0	1
17:15	17:30	0	4	0	0	1	0	0	0	0
17:30	17:45	0	2	1	0	0	0	0	0	3
17:45	18:00	0	1	0	0	0	0	0	0	0

Peak Time		North Approach River St			East Approach North St			South Approach River St			Peak
Period Start	**Period End**	U	SB	L	U	R	L	U	R	NB	**total**
8:00	9:00	0	9	17	0	9	4	0	3	10	52
15:00	16:00	0	12	10	0	14	1	0	3	14	54

TRANS TRAFFIC SURVEY

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TURNING MOVEMENT SURVEY

Intersection of Second Ln and Saleyards Rd, Kempsey

GPS *-31.053835, 152.837018*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	Saleyards Rd
East:	Second Ln
South:	Kemp St
West:	North St

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:15 PM-4:15 PM

All Vehicles

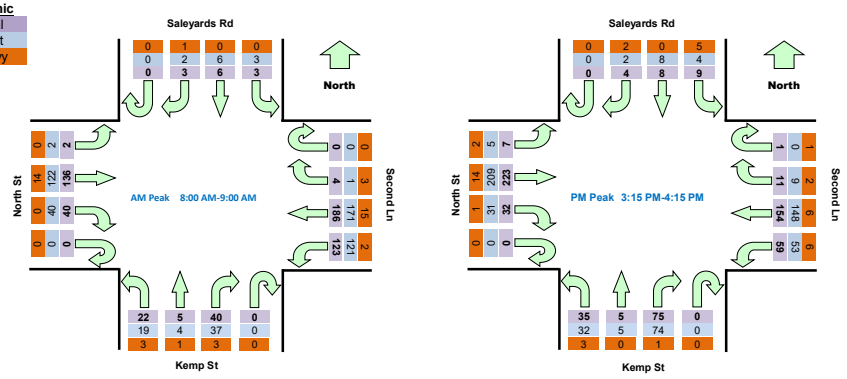
Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:00	6:15	0	1	0	0	0	0	8	8	0	2	0	0	0	0	16	0	235	
6:15	6:30	0	0	1	0	0	0	16	4	0	6	0	1	0	2	27	0	265	
6:30	6:45	0	1	0	1	0	1	37	15	0	2	0	1	0	2	17	0	279	
6:45	7:00	0	0	0	0	0	0	28	4	0	6	1	5	0	3	19	0	308	
7:00	7:15	0	1	0	1	0	0	22	5	0	5	0	3	0	4	24	0	355	
7:15	7:30	0	0	0	0	0	0	25	13	0	6	0	1	0	4	22	0	410	
7:30	7:45	0	0	0	0	0	1	49	7	0	14	1	1	0	8	25	0	484	
7:45	8:00	0	0	1	0	0	0	47	24	0	6	1	6	0	7	21	0	546	
8:00	8:15	0	1	1	0	0	0	41	26	0	9	0	4	0	11	27	0	570	Peak
8:15	8:30	0	1	2	1	0	0	44	38	0	13	2	4	0	11	28	1		
8:30	8:45	0	1	2	1	0	0	54	41	0	9	1	7	0	11	41	0		
8:45	9:00	0	0	1	1	0	4	47	18	0	9	2	7	0	7	40	1		
15:00	15:15	0	2	3	0	0	2	35	14	0	11	1	8	0	2	45	1	614	
15:15	15:30	0	1	1	4	1	1	35	14	0	10	3	13	0	8	45	2	623	Peak
15:30	15:45	0	1	3	2	0	6	37	17	0	32	1	5	0	6	91	0	614	
15:45	16:00	0	0	2	2	0	2	39	12	0	21	0	9	0	7	53	4	545	
16:00	16:15	0	2	2	1	0	2	43	16	0	12	1	8	0	11	34	1	511	
16:15	16:30	0	0	2	0	0	1	50	9	0	17	4	9	0	6	31	0	502	
16:30	16:45	0	0	1	1	0	1	49	10	0	19	0	12	0	4	34	1	501	
16:45	17:00	0	0	0	2	0	3	35	9	0	14	3	10	0	3	36	2	461	
17:00	17:15	0	5	2	1	0	4	28	5	0	24	2	10	0	6	34	3	433	
17:15	17:30	0	2	1	3	0	6	41	7	0	19	2	5	0	6	35	1		
17:30	17:45	0	1	1	2	0	2	31	5	0	14	0	4	0	6	23	3		
17:45	18:00	0	0	2	3	0	5	27	10	0	6	1	4	0	4	27	0		

Peak Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	3	6	3	0	4	186	123	0	40	5	22	0	40	136	2	570
15:15	16:15	0	4	8	9	1	11	154	59	0	75	5	35	0	32	223	7	623

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:00	6:15	0	1	0	0	0	0	7	8	0	2	0	0	0	0	16	0
6:15	6:30	0	0	1	0	0	0	14	4	0	5	0	1	0	2	27	0
6:30	6:45	0	1	0	1	0	1	37	14	0	0	0	1	0	2	16	0
6:45	7:00	0	0	0	0	0	0	26	4	0	5	1	4	0	3	18	0
7:00	7:15	0	0	0	1	0	0	22	5	0	2	0	3	0	4	20	0
7:15	7:30	0	0	0	0	0	0	24	12	0	5	0	1	0	4	21	0
7:30	7:45	0	0	0	0	0	1	46	7	0	11	1	1	0	8	24	0
7:45	8:00	0	0	1	0	0	0	44	22	0	5	1	6	0	7	18	0
8:00	8:15	0	1	1	0	0	0	40	26	0	9	0	3	0	11	24	0
8:15	8:30	0	1	2	1	0	0	39	37	0	12	2	4	0	11	27	1
8:30	8:45	0	0	2	1	0	0	47	40	0	7	0	5	0	11	39	0
8:45	9:00	0	0	1	1	0	1	45	18	0	9	2	7	0	7	32	1
15:00	15:15	0	1	2	0	0	1	33	13	0	10	1	8	0	2	44	0
15:15	15:30	0	1	1	2	0	1	33	14	0	10	3	12	0	8	45	2
15:30	15:45	0	1	3	1	0	5	36	15	0	31	1	4	0	6	80	0
15:45	16:00	0	0	2	1	0	1	38	10	0	21	0	8	0	7	50	2
16:00	16:15	0	0	2	0	0	2	41	14	0	12	1	8	0	10	34	1
16:15	16:30	0	0	1	0	0	0	49	9	0	17	3	9	0	6	30	0
16:30	16:45	0	0	1	1	0	1	49	9	0	19	0	11	0	4	33	1
16:45	17:00	0	0	0	1	0	1	34	9	0	14	3	10	0	3	34	1
17:00	17:15	0	3	2	0	0	1	27	5	0	24	2	10	0	6	32	3
17:15	17:30	0	2	1	1	0	3	40	7	0	19	2	5	0	6	34	1
17:30	17:45	0	1	1	1	0	2	31	5	0	14	0	4	0	6	23	3
17:45	18:00	0	0	2	2	0	3	27	9	0	6	1	4	0	4	27	0

Peak Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	2	6	3	0	1	171	121	0	37	4	19	0	40	122	2	528
15:15	16:15	0	2	8	4	0	9	148	53	0	74	5	32	0	31	209	5	580

Heavy Vehicles

Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:00	6:15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0
6:30	6:45	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	0
6:45	7:00	0	0	0	0	0	0	2	0	0	1	0	1	0	0	1	0
7:00	7:15	0	1	0	0	0	0	0	0	0	3	0	0	0	0	4	0
7:15	7:30	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0
7:30	7:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	1	0
7:45	8:00	0	0	0	0	0	0	3	2	0	1	0	0	0	0	3	0
8:00	8:15	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0
8:15	8:30	0	0	0	0	0	0	5	1	0	1	0	0	0	0	1	0
8:30	8:45	0	1	0	0	0	0	7	1	0	2	1	2	0	0	2	0
8:45	9:00	0	0	0	0	0	3	2	0	0	0	0	0	0	0	8	0
15:00	15:15	0	1	1	0	0	1	2	1	0	1	0	0	0	0	1	1
15:15	15:30	0	0	0	2	1	0	2	0	0	0	0	1	0	0	0	0
15:30	15:45	0	0	0	1	0	1	1	2	0	1	0	1	0	0	11	0
15:45	16:00	0	0	0	1	0	1	1	2	0	0	0	1	0	0	3	2
16:00	16:15	0	2	0	1	0	0	2	2	0	0	0	0	0	1	0	0
16:15	16:30	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0
16:30	16:45	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0
16:45	17:00	0	0	0	1	0	2	1	0	0	0	0	0	0	0	2	1
17:00	17:15	0	2	0	1	0	3	1	0	0	0	0	0	0	0	2	0
17:15	17:30	0	0	0	2	0	3	1	0	0	0	0	0	0	0	1	0
17:30	17:45	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0

Peak Time		North Approach Saleyards Rd				East Approach Second Ln				South Approach Kemp St				West Approach North St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
8:00	9:00	0	1	0	0	0	3	15	2	0	3	1	3	0	0	14	0	42
15:15	16:15	0	2	0	5	1	2	6	6	0	1	0	3	0	1	14	2	43

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Second Ln and Griffins Ln, Kempsey

GPS *-31.053773, 152.837741*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	Griffins Ln
East:	Second Ln
South:	N/A
West:	Second Ln

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:30 PM-4:30 PM

All Vehicles

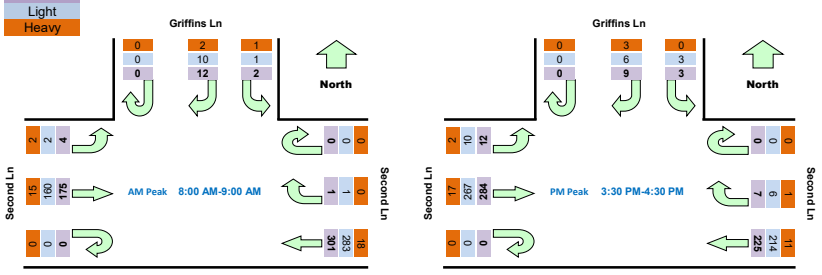
Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln			Hourly Total	
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	Hour	Peak
6:00	6:15	0	1	0	0	0	15	0	18	0	220	
6:15	6:30	0	0	2	0	0	20	0	33	0	244	
6:30	6:45	0	1	0	0	1	52	0	20	0	255	
6:45	7:00	0	0	0	0	0	32	0	24	1	278	
7:00	7:15	0	0	1	0	0	27	0	29	1	322	
7:15	7:30	0	2	0	0	0	36	0	27	1	367	
7:30	7:45	0	0	1	0	0	57	0	39	0	426	
7:45	8:00	0	1	2	0	1	70	0	25	2	475	
8:00	8:15	0	1	0	0	0	66	0	35	1	495	Peak
8:15	8:30	0	5	1	0	0	77	0	42	0		
8:30	8:45	0	3	0	0	0	92	0	48	3		
8:45	9:00	0	3	1	0	1	66	0	50	0		
15:00	15:15	0	2	1	0	2	49	0	54	2	538	
15:15	15:30	0	5	0	1	0	46	0	59	1	538	
15:30	15:45	0	3	0	0	1	57	0	119	6	540	Peak
15:45	16:00	0	2	0	0	1	51	0	72	4	472	
16:00	16:15	0	2	1	0	1	59	0	46	1	446	
16:15	16:30	0	2	2	0	4	58	0	47	1	434	
16:30	16:45	0	3	1	0	3	57	0	53	1	434	
16:45	17:00	0	0	3	0	2	47	0	50	2	393	
17:00	17:15	0	0	0	0	2	37	0	58	1	368	
17:15	17:30	0	2	1	0	2	52	0	56	1		
17:30	17:45	0	1	0	0	0	37	0	38	1		
17:45	18:00	0	1	1	0	0	41	0	34	2		

Peak Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
8:00	9:00	0	12	2	0	1	301	0	175	4	495
15:30	16:30	0	9	3	0	7	225	0	284	12	540

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	1	0	0	0	14	0	18	0
6:15	6:30	0	0	1	0	0	18	0	32	0
6:30	6:45	0	1	0	0	1	51	0	17	0
6:45	7:00	0	0	0	0	0	30	0	22	1
7:00	7:15	0	0	1	0	0	27	0	23	0
7:15	7:30	0	1	0	0	0	35	0	25	1
7:30	7:45	0	0	1	0	0	54	0	35	0
7:45	8:00	0	0	2	0	1	66	0	22	1
8:00	8:15	0	1	0	0	0	65	0	33	0
8:15	8:30	0	4	1	0	0	72	0	40	0
8:30	8:45	0	2	0	0	0	85	0	45	2
8:45	9:00	0	3	0	0	1	61	0	42	0
15:00	15:15	0	2	1	0	2	45	0	52	2
15:15	15:30	0	5	0	0	0	43	0	56	1
15:30	15:45	0	2	0	0	1	54	0	107	5
15:45	16:00	0	1	0	0	1	48	0	69	3
16:00	16:15	0	1	1	0	0	56	0	45	1
16:15	16:30	0	2	2	0	4	56	0	46	1
16:30	16:45	0	3	1	0	2	56	0	52	1
16:45	17:00	0	0	3	0	2	44	0	47	2
17:00	17:15	0	0	0	0	2	33	0	55	1
17:15	17:30	0	2	1	0	2	48	0	53	1
17:30	17:45	0	1	0	0	0	37	0	37	1
17:45	18:00	0	1	1	0	0	38	0	33	2

Peak Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
8:00	9:00	0	10	1	0	1	283	0	160	2	457
15:30	16:30	0	6	3	0	6	214	0	267	10	506

Heavy Vehicles

Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln		
Period Start	Period End	U	R	L	U	R	WB	U	EB	L
6:00	6:15	0	0	0	0	0	1	0	0	0
6:15	6:30	0	0	1	0	0	2	0	1	0
6:30	6:45	0	0	0	0	0	1	0	3	0
6:45	7:00	0	0	0	0	0	2	0	2	0
7:00	7:15	0	0	0	0	0	0	0	6	1
7:15	7:30	0	1	0	0	0	1	0	2	0
7:30	7:45	0	0	0	0	0	3	0	4	0
7:45	8:00	0	1	0	0	0	4	0	3	1
8:00	8:15	0	0	0	0	0	1	0	2	1
8:15	8:30	0	1	0	0	0	5	0	2	0
8:30	8:45	0	1	0	0	0	7	0	3	1
8:45	9:00	0	0	1	0	0	5	0	8	0
15:00	15:15	0	0	0	0	0	4	0	2	0
15:15	15:30	0	0	0	1	0	3	0	3	0
15:30	15:45	0	1	0	0	0	3	0	12	1
15:45	16:00	0	1	0	0	0	3	0	3	1
16:00	16:15	0	1	0	0	1	3	0	1	0
16:15	16:30	0	0	0	0	0	2	0	1	0
16:30	16:45	0	0	0	0	1	1	0	1	0
16:45	17:00	0	0	0	0	0	3	0	3	0
17:00	17:15	0	0	0	0	0	4	0	3	0
17:15	17:30	0	0	0	0	0	4	0	3	0
17:30	17:45	0	0	0	0	0	0	0	1	0
17:45	18:00	0	0	0	0	0	3	0	1	0

Peak Time		North Approach Griffins Ln			East Approach Second Ln			West Approach Second Ln			Peak
Period Start	Period End	U	R	L	U	R	WB	U	EB	L	total
8:00	9:00	0	2	1	0	0	18	0	15	2	38
15:30	16:30	0	3	0	0	1	11	0	17	2	34

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Second Ln and Macleay Valley Way, Kemp

GPS *-31.055680, 152.849921*

Date:	Wed 29/06/22
Weather:	Overcast
Suburban:	Kempsey
Customer:	N/A

North:	Macleay Valley Way
East:	N/A
South:	Macleay Valley Way
West:	Second Ln

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	8:00 AM-9:00 AM
	PM:	3:30 PM-4:30 PM

All Vehicles

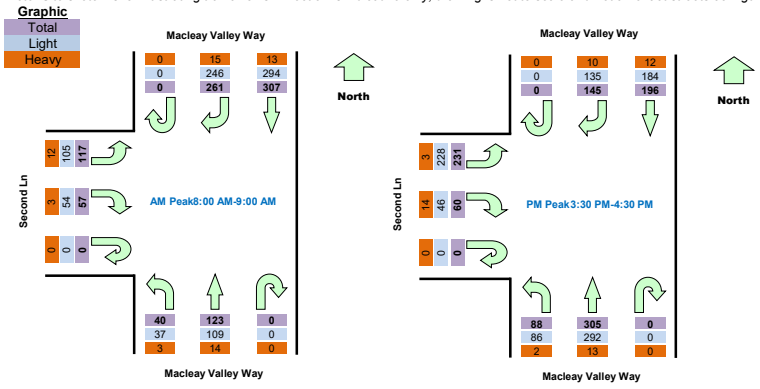
Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln			Hourly Total	
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	Hour	Peak
6:00	6:15	0	15	23	0	14	1	0	3	15	390	
6:15	6:30	0	16	15	0	16	5	0	11	23	439	
6:30	6:45	0	47	38	0	19	7	0	9	12	476	
6:45	7:00	0	30	31	0	16	1	0	7	16	516	
7:00	7:15	0	20	36	0	27	8	0	8	21	607	
7:15	7:30	0	32	44	0	15	4	0	9	19	689	
7:30	7:45	0	54	51	0	21	5	0	13	28	814	
7:45	8:00	0	57	69	0	25	13	0	11	17	880	
8:00	8:15	0	58	76	0	25	9	0	6	28	905	Peak
8:15	8:30	0	70	91	0	38	8	0	12	29		
8:30	8:45	0	80	77	0	22	9	0	20	30		
8:45	9:00	0	53	63	0	38	14	0	19	30		
15:00	15:15	0	34	62	0	58	19	0	20	34	991	
15:15	15:30	0	23	52	0	47	22	0	14	44	1000	
15:30	15:45	0	37	60	0	82	20	0	30	93	1025	Peak
15:45	16:00	0	34	50	0	66	18	0	11	61	945	
16:00	16:15	0	35	43	0	85	25	0	9	39	916	
16:15	16:30	0	39	43	0	72	25	0	10	38	917	
16:30	16:45	0	33	49	0	82	25	0	8	45	913	
16:45	17:00	0	22	28	0	77	28	0	13	43	809	
17:00	17:15	0	21	43	0	96	21	0	12	44	758	
17:15	17:30	0	35	26	0	87	16	0	18	41		
17:30	17:45	0	20	24	0	40	17	0	5	32		
17:45	18:00	0	23	41	0	43	17	0	8	28		

Peak Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	total
8:00	9:00	0	261	307	0	123	40	0	57	117	905
15:30	16:30	0	145	196	0	305	88	0	60	231	1025

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
6:00	6:15	0	14	22	0	12	1	0	3	15
6:15	6:30	0	14	13	0	12	5	0	10	22
6:30	6:45	0	46	37	0	15	7	0	9	9
6:45	7:00	0	28	29	0	14	1	0	6	15
7:00	7:15	0	20	34	0	21	8	0	8	15
7:15	7:30	0	31	40	0	10	4	0	9	17
7:30	7:45	0	51	48	0	16	5	0	13	24
7:45	8:00	0	53	65	0	21	13	0	11	14
8:00	8:15	0	57	71	0	22	9	0	6	26
8:15	8:30	0	66	86	0	34	7	0	12	27
8:30	8:45	0	74	76	0	21	8	0	20	27
8:45	9:00	0	49	61	0	32	13	0	16	25
15:00	15:15	0	31	56	0	55	18	0	18	33
15:15	15:30	0	20	48	0	46	21	0	12	42
15:30	15:45	0	35	58	0	82	19	0	20	91
15:45	16:00	0	32	47	0	61	17	0	8	61
16:00	16:15	0	31	41	0	81	25	0	9	38
16:15	16:30	0	37	38	0	68	25	0	9	38
16:30	16:45	0	31	47	0	80	25	0	8	44
16:45	17:00	0	22	27	0	77	25	0	11	41
17:00	17:15	0	18	41	0	95	19	0	11	43
17:15	17:30	0	34	25	0	86	14	0	15	40
17:30	17:45	0	20	24	0	39	17	0	4	32
17:45	18:00	0	22	41	0	43	15	0	8	27

Peak Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	total
8:00	9:00	0	246	294	0	109	37	0	54	105	845
15:30	16:30	0	135	184	0	292	86	0	46	228	971

Heavy Vehicles

Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
6:00	6:15	0	1	1	0	2	0	0	0	0
6:15	6:30	0	2	2	0	4	0	0	1	1
6:30	6:45	0	1	1	0	4	0	0	0	3
6:45	7:00	0	2	2	0	2	0	0	1	1
7:00	7:15	0	0	2	0	6	0	0	0	6
7:15	7:30	0	1	4	0	5	0	0	0	2
7:30	7:45	0	3	3	0	5	0	0	0	4
7:45	8:00	0	4	4	0	4	0	0	0	3
8:00	8:15	0	1	5	0	3	0	0	0	2
8:15	8:30	0	4	5	0	4	1	0	0	2
8:30	8:45	0	6	1	0	1	1	0	0	3
8:45	9:00	0	4	2	0	6	1	0	3	5
15:00	15:15	0	3	6	0	3	1	0	2	1
15:15	15:30	0	3	4	0	1	1	0	2	2
15:30	15:45	0	2	2	0	0	1	0	10	2
15:45	16:00	0	2	3	0	5	1	0	3	0
16:00	16:15	0	4	2	0	4	0	0	0	1
16:15	16:30	0	2	5	0	4	0	0	1	0
16:30	16:45	0	2	2	0	2	0	0	0	1
16:45	17:00	0	0	1	0	0	3	0	2	2
17:00	17:15	0	3	2	0	1	2	0	1	1
17:15	17:30	0	1	1	0	1	2	0	3	1
17:30	17:45	0	0	0	0	1	0	0	1	0
17:45	18:00	0	1	0	0	0	2	0	0	1

Peak Time		h Approach Macleay Valley			h Approach Macleay Valley			West Approach Second Ln			Peak
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	total
8:00	9:00	0	15	13	0	14	3	0	3	12	60
15:30	16:30	0	10	12	0	13	2	0	14	3	54

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Waterfall Way and Kempsey Rd, Wollomo

GPS *-30.515856, 152.064347*

Date:	Tue 28/06/22
Weather:	Overcast
Suburban:	Wollomombi
Customer:	N/A

North:	N/A
East:	Waterfall Way
South:	Kempsey Rd
West:	Waterfall Way

Survey Period	AM:	6:00 AM-9:00 AM
	PM:	3:00 PM-6:00 PM
Traffic Peak	AM:	7:45 AM-8:45 AM
	PM:	3:45 PM-4:45 PM

All Vehicles

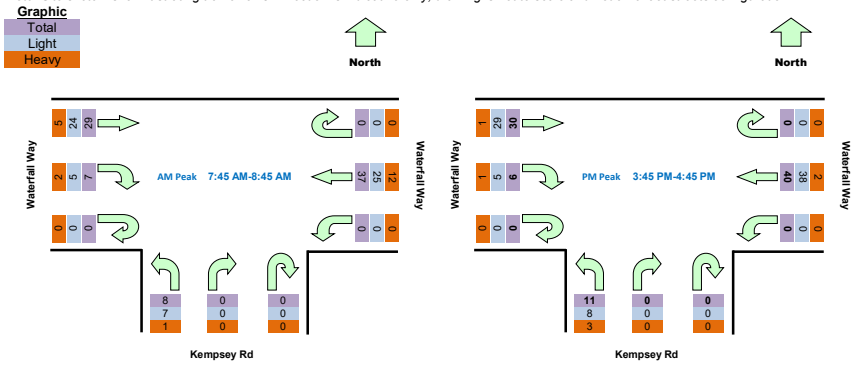
Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa			Hourly Total	
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	Hour	Peak
6:00	6:15	0	1	0	0	0	0	0	2	1	23	
6:15	6:30	0	0	0	0	0	0	0	2	3	30	
6:30	6:45	0	3	0	0	0	0	0	3	4	37	
6:45	7:00	0	0	0	0	0	1	0	1	2	37	
7:00	7:15	0	3	0	0	0	2	0	0	6	54	
7:15	7:30	0	6	0	0	0	2	0	0	4	60	
7:30	7:45	0	3	0	0	0	0	0	2	5	69	
7:45	8:00	0	14	0	0	0	1	0	2	4	81	Peak
8:00	8:15	0	4	0	0	0	4	0	1	8	77	
8:15	8:30	0	11	0	0	0	1	0	3	6		
8:30	8:45	0	8	0	0	0	2	0	1	11		
8:45	9:00	0	7	0	0	0	0	0	1	9		
15:00	15:15	0	9	0	0	0	2	0	0	7	74	
15:15	15:30	0	11	1	0	0	0	0	2	7	82	
15:30	15:45	0	9	0	0	0	0	0	0	3	82	
15:45	16:00	0	14	0	0	0	2	0	2	5	87	Peak
16:00	16:15	0	14	0	0	0	5	0	0	7	77	
16:15	16:30	0	11	0	0	0	0	0	1	9	69	
16:30	16:45	0	1	0	0	0	4	0	3	9	65	
16:45	17:00	0	4	0	0	0	4	0	2	3	64	
17:00	17:15	0	6	0	0	1	3	0	3	5	62	
17:15	17:30	0	10	0	0	0	1	0	0	6		
17:30	17:45	0	8	0	0	0	1	0	0	7		
17:45	18:00	0	5	0	0	0	1	0	2	3		

Peak Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	37	0	0	0	8	0	7	29	81
15:45	16:45	0	40	0	0	0	11	0	6	30	87

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy



Light Vehicles

Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:00	6:15	0	1	0	0	0	0	0	2	1
6:15	6:30	0	0	0	0	0	0	0	2	1
6:30	6:45	0	3	0	0	0	0	0	2	3
6:45	7:00	0	0	0	0	0	1	0	1	2
7:00	7:15	0	3	0	0	0	1	0	0	4
7:15	7:30	0	5	0	0	0	1	0	0	2
7:30	7:45	0	3	0	0	0	0	0	1	5
7:45	8:00	0	8	0	0	0	1	0	2	4
8:00	8:15	0	3	0	0	0	4	0	1	4
8:15	8:30	0	8	0	0	0	1	0	2	6
8:30	8:45	0	6	0	0	0	1	0	0	10
8:45	9:00	0	5	0	0	0	0	0	1	7
15:00	15:15	0	7	0	0	0	2	0	0	7
15:15	15:30	0	11	1	0	0	0	0	2	6
15:30	15:45	0	8	0	0	0	0	0	0	3
15:45	16:00	0	14	0	0	0	1	0	1	5
16:00	16:15	0	13	0	0	0	5	0	0	7
16:15	16:30	0	10	0	0	0	0	0	1	8
16:30	16:45	0	1	0	0	0	2	0	3	9
16:45	17:00	0	4	0	0	0	4	0	2	3
17:00	17:15	0	6	0	0	1	3	0	3	5
17:15	17:30	0	8	0	0	0	0	0	0	5
17:30	17:45	0	8	0	0	0	1	0	0	7
17:45	18:00	0	4	0	0	0	1	0	1	2

Peak Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	25	0	0	0	7	0	5	24	61
15:45	16:45	0	38	0	0	0	8	0	5	29	80

Heavy Vehicles

Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa		
Period Start	Period End	U	WB	L	U	R	L	U	R	EB
6:00	6:15	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	0	0	0	0	0	2
6:30	6:45	0	0	0	0	0	0	0	1	1
6:45	7:00	0	0	0	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	1	0	0	2
7:15	7:30	0	1	0	0	0	1	0	0	2
7:30	7:45	0	0	0	0	0	0	0	1	0
7:45	8:00	0	6	0	0	0	0	0	0	0
8:00	8:15	0	1	0	0	0	0	0	0	4
8:15	8:30	0	3	0	0	0	0	0	1	0
8:30	8:45	0	2	0	0	0	1	0	1	1
8:45	9:00	0	2	0	0	0	0	0	0	2
15:00	15:15	0	2	0	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0	0	0	1
15:30	15:45	0	1	0	0	0	0	0	0	0
15:45	16:00	0	0	0	0	0	1	0	1	0
16:00	16:15	0	1	0	0	0	0	0	0	0
16:15	16:30	0	1	0	0	0	0	0	0	1
16:30	16:45	0	0	0	0	0	2	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0
17:15	17:30	0	2	0	0	0	1	0	0	1
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	1	0	0	0	0	0	1	1

Peak Time		East Approach Waterfall Wa			South Approach Kempsey R			West Approach Waterfall Wa			Peak
Period Start	Period End	U	WB	L	U	R	L	U	R	EB	total
7:45	8:45	0	12	0	0	0	1	0	2	5	20
15:45	16:45	0	2	0	0	0	3	0	1	1	7

Attachment B
SIDRA results

EMM
creating opportunities

MOVEMENT SUMMARY

Site: 101 [Waterfall Way/Kempsey Road (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kempsey Road														
1	L2	8	1	8	12.5	0.007	8.3	LOS A	0.0	0.2	0.12	0.61	0.12	64.9
3	R2	1	0	1	0.0	0.001	8.1	LOS A	0.0	0.0	0.21	0.59	0.21	69.0
Approach		9	1	9	11.1	0.007	8.3	LOS A	0.0	0.2	0.13	0.61	0.13	65.3
East: Waterfall Way														
4	L2	1	0	1	0.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
5	T1	38	12	40	31.6	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach		39	12	41	30.8	0.025	0.2	NA	0.0	0.0	0.00	0.02	0.00	79.5
West: Waterfall Way														
11	T1	30	5	32	16.7	0.018	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
12	R2	7	2	7	28.6	0.006	7.5	LOS A	0.0	0.2	0.14	0.59	0.14	60.2
Approach		37	7	39	18.9	0.018	1.4	NA	0.0	0.2	0.03	0.11	0.03	75.3
All Vehicles		85	20	89	23.5	0.025	1.6	NA	0.0	0.2	0.03	0.12	0.03	75.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Lord Street/Rudder Street intersection (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Lord Street														
5	T1	892	51	939	5.7	0.503	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
6	R2	23	3	24	13.0	0.034	9.6	LOS A	0.1	1.0	0.60	0.74	0.60	50.2
Approach		915	54	963	5.9	0.503	0.6	NA	0.1	1.0	0.02	0.02	0.02	59.3
NorthEast: Rudder Street														
1	L2	67	8	71	11.9	0.041	7.4	LOS A	0.0	0.0	0.00	0.52	0.00	54.5
2	R2	245	11	258	4.5	0.605	21.8	LOS B	3.5	25.2	0.84	1.18	1.45	42.5
Approach		312	19	328	6.1	0.605	18.7	LOS B	3.5	25.2	0.66	1.04	1.14	44.9
NorthWest: Lord Street														
3	L2	132	13	139	9.8	0.463	5.9	LOS A	1.3	9.5	0.05	0.09	0.05	57.3
4	T1	652	43	686	6.6	0.463	0.0	LOS A	1.3	9.5	0.05	0.09	0.05	58.7
Approach		784	56	825	7.1	0.463	1.0	NA	1.3	9.5	0.05	0.09	0.05	58.5
All Vehicles		2011	129	2117	6.4	0.605	3.5	NA	3.5	25.2	0.13	0.21	0.20	56.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [Smith Street/Belgrave Street (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Smith Street														
21a	L1	820	45	901	5.5	* 0.783	15.1	LOS B	21.4	156.6	0.79	0.86	0.80	45.3
23a	R1	332	17	386	5.1	0.448	22.0	LOS B	11.4	83.3	0.72	0.78	0.72	34.9
Approach		1152	62	1287	5.4	0.783	17.2	LOS B	21.4	156.6	0.77	0.84	0.77	42.6
North: Smith Street														
7	L2	25	0	30	0.0	0.350	12.7	LOS A	6.8	49.3	0.52	0.70	0.52	39.8
7a	L1	245	9	295	3.7	0.350	13.8	LOS A	6.8	49.3	0.52	0.70	0.52	40.6
9	R2	51	3	71	5.9	* 0.596	51.6	LOS D	3.3	24.3	1.00	0.80	1.08	23.4
Approach		321	12	396	3.8	0.596	20.5	LOS B	6.8	49.3	0.60	0.72	0.62	35.2
West: Belgrave Street														
10	L2	50	6	63	12.0	0.176	32.3	LOS C	2.7	20.7	0.81	0.72	0.81	29.7
11	T1	14	1	17	7.1	0.176	27.6	LOS B	2.7	20.7	0.81	0.72	0.81	35.0
12a	R1	499	45	594	9.0	* 1.239	159.6	LOS F	55.5	418.6	1.00	1.45	2.24	14.4
Approach		563	52	673	9.2	1.239	144.5	LOS F	55.5	418.6	0.98	1.36	2.07	15.2
All Vehicles		2036	126	2356	6.2	1.239	54.1	LOS D	55.5	418.6	0.80	0.97	1.12	26.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Belgrave Street												
P2	Full	1	1	39.2	LOS D	0.0	0.0	0.93	0.93	197.1	205.3	1.04
North: Smith Street												
P3	Full	14	15	39.2	LOS D	0.0	0.0	0.93	0.93	203.8	213.9	1.05
West: Belgrave Street												
P4	Full	31	33	37.4	LOS D	0.1	0.1	0.91	0.91	206.0	219.2	1.06
All Pedestrians		46	48	38.0	LOS D	0.1	0.1	0.92	0.92	205.1	217.3	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 104 [River Street/North Street (Site Folder: Baseline scenario AM Peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: River Street														
22	T1	173	11	182	6.4	0.098	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	18	3	19	16.7	0.028	8.9	LOS A	0.1	0.9	0.61	0.74	0.61	43.6
Approach		191	14	201	7.3	0.098	0.9	NA	0.1	0.9	0.06	0.07	0.06	49.3
NorthEast: North Street														
24	L2	27	4	28	14.8	0.340	8.8	LOS A	1.5	11.3	0.74	0.95	0.93	41.1
26	R2	102	9	107	8.8	0.340	16.3	LOS B	1.5	11.3	0.74	0.95	0.93	43.2
Approach		129	13	136	10.1	0.340	14.7	LOS B	1.5	11.3	0.74	0.95	0.93	42.7
NorthWest: River Street														
27	L2	181	18	191	9.9	0.379	4.8	LOS A	0.0	0.0	0.00	0.14	0.00	48.4
28	T1	492	9	518	1.8	0.379	0.2	LOS A	0.0	0.0	0.00	0.14	0.00	49.0
Approach		673	27	708	4.0	0.379	1.4	NA	0.0	0.0	0.00	0.14	0.00	48.9
All Vehicles		993	54	1045	5.4	0.379	3.0	NA	1.5	11.3	0.11	0.23	0.13	48.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105 [North Street/Kemp Street/Saleyards Road/Second Lane (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kemp Street														
1b	L3	23	3	24	13.0	0.115	9.7	LOS A	0.4	3.1	0.44	1.03	0.44	46.4
2	T1	5	1	5	20.0	0.115	12.0	LOS A	0.4	3.1	0.44	1.03	0.44	41.1
3a	R1	42	3	44	7.1	0.115	12.2	LOS A	0.4	3.1	0.44	1.03	0.44	46.3
Approach		70	7	74	10.0	0.115	11.4	LOS A	0.4	3.1	0.44	1.03	0.44	46.0
NorthEast: Second Lane														
24a	L1	129	2	136	1.6	0.189	5.4	LOS A	0.1	0.6	0.02	0.24	0.02	51.7
25	T1	196	16	206	8.2	0.189	0.0	LOS A	0.1	0.6	0.02	0.24	0.02	57.8
26b	R3	4	3	4	75.0	0.189	8.1	LOS A	0.1	0.6	0.02	0.24	0.02	50.1
Approach		329	21	346	6.4	0.189	2.2	NA	0.1	0.6	0.02	0.24	0.02	55.2
North: Saleyards Road														
7b	L3	3	0	3	0.0	0.019	8.8	LOS A	0.1	0.5	0.40	0.96	0.40	45.9
8	T1	6	0	6	0.0	0.019	10.6	LOS A	0.1	0.5	0.40	0.96	0.40	41.6
9a	R1	3	1	3	33.3	0.019	13.6	LOS A	0.1	0.5	0.40	0.96	0.40	44.2
Approach		12	1	13	8.3	0.019	10.9	LOS A	0.1	0.5	0.40	0.96	0.40	43.2
SouthWest: North Street														
30a	L1	2	0	2	0.0	0.120	6.6	LOS A	0.4	2.7	0.23	0.16	0.23	52.2
31	T1	143	15	151	10.5	0.120	0.5	LOS A	0.4	2.7	0.23	0.16	0.23	57.7
32b	R3	42	0	44	0.0	0.120	7.4	LOS A	0.4	2.7	0.23	0.16	0.23	51.5
Approach		187	15	197	8.0	0.120	2.1	NA	0.4	2.7	0.23	0.16	0.23	56.1
All Vehicles		598	44	629	7.4	0.189	3.4	NA	0.4	3.1	0.14	0.32	0.14	54.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105a [Second Lane/Griffins Lane (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Second Lane														
5	T1	316	19	333	6.0	0.178	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	60.0
6	R2	1	0	1	0.0	0.178	6.2	LOS A	0.0	0.1	0.00	0.00	0.00	53.4
Approach		317	19	334	6.0	0.178	0.0	NA	0.0	0.1	0.00	0.00	0.00	59.9
North: Griffins Lane														
7	L2	1	0	1	0.0	0.021	5.1	LOS A	0.1	0.5	0.44	0.65	0.44	54.6
9	R2	13	2	14	15.4	0.021	7.5	LOS A	0.1	0.5	0.44	0.65	0.44	47.1
Approach		14	2	15	14.3	0.021	7.3	LOS A	0.1	0.5	0.44	0.65	0.44	47.6
West: Second Lane														
10	L2	4	2	4	50.0	0.108	6.1	LOS A	0.0	0.0	0.00	0.01	0.00	55.8
11	T1	184	16	194	8.7	0.108	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		188	18	198	9.6	0.108	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		519	39	546	7.5	0.178	0.3	NA	0.1	0.5	0.01	0.02	0.01	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 106 [Macleay Valley Way/Second Lane (Site Folder: Baseline scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macleay Valley Way														
1	L2	42	3	44	7.1	0.025	8.0	LOS A	0.0	0.0	0.00	0.66	0.00	71.9
2	T1	129	15	136	11.6	0.075	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach		171	18	180	10.5	0.075	2.0	NA	0.0	0.0	0.00	0.16	0.00	91.2
North: Macleay Valley Way														
8	T1	323	14	340	4.3	0.180	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	274	16	288	5.8	0.248	8.8	LOS A	1.2	8.5	0.35	0.66	0.35	70.5
Approach		597	30	628	5.0	0.248	4.0	NA	1.2	8.5	0.16	0.30	0.16	83.8
West: Second Lane														
10	L2	123	13	129	10.6	0.306	9.0	LOS A	1.3	9.8	0.38	0.70	0.40	65.2
12	R2	60	3	63	5.0	0.306	20.1	LOS B	1.3	9.8	0.38	0.70	0.40	66.7
Approach		183	16	193	8.7	0.306	12.6	LOS A	1.3	9.8	0.38	0.70	0.40	65.7
All Vehicles		951	64	1001	6.7	0.306	5.3	NA	1.3	9.8	0.17	0.35	0.18	80.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Waterfall Way/Kempsey Road (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kempsey Road														
1	L2	11	3	12	27.3	0.010	8.7	LOS A	0.0	0.3	0.12	0.61	0.12	60.2
3	R2	1	0	1	0.0	0.001	8.1	LOS A	0.0	0.0	0.20	0.59	0.20	69.0
Approach		12	3	13	25.0	0.010	8.7	LOS A	0.0	0.3	0.13	0.61	0.13	60.9
East: Waterfall Way														
4	L2	1	0	1	0.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
5	T1	42	2	44	4.8	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach		43	2	45	4.7	0.023	0.2	NA	0.0	0.0	0.00	0.01	0.00	79.6
West: Waterfall Way														
11	T1	31	1	33	3.2	0.017	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
12	R2	6	1	6	16.7	0.005	7.3	LOS A	0.0	0.2	0.13	0.59	0.13	63.5
Approach		37	2	39	5.4	0.017	1.2	NA	0.0	0.2	0.02	0.10	0.02	76.8
All Vehicles		92	7	97	7.6	0.023	1.7	NA	0.0	0.3	0.03	0.13	0.03	75.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Lord Street/Rudder Street intersection (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Lord Street														
5	T1	825	45	868	5.5	0.464	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
6	R2	35	3	37	8.6	0.080	12.9	LOS A	0.3	2.1	0.75	0.89	0.75	48.1
Approach		860	48	905	5.6	0.464	0.8	NA	0.3	2.1	0.03	0.04	0.03	59.0
NorthEast: Rudder Street														
1	L2	45	2	47	4.4	0.026	8.5	LOS A	0.0	0.0	0.00	0.53	0.00	54.8
2	R2	189	12	199	6.3	1.021	86.5	LOS F	9.8	72.0	1.00	1.67	3.68	22.7
Approach		234	14	246	6.0	1.021	71.5	LOS F	9.8	72.0	0.81	1.45	2.97	26.1
NorthWest: Lord Street														
3	L2	239	12	252	5.0	0.667	6.0	LOS A	3.3	24.0	0.11	0.12	0.11	57.1
4	T1	901	32	948	3.6	0.667	0.1	LOS A	3.3	24.0	0.11	0.12	0.11	58.2
Approach		1140	44	1200	3.9	0.667	1.3	NA	3.3	24.0	0.11	0.12	0.11	58.0
All Vehicles		2234	106	2352	4.7	1.021	8.5	NA	9.8	72.0	0.15	0.22	0.38	51.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [Smith Street/Belgrave Street (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Smith Street														
21a	L1	642	43	705	6.7	* 0.673	19.2	LOS B	17.5	129.4	0.75	0.88	0.75	42.8
23a	R1	377	14	438	3.7	0.547	27.4	LOS B	15.9	114.8	0.80	0.81	0.80	32.0
Approach		1019	57	1144	5.6	0.673	22.3	LOS B	17.5	129.4	0.77	0.85	0.77	39.1
North: Smith Street														
7	L2	25	0	30	0.0	0.637	19.3	LOS B	18.9	136.6	0.71	0.79	0.71	36.1
7a	L1	466	19	561	4.1	0.637	20.4	LOS B	18.9	136.6	0.71	0.79	0.71	36.0
9	R2	46	2	64	4.3	* 0.591	57.2	LOS E	3.3	24.0	1.00	0.79	1.07	22.3
Approach		537	21	655	3.9	0.637	24.0	LOS B	18.9	136.6	0.74	0.79	0.75	33.6
West: Belgrave Street														
10	L2	92	4	115	4.3	0.268	31.9	LOS C	5.7	40.7	0.79	0.73	0.79	29.9
11	T1	34	0	40	0.0	0.268	27.3	LOS B	5.7	40.7	0.79	0.73	0.79	35.2
12a	R1	649	24	773	3.7	* 1.256	169.3	LOS F	78.4	566.3	1.00	1.43	2.14	13.8
Approach		775	28	928	3.6	1.256	146.1	LOS F	78.4	566.3	0.96	1.31	1.91	15.0
All Vehicles		2331	106	2727	4.5	1.256	64.8	LOS E	78.4	566.3	0.83	0.99	1.15	23.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Belgrave Street												
P2	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	202.1	205.3	1.02
North: Smith Street												
P3	Full	40	42	44.3	LOS E	0.1	0.1	0.94	0.94	208.8	213.9	1.02
West: Belgrave Street												
P4	Full	51	54	42.4	LOS E	0.1	0.1	0.92	0.92	211.0	219.2	1.04
All Pedestrians		92	97	43.2	LOS E	0.1	0.1	0.93	0.93	210.0	216.7	1.03

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 104 [River Street/North Street (Site Folder: Baseline scenario PM Peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: River Street														
22	T1	395	13	416	3.3	0.219	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
23	R2	32	3	34	9.4	0.033	6.7	LOS A	0.1	1.0	0.50	0.64	0.50	44.9
Approach		427	16	449	3.7	0.219	0.6	NA	0.1	1.0	0.04	0.05	0.04	49.5
NorthEast: North Street														
24	L2	25	1	26	4.0	0.509	9.3	LOS A	2.7	20.4	0.77	1.03	1.20	39.8
26	R2	162	16	171	9.9	0.509	19.1	LOS B	2.7	20.4	0.77	1.03	1.20	41.6
Approach		187	17	197	9.1	0.509	17.8	LOS B	2.7	20.4	0.77	1.03	1.20	41.4
NorthWest: River Street														
27	L2	148	7	156	4.7	0.255	4.7	LOS A	0.0	0.0	0.00	0.18	0.00	48.4
28	T1	303	13	319	4.3	0.255	0.1	LOS A	0.0	0.0	0.00	0.18	0.00	48.9
Approach		451	20	475	4.4	0.255	1.6	NA	0.0	0.0	0.00	0.18	0.00	48.7
All Vehicles		1065	53	1121	5.0	0.509	4.0	NA	2.7	20.4	0.15	0.27	0.23	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105 [North Street/Kemp Street/Saleyards Road/Second Lane (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kemp Street														
1b	L3	37	3	39	8.1	0.197	9.3	LOS A	0.7	5.2	0.44	1.04	0.44	46.4
2	T1	5	0	5	0.0	0.197	10.7	LOS A	0.7	5.2	0.44	1.04	0.44	41.3
3a	R1	79	1	83	1.3	0.197	12.3	LOS A	0.7	5.2	0.44	1.04	0.44	46.3
Approach		121	4	127	3.3	0.197	11.3	LOS A	0.7	5.2	0.44	1.04	0.44	46.2
NorthEast: Second Lane														
24a	L1	62	6	65	9.7	0.136	5.6	LOS A	0.1	1.1	0.06	0.18	0.06	51.8
25	T1	161	6	169	3.7	0.136	0.1	LOS A	0.1	1.1	0.06	0.18	0.06	58.2
26b	R3	11	2	12	18.2	0.136	7.4	LOS A	0.1	1.1	0.06	0.18	0.06	52.1
Approach		234	14	246	6.0	0.136	1.9	NA	0.1	1.1	0.06	0.18	0.06	56.1
North: Saleyards Road														
7b	L3	9	5	9	55.6	0.036	11.7	LOS A	0.1	1.1	0.45	0.97	0.45	43.4
8	T1	8	0	8	0.0	0.036	10.5	LOS A	0.1	1.1	0.45	0.97	0.45	41.5
9a	R1	4	2	4	50.0	0.036	16.6	LOS B	0.1	1.1	0.45	0.97	0.45	43.4
Approach		21	7	22	33.3	0.036	12.2	LOS A	0.1	1.1	0.45	0.97	0.45	42.7
SouthWest: North Street														
30a	L1	7	2	7	28.6	0.164	6.5	LOS A	0.3	2.3	0.12	0.10	0.12	52.5
31	T1	234	15	246	6.4	0.164	0.2	LOS A	0.3	2.3	0.12	0.10	0.12	58.7
32b	R3	34	1	36	2.9	0.164	7.0	LOS A	0.3	2.3	0.12	0.10	0.12	52.2
Approach		275	18	289	6.5	0.164	1.2	NA	0.3	2.3	0.12	0.10	0.12	57.7
All Vehicles		651	43	685	6.6	0.197	3.7	NA	0.7	5.2	0.17	0.33	0.17	54.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105a [Second Lane/Griffins Lane (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Second Lane														
5	T1	224	13	236	5.8	0.129	0.0	LOS A	0.0	0.3	0.02	0.01	0.02	59.9
6	R2	3	1	3	33.3	0.129	7.8	LOS A	0.0	0.3	0.02	0.01	0.02	52.6
Approach		227	14	239	6.2	0.129	0.1	NA	0.0	0.3	0.02	0.01	0.02	59.8
North: Griffins Lane														
7	L2	1	0	1	0.0	0.022	5.6	LOS A	0.1	0.6	0.48	0.68	0.48	54.1
9	R2	12	3	13	25.0	0.022	8.2	LOS A	0.1	0.6	0.48	0.68	0.48	46.4
Approach		13	3	14	23.1	0.022	8.0	LOS A	0.1	0.6	0.48	0.68	0.48	46.9
West: Second Lane														
10	L2	13	2	14	15.4	0.183	5.8	LOS A	0.0	0.0	0.00	0.02	0.00	57.3
11	T1	311	20	327	6.4	0.183	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.7
Approach		324	22	341	6.8	0.183	0.3	NA	0.0	0.0	0.00	0.02	0.00	59.6
All Vehicles		564	39	594	6.9	0.183	0.4	NA	0.1	0.6	0.02	0.03	0.02	59.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 106 [Macleay Valley Way/Second Lane (Site Folder: Baseline scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macleay Valley Way														
1	L2	89	3	94	3.4	0.052	7.9	LOS A	0.0	0.0	0.00	0.66	0.00	73.2
2	T1	295	11	311	3.7	0.163	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		384	14	404	3.6	0.163	1.8	NA	0.0	0.0	0.00	0.15	0.00	92.1
North: Macleay Valley Way														
8	T1	216	12	227	5.6	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	136	12	143	8.8	0.162	10.2	LOS A	0.7	5.0	0.49	0.75	0.49	68.3
Approach		352	24	371	6.8	0.162	3.9	NA	0.7	5.0	0.19	0.29	0.19	84.7
West: Second Lane														
10	L2	249	5	262	2.0	0.502	11.7	LOS A	3.3	24.7	0.59	0.88	0.90	65.3
12	R2	67	16	71	23.9	0.502	25.1	LOS B	3.3	24.7	0.59	0.88	0.90	59.2
Approach		316	21	333	6.6	0.502	14.5	LOS A	3.3	24.7	0.59	0.88	0.90	63.9
All Vehicles		1052	59	1107	5.6	0.502	6.3	NA	3.3	24.7	0.24	0.42	0.33	79.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Waterfall Way/Kempsey Road (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kempsey Road														
1	L2	10	1	11	10.0	0.009	8.3	LOS A	0.0	0.2	0.12	0.61	0.12	65.8
3	R2	1	0	1	0.0	0.001	8.1	LOS A	0.0	0.0	0.21	0.59	0.21	69.0
Approach		11	1	12	9.1	0.009	8.3	LOS A	0.0	0.2	0.13	0.61	0.13	66.0
East: Waterfall Way														
4	L2	1	0	1	0.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
5	T1	38	12	40	31.6	0.025	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach		39	12	41	30.8	0.025	0.2	NA	0.0	0.0	0.00	0.02	0.00	79.5
West: Waterfall Way														
11	T1	30	5	32	16.7	0.018	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
12	R2	9	2	9	22.2	0.008	7.4	LOS A	0.0	0.2	0.13	0.59	0.13	61.9
Approach		39	7	41	17.9	0.018	1.7	NA	0.0	0.2	0.03	0.14	0.03	74.9
All Vehicles		89	20	94	22.5	0.025	1.9	NA	0.0	0.2	0.03	0.14	0.03	75.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Lord Street/Rudder Street intersection (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Lord Street														
5	T1	897	51	944	5.7	0.506	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
6	R2	23	3	24	13.0	0.034	9.6	LOS A	0.1	1.0	0.60	0.75	0.60	50.2
Approach		920	54	968	5.9	0.506	0.6	NA	0.1	1.0	0.02	0.02	0.02	59.3
NorthEast: Rudder Street														
1	L2	67	8	71	11.9	0.041	7.4	LOS A	0.0	0.0	0.00	0.52	0.00	54.5
2	R2	245	11	258	4.5	0.610	22.0	LOS B	3.5	25.5	0.84	1.18	1.47	42.4
Approach		312	19	328	6.1	0.610	18.9	LOS B	3.5	25.5	0.66	1.04	1.15	44.8
NorthWest: Lord Street														
3	L2	132	13	139	9.8	0.465	5.9	LOS A	1.3	9.6	0.05	0.09	0.05	57.3
4	T1	656	43	691	6.6	0.465	0.0	LOS A	1.3	9.6	0.05	0.09	0.05	58.7
Approach		788	56	829	7.1	0.465	1.0	NA	1.3	9.6	0.05	0.09	0.05	58.5
All Vehicles		2020	129	2126	6.4	0.610	3.6	NA	3.5	25.5	0.13	0.21	0.20	56.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [Smith Street/Belgrave Street (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Smith Street														
21a	L1	825	45	907	5.5	* 0.788	15.4	LOS B	21.7	158.9	0.80	0.87	0.80	45.1
23a	R1	332	17	386	5.1	0.448	22.0	LOS B	11.4	83.3	0.72	0.78	0.72	34.9
Approach		1157	62	1293	5.4	0.788	17.4	LOS B	21.7	158.9	0.78	0.84	0.78	42.5
North: Smith Street														
7	L2	25	0	30	0.0	0.350	12.7	LOS A	6.8	49.3	0.52	0.70	0.52	39.8
7a	L1	245	9	295	3.7	0.350	13.8	LOS A	6.8	49.3	0.52	0.70	0.52	40.6
9	R2	51	3	71	5.9	* 0.596	51.6	LOS D	3.3	24.3	1.00	0.80	1.08	23.4
Approach		321	12	396	3.8	0.596	20.5	LOS B	6.8	49.3	0.60	0.72	0.62	35.2
West: Belgrave Street														
10	L2	50	6	63	12.0	0.176	32.3	LOS C	2.7	20.7	0.81	0.72	0.81	29.7
11	T1	14	1	17	7.1	0.176	27.6	LOS B	2.7	20.7	0.81	0.72	0.81	35.0
12a	R1	503	45	599	8.9	* 1.248	163.5	LOS F	56.6	426.7	1.00	1.46	2.26	14.1
Approach		567	52	678	9.2	1.248	148.0	LOS F	56.6	426.7	0.98	1.38	2.09	15.0
All Vehicles		2045	126	2367	6.2	1.248	55.3	LOS D	56.6	426.7	0.80	0.97	1.13	26.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Belgrave Street												
P2	Full	1	1	39.2	LOS D	0.0	0.0	0.93	0.93	197.1	205.3	1.04
North: Smith Street												
P3	Full	14	15	39.2	LOS D	0.0	0.0	0.93	0.93	203.8	213.9	1.05
West: Belgrave Street												
P4	Full	31	33	37.4	LOS D	0.1	0.1	0.91	0.91	206.0	219.2	1.06
All Pedestrians		46	48	38.0	LOS D	0.1	0.1	0.92	0.92	205.1	217.3	1.06

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 104 [River Street/North Street (Site Folder: Baseline + Construction scenario AM Peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: River Street														
22	T1	178	11	187	6.2	0.101	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
23	R2	18	3	19	16.7	0.028	8.9	LOS A	0.1	0.9	0.61	0.74	0.61	43.6
Approach		196	14	206	7.1	0.101	0.8	NA	0.1	0.9	0.06	0.07	0.06	49.3
NorthEast: North Street														
24	L2	27	4	28	14.8	0.360	9.0	LOS A	1.6	12.1	0.75	0.96	0.96	40.9
26	R2	107	9	113	8.4	0.360	16.8	LOS B	1.6	12.1	0.75	0.96	0.96	42.9
Approach		134	13	141	9.7	0.360	15.2	LOS B	1.6	12.1	0.75	0.96	0.96	42.5
NorthWest: River Street														
27	L2	181	18	191	9.9	0.381	4.8	LOS A	0.0	0.0	0.00	0.14	0.00	48.4
28	T1	496	9	522	1.8	0.381	0.2	LOS A	0.0	0.0	0.00	0.14	0.00	49.0
Approach		677	27	713	4.0	0.381	1.4	NA	0.0	0.0	0.00	0.14	0.00	48.9
All Vehicles		1007	54	1060	5.4	0.381	3.1	NA	1.6	12.1	0.11	0.24	0.14	48.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105 [North Street/Kemp Street/Saleyards Road/Second Lane (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kemp Street														
1b	L3	23	3	24	13.0	0.116	9.7	LOS A	0.4	3.1	0.45	1.03	0.45	46.3
2	T1	5	1	5	20.0	0.116	12.1	LOS A	0.4	3.1	0.45	1.03	0.45	41.1
3a	R1	42	3	44	7.1	0.116	12.3	LOS A	0.4	3.1	0.45	1.03	0.45	46.2
Approach		70	7	74	10.0	0.116	11.4	LOS A	0.4	3.1	0.45	1.03	0.45	46.0
NorthEast: Second Lane														
24a	L1	129	2	136	1.6	0.191	5.4	LOS A	0.1	0.6	0.02	0.23	0.02	51.7
25	T1	201	16	212	8.0	0.191	0.0	LOS A	0.1	0.6	0.02	0.23	0.02	57.9
26b	R3	4	3	4	75.0	0.191	8.2	LOS A	0.1	0.6	0.02	0.23	0.02	50.1
Approach		334	21	352	6.3	0.191	2.2	NA	0.1	0.6	0.02	0.23	0.02	55.2
North: Saleyards Road														
7b	L3	3	0	3	0.0	0.020	8.9	LOS A	0.1	0.5	0.41	0.96	0.41	45.8
8	T1	6	0	6	0.0	0.020	10.7	LOS A	0.1	0.5	0.41	0.96	0.41	41.6
9a	R1	3	1	3	33.3	0.020	13.7	LOS A	0.1	0.5	0.41	0.96	0.41	44.1
Approach		12	1	13	8.3	0.020	11.0	LOS A	0.1	0.5	0.41	0.96	0.41	43.2
SouthWest: North Street														
30a	L1	2	0	2	0.0	0.123	6.7	LOS A	0.4	2.7	0.22	0.16	0.22	52.3
31	T1	147	15	155	10.2	0.123	0.5	LOS A	0.4	2.7	0.22	0.16	0.22	57.7
32b	R3	42	0	44	0.0	0.123	7.4	LOS A	0.4	2.7	0.22	0.16	0.22	51.5
Approach		191	15	201	7.9	0.123	2.1	NA	0.4	2.7	0.22	0.16	0.22	56.2
All Vehicles		607	44	639	7.2	0.191	3.4	NA	0.4	3.1	0.14	0.32	0.14	54.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105a [Second Lane/Griffins Lane (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Second Lane														
5	T1	321	19	338	5.9	0.181	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	60.0
6	R2	1	0	1	0.0	0.181	6.2	LOS A	0.0	0.1	0.00	0.00	0.00	53.4
Approach		322	19	339	5.9	0.181	0.0	NA	0.0	0.1	0.00	0.00	0.00	59.9
North: Griffins Lane														
7	L2	1	0	1	0.0	0.021	5.2	LOS A	0.1	0.5	0.45	0.65	0.45	54.6
9	R2	13	2	14	15.4	0.021	7.6	LOS A	0.1	0.5	0.45	0.65	0.45	47.1
Approach		14	2	15	14.3	0.021	7.4	LOS A	0.1	0.5	0.45	0.65	0.45	47.5
West: Second Lane														
10	L2	4	2	4	50.0	0.110	6.1	LOS A	0.0	0.0	0.00	0.01	0.00	55.8
11	T1	188	16	198	8.5	0.110	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		192	18	202	9.4	0.110	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		528	39	556	7.4	0.181	0.3	NA	0.1	0.5	0.01	0.02	0.01	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 106 [Macleay Valley Way/Second Lane (Site Folder: Baseline + Construction scenario AM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macleay Valley Way														
1	L2	42	3	44	7.1	0.025	8.0	LOS A	0.0	0.0	0.00	0.66	0.00	71.9
2	T1	129	15	136	11.6	0.075	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
Approach		171	18	180	10.5	0.075	2.0	NA	0.0	0.0	0.00	0.16	0.00	91.2
North: Macleay Valley Way														
8	T1	323	14	340	4.3	0.180	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	279	16	294	5.7	0.253	8.8	LOS A	1.2	8.7	0.35	0.66	0.35	70.5
Approach		602	30	634	5.0	0.253	4.1	NA	1.2	8.7	0.16	0.30	0.16	83.7
West: Second Lane														
10	L2	127	13	134	10.2	0.311	9.0	LOS A	1.3	10.0	0.38	0.70	0.40	65.3
12	R2	60	3	63	5.0	0.311	20.3	LOS B	1.3	10.0	0.38	0.70	0.40	66.7
Approach		187	16	197	8.6	0.311	12.6	LOS A	1.3	10.0	0.38	0.70	0.40	65.7
All Vehicles		960	64	1011	6.7	0.311	5.4	NA	1.3	10.0	0.18	0.36	0.18	80.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Waterfall Way/Kempsey Road (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kempsey Road														
1	L2	14	3	15	21.4	0.013	8.6	LOS A	0.0	0.4	0.12	0.61	0.12	62.0
3	R2	1	0	1	0.0	0.001	8.1	LOS A	0.0	0.0	0.20	0.59	0.20	69.0
Approach		15	3	16	20.0	0.013	8.5	LOS A	0.0	0.4	0.13	0.61	0.13	62.4
East: Waterfall Way														
4	L2	1	0	1	0.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
5	T1	42	2	44	4.8	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
Approach		43	2	45	4.7	0.023	0.2	NA	0.0	0.0	0.00	0.01	0.00	79.6
West: Waterfall Way														
11	T1	31	1	33	3.2	0.017	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
12	R2	6	1	6	16.7	0.005	7.3	LOS A	0.0	0.2	0.13	0.59	0.13	63.5
Approach		37	2	39	5.4	0.017	1.2	NA	0.0	0.2	0.02	0.10	0.02	76.8
All Vehicles		95	7	100	7.4	0.023	1.9	NA	0.0	0.4	0.03	0.14	0.03	75.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Lord Street/Rudder Street intersection (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Lord Street														
5	T1	826	45	869	5.4	0.464	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
6	R2	35	3	37	8.6	0.081	13.1	LOS A	0.3	2.2	0.75	0.90	0.75	48.0
Approach		861	48	906	5.6	0.464	0.8	NA	0.3	2.2	0.03	0.04	0.03	59.0
NorthEast: Rudder Street														
1	L2	45	2	47	4.4	0.026	8.6	LOS A	0.0	0.0	0.00	0.53	0.00	54.8
2	R2	189	12	199	6.3	1.043	93.1	LOS F	10.5	77.8	1.00	1.72	3.87	21.7
Approach		234	14	246	6.0	1.043	76.8	LOS F	10.5	77.8	0.81	1.49	3.13	24.9
NorthWest: Lord Street														
3	L2	239	12	252	5.0	0.671	6.0	LOS A	3.4	24.3	0.11	0.11	0.11	57.1
4	T1	908	32	956	3.5	0.671	0.1	LOS A	3.4	24.3	0.11	0.11	0.11	58.2
Approach		1147	44	1207	3.8	0.671	1.3	NA	3.4	24.3	0.11	0.11	0.11	58.0
All Vehicles		2242	106	2360	4.7	1.043	9.0	NA	10.5	77.8	0.15	0.23	0.39	51.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 103 [Smith Street/Belgrave Street (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Smith Street														
21a	L1	643	43	707	6.7	* 0.674	19.2	LOS B	17.5	129.6	0.75	0.88	0.75	42.8
23a	R1	377	14	438	3.7	0.547	27.4	LOS B	15.9	114.8	0.80	0.81	0.80	32.0
Approach		1020	57	1145	5.5	0.674	22.3	LOS B	17.5	129.6	0.77	0.85	0.77	39.1
North: Smith Street														
7	L2	25	0	30	0.0	0.637	19.3	LOS B	18.9	136.6	0.71	0.79	0.71	36.1
7a	L1	466	19	561	4.1	0.637	20.4	LOS B	18.9	136.6	0.71	0.79	0.71	36.0
9	R2	46	2	64	4.3	* 0.591	57.2	LOS E	3.3	24.0	1.00	0.79	1.07	22.3
Approach		537	21	655	3.9	0.637	24.0	LOS B	18.9	136.6	0.74	0.79	0.75	33.6
West: Belgrave Street														
10	L2	92	4	115	4.3	0.268	31.9	LOS C	5.7	40.7	0.79	0.73	0.79	29.9
11	T1	34	0	40	0.0	0.268	27.3	LOS B	5.7	40.7	0.79	0.73	0.79	35.2
12a	R1	655	24	780	3.7	* 1.268	174.0	LOS F	80.2	578.7	1.00	1.44	2.17	13.5
Approach		781	28	935	3.6	1.268	150.2	LOS F	80.2	578.7	0.96	1.32	1.94	14.7
All Vehicles		2338	106	2736	4.5	1.268	66.4	LOS E	80.2	578.7	0.83	1.00	1.16	23.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Belgrave Street												
P2	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	202.1	205.3	1.02
North: Smith Street												
P3	Full	40	42	44.3	LOS E	0.1	0.1	0.94	0.94	208.8	213.9	1.02
West: Belgrave Street												
P4	Full	51	54	42.4	LOS E	0.1	0.1	0.92	0.92	211.0	219.2	1.04
All Pedestrians		92	97	43.2	LOS E	0.1	0.1	0.93	0.93	210.0	216.7	1.03

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 104 [River Street/North Street (Site Folder: Baseline + Construction scenario PM Peak)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: River Street														
22	T1	396	13	417	3.3	0.220	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
23	R2	32	3	34	9.4	0.033	6.7	LOS A	0.1	1.0	0.50	0.64	0.50	44.9
Approach		428	16	451	3.7	0.220	0.6	NA	0.1	1.0	0.04	0.05	0.04	49.5
NorthEast: North Street														
24	L2	25	1	26	4.0	0.516	9.5	LOS A	2.7	20.7	0.78	1.03	1.22	39.7
26	R2	162	16	171	9.9	0.516	19.5	LOS B	2.7	20.7	0.78	1.03	1.22	41.4
Approach		187	17	197	9.1	0.516	18.1	LOS B	2.7	20.7	0.78	1.03	1.22	41.2
NorthWest: River Street														
27	L2	148	7	156	4.7	0.259	4.7	LOS A	0.0	0.0	0.00	0.17	0.00	48.4
28	T1	310	13	326	4.2	0.259	0.1	LOS A	0.0	0.0	0.00	0.17	0.00	48.9
Approach		458	20	482	4.4	0.259	1.6	NA	0.0	0.0	0.00	0.17	0.00	48.7
All Vehicles		1073	53	1129	4.9	0.516	4.1	NA	2.7	20.7	0.15	0.27	0.23	47.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105 [North Street/Kemp Street/Saleyards Road/Second Lane (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kemp Street														
1b	L3	37	3	39	8.1	0.199	9.3	LOS A	0.7	5.3	0.44	1.04	0.44	46.4
2	T1	5	0	5	0.0	0.199	10.8	LOS A	0.7	5.3	0.44	1.04	0.44	41.3
3a	R1	79	1	83	1.3	0.199	12.4	LOS A	0.7	5.3	0.44	1.04	0.44	46.3
Approach		121	4	127	3.3	0.199	11.4	LOS A	0.7	5.3	0.44	1.04	0.44	46.1
NorthEast: Second Lane														
24a	L1	62	6	65	9.7	0.137	5.7	LOS A	0.2	1.1	0.07	0.18	0.07	51.8
25	T1	162	6	171	3.7	0.137	0.1	LOS A	0.2	1.1	0.07	0.18	0.07	58.2
26b	R3	11	2	12	18.2	0.137	7.5	LOS A	0.2	1.1	0.07	0.18	0.07	52.2
Approach		235	14	247	6.0	0.137	1.9	NA	0.2	1.1	0.07	0.18	0.07	56.1
North: Saleyards Road														
7b	L3	9	5	9	55.6	0.037	11.8	LOS A	0.1	1.1	0.46	0.97	0.46	43.4
8	T1	8	0	8	0.0	0.037	10.6	LOS A	0.1	1.1	0.46	0.97	0.46	41.4
9a	R1	4	2	4	50.0	0.037	16.8	LOS B	0.1	1.1	0.46	0.97	0.46	43.4
Approach		21	7	22	33.3	0.037	12.3	LOS A	0.1	1.1	0.46	0.97	0.46	42.6
SouthWest: North Street														
30a	L1	7	2	7	28.6	0.168	6.5	LOS A	0.3	2.3	0.11	0.10	0.11	52.6
31	T1	241	15	254	6.2	0.168	0.2	LOS A	0.3	2.3	0.11	0.10	0.11	58.7
32b	R3	34	1	36	2.9	0.168	7.0	LOS A	0.3	2.3	0.11	0.10	0.11	52.3
Approach		282	18	297	6.4	0.168	1.2	NA	0.3	2.3	0.11	0.10	0.11	57.7
All Vehicles		659	43	694	6.5	0.199	3.7	NA	0.7	5.3	0.17	0.33	0.17	54.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 105a [Second Lane/Griffins Lane (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Second Lane														
5	T1	225	13	237	5.8	0.130	0.0	LOS A	0.0	0.3	0.02	0.01	0.02	59.9
6	R2	3	1	3	33.3	0.130	7.9	LOS A	0.0	0.3	0.02	0.01	0.02	52.6
Approach		228	14	240	6.1	0.130	0.1	NA	0.0	0.3	0.02	0.01	0.02	59.8
North: Griffins Lane														
7	L2	1	0	1	0.0	0.022	5.7	LOS A	0.1	0.6	0.49	0.68	0.49	54.1
9	R2	12	3	13	25.0	0.022	8.3	LOS A	0.1	0.6	0.49	0.68	0.49	46.4
Approach		13	3	14	23.1	0.022	8.1	LOS A	0.1	0.6	0.49	0.68	0.49	46.9
West: Second Lane														
10	L2	13	2	14	15.4	0.187	5.8	LOS A	0.0	0.0	0.00	0.02	0.00	57.3
11	T1	318	20	335	6.3	0.187	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.7
Approach		331	22	348	6.6	0.187	0.3	NA	0.0	0.0	0.00	0.02	0.00	59.6
All Vehicles		572	39	602	6.8	0.187	0.4	NA	0.1	0.6	0.02	0.03	0.02	59.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 106 [Macleay Valley Way/Second Lane (Site Folder: Baseline + Construction scenario PM Peak)]

Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Macleay Valley Way														
1	L2	89	3	94	3.4	0.052	7.9	LOS A	0.0	0.0	0.00	0.66	0.00	73.2
2	T1	295	11	311	3.7	0.163	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		384	14	404	3.6	0.163	1.8	NA	0.0	0.0	0.00	0.15	0.00	92.1
North: Macleay Valley Way														
8	T1	216	12	227	5.6	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
9	R2	137	12	144	8.8	0.163	10.2	LOS A	0.7	5.0	0.49	0.75	0.49	68.3
Approach		353	24	372	6.8	0.163	3.9	NA	0.7	5.0	0.19	0.29	0.19	84.7
West: Second Lane														
10	L2	256	5	269	2.0	0.510	11.7	LOS A	3.4	25.5	0.59	0.88	0.91	65.3
12	R2	67	16	71	23.9	0.510	25.3	LOS B	3.4	25.5	0.59	0.88	0.91	59.2
Approach		323	21	340	6.5	0.510	14.5	LOS B	3.4	25.5	0.59	0.88	0.91	63.9
All Vehicles		1060	59	1116	5.6	0.510	6.4	NA	3.4	25.5	0.24	0.42	0.34	79.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

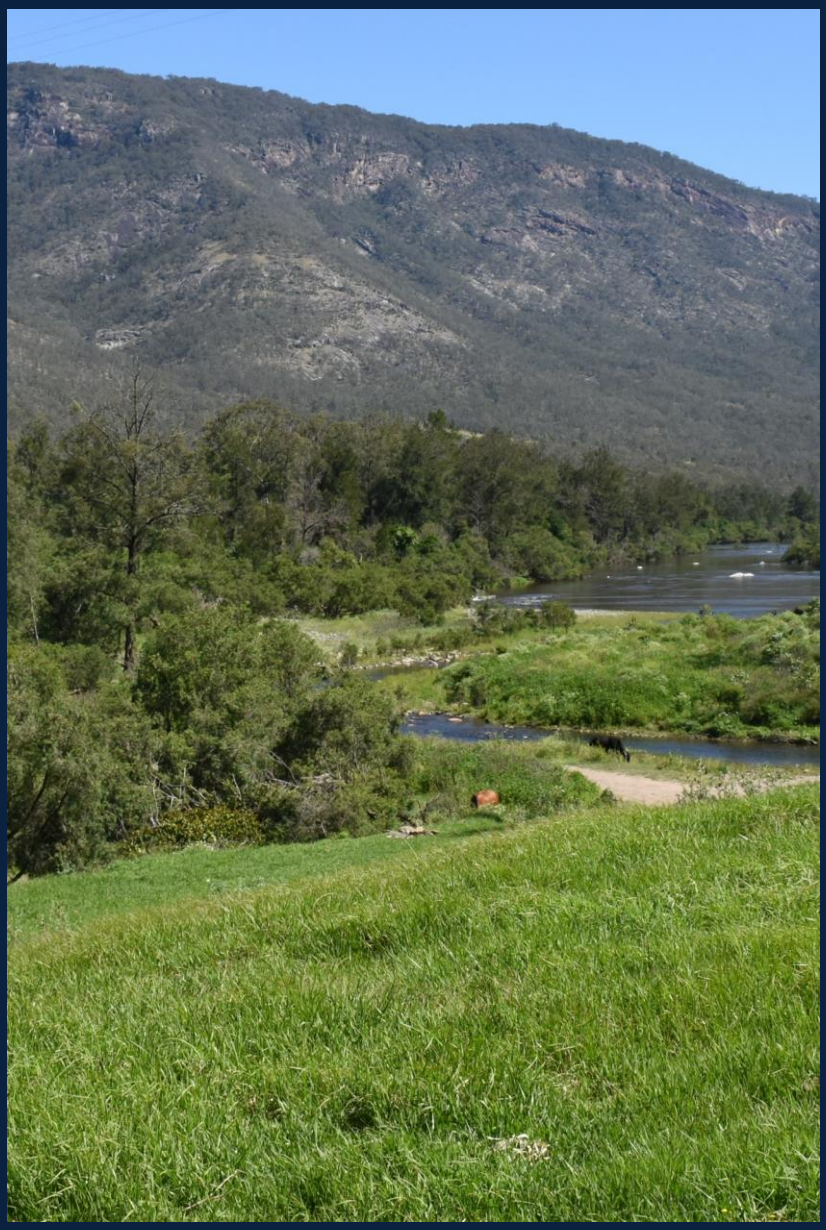
Attachment C

SMEC Road safety audit report

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Road Safety Audit – Existing Conditions

Armidale to Kempsey Road

Prepared for SMEC, Oven Mountain Pumped Hydro Project

19 November 2021

Document Control

Document Control

Document	Stage 4 Road Safety Audit Report
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A	19 November 2021	Trevor Ferris	Lance Vickery	Stephen Williamson

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Audit Summary

Audit Details	
Audit ID	
Project	Oven Mountain Pumped Storage Hydro Project
Client	SMEC, on behalf of OMPSH
Address	52 Victoria Street, Grafton NSW 2060
Telephone	6642 7737
Client Project Manager	Stephen Williamson
Audit Team	Trevor Ferris (Lead Auditor) Chris Weavers (Level 3)
Audit Stage	Stage 4 Existing Conditions
Audit Date	19/11/2021
Previous Audits	N/A

Summary of Audit Findings

The road safety audit findings reflect the usage of the area as an access road to a dam construction site with up to 100 heavy vehicles per month using it for delivery access to the Oven Mountain Pumped Storage Hydro construction phase.

The construction site is on Oven Mountain, south of the Macleay River near the confluence with Georges Creek. The Armidale to Kempsey Road runs from Waterfall way near Wollomombi to Kempsey, allowing access options from Armidale and from Kempsey to the construction site.

The road has a low standard alignment in steep terrain.

- The road is listed as a 100km/h speed road, the road standard is generally below 70km/h
- There are long sections of narrow road requiring passing vehicles to use the verge area
- There are section of single lane width that will require Give Way priority and traffic control
- Rock is continuously falling onto the road with a high risk of land slips
- The high fill slopes are on steep cross slopes of unknown strength, there is a risk for heavy loads running close to the formation edges
- The road is likely to experience road closures due to land slips
- With up to 600 workers on site during construction safety strategies will be required for protection against storm flooding, road closures and bush fires.

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1 Introduction

1.1 Background

The Oven Mountain Pumped Hydro Energy Storage project is a 600MW 'off river' development located on private land near the Macleay River between Armidale and Kempsey and is expected to provide up to 12 hours of storage. The project has highly favourable and studied natural terrain, including an excellent head height and only a short distance between the two reservoirs.

A closed loop will be constructed that pumps water from a lower reservoir to an upper reservoir to store energy. Water is released back down to the lower reservoir, generating electricity as needed. It is effectively a giant 'water battery'.

The project is in the Armidale Regional Local Government Area, approximately 60km southeast of Armidale and 70km northwest of Kempsey, via the Kempsey-Armidale road. The proposal is located on private land near the Macleay River.

During the construction phase of the project, spanning approximately 3 years, the project will create around 600 direct plus supply chain jobs spanning a wide range of skills and activities. In order to accommodate the level of construction required, significant upgrade of local roads will be needed for access from Kempsey and Armidale. A construction camp is expected to be established to house workers and reduce the light vehicle traffic load to access the site.

Once constructed, around 30 operational jobs will be required to support the project over its 50+ year life and the project will seek to maximise ongoing local economic and community benefits as much as possible.

All-weather road access will be required over the project's operational life to ensure high project availability and local road safety. Roads and the reservoirs have the potential to improve emergency services access and fire management.

1.2 Purpose and Scope of this Report

The report details the findings of the Stage 4 (Existing Road Conditions) Road Safety Audit undertaken on 15 and 16 November 2021. The audit was conducted by Trevor Ferris (Lead Auditor) and Chris Weavers (Level 3 Auditor).

The purpose of the road safety audit is to assess the suitability of the existing Armidale to Kempsey Road between the Waterfall Way near Wollomombi and Kempsey to provide access for construction and delivery vehicles to construct and maintain the Oven Mountain Pumped Storage Hydro project.

Vehicles expected to access the construction site include:

- Single unit trucks and buses
- Semi-trailers with standard and over-width loads
- Special platform trailers 21.6m long by 4.2m wide to transport electrical transformers and power generation turbine components. The trailer may be linked to prime movers.

There are three main options to access the site located near Georges Creek on the Armidale to Kempsey Road:

- Waterfall Way to Georges Creek, accessed through Armidale
- Georges Creek to Smiths Creek, accessed from Kempsey to Georges Creek and
- Smiths Creek to Kempsey if a bridge is constructed near Smiths Creek and an alternate route is constructed on the southern side of the Macleay River to access the construction site.

1.3 Project location

The site is located on private property on Oven Mountain. The site locality is shown in Figure 1-1 below, and the specific site audited and documented is shown in Figure 1-2 below.



Figure 1-1: Site Locality

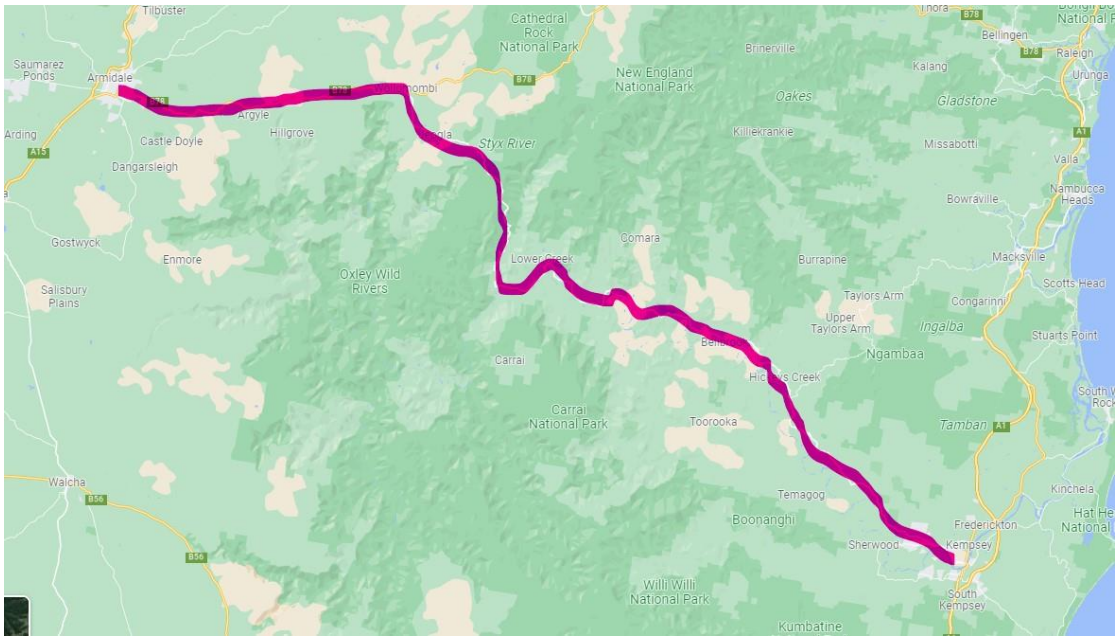


Figure 1-2: Location of audit

Site access will be off the Armidale-Kempsey Road with a new access road from Georges Junction, crossing the Macleay River at the base of Oven Mountain. An alternative access is being considered with a new access road intersecting the Armidale-Kempsey Road near Whites Creek.

1.4 Previous Audits

There are no previous audits undertaken on this project as far as the audit team is aware.

2 Road Safety Audit Details

2.1 Road Safety Audit

A road safety audit is a formal examination of a future road or traffic project or an existing road, in which an independent, qualified team reports on the project's crash potential and safety performance. The road safety audit process concerns the safety of all road users.

The Lead Auditor and audit team must be independent, so that the road is viewed with "fresh eyes". The purpose of the audit is not to rate the road, but rather to identify any road safety concerns.

In reviewing the safety aspects of a road, the reporting procedure is not intended as a redesign process, but to outline potential or existing road safety issues and establish a basis upon which ongoing works may produce an acceptable solution to the safety problem.

The objectives of the road safety audit are to:

1. Select an audit team which is independent and has appropriate skills for the particular project.
2. Provide the audit team with all the necessary information to allow an adequate assessment of the project.
3. Ensure the design team understands the audit process; to provide the audit team with any additional information, identify key issues, constraints and potential issues requiring specific consideration.
4. Safety audit the designs and background information and form conclusions about the safety performance and crash potential of the road.
5. See how the proposal interacts with its surroundings and nearby roads; to visualise potential impediments and conflicts for road users.
6. Report on the audit's findings, and if requested by the client, recommendations regarding how identified safety deficiencies may be addressed.
7. Discuss the findings and recommendations for corrective action.
8. Deal with audit findings or recommendations in an effective manner; to judge whether the recommendations of the road safety audit should be implemented and, where it is decided otherwise, to give reasons in writing for the decision; to put agreed audit recommendations into effect.
9. To disseminate the knowledge gained from an audit, for the wider benefit of road and traffic designers.

This report cover items 1 – 7 above, the final two objectives follow on from this report and are the responsibility of the project manager/road authority.

2.2 Audit Team Details

Client: SMEC Australia, on behalf of Oven Mountain Pumped Storage Hydro Scheme

Lead Road Safety Auditor: Trevor Ferris, SMEC

Auditor level: Level 3 (Lead)
Auditor ID: RSA- C172580

Chris Weavers, an experienced Lead Road Safety Auditor and director of Weavers Consulting Group Pty Ltd

Auditor level: Level 3

2.3 Commencement Meeting

A commencement meeting was undertaken for this road safety audit between Trevor Ferris (Level 3 Auditor, SMEC) and Lance Vickery (SMEC) on 15 November 2021, in which specifics of the project were discussed. Links to the design documentation as well as additional project information were provided.

2.4 Site Inspection and Audit

The site inspection was carried out on the 15-16 November 2021 by driving between Kempsey and Armidale, returning to Kempsey the following day. The weather was sunny for both days of the site inspection. The road conditions were dry.

At the time of the audit a preferred access route was not confirmed. The audit assessment has considered from:

- Armidale to the site via Waterfall Way and the Armidale Kempsey Road intersecting with a new construction access road at Georges Junction near the confluence of the Macleay River and Georges Creek
- The alternate access is from Kempsey along the Armidale-Kempsey Road to Georges Junction.
- Due to unstable rock slopes in the upper section from Whites Creek to Georges Junction an option to cross the Macleay River near Whites Creek and construct a new access road south of the Macleay River
- There are two access options through Kempsey from Fredericton travelling along Second Lane and North Street or travelling into Kempsey business area turning into Belgrave Street

The audit report has been divided into sections to separate the sections to improve reporting clarity.

2.5 Completion Meeting

A completion meeting was undertaken on 17 November 2021 between Trevor Ferris and Lance Vickery.

2.6 References and Documentation Audited

The following general standards and guidelines were used as a reference in conducting this Road Safety Audit:

- Transport Roads and traffic Authority “Guidelines for Road Safety Audit Practices”, 2011.
- Austroads “Guide to Road Safety, Part 6: Managing Road Safety Audits”, 2019
- Austroads “Guide to Road Safety, Part 6A: Implementing Road Safety Audit”, 2019.
- Austroads, Guide to Road Design Series, 2009-2017.
- Standards Australia “AS 1742 Series 2009: Manual of uniform traffic control devices”, 2009.
- Austroads Road Safety Engineering Toolkit

The following documents were reviewed during the audit:

Table 2-1: Documents reviewed during the audit

Part	Package	Drawings
1	Swept paths	Austroads vehicle turning templates
2	Platform Trailer	Rex J Andrews Pty Ltd, 12x8 960 Series Platform Trailer

The audit has considered the following items:

- Consideration of heavy vehicle volumes
- Existing road features and constraints
- Verification checks including swept paths
- Maintenance access requirements.

2.7 Limitations on this Audit

The following items have been excluded from the audit:

- Assessment of site during night time / reduced visibility
- Formal sight distance and acceleration/deceleration verification checks.

The following items are to be considered when reviewing the findings of the audit:

- Although no formal mechanism is currently adopted in the NSW road safety auditing procedure for assessing against Safe Systems requirements, this audit has attempted to relate certain incidents back to Safe Systems speeds and impact types
- In order to apply the current AGRD Part 6 (2020), the road authority or local jurisdiction is required to determine a Network Roadside Risk Intervention Threshold (NRRIT) risk value to which all project-specific risks can be compared to. A NRRIT has not been determined for this project and therefore the current AGRD Part 6 (2020) cannot be applied in full. However, an attempt has been made in this audit to understand potential risks of the road and roadside features in relation to the risk assessment practice demonstrated in AGRD Part 6 (2020).

3 Assessment Methodology and Details

3.1 Risk Assessment System

Identified issues and deficiencies have been rated based on estimated crash frequency, crash severity and level of risk in accordance with *Austroads Guide to Road Safety, Part 6A: Implementing Road Safety Audits (2019)*. Austroads specifies that this is not a *scientific system and professional judgement should be used*.

3.1.1 Crash Frequency

The probable frequency of an incident or crash occurring has been estimated for each issue listed in the Road Safety Audit findings based on the options listed in Table 3-1.

Table 3-1: Crash Frequency

Frequency	Description
Frequent (F)	Once or more per week
Probable (P)	Once or more per year (but less than once a week)
Occasional (O)	Once every five or ten years
Improbable (I)	Less often than once every ten years

3.1.2 Crash Severity

The severity of a crash identified in the Road Safety Audit is assessed based on the options listed in Table 3-2.

Table 3-2: Crash Severity

Severity	Description	Examples
Catastrophic (C)	Likely multiple deaths	• High-speed, multi-vehicle crash on a freeway. • Car runs into crowded bus stop. • Bus and petrol tanker collide. • Collapse of a bridge or tunnel.
Serious (S)	Likely death or serious injury	• High or medium-speed vehicle/vehicle collision. • High or medium-speed collision with a fixed roadside object. • Pedestrian or cyclist struck by a car.
Minor (M)	Likely minor injury	• Some low-speed vehicle collisions. • Cyclist falls from bicycle at low speed. • Left-turn rear-end crash in a slip lane.
Limited (L)	Likely trivial injury or property damage only	• Some low-speed vehicle collisions. • Pedestrian walks into object (no head injury). • Car reverses into post.

3.1.3 Level of Risk

Findings are rated for their importance according to a four tiered system based on the matrix in Table 3-3 with a suggested treatment approach outlined in Table 3-4

Table 3-3: Risk Matrix

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 3-4: Treatment Approach

Risk rating	Suggested treatment approach
Intolerable	Must be corrected.
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
Low	Should be corrected or the risk reduced, if the treatment cost is low.

3.2 Safe Systems

The "Safe Systems" approach is regarded as international best practice in road safety and provides an outcome whereby death and serious injury are virtually eliminated amongst users of the road system. Safe Systems is the management and design of the road system such that impact energy on the human body is firstly avoided or secondly managed at tolerable levels by manipulating speed, mass and crash angles to reduce crash injury severity. (Austroads 2018b – AP-R560-18).

With the adoption of the Safe Systems approach, it is important that it is integrated into the Road Safety process. There is currently only limited guidance on how this integration should be done and Austroads (Guide to Road safety Part 6, 2019) suggests that *'road safety auditors are given the freedom on how to go about meeting these requirements'*. This section describes how the Safe Systems approach has been integrated into this Road Safety Audit.

3.2.1 Integration – Severity

One of the suggested ways of integration of the Safe Systems approach in a Road Safety audit is *'relating possible crash forces to tolerable levels of the human body before fatal and serious injury (FSI) occurs (regardless of the likelihood) when identifying and assessing FSI risks'* This is covered with the use of the crash severity matrix shown in Table 3-2, where Catastrophic (C) and Serious (S) highlight the finding that could result in a fatal or serious injury. One minor adjustment with the assessment of severity will be the use of the Safe Systems speed, discussed below.

3.2.2 Integration – Speed

Embedding Safe System principles in RSA practice is a key to integration. Understanding and applying these new principles is something that is strongly encouraged within SMEC and is fundamental to the development of our staff, not only our auditors. To aid the auditors a more quantitative approach to assessing the potential severity of a crash is to use critical speed thresholds to determine if a fatality or serious injury could occur. There is some research done in this area, but Austroads recognise that more needs to be undertaken. Reviewing this research Jurewicz, Sobhani et al. (2015) "*Relationships between bullet vehicle impact speed and probability of a MAIS 3+ injury to a target vehicle occupant for different crash configurations*" provides a comprehensive approach.

Table 3-5 Relationship Between Vehicle Impact Speed and Probability of Serious Injury

Austroads 2015 (AP-R498-15 Figure 4.8)			
	10% Severe Injury Risk	50% Severe Injury Risk	100% Severe Injury Risk
Crash Type	Bullet Vehicle Impact Speed		
Car → Pedestrian/Cyclist/Motorcyclist	20	38	75
Car → Tree/Pole	20	38	75
Car → Car (Adjacent Direction)	30	42	75
Car → Car (Opposing – Turning)	30	54	100
Car → Car (Head-On)	30	42	75
Car → Car (Rear-End)	55	83	>100

It must be noted that the speeds referred to are impact speed, which has many contributing factors, such as weather conditions, distance of hazard from travel lane, road geometry etc. It is imperative that the auditor takes all the factors into consideration when determining the impact speed. A separate column is provided in the findings table to assign impact speed where applicable.

3.2.3 Integration – Crash Type

A method used to improve safe System alignment is the adoption of treatments that reduce exposure, likelihood and severity in a compensatory way across key crash types. These crash types are:

- Car / Pedestrian / Cyclist
- Car / Motorcyclist
- Car / Tree / Pole
- Car / Car (side impact, intersection)
- Car / Car (Head On)

By highlighting the audit findings that relate to these types of crashes, mitigation measures or recommendations can be aligned with the Safe Systems approach. A separate column is provided in the findings table to assign a crash type where applicable.

4 Road Safety Audit Findings

The following section details the findings from the road safety audit.

Construction traffic would travel on Waterfall Way from Armidale to the intersection with Armidale-Kempsey Road at Wollomombi and then follow the Armidale-Kempsey Road to Georges Junction. Waterfall Way to Georges Junction is approximately 40km.

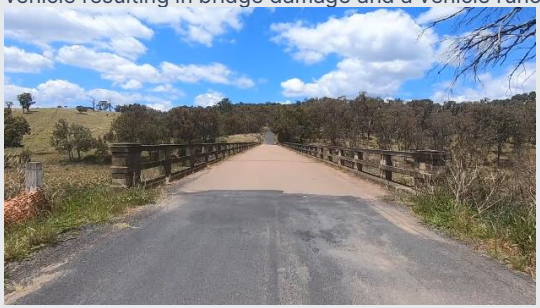
Waterfall Way is considered to be safe for all expected traffic, no safety issues were identified. The audit findings table starts at the intersection of Waterfall Way and the Armidale-Kempsey Road.

The alternate route is from Kempsey to Georges Junction, a distance of approximately 70km. The road is sealed between Kempsey and Pee Dee Creek bridge. The road between Pee Dee Creek and Georges Junction has a gravel surface.

There is an alternate option to construct a bridge over the Macleay River near Smiths Creek and construct a new access road to the construction site along the southern side of the Macleay River.

Table 4-1 Audit Findings

ID	Category	Safe Systems		Audit Finding	Risk Assessment		
		Crash Type	Crash Speed (km/h)		Frequency	Severity	Level of Risk
		Waterfall Way to Georges Junction					
001	Intersection Safety	Rear end and side impact	100	**Description:** The northbound right turn from Waterfall Way is too short for deceleration and storage due to the close proximity to an existing bridge. **Safety Risk:** This will require vehicles to slow down significantly within the through lane on Waterfall Way which may lead to a rear end collision with a vehicle behind them. The lack of appropriate warning signage will exacerbate the above issue due to driver inattention on a rural highway. 	Occasional	Serious	High

002	Roadside Activities	Rear end / side impact	100 - 50	**Description:** The approach to Waterfall Way from Kempsey is depressed in side cuts reducing intervisibility between vehicles on Waterfall Way and approaching vehicles from Kempsey. There re no acceleration lanes on Waterfall Way - **Insufficient acceleration distance:** there is a significant speed difference between vehicles travelling at 100km/h on Waterfall Way and entering vehicles from Kempsey - **Insufficient sight distance to approaching vehicles:** Minimum gap sight distance is not available for an entering vehicle . **- Safety Risk:** Due to the substandard features associated with the intersection there is a risk of rear end or side impact collisions. When considered in combination of all the factors the likelihood of an incident occurring increases. 	Occasional	Serious	High
003	Roadside hazard	Impact with bridge safety rail	100	**Description:** Oaky River bridge has substandard concrete parapets and no hazard delineation. **Safety Risk:** There is a risk a vehicle may impact the bridge parapet due to poor visibility or avoiding an approaching vehicle resulting in bridge damage and a vehicle runoff. 	Occasional	Serious	High

004	Roadside hazards	Impact with road side vegetation	>100	**Observation:** The Armidale-Kempsey Road is a gravel surfaced two-way road on an undulating alignment for the first 20km to Raspberry Road with property accesses occurring along the alignment except the sealed winding section through the Styx River gorge. **Safety risk:** The road speed limit is 100km/h, there is a risk of drivers not familiar to the road running into road side hazards such as vegetation. 	Occasional	Serious	High
005	Safety Barriers	Oversized vehicle unable to remain on road	N/A	**Description:** The eastbound approach to the Styx River bridge has a narrow culvert followed by a small radius horizontal curve. Trucks will occupy the full road width and oversize vehicles may have difficulty with the combination of the narrow culvert followed by a tight curve. **Safety Risk:** There is a risk of an errant vehicle running off the culvert 	Improbable	Minor	Low

006	Safety Barriers	N/A	N/A	**Description:** The Styx River concrete bridge is a single lane bridge with a small radius horizontal curve on the eastern end of the bridge. Oversized vehicles may not be able to fit around the end barriers. **Safety Risk:** An oversized vehicle may become stuck blocking the road. 	Improbable	Minor	Low
007	Safety Barriers	N/A	N/A	**Description:** Safety barriers have not been installed for most of the gravel surface alignment leaving road side hazards and steep fill slopes exposed to vehicles. There are no posted speed limits on this section of road. **Safety Risk:** Errant vehicles may run into hazards such as vegetation or roll down steep side slopes.	Improbable	Serious	Medium
008	Vehicle conflict	Vehicle to vehicle due to road width	N/A	**Description:** East of Raspberry Road the road narrows, remaining on the top of a ridge for 5km. Vehicles have to move off the road to avoid approaching trucks. **Safety Risk:** While there is generally adequate verge width to avoid approaching vehicles there is a risk of vehicles colliding.  	Improbable	Serious	Medium

009	Sight distance	Collision with approaching vehicle	N/A	**Description:** From Chainage 25km to Georges Junction the road is narrow with no edge protection to the steep side slope. The road is graded down towards Kempsey at approximately 9%. **Safety Risk:** There is a risk of an errant vehicle rolling down the slope. **Description:** From Chainage 25km to Georges Junction the road is narrow with limited sight distance to approaching vehicles.. **Safety Risk:** There is a risk of vehicles colliding on the blind bends.. 	Improbable	Serious	Medium
010	Roadside Activities	Road closure	100	**Description:** Georges Creek bridge is narrow and may not provide access for oversized vehicles **Safety Risk:** There is a risk of an over-width vehicle blocking the road 	Improbable	Limited	Low
011	Safety Barriers	N/A	N/A	**Observation:** Due to the narrow road width, steep side slopes and small radius horizontal curves the road will require additional passing bays and turn out lanes to allow vehicles to pass safely. Some horizontal curves will require widening to provide adequate width for oversized vehicle swept paths	Occasional	Minor	Medium

		Georges Junction to Smiths Creek					
012	Falling rocks	Site access blockage due to land slips	N/A	**Description:** The 15km section of road between Georges Junction and Smiths Creek traverses' areas with extremely steep cut and fill side slopes. The rock cuts are generally unstable while some fill slopes are supported by old dry-stone walls of unknown strength. **Safety Risk:** During adverse weather event there is a high risk of cut faces collapsing over the road. The bearing strength of the fill slopes to the river are also at risk of collapse under heavy construction vehicle loads.  	probable	Serious	Intolerable
013	Oversized vehicle access	Lack of vehicle swept path widths	N/A	**Description:** Small radius horizontal curves will require widening to provide adequate swept paths to provide access for over-width vehicles **Safety Risk:** Wheel loads close to the edge of fill slopes may cause the road to collapse resulting in closures and construction delays. 	probable	Minor	High

014	Flood water	Water over road	N/A	**Description:** Where the road crosses drainage gullies the flood debris has blocked road culverts resulting in stormwater flowing across the road **Safety Risk:** There is a risk of dangerous flood water depths and road pavement collapse due to pavement saturation.  	Probable	Serious	Intolerable
015	Narrow Road	Single lane road	100	**Description:** There is a length of narrow, single lane sealed road (3.0m wide) through Lower Creek to the west of Dyke River bridge. 4.2m wide, the platform trailer wheel path will be outside the bitumen. **Safety Risk:** The shoulders will not be able to support the wheel loads particularly when saturated resulting in pavement failure and an irregular destabilising heavy vehicle loads resulting in rough pavement surfaces 	Probable	Minor	High

016	Falling rocks	Vehicle damage	N/A	**Description:** Between Dyke River and Smiths Creek there is a narrow section of road with steep side slopes to the river. The cut slopes are unstable with a high risk of failure and the fill slopes are generally supported by old dry stone walls. **Safety Risk:** There is a high risk of land slips during adverse weather events and under heavy wheel loads when transporting power generators and turbine components. There is a risk of vehicles being crushed by a land slip.  	Probable	Serious	Intolerable
017	Vehicle collision	Head on crash	N/A	**Description:** There are blind corners around vertical cut faces that restrict sight distance to approaching vehicles . **Safety Risk:** There is a risk of vehicle collisions resulting in vehicles rolling down fill slopes to the river. 	Probable	Serious	Intolerable
018	Vehicle collision	Head on crash	100	**Description:** Smiths Creek bridge is a single lane bridge with limited approach sight distance. **Safety Risk:** There is a risk of vehicle collisions due to the road width and reduced sight distance available. 	Improbable	Serious	High

		Smiths Creek to Kempsey					
019	Vehicle collision	Head on crash		**Description:** While the general topography east of Smiths Creek is more open there are constrained sections with steep side slopes and unstable rock cut formations resulting in poor sight distance around curves. **Safety Risk:** There is a risk of vehicle to vehicle collisions due to narrow road formations and poor sight distance.  	Probable	Serious	Intolerable
020	Falling rocks	Land slip on road		**Description:** Lagoon Creek to Blackbird Creek . The terrain is generally open with an undulating alignment except for a short section adjacent to the Macleay River that is a single lane formation with vertical rock faces and steep fill slopes into the Macleay River. **Safety Risk:** Vehicle collisions on narrow roads and damage to vehicles from falling rocks. 	Probable	Serious	Intolerable

021	Falling rocks	Land slip on road		**Description:** Blackbird Creek to Pee Dee Nature Reserve. There are short sections with restricted width due to steep side slopes and the Macleay River. **Safety Risk:** Vehicle collisions on narrow roads and damage to vehicles from falling rocks.  	Probable	Serious	Intolerable
022	Vehicle Collision	Vehicle swept path		**Description:** The Pee Dee Nature Reserve has small radius horizontal curves the may need widening for vehicle swept path requirements. The Armidale – Kempsey Road is a school bus run. **Safety Risk:** Long vehicles will use the full road width to negotiate small radius curves and the school bus may stop regularly without a pull off area.  	Improbable	Minor	Low

023	Narrow road formation	Vehicle side swipe	100	**Description:** The road is sealed between Pee Dee Creek and Kempsey with 3.5m lanes and narrow shoulders. **Safety Risk:** Opposing trucks will have a reduced offset between vehicles with a risk of vehicle side swipes on tight bends.  	Improbable	Minor	Low
024	Vehicle damage	Land slip	100	**Description:** East of Devils Nook Creek there is a section of steep side slopes and unstable rock cuts. **Safety Risk:** There is a risk of damage from falling rocks and road closures due to land slips.  	Occasional	Serious	High

025	N/A	N/A	100	**Observation:** Typical cross section of the Armidale to Kempsey Road approaching Kempsey. Note the motorcycle protection rail on the guard fence. The road has adequate advanced warning signage. **Safety Risk:** The road cross section is narrow with minimal shoulder width. It does not support on-road cycling, emergency stopping will use the table drains  			
		Alternate routes through Kempsey					
026	Urban activity	Through traffic interaction with urban activity	50	**Observation:** The photo below is the Armidale-Kempsey Road intersection with North Street. Access through Kempsey can either continue along River Street into the CBD or turn left into North Street to bypass Kempsey via Second Lane and the Old Pacific Highway to Fredericton to the Pacific Highway. The second photo is a typical pedestrian access across River Street.  	Improbable	Serious	Medium

027	Interaction with CBD activity	Heavy vehicle interaction with CBD activity		**Description:** River Street, Elbow Street and Belgrave Street into Smith Street (Old Pacific Hwy) runs through the CBD with on street parking and pedestrian movements. There are also two small roundabouts. **Safety Risk:** Minor accidents with local traffic and pedestrians. 	Improbable	Serious	Medium
028	Vehicle-pedestrian collision	Vehicles and pedestrian		**Description:** North Street is a narrow urban street with housing on one side of the road. **Safety Risk:** An increase in heavy vehicle traffic may impact local noise levels and increase the risk of an accident involving a child or a vehicle accessing a driveway. 	Improbable	Serious	Medium

029	Errant vehicle	Vehicle over headwall	100	**Description:** The Second Lane intersection with the Old Pacific Hwy is restricted by existing pipe culvert headwalls located adjacent to the turn lane. **Safety Risk:** There is a risk that a heavy vehicle rear axle combination may fall over the headwall when turning left. 	Improbable	Minor	Low

5 Audit Statement

We, the undersigned, have undertaken a Detailed Design Road Safety Audit in accordance with the Austroads Guide to Road Safety – Part 6 and Part 6A. An assessment of the documentation detailing the existing road conditions for the Armidale to Kempsey Road was undertaken for the purpose of identifying features which could potentially impair road safety.

Whilst care and diligence has been taken to identify potential safety concerns (as detailed in this report), we do not warrant that every safety issue has been identified.

Date: 22/11/2021

Trevor Ferris

LEAD ROAD SAFETY AUDITOR (LEVEL 3)

Date: 22/11/2021

Chris Weavers

ROAD SAFETY AUDITOR (LEVEL 3)

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Attachment D

OSOM Report J Andrews

EMM
creating opportunities

REX J ANDREWS
ENGINEERED TRANSPORTATION

ROUTE STUDY: SMEC

PROJECT: OVENS MOUNTAIN PUMPED HYDRO STORAGE

PORT OF IMPORT: NEWCASTLE

SITE LOCATION: CARRAI, NSW

22/02/2022 REV 01

Rev.	Date	Change	Responsible	Checked
00	17/01/22	Route Assessed	W Andrews	✓
00	02/02/22	Report Compiled	W Andrews	✓
00	18/02/22	Report Completed	W Andrews	✓
01	22/02/22	Edits	W Andrews	✓

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1.0 Introduction

SMEC are in the early stages of investigating access to a potential pumped hydro storage project on the NSW mid north coast. This site is next to the Macleay River close to Carrai in the Upper Macleay Valley.
This study describes observations and previous experience on sections of this route and explains the transport of the largest/heaviest items been delivered to site, which would be the power transformers.
The study will show the most suitable route to transport the transformers from the port through to the site, and the constraints on these routes. The report also takes into account the widest lad which would be a section of the turbine.
Additionally, a second route has been scoped for this project via the New England Tablelands. This second route is also listed in the report but appears to be unsuitable for the delivery of the components.

The route surveys took place on the 17/01/2022

2.0 Evaluation

1	No Cost
2	Some Work
3	Moderate Amount of Work
4	Extreme Amount of Work

(Mark below boxes with an X)

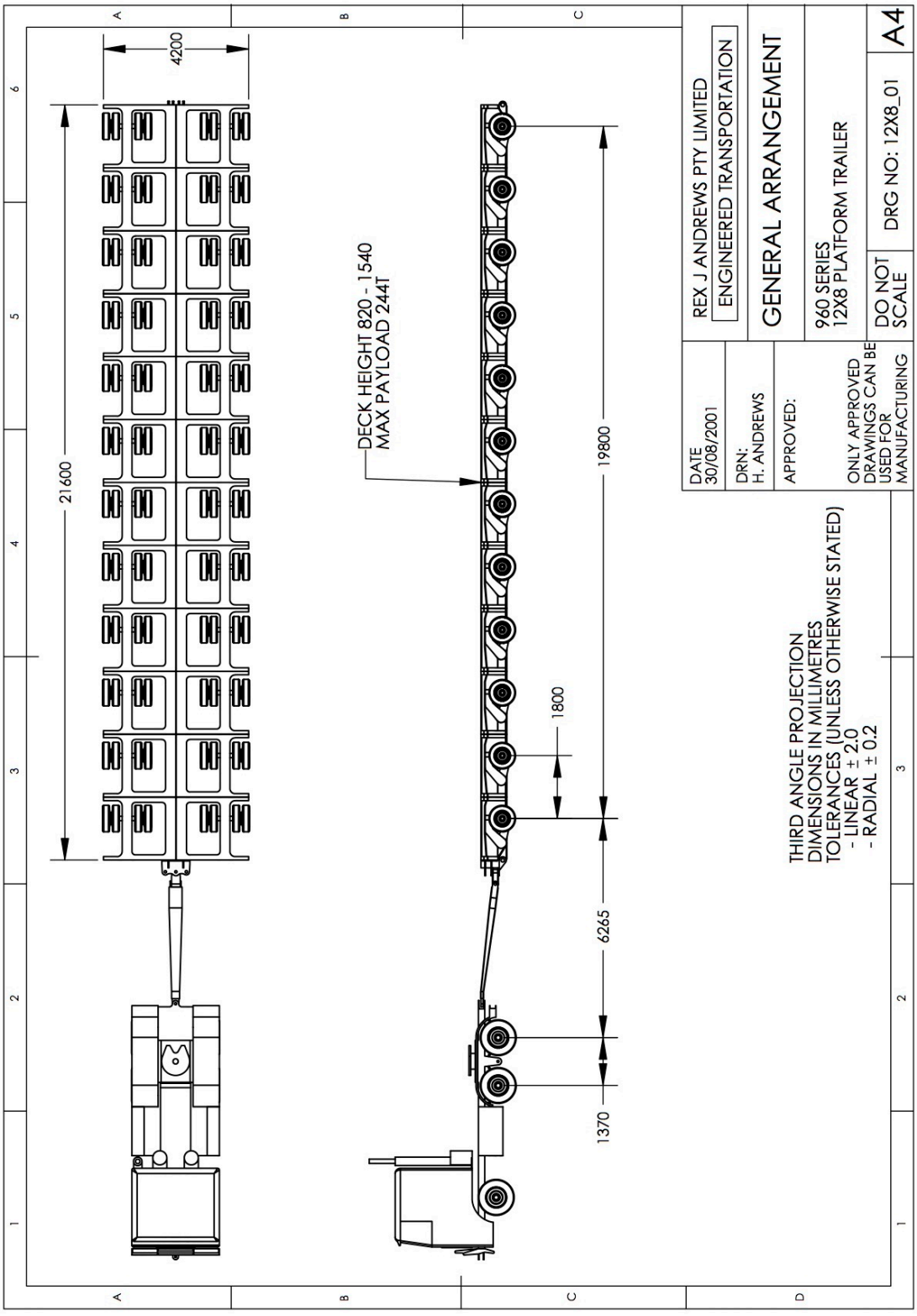
		1	**2**	**3**	**4**
A	Harbour	**X**			
B	Road Modification				**X**
C	Road Furnishings		**X**	**X**	
D	Vegetation				**X**
E	Site Entrance				**X**
F	Bridge Calculations			**X**	
G	Traffic Control		**X**		

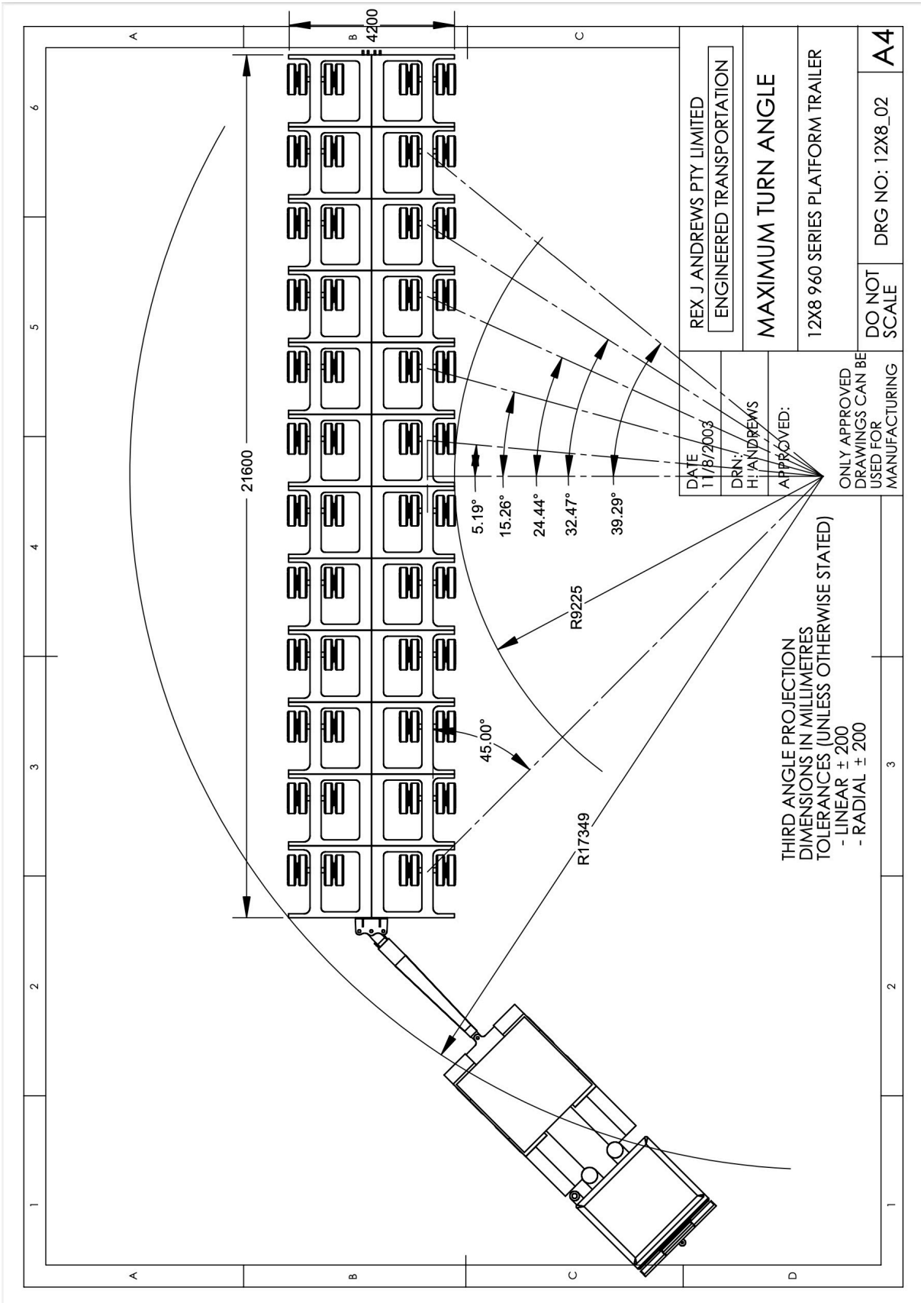
3.0 Project data

Date of latest Route Assessment: 17/01/2022
Survey undertaken by: (Rex J Andrews P/L)
Project name: Ovens Mountain pumped hydro storage “OMPS”
Location: Newcastle Port (NSW) to Carrai (NSW)
Items to be delivered: Case study is for the following components.
250MVA 3 phase transformer: 9.0l x 4.0w x 4.0h 120T
Turbine top: 6.7l x 6.7w x 4.0h 40T

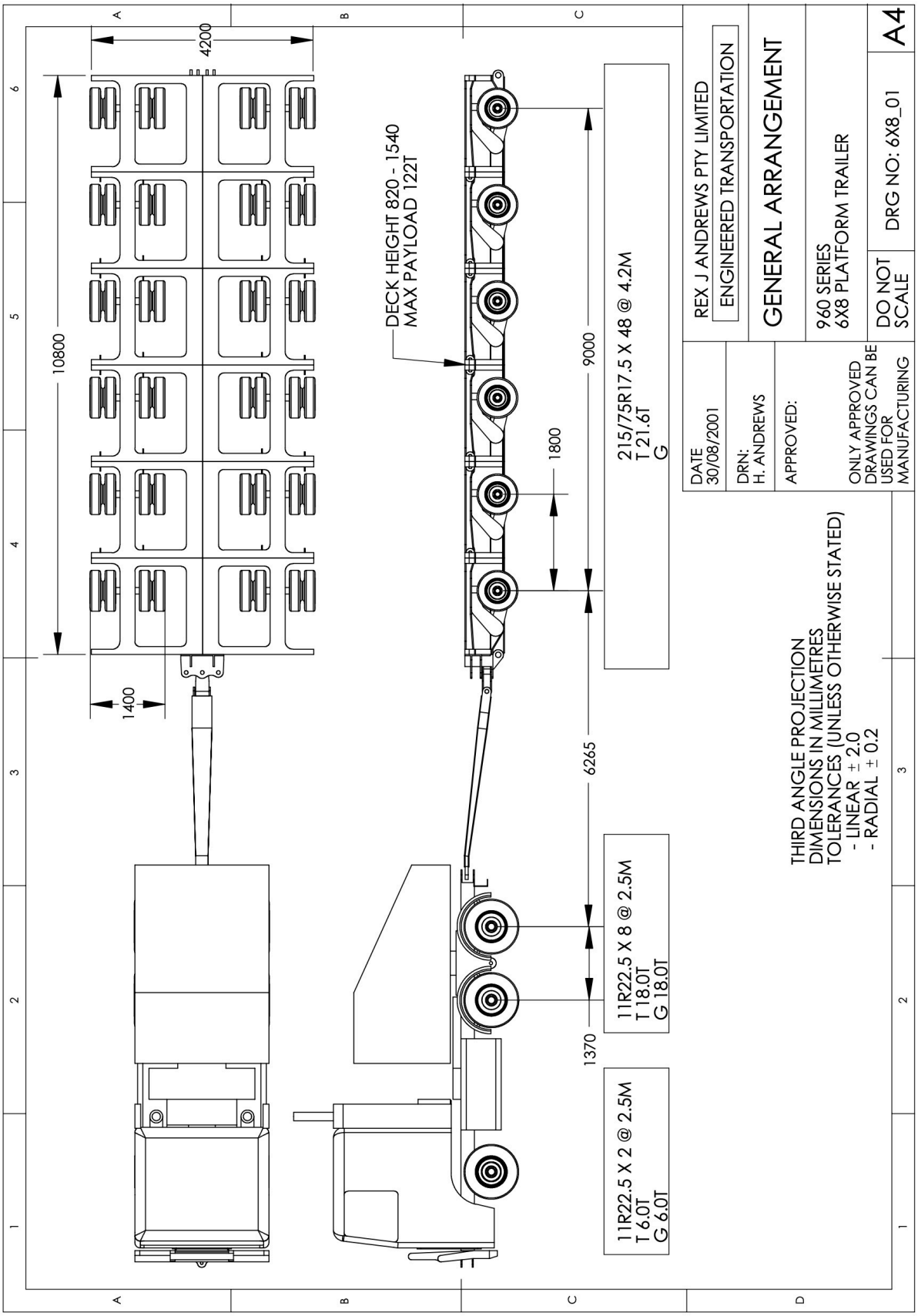
4.0 Transport drawings

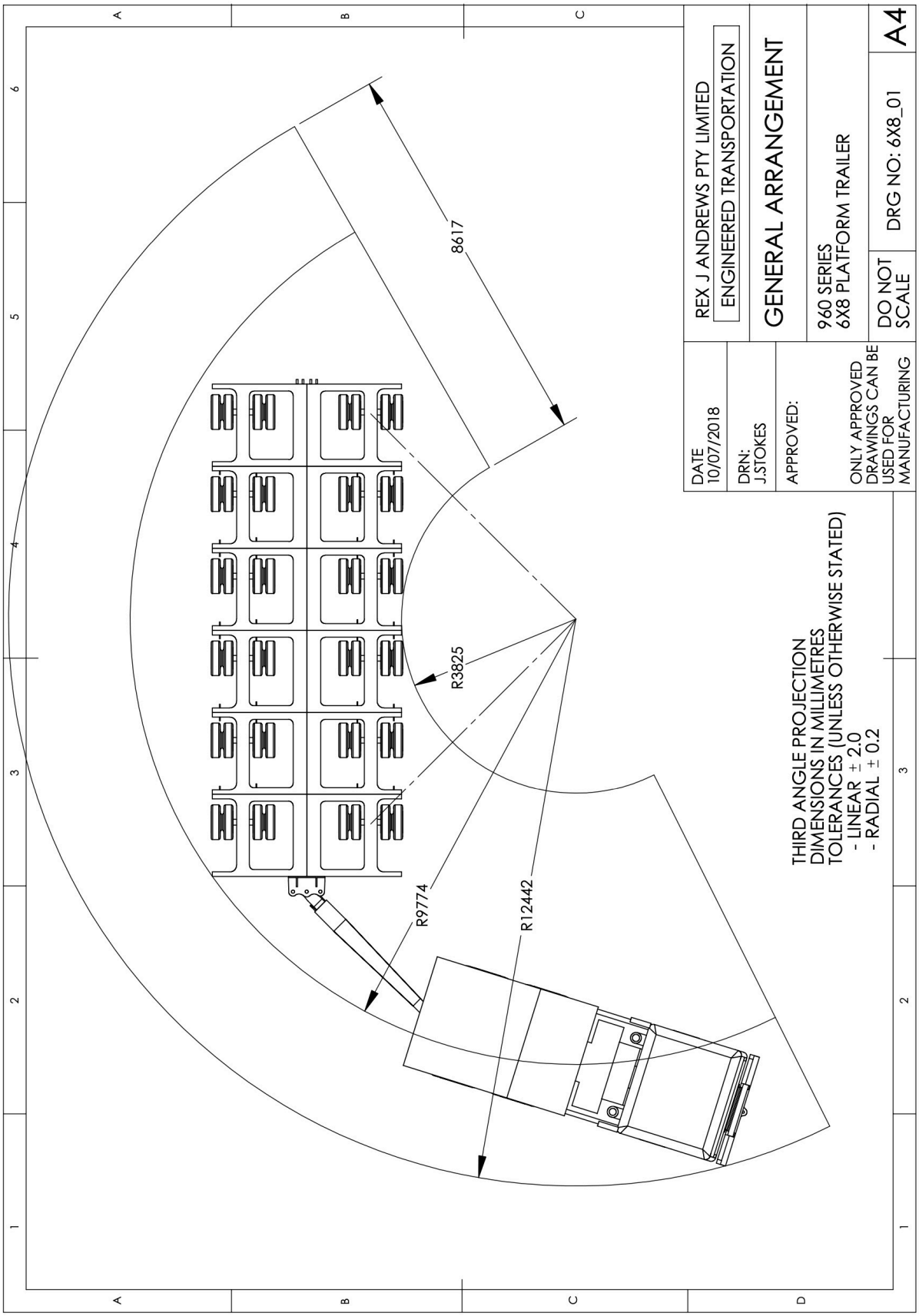
250MVA transformer transporter: 12x8 Platform trailer




4200
21600
5.19°
15.26°
24.44°
32.47°
39.29°
R9225
45.00°
R17349
REX J ANDREWS PTY LIMITED
ENGINEERED TRANSPORTATION
MAXIMUM TURN ANGLE
12X8 960 SERIES PLATFORM TRAILER
DRG NO: 12X8_02
A4
DO NOT SCALE
DATE 11/8/2003
DRN: H:\ANDREWS
APPROVED:
ONLY APPROVED DRAWINGS CAN BE USED FOR MANUFACTURING
THIRD ANGLE PROJECTION
DIMENSIONS IN MILLIMETRES
TOLERANCES (UNLESS OTHERWISE STATED)
- LINEAR ± 200
- RADIAL ± 200

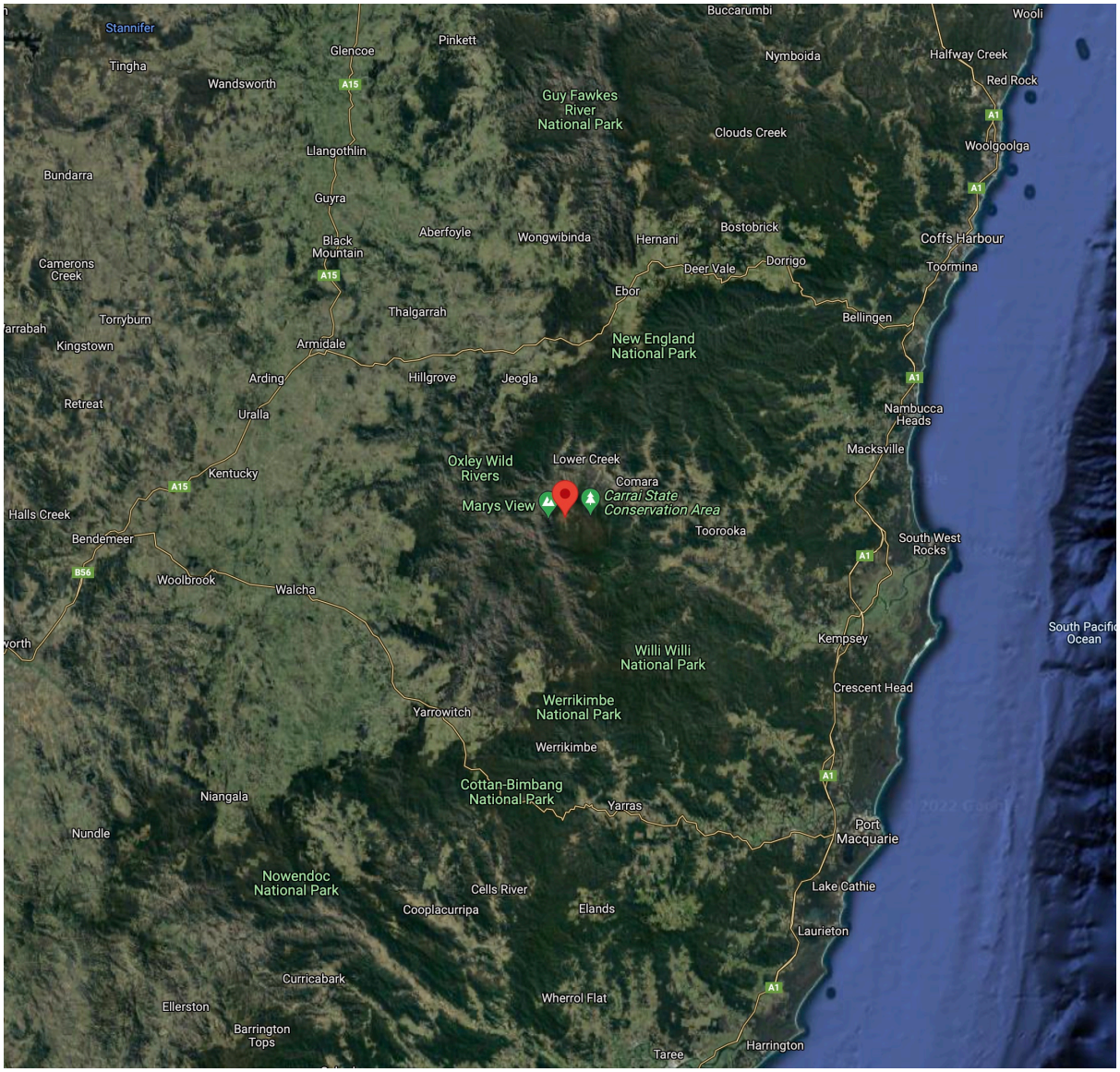
Turbine Top transporter: 6x8 platform trailer




8617
R3825
R9774
R12442
REX J ANDREWS PTY LIMITED
ENGINEERED TRANSPORTATION
GENERAL ARRANGEMENT
960 SERIES
6X8 PLATFORM TRAILER
DRG NO: 6X8_01
A4
DO NOT SCALE
DATE 10/07/2018
DRN: J.STOKES
APPROVED:
ONLY APPROVED DRAWINGS CAN BE USED FOR MANUFACTURING
THIRD ANGLE PROJECTION
DIMENSIONS IN MILLIMETRES
TOLERANCES (UNLESS OTHERWISE STATED)
- LINEAR ± 2.0
- RADIAL ± 0.2

5.0 Site location

The project is located on the NSW mid north coast. The site is next to the Macleay River close to Carrai in the Upper Macleay Valley and will be accessed by the Armidale/Kempsey Road.



6.0 Port of Import

The equipment will be imported from various countries and will arrive on ships into the Port of Newcastle. The ideal berth for these shipments is the Mayfield #4 Berth. This facility has a hardstand storage area of roughly 100,000 s/q meters, adjacent to the berth.

Access from the storage to the public roads, is via a port operated road onto Selwyn Street. There will need to be a small amount of road modifications within the port.

Image 1: Mayfield #4 berth overview

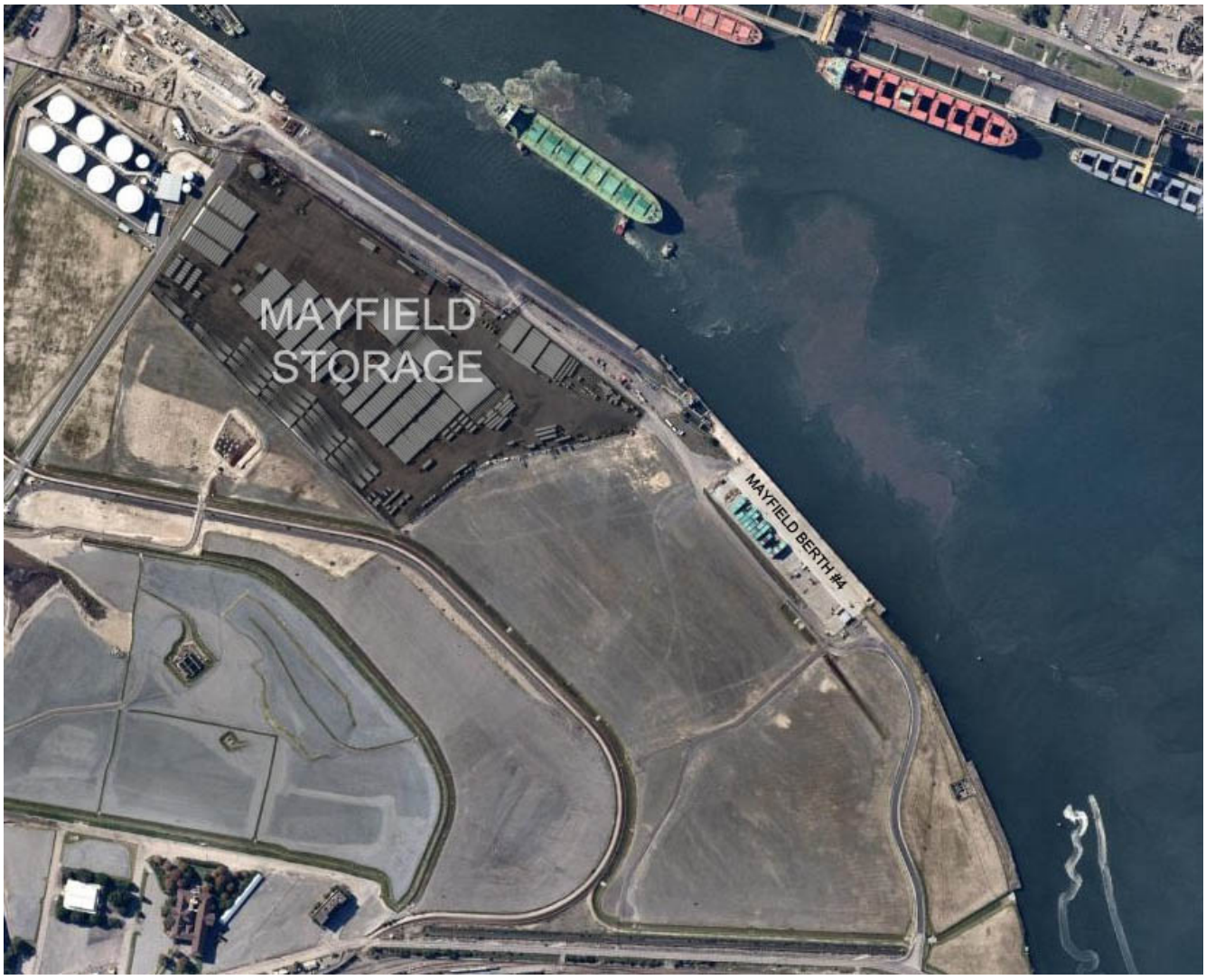


Image 2: Mayfield #4 Port storage area



7.0 Transport Summary

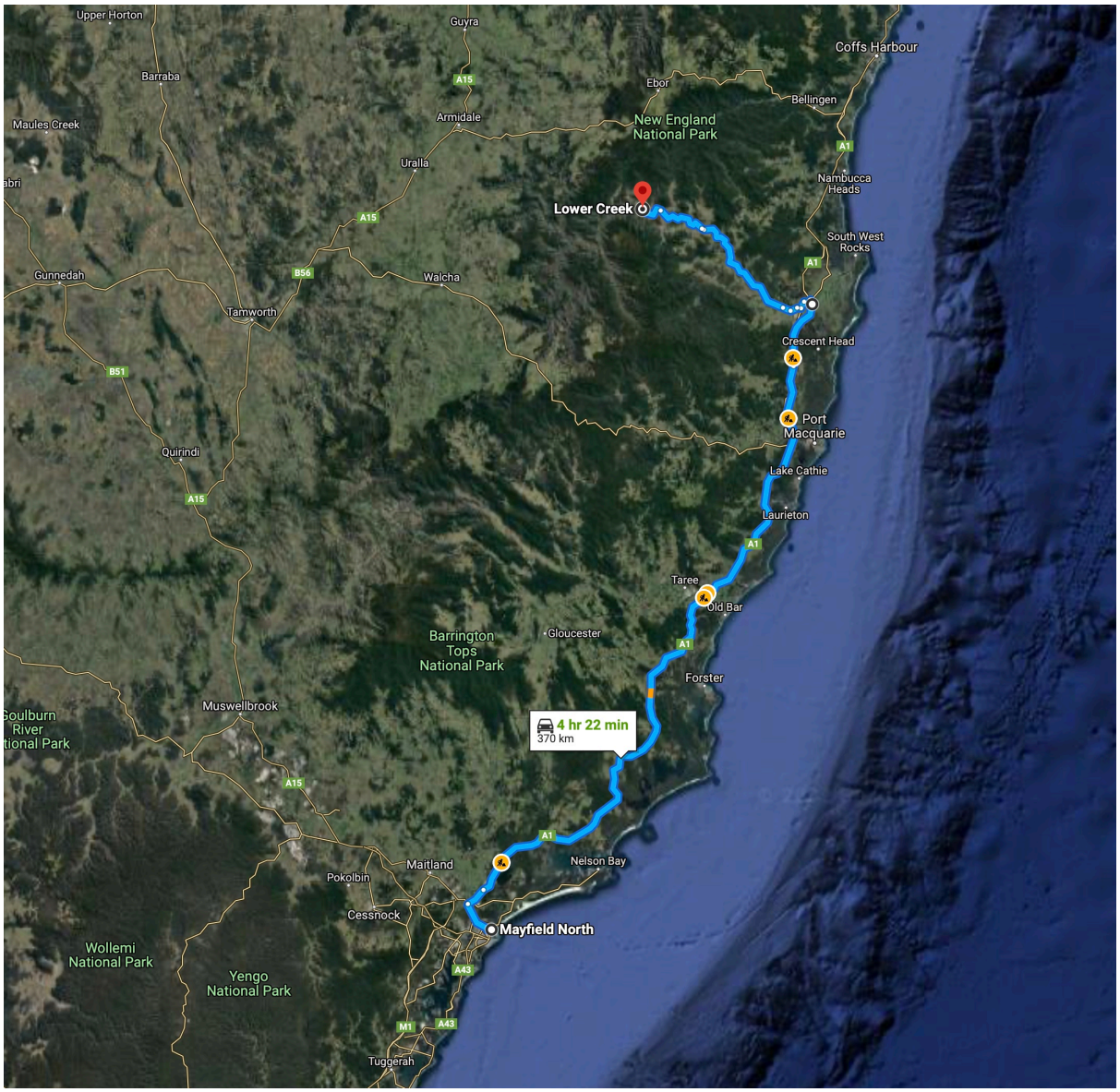
We have based this study on the transformer components entering Australia via the Port of Newcastle, Mayfield #4 berth. This study will show the likely route for these components, and the restraints that they may encounter on the route. Additionally, we have included a second route that we were asked to assess. This route is included but is not feasible for the size of the components in this report.

ROUTE SURVEY 1: Newcastle to Ovens Mountain via Kempsey
DISTANCE: 370.0 kilometres
GPS LINK: https://goo.gl/maps/HxXPoAwGE1j4dCuW8
VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, Pacific Hwy, Macleay Valley Way, Second Lane, North Street, Armidale Road, Kempsey Road.

ROUTE SURVEY 2: Newcastle to Ovens Mountain via Armidale
DISTANCE: 578.0 kilometres
GPS LINK: https://goo.gl/maps/9MzsQSFtJhseUr8F6
VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, Pacific Hwy, New England Highway, John Renshaw Drive, New England Highway, Bell Street, Victoria Street, Market Street, New England Highway, Ollera Street, Guyra Road, Waterfall Way, Kempsey Road.

8.0 Route Survey 1: Newcastle to Ovens Mountain via Kempsey

DISTANCE: 370.0 kilometres
GPS LINK: https://goo.gl/maps/HxXPoAwGE1j4dCuW8
VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, Pacific Hwy, Macleay Valley Way, Second Lane, North Street, Armidale Road, Main Street, Armidale Road, Kempsey Road.



REX J ANDREWS
ENGINEERED TRANSPORTATION

ROUTE STUDY
Newcastle Port to OMPS

KEY	
MODIFICATIONS REQUIRED	
MINOR WORKS OR CAUTION	
PARKING	

KM index	Location	Section of road	Current clearance	Procedure	Comments
0.0	Mayfield	Mayfield #4 berth onto Selwyn Street https://goo.gl/maps/afLwPYKuNdm	Length: 60.0m Width: 8.0m	Moderate right-hand turn	No problems with this section of road.
0.4	Mayfield	Selwyn Street rail crossing https://goo.gl/maps/864FhMSaF9P2	Width: 9.0m	Travel directly ahead	Loads to travel over the crossing in the center of the road. Approval required crossing this line, likely cross with caution.
1.3	Mayfield	Selwyn Street onto Industrial Drive via George Street https://goo.gl/maps/brPRAckLr572	Length: 50.0m Width: 8.0m	Right hand turn	Trailer will need to be raised to travel over the hump in the road.
4.9	Mayfield	Industrial Drive under traffic signals https://goo.gl/maps/5DpD3b7KnT72	Clearance: Height: 5.4m	Travel directly ahead	The lowest traffic signal on route is at the intersection of Steel River Blvd. Trucks that exceed 5.3 metres will need to travel in the right-hand lane.
5.5	Mayfield West	Industrial Drive onto Maitland Road https://goo.gl/maps/Kn49dhWG2qG2	Length: 45.0m Width: 8.0m	Right hand turn	No problems with this section of road.
12.0	Hexham	Maitland Road onto the Pacific Highway GPS Link: https://goo.gl/maps/Pih1N51gGtm	8.0 Metres wide	Travel directly ahead	No problems with this section of road
18.0	Raymond Terrace	Pacific Highway GPS Link: https://goo.gl/maps/XTWtHVcrj9q	Length: 60.0m Width: 8.0m	Left hand merge	Medium parking bay
20.0	Raymond Terrace	The Pacific Highway through the roundabout at Adelaide Street GPS Link: https://goo.gl/maps/wrRct84MgoG2	Length: 40.0m Width: 7.0m	Travel directly ahead	Spotter to guide load through this section of road.
43.0	Twelve Mile	Pacific Highway GPS Link: https://goo.gl/maps/4eZ5oTPxtWS2	200.0 Metres x 12.0 Metres	Left hand merge	Large parking bay
102.0	Topi Topi	Pacific Highway GPS Link: https://goo.gl/maps/VzRUJZkk3VM2	80.0 Metres x 80 Metres	Left hand merge	Large parking bay
111.0	Wootoon	Pacific Highway GPS Link: https://goo.gl/maps/sPngndyyvr72	100.0 Metres x 12 Metres	Left hand merge	Large parking bay
153.0	Koorainghat	Pacific Highway GPS Link: https://goo.gl/maps/BnMQamybhUA2	80.0 Metres x 6.0 Metres	Left hand merge	Medium parking bay
218.0	Lake Innes	Pacific Highway GPS Link: https://goo.gl/maps/PRTjQ7qcDgP2	100.0 Metres x 120 Metres	Left hand merge	Large parking bay
251.0	Barrys Creek	Pacific Highway GPS Link: https://goo.gl/maps/pj4Cb4rn8Dm	100.0 Metres x 7.0 Metres	Left hand merge	Emergency parking only
268.0	South Kempsey	Pacific Highway GPS Link: https://goo.gl/maps/gaYyNUhaqpo	60.0 Metres x 5.5 Metres	Left hand merge	Emergency parking only

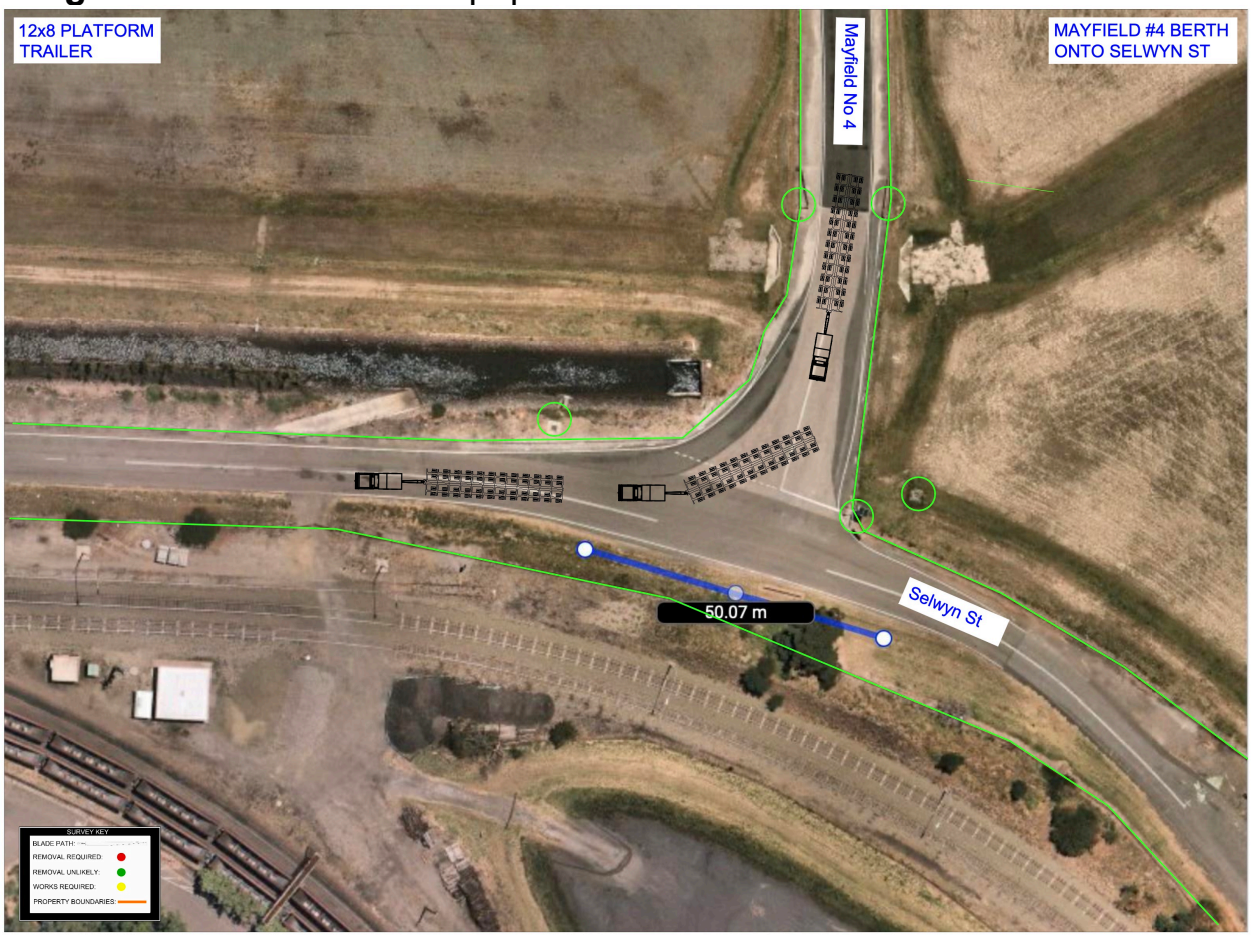
KM index	Location	Section of road	Current clearance	Procedure	Comments
283.0	Frederickton	The Pacific Highway onto Macleay Valley Way GPS Link: https://goo.gl/maps/3tuNs1DGvJen8TECA	7.0 Metres into 7.0 metres	Merge left than left at the roundabout	Spotter to guide load through this section of road.
288.0	Kempsey	Macleay Valley Way into Second Lane GPS Link: https://goo.gl/maps/35BRaSYdwfVsUkwQ8	Length: 50.0m Width: 8.0m	Right hand turn	No problems with this section of road
288.9	West Kempsey	Second Lane over rail crossing GPS Link: https://goo.gl/maps/3DTnuMzxw8NsXMUk9	Width: 9.0m	Travel directly ahead over the railway line	Loads to travel over the crossing in the center of the road. Approval required crossing this line, likely cross with caution.
289.0	West Kempsey	Second Lane onto North Street GPS Link: https://goo.gl/maps/eiuhnrrT7XHSfn7u6	Length: 70.0m Width: 10.0m	Left hand bend	No problems with this section of road
292.0	West Kempsey	North Street onto River Street GPS Link: https://goo.gl/maps/bqLMBTppenUtDx496	Length: 45.0m Width: 8.0m	Right hand turn	Signs to be made removable and removed and replaced for each load.
295.0	Yarravel	River Street onto Armidale Road GPS Link: https://goo.gl/maps/nDsSASJcjQH6ksNw9	Width: 9.0m	Travel directly ahead	No problems with this section of road
295.0 to 339.0	Yarravel to Bellbrook	Armidale Road GPS Link: https://goo.gl/maps/tsgFuW1HbFyTsA3H8	Length: 30.0m Width: 6.0m Height: 4.8m	Travel directly ahead	This section of road is sealed and in good condition. It has several bridges, pipes and culverts that would need to be checked for capacity. The road has several tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 metres in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 metres in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Kempsey and Bellbrook.
339.0	Bellbrook	Armidale Road onto Main Street GPS Link: https://goo.gl/maps/mtcDfWT9vz7NZnvt5	Width: 6.0m	Travel directly ahead	No problems with this section of road
340.0	Bellbrook	Main Street GPS Link: https://goo.gl/maps/VHpeo8xrM8PM3E2BA	Length: 70.0m Width: 6.0m	Merge to the left	Possible parking outside of the tennis courts.
341.0	Bellbrook	Main Street onto Armidale Road GPS Link: https://goo.gl/maps/jrcydASFjmrPoWe7A	Width: 7.0m	Travel directly ahead	No problems with this section of road
341.0 to 344.0	Bellbrook to Tynes Gap	Armidale Road GPS Link: https://goo.gl/maps/PhWiKjCRMtLi6oFM7	Length: 30.0m Width: 6.0m Height: 4.8m	Travel directly ahead	This section of road is sealed and in good condition up until the east side of Tynes Gap. It has several pipes and culverts that would need to be checked for capacity. If loads exceed 4.8 metres in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 metres in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Bellbrook and Tynes Gap.

KM index	Location	Section of road	Current clearance	Procedure	Comments
344.0 to 346.0	Tynes Gap	Armidale Road GPS Link: https://goo.gl/maps/x5or8JMCitCpvSs97	Length: 15.0m Width: 4.5m Height: 4.6m	Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.	This section of road is sealed and in okay condition. It has several pipes and culverts that would need to be checked for capacity. The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site. If loads exceed 4.6 metres in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel over Tynes Gap.
346.0 to 348.0	Tynes Gap to Pee Dee Creek	Armidale Road GPS Link: https://goo.gl/maps/NbezBtRHxWncn8hD7	Length: 30.0m Width: 5.0m Height: 4.8m	Travel directly ahead	This section of road is sealed and in good condition. It has some pipes and culverts that would need to be checked for capacity. The road has several bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 metres in overall height, there will need to be some vegetation trimming. If loads exceed 6.0 metres in width, there will need to be some vegetation removal. With some road modifications the loads will be able to travel on the existing road between Tynes Gap and Pee Dee Creek.
348.0 to 350.0	Pee Dee Creek to O'Sullivans Pass	Armidale Road GPS Link: https://goo.gl/maps/RHyxtNvaRcPvRzhX7	Length: 30.0m Width: 4.5m Height: 4.8m	Travel directly ahead	This section of road is gravel and in okay condition. The road width in places is narrow and will need some widening, especially in areas where the road steeply falls away. It has a bridge as well as pipes and culverts that would need to be checked for capacity. The road has several tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 metres in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel on the existing road between Pee Dee Creek and O'Sullivans pass.

KM index	Location	Section of road	Current clearance	Procedure	Comments
350.0 to 354.0	O'Sullivans Pass	Armidale Road GPS Link: https://goo.gl/maps/VQCPcRntkSExFoWC7	Length: 15.0m Width: 4.5m Height: 4.6m	Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.	This section of road is gravel and in average condition. It has several pipes and culverts that would need to be checked for capacity. The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site. If loads exceed 4.6 metres in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel over O'Sullivans Pass.
354.0	O'Sullivan's Pass to Proposed River crossing at Smith Bluff	Armidale/Kempsey Road GPS Link: https://goo.gl/maps/rbfTAtuE5q67Vv5U6	Length: 30.0m Width: 4.5m Height: 4.8m	Travel directly ahead	This section of road is gravel and in okay condition. The road width in places is narrow and will need some widening, especially in areas where the road steeply falls away. It has a bridge and several pipes and culverts that would need to be checked for capacity. The road has mutiple tight bends which will require the transformer to be delivered on a drawbar platform trailer. If loads exceed 4.8 metres in overall height, there will need to be some vegetation trimming. If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened. With some road modifications the loads could be able to travel on the existing road between O'Sullivans pass and Smiths Bluff.
370.0	Smith Bluff	Armidale/Kempsey Road onto the proposed river crossing GPS Link: https://goo.gl/maps/SiGKXXpzvJHFbD6GA	Length: N/A Width: N/A Height: N/A	Left hand turn	Access from Armidale/Kempsey Road onto the proposed River crossing route and final access route to the project site will need to be made suitable for the swept path of the largest load.

0.0 Km's: Mayfield #4 onto Selwyn Street at Mayfield

Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/afLwPYKuNdm
PROCEDURE: Right hand turn from Mayfield Storage to Selwyn St.
COMMENTS: A spotter will need to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No works required.

0.4 Km's: Rail crossing over Selwyn Street at Mayfield

Image 1: Looking west across the crossing.



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/864FhMSaF9P2
PROCEDURE: Travel directly ahead over the crossing.
COMMENTS: Large width clearance and good ground clearance over this crossing. Police and escorts to control local traffic either side of the crossing. ARTC approval will need to be obtained to travel over this crossing. Likely to cross with caution, no escort required.
ROAD MODIFICATIONS: No works are required.

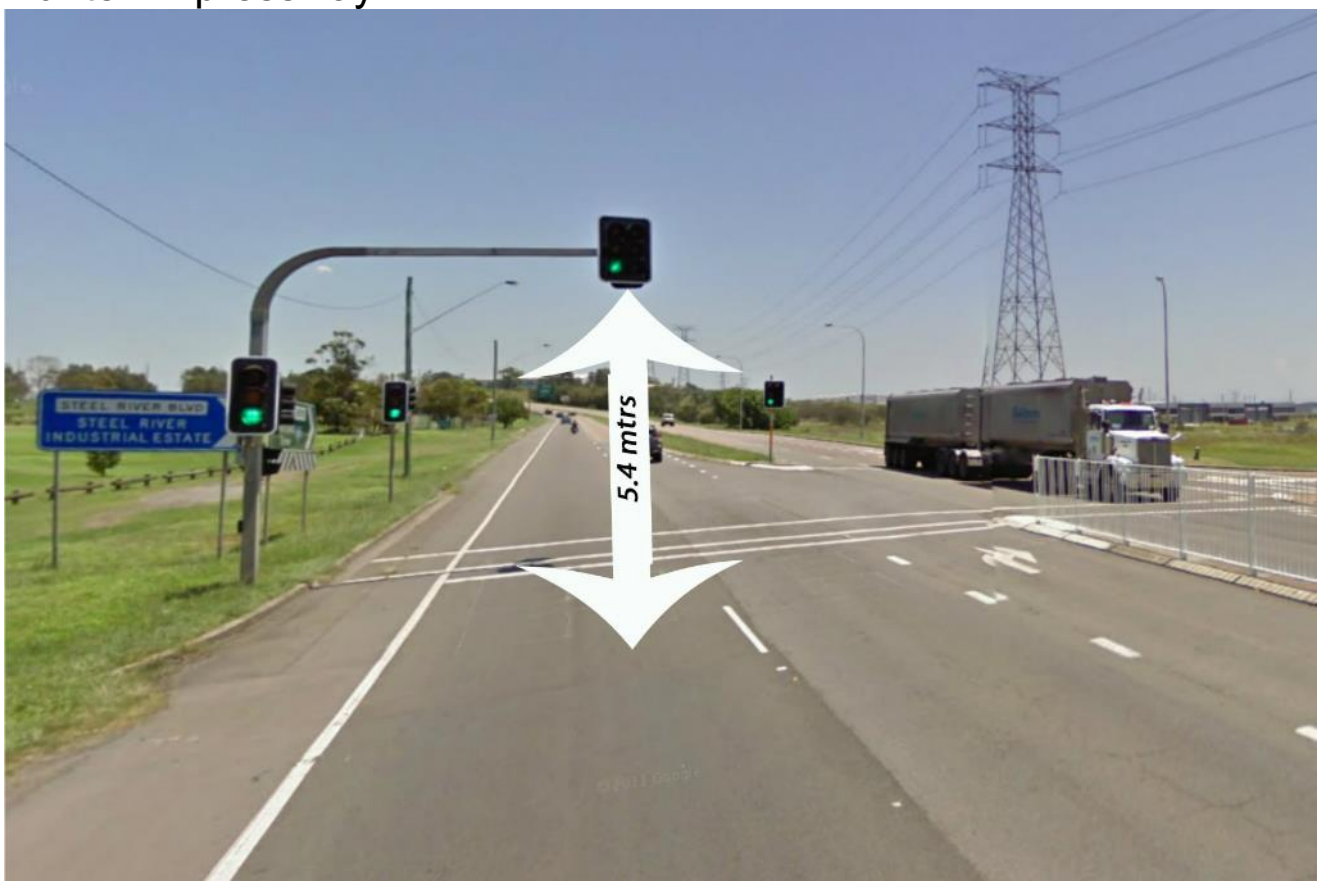
1.3 Km's: Selwyn Street onto Industrial Drive, via George Street at Mayfield

Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/brPRAckLr572
PROCEDURE: Right hand turn from Selwyn Street through George Street and onto Industrial Drive.
COMMENTS: A spotter would need to assist the load through this intersection. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No work is required.

4.9 Km's: Standard overhanging Traffic signals Mayfield to Hunter Expressway



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/5DpD3b7KnT72
PROCEDURE: Overhanging signals while travelling through the intersection.
COMMENTS: The lowest traffic signal on route has 5.4 metres clearance. This signal is on the corner of Steel River Blvd at Mayfield West. Loads with an overall height of 5.3 or higher, can avoid this signal by travelling in the centre lane. Loads to slow down while doing this manoeuvre. All other signals exceed 5.6 metres high on this section of road.
ROAD MODIFICATIONS: No works are required.

5.5 Km's: Industrial Drive onto Maitland Road at Mayfield West

Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/Kn49dhWG2qG2
PROCEDURE: Right hand turn from Industrial Drive onto Maitland Road.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No work is required.

20.0 Km's: Pacific Highway intersection of Adelaide Street at Raymond Terrace

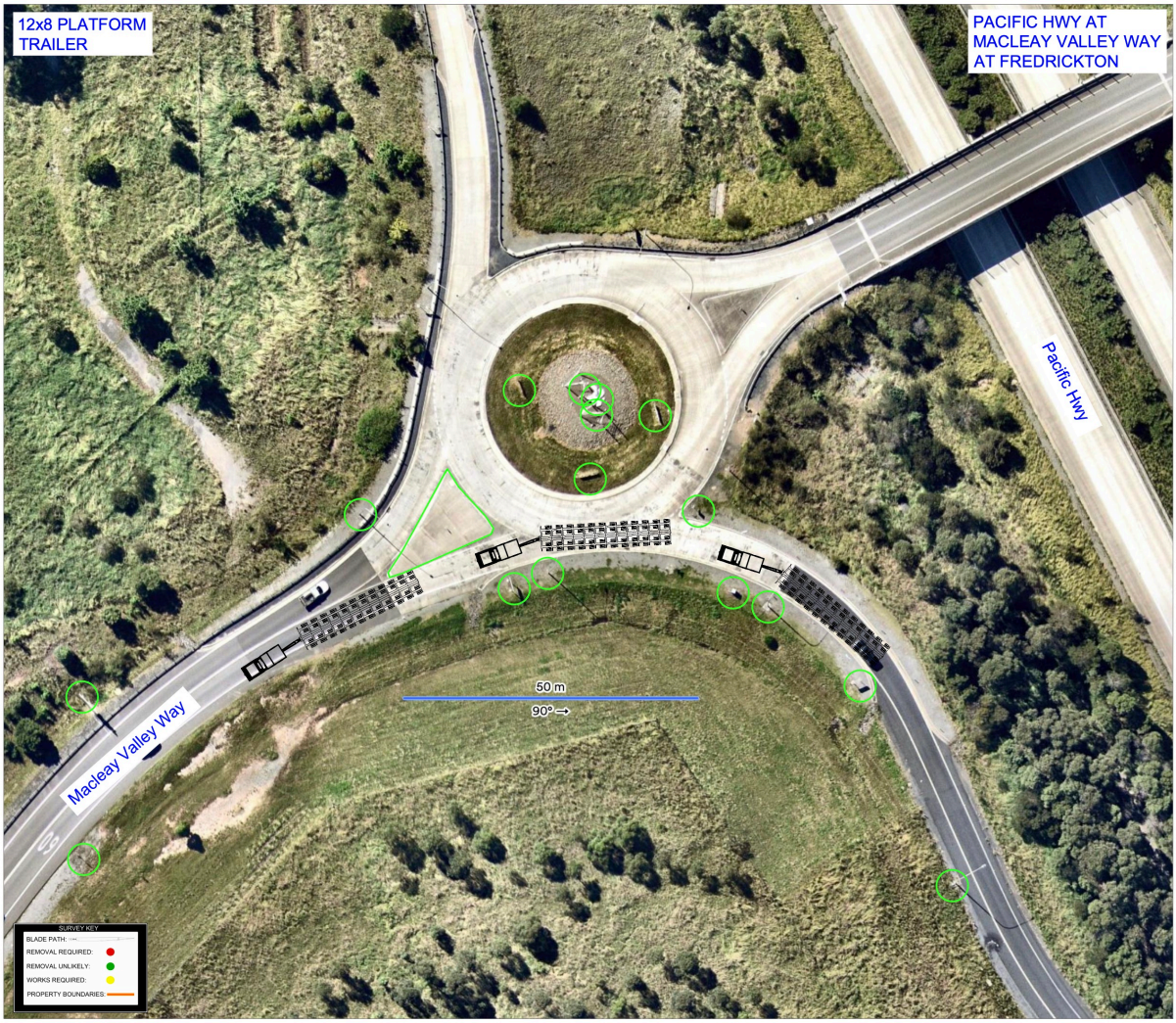
Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/wrRct84MqoG2
PROCEDURE: Travel directly ahead at the roundabout and stay on the Pacific Highway.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No work is required.

283.0 Km's: Pacific Highway onto Macleay Valley Way at Frederickton.

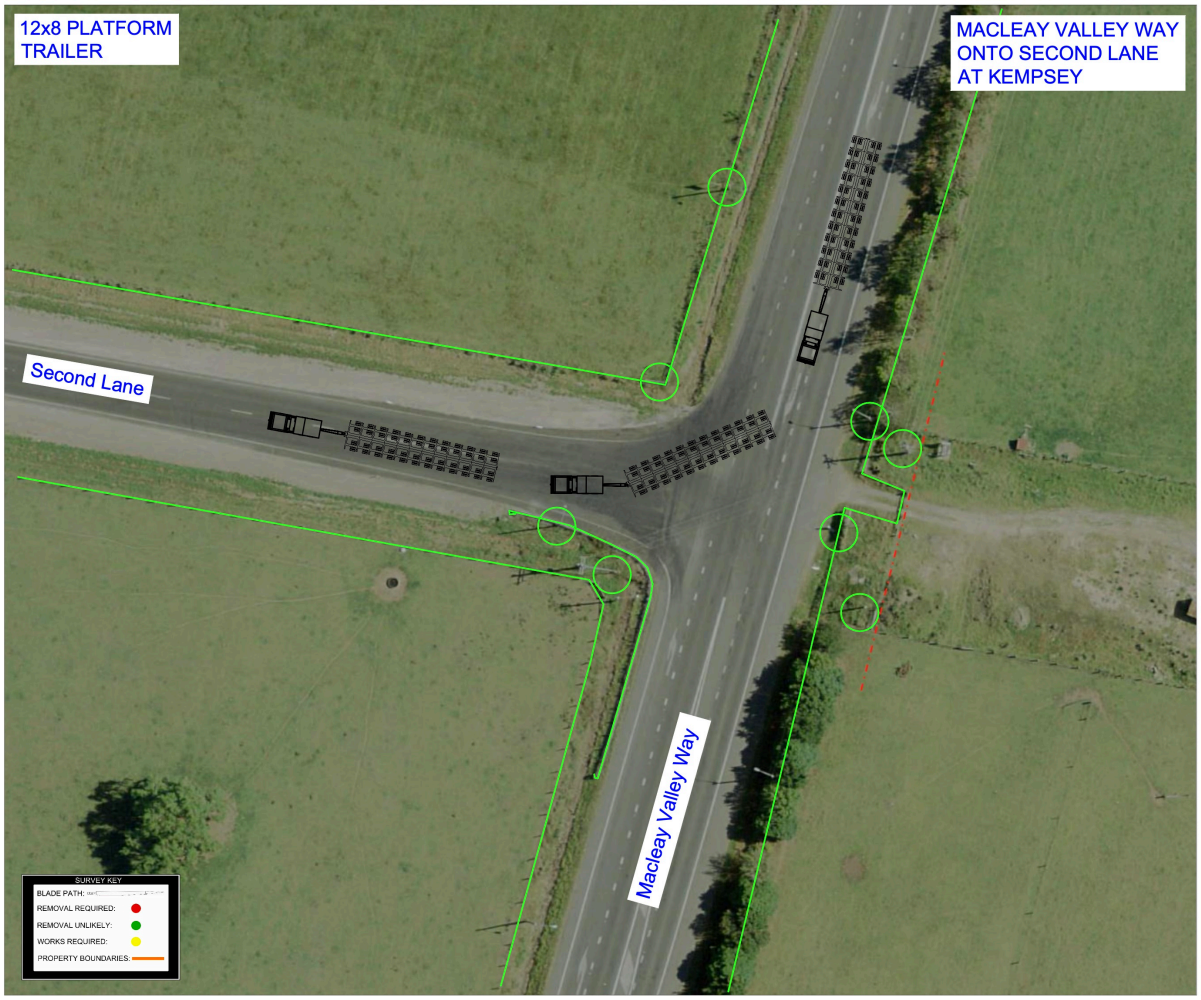
Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/3tuNs1DGvJen8TECA
PROCEDURE: Merge to the left off the Pacific Highway onto the offramp. At the roundabout turn left onto the Macleay Valley Way.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No work is required.

288.0 Km's: Macleay Valley Way onto Second Lane at Kempsey.

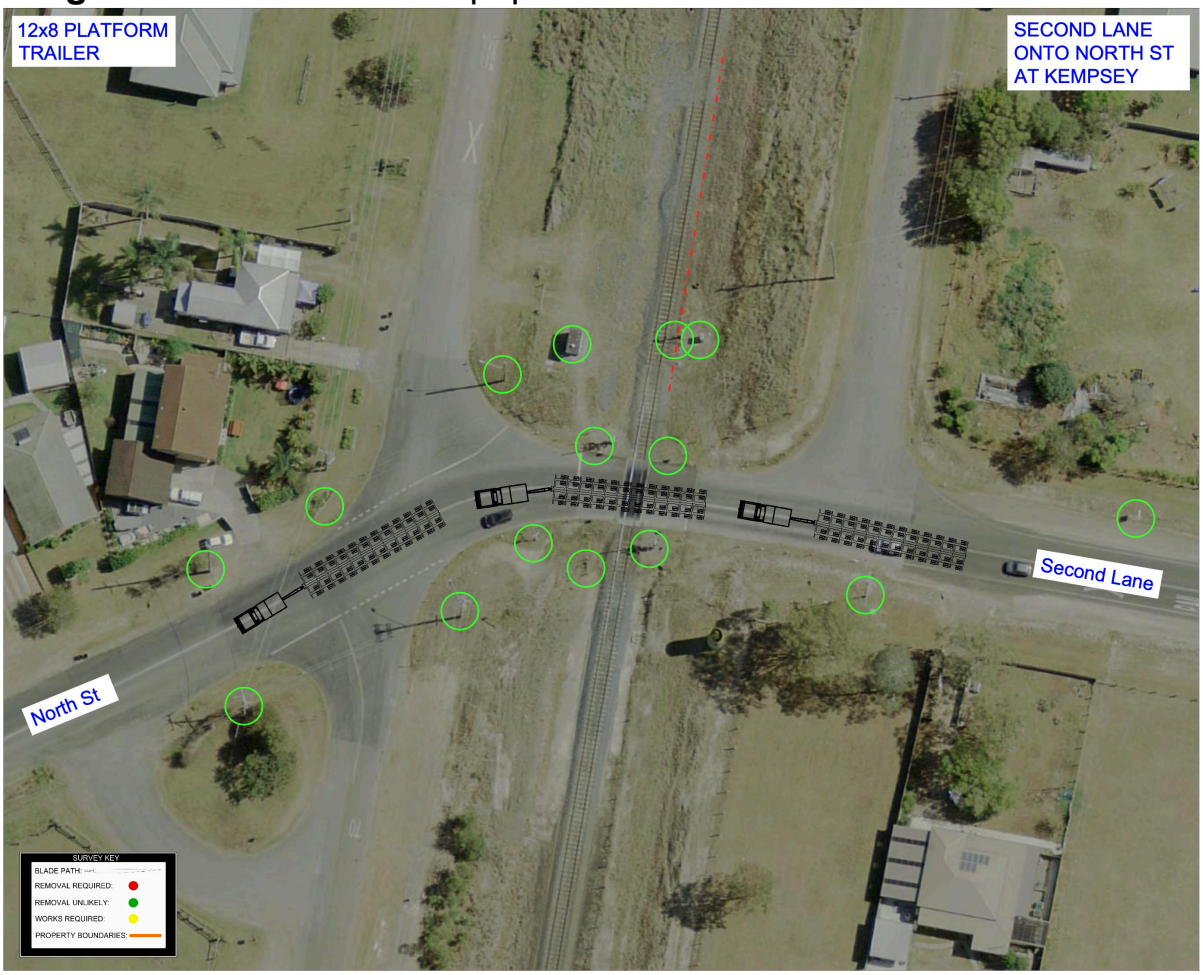
Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/eiuhnrrT7XHSfn7u6
PROCEDURE: Left hand turn off the Macleay Valley Way onto Second Lane.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: No work is required.

289.0 Km's: Second Lane onto North Street at West Kempsey.

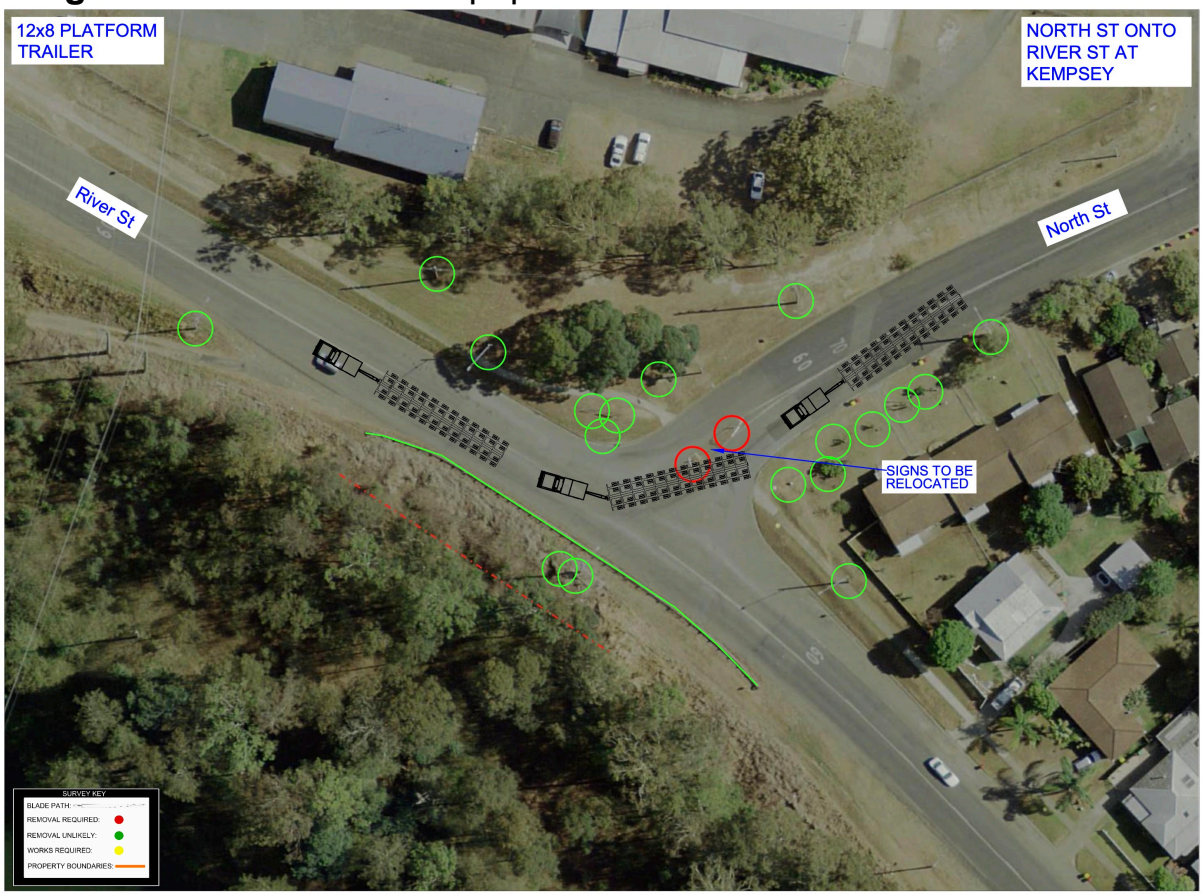
Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/eiuhnrrT7XHSfn7u6
PROCEDURE: Left hand bend on Second Lane over the rail line and onto North Street.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic. Rail approval will need to be obtained to travel over this crossing.
ROAD MODIFICATIONS: No work is required.

292.0 Km's: North Street onto River Street at West Kempsey.

Image 1: 12x8 Platform swept path



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/bqLMBTppenUtDx496
PROCEDURE: Right hand turn from North Street onto River Street.
COMMENTS: Spotter to keep the driver informed throughout the procedure. Pilots and or Police to control local traffic.
ROAD MODIFICATIONS: Yes, some signs will need to be made removable or relocated.

344.0 to 346.0 Km's: Armidale Road at Tynes Gap.

Image 1: 12x8 Platform swept path. Left hand turn on ascent.



https://goo.gl/maps/pjYE6ho84fMc2yka7

Image 2: 12x8 Platform swept path. Dog leg on ascent.



https://goo.gl/maps/N5YEhzBBBr1Qpv5X9

Image 3: 12x8 Platform swept path. Left hand turn on ascent.



https://goo.gl/maps/TkAh5iRtyn3wfXY68

Image 4: 12x8 Platform swept path. Dogleg turn on descent.



https://goo.gl/maps/xuUTwbqUnoLR3xmv5

Image 5: 12x8 Platform swept path. Dogleg turns on descent.



https://goo.gl/maps/9RG5W2B4NeAwioo38

Image 6: 12x8 Platform swept path. Dogleg turn on descent.



https://goo.gl/maps/DveYM3PRWMtH2TnLA

Image 7: 12x8 Platform swept path. Left hand hairpin on descent.



https://goo.gl/maps/r4iGF4wrJ145as536

Image 8: 12x8 Platform swept path. Right hand hairpin on descent.



https://goo.gl/maps/PHWByyzcrd32zgSL7

Image 9: Looking across a section of Tynes gap.



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/x5or8JMCitCpvSs97
PROCEDURE: Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.
COMMENTS: This section of road is sealed and in okay condition. It has several pipes and culverts that would need to be checked for capacity.
The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site.
If loads exceed 4.6 metres in overall height, there will need to be some vegetation trimming.
If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened.
With a large amount of work the loads could be able to travel over Tynes Gap.
Pilots and or police will need to hold all traffic on the west side of Tynes Gap while the load travels over the range. A spotter/Steerer will need to assist with the load while traversing this mountain range.
ROAD MODIFICATIONS: Yes, road modifications are required.

350.0 to 354.0 Km's: Armidale Road at O'Sullivans Pass.

Image 1: 12x8 Platform swept path. Left hand turn on ascent.



https://goo.gl/maps/HsaqczcC8HZLe21A8

Image 2: 12x8 Platform swept path. Left hand turn on ascent.



https://goo.gl/maps/3FyuFN1g8VJf7kUe7

Image 3: 12x8 Platform swept path. Right hand turn on ascent.



https://goo.gl/maps/vxi8ZJX2dh1tC62n7

Image 4: 12x8 Platform swept path. Left hand turn on descent.



https://goo.gl/maps/aB9bMXRHMndFhuxKA

Image 5: 12x8 Platform swept path. Right hand turn on ascent.



https://goo.gl/maps/KUEvE1U4vgNZytSM9

Image 6: 12x8 Platform swept path. Left hand turn on descent.



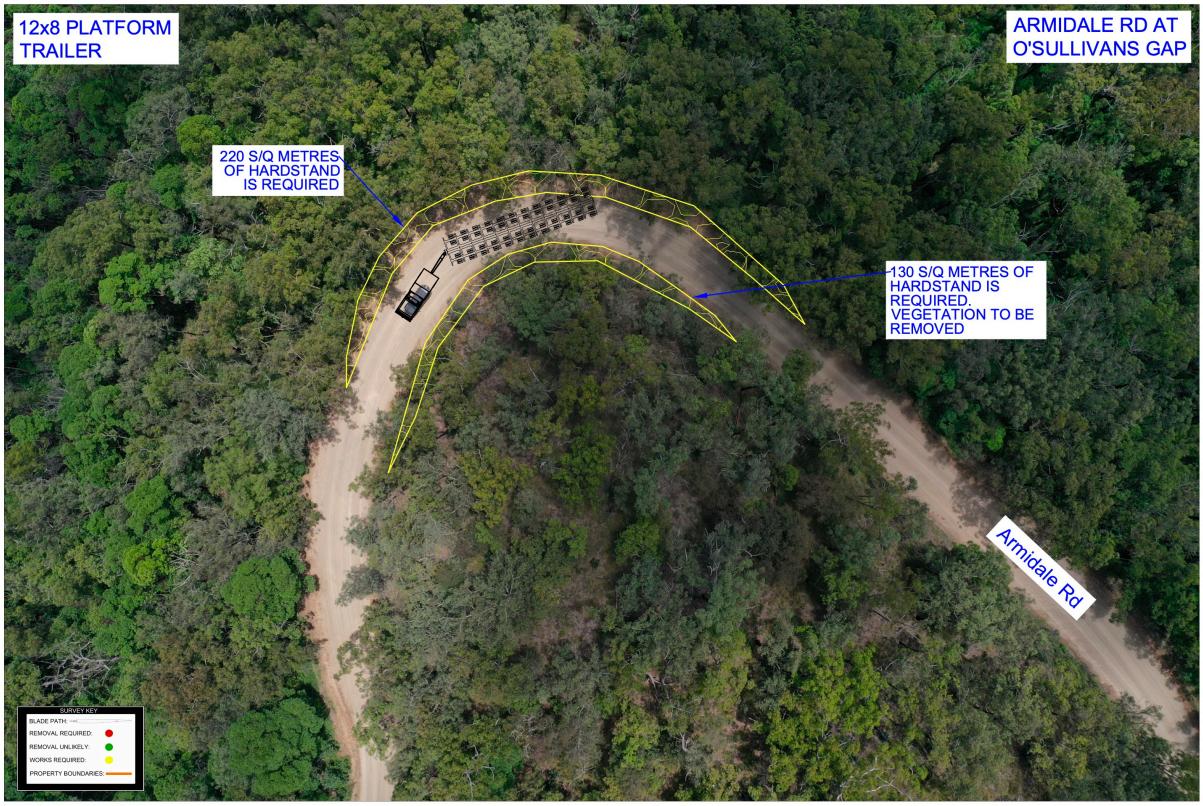
https://goo.gl/maps/KvDzkDinFvrdGrxF7

Image 7: 12x8 Platform swept path. Right hand turn on descent.



https://goo.gl/maps/ysJFwsUxdTbX3xST9

Image 8: 12x8 Platform swept path. Left hand turn on descent.



https://goo.gl/maps/LtByR81amvAdnJA39

Image 8: 12x8 Platform swept path. Right hand hairpin on descent.



https://goo.gl/maps/DWt3N46GTBmtn74v5

Image 9: A typical section of road ascending O'Sullivans Pass.



https://goo.gl/maps/wLC8muUgCT4k3f54A

Image 10: Looking across a section of O'Sullivans Pass.



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/VQCPcRntkSExFoWC7
PROCEDURE: Travel directly ahead around several tight corners while ascending to the pass from the east and descending away from the pass to the west.
COMMENTS: This section of road is gravel and in average condition. It has several pipes and culverts that would need to be checked for capacity.
The road has multiple tight bends which will need to be modified to allow the transformer to be delivered to site.
If loads exceed 4.6 metres in overall height, there will need to be some vegetation trimming.
If loads exceed 4.5 metres in width, there will need to be some vegetation removal and the road corridor widened.
With an extreme amount of work the loads could be able to travel over O'Sullivans Pass.
ROAD MODIFICATIONS: Yes, road modifications are required.

364.0 Km's: Armidale Road at Lagoon Creek

Image 1: Looking west across Lagoon Creek



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/3hUfoEKtq6zhY41S6
PROCEDURE: Travel directly ahead across the bridge in the center and at walking pace.
COMMENTS: This is one of many bridges on the Armidale Road of similar design that will require bridge assessments to determine if they are suitable for the axle loadings of the loads.
This structure is 5.0 metres wide at ground level and would be wide enough for 4.2 metre axle width trailers.
The signs would need to be made removable for loads over 4.5 metres in width.
Loads over 5.0 metres in width will need to lift the load and travel over the bridge guard rails at a minimum 1.0 metres clearance.
ROAD MODIFICATIONS: Yes, Bridge investigations are required, and the signs made removable.

364.0 Km's: Kempsey Road into possible site entrance at Smiths Bluff

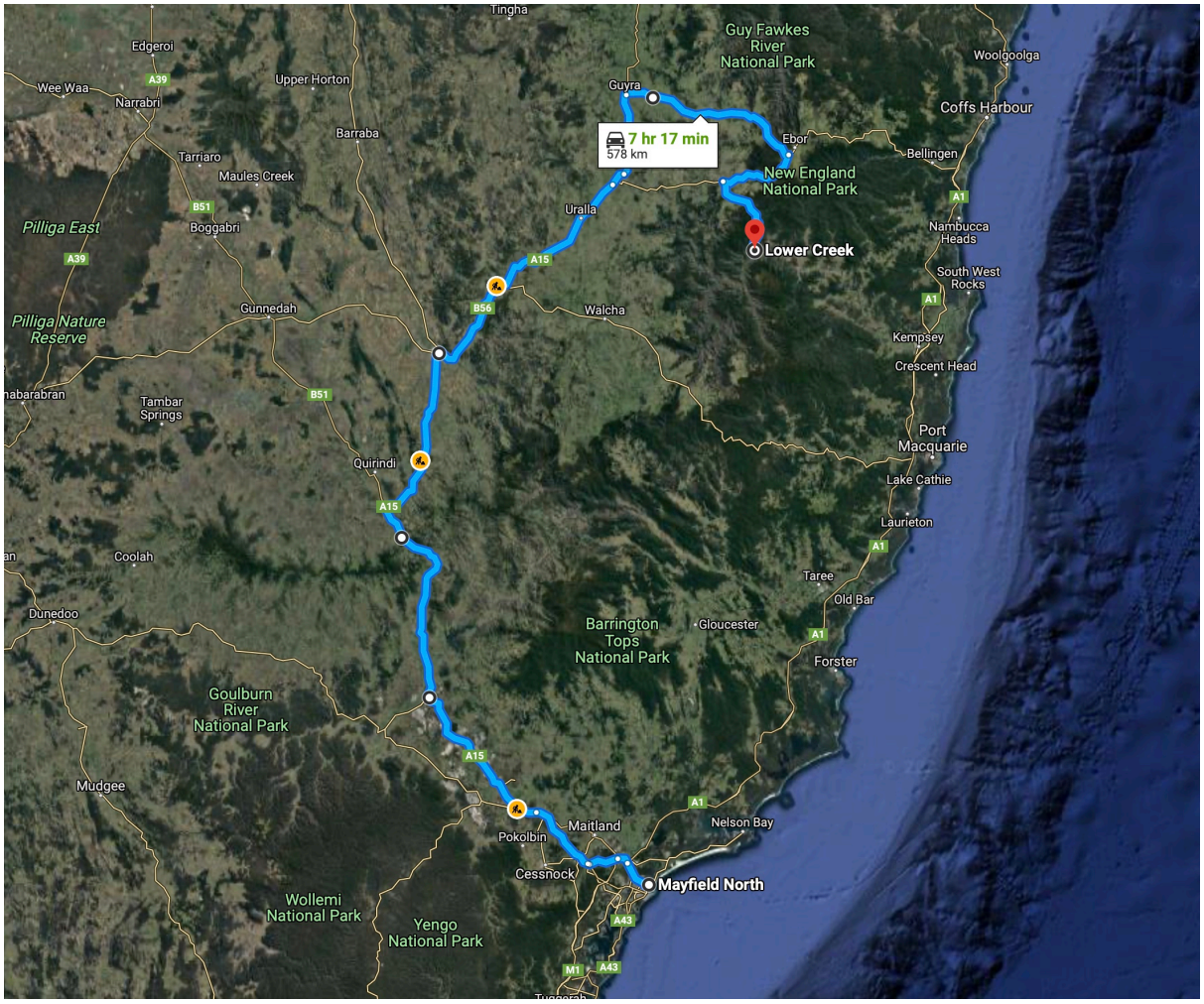
Image 1: Looking east towards Kempsey Road from the potential river crossing site.



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/SiGKXXpzvJHFbD6GA
PROCEDURE: Left hand turn off Kempsey Road and onto potential site entrance access road.
COMMENTS: This is the proposed site access point to the project site.
ROAD MODIFICATIONS: Yes, client to provide suitable access for the swept path of the largest loads.

9.0 Route Survey 2: Newcastle to Ovens Mountain via Armidale

DISTANCE: 578.0 kilometres
GPS LINK: https://goo.gl/maps/9MzsQSFtJhseUr8F6
VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, Pacific Hwy, New England Highway, John Renshaw Drive, New England Highway, Bell Street, Victoria Street, Market Street, New England Highway, Ollera Street, Guyra Road, Waterfall Way, Kempsey Road.



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ENGINEERED TRANSPORTATION

ROUTE STUDY
Newcastle Port to OMPS

KEY	
PINCH POINT	
CAUTION	
EMERGENCY PARKING	

KM index	Location	Section of road	Critical Measurement	Procedure	Notes
0.0	Mayfield	Mayfield #4 berth onto Selwyn Street GPS link: https://goo.gl/maps/afLwPYKuNdm	Length: 70.0 metres Width: 8.0 metres	Right hand turn	No problems with this section of road.
0.4	Mayfield	Selwyn Street rail crossing GPS link: https://goo.gl/maps/AmohE54hKSz	Width: 9.0 metres	Travel directly ahead	Loads to travel over the crossing in the center of the road. Approval required crossing this line, likely cross with caution.
1.3	Mayfield	Selwyn Street onto George Street GPS link: https://goo.gl/maps/gXeHvBtCp4D2	Length: 70.0 metres Width: 8.0 metres	Right hand turn	No problems with this section of road.
1.4	Mayfield	George Street onto Industrial Drive https://goo.gl/maps/s4ayrsuoAsD2	Length: 70.0 metres Width: 8.0 metres	Moderate right hand turn	No problems with this section of road.
4.9	Mayfield	Industrial Drive under traffic signals GPS link: https://goo.gl/maps/YmqhiS2iR582	Height: 5.4 Metres	Travel directly ahead	The lowest traffic signal on route is at the intersection of Steel River Blvd. Trucks that exceed 5.3 metres will need to travel in the right hand lane.
5.5	Mayfield West	Industrial Drive onto Maitland Road GPS link: https://goo.gl/maps/Kn49dhWG2qG2	Length: 50.0 metres Width: 10.0 metres	Right hand turn	No problems with this section of road.
13.9	Hexham	New England Highway under gantry GPS link: https://goo.gl/maps/YTMoFe7Aick	Height: 5.95 Metres	Travel directly ahead	This is the lowest structure on route. There is no bypass around the gantry. A maximum loaded height of 5.8 metres should not be exceeded.
17.4	Tarro	New England Highway onto John Renshaw Drive GPS link: https://goo.gl/maps/SRDr5JigkBp	Width: 12.0 metres	Left hand merge	No problems with this section of road.
18.4	Beresfield	John Renshaw Drive GPS link: https://goo.gl/maps/N19vJih1Fgr	Width: 9.0 metres Height: 5.9 metres	Travel directly ahead	No problems with this section of road.
28.7	Buchanan	John Renshaw Drive onto the Hunter Expressway GPS link: https://goo.gl/maps/1STJ1PfQt9E2	Length: 65.0 metres Width: 7.0 metres	Right hand turn	No problems with this section of road.
58.9	Branxton	The Hunter Expressway onto The New England Highway GPS link: https://goo.gl/maps/7rauNuxzqjq	Width: 9.0 metres	Travel directly ahead	No problems with this section of road.
67.7	Whittingham	The New England Highway GPS link: https://goo.gl/maps/6D2JxKHfBgLh4yjx7	Width: 9.0 metres	Travel directly ahead	Stay on The New England Highway No problems with this section of road.
80.6	Gowrie	The New England Highway GPS link: https://goo.gl/maps/4AcyAsCCFKGmHrUi8	Height: 5.7 Metres Width: 12.0 Metres	Travel Directly ahead	No problems with this section of road.
82.0	McDougalls Hill	The New England Highway GPS link: https://goo.gl/maps/vVeH6PLGRQJTVqEv6	60.0 x 7.0 metres	Left Hand Merge	Possible Parking & Fuel on correct side of road - Ampol
84.6	Liddell	The New England Highway GPS link: https://goo.gl/maps/mu28Jn88qrP5W6Rn7	Height: 5.2 Metres	Travel Directly ahead	Maximum loaded height not to exceed 5.2 metres.
125.0	Muswellbrook	The New England Highway onto Bell St GPS link: https://goo.gl/maps/YtVwZY2k3ymDPaxs8	Length: 40.0 metres Width: 7.0 metres	Right hand turn	No problems with this section of road.

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KM index	Location	Section of road	Critical Measurement	Procedure	Notes
125.5	Muswellbrook	Bell Street onto Victoria Street GPS link: https://goo.gl/maps/aHhW27teZy9y3WNq9	Length: 40.0 metres Width: 7.0 metres	Left hand corners	Tight left-hand bend over a rail bridge before another tight left hand bend. Spotter to guide loads through this section of road, and approval from rail required to cross this structure.
126	Muswellbrook	Victoria Street onto Market Street GPS link: https://goo.gl/maps/pyiTUH25bANG3m9n9	Width: 7.0 metres	Travel directly ahead	No problems with this section of road.
126.5	Muswellbrook	Market Street onto New England Highway (Bridge St) GPS link: https://goo.gl/maps/3kpU6XdCBmCW75qM7	Length: 30.0 metres Width: 7.0 metres	Right hand turn at roundabout	Loads may need to cross to the incorrect side of the roundabout if they exceed 30.0 meters in length, and do not exceed 42 meters in length.
199.3	Murrurundi	New England highway (Township) GPS link: https://goo.gl/maps/Sj3ixAkhujt	60.0 x 5.0 metres	Parking Bay	Suitable parking for Fatigue breaks.
203.9	Murrurundi Hill	New England highway Nowlands Gap GPS link: https://goo.gl/maps/R5yufobPeMG2	120.0 x 12.0 metres	Parking Bay	Emergency parking only.
209.8	Willow Tree	New England highway GPS link: https://goo.gl/maps/XLTq7CRV7EU2	Width: 5.0 metres Length: 35 metres Height: 5.2 metres	Kankool weighbridge	It is likely that loads over 5.0 metres wide will not fit into this facility. We would need to have engineered documentation showing correct weights for all loads.
216.4	Willow Tree Township	New England highway GPS link: https://goo.gl/maps/qw38qmvVfTC2	60.0 x 5.0 metres	Parking Bay	Suitable parking for Fatigue breaks.
218	Willow Tree Truck Stop	New England highway GPS link: https://goo.gl/maps/RRdPVHupGCs	120.0 x 12.0 metres	Parking Bay	Suitable parking for Fatigue breaks for small loads only.
227.5	Wallabadah	New England highway GPS link: https://goo.gl/maps/QWCyeHQSohS2	80.0 x 5.0 metres	Parking Bay (side of road)	Suitable parking for Fatigue breaks.
233.3	Goono Goono	New England highway GPS link: https://goo.gl/maps/im4QhUfW24D2	80.0 x 10.0 metres	Parking Bay	Emergency parking only. Incorrect side of the road
276.6	Tamworth	Standard roundabout on the New England GPS link: https://goo.gl/maps/j1tpfb8JJf83jjt2A	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
278.6	Tamworth	Standard roundabout on the New England GPS link: https://goo.gl/maps/UM9a6UEw14GhSAXm8	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
279.1	Tamworth	Standard roundabout on the New England GPS link: https://goo.gl/maps/3J9dCHxtYim	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
279.8	Tamworth	New England Highway onto the heavy vehicle bypass at Scott Road. GPS link: https://goo.gl/maps/BXdwaSiLSBw	Length: 66.0 metres Width: 6.0 metres	Right hand turn. Loads over 20 metres long will need to cross to the incorrect side of the roundabout.	Signs to be made removable for loads over 6.0 metres in width.
281.8	Tamworth	Scott Road onto Murray Street GPS link: https://goo.gl/maps/nix2oREeh6H2	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
282	Tamworth	Murray Street onto New England Highway GPS link: https://goo.gl/maps/45dffqHmUcs	Length: 66.0 metres Width: 6.0 metres	Loads to cut across the wrong side of the roundabout from correct side to correct side. But travel through the incorrect side of the roundabout.	Loads over 20 metres in length will need to cross to the incorrect side of the roundabout. Signs to be made removable for loads over 6.0 metres in width.
283.3	East Tamworth	New England highway GPS link: https://goo.gl/maps/9cpBrT5qUAU2	200.0 x 9.0 metres	Parking Bay	Suitable parking for Fatigue breaks

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KM index	Location	Section of road	Critical Measurement	Procedure	Notes
302.1	Moonbi	New England highway GPS link: https://goo.gl/maps/E3TL2KkEctG2	80.0 x 7.0 metres	Parking Bay	Suitable parking for Fatigue breaks.
313.90	Moonbi range	New England highway GPS link: https://goo.gl/maps/rwJQaAYkLTQ2	100.0 x 9.0 metres	Parking Bay	Suitable parking for Fatigue breaks
358.2	Uralla	New England highway GPS link: https://goo.gl/maps/NpEeAEcV3jr	100.0 x 6.0 metres	Parking Bay	Suitable parking for Fatigue breaks.
383.3	Saumarez	New England highway GPS link: https://goo.gl/maps/625byaWW5un	150.0 x 8.0 metres	Parking Bay	Suitable parking for Fatigue breaks.
387.5	Armidale	Roundabout GPS link: https://goo.gl/maps/Q1dQZicemDspYEHPA	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
391.4	Armidale	Queen Elizabeth Drive over the New England Highway GPS link: https://goo.gl/maps/V4cXozF9tTH13Fb38	5.6 metres height	Travel under overhead bridge structure	Bridge structure has a minimum height clearance of 5.6 metres. All loads can pass under this structure unrestricted.
394.5	Armidale	Roundabout GPS link: https://goo.gl/maps/dQpbdaUgJ3p1bMdw8	Length: 66.0 metres Width: 6.0 metres	Drive directly ahead	Signs to be made removable for loads over 6.0 metres in width.
405.5	Armidale	New England highway GPS link: https://goo.gl/maps/irj5p9HveH52	100.0 x 9.0 metres	Parking Bay	Suitable parking for Fatigue breaks
420	Black Mountain	New England highway GPS link: https://goo.gl/maps/E5XRqUYekfA2	100.0 x 9.0 metres	Parking Bay (blades)	Suitable parking for Fatigue breaks
428.0	Guyra	New England Highway onto Ollera Street GPS link: https://goo.gl/maps/748y7hZqok3US4kGA	Length: 50.0 metres Width: 8.0 metres	Right hand turn	No problems with this section of road.
428.0	Guyra	Ollera Street onto Guyra Road GPS link: https://goo.gl/maps/Qyk79GGx8mthqbaAA	Length: 100.0 metres Width: 8.0 metres	Left hand Curve	No problems with this section of road.
503.0	Ebor	Guyra Road onto Waterfall Way GPS link: https://goo.gl/maps/YPUWGWYhHEfygs8e6	Length: 50.0 metres Width: 8.0 metres	Right hand turn	No problems with this section of road.
510.0	Ebor	Cutting along Waterfall Way GPS link: https://goo.gl/maps/QqUDqJTxTte7wtvVA	Length: 80.0 metres Width: 7.0 metres	Lefthand curve	No problems with this section of road.
537.0	Wollomombi	Waterfall Way onto Kempsey Road GPS link: https://goo.gl/maps/fHG87PPc4589p7xK9	Length: 50.0 metres Width: 7.0 metres	Left hand turn	No problems with this section of road.
537.0 to 578.0	Wollomombi to Georges Junction	Kempsey Road GPS link: https://goo.gl/maps/aDQmToeJ2TCYgpWo8	Length: 10.0 metres Width: 2.4 metres	Travel directly ahead around several tight corners while ascending to the gap from the east and descending away from the gap to the west.	This section of road is sealed for a small section than gravel that varies in grade from good to poor. It has several Bridges and pipes and culverts that would need to be checked for capacity. The road has multiple tight bends with many at the edge of sheer cliffs. Even with extensive modifications the loads would be just too large to travel down the mountain pass. After travelling this section of road, we believe the risk is too great and the modifications are too extensive, to make this a realistic option. We would recommend that route 1 be used for this project.
578.0	Georges Junction	Kempsey Road GPS link: https://goo.gl/maps/juqRw35j62eKxtxL8	N/A	Right hand turn	Access from Kempsey Road onto the final access route to the project site will need to be made suitable for the swept path of the largest load.

565.0 Km's: Kempsey Road north of Georges Junction

Image 1: Section of road descending into Georges Junction



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/msRazsvMjs6WCQbj9
PROCEDURE: Travel around multiple tight corners while descending into Georges Junction.
COMMENTS: After travelling this section of road, we believe the risk is too great and the modifications are too extensive, to make this a realistic option.
We would recommend that route 1 be used for this project.
ROAD MODIFICATIONS: Too extensive and high risk to make this an option.

10.0 Summary of route

After studying all the options and undertaking both route surveys, it was observed that Route 1 would be the only realistic option. Route 2 requires an extensive amount of work and is just unrealistic for the components listed in this report.

If Route 1 is to become realistic, then the following would need to be undertaken at a minimum.

NEWCASTLE:

- Access out of Newcastle and through to the Pacific Highway is suitable for the loads listed in this report.

PACIFIC HIGHWAY:

- The Pacific Highway is suitable for the loads listed in this report.

PACIFIC HIGHWAY TO BELLBROOK:

- Several signs to be modified on this section of road.
- Some vegetation will need to be trimmed on this road.
- Bridge assessments required for all structures on this road.
- The road itself appears to be okay for the swept path of the loads. However, we would recommend a drawbar platform trailer instead of a gooseneck platform trailer.

BELLBROOK TO OVENS MOUNTIAN SITE ACCESS ROAD:

- There are multiple corners that require upgrades on this section of road. We have shown a number of these in the report showing possible upgrades that would need to take place. A thorough survey and civil design needs to be undertaken to determine the extent of the works that would be required.
- The road itself changes from Asphalt to Gravel and is poor in some areas.
- Large amounts of vegetation will need to be removed on this road.
- Bridge assessments required for all structures on this road.
- The road itself appears to be okay for the swept path of the loads. However,

OVENS MOUNTAIN SITE ACCESS:

- The new site access will need to be made suitable for the largest swept path in this report.

OVERHEAD STRUCTURES: (5.3 Maximum loaded height)

- Loads listed in this report are suitable for height clearance under all structures. We would recommend that any other loads do not exceed 5.3 metres in overall height.

OVERHEAD UTILITIES:

- This route will need to be checked by an authorised scoping company. It is likely that a route up to 5.3 metres is required for this project.

BRIDGES:

- The route up until Kempsey is likely to be okay but will still need to have an assessment for each type of vehicle combination.
- A full bridge assessment will be required from Kempsey through to site.

RAIL ASSETS:

- There are a number of rail overbridges and crossings on route that will require approval from authorities before loads can access the routes.

WIDTH:

- The existing road past Bellbrook will not accommodate loads over 2.5 metres in axle width. This will cause issues with the heavier loads which are 4.2 metres wide at the axle width. For these wider trailers the road width needs to be at a minimum 5.5 metres plus side verges along the straight sections, and wider on corners depending on the radius of the swept path.
- An item width of 4.5 metres is not possible along this road in its current form. Large sections of this road will need to be widened to allow loads of up to 6.5 metres to travel along the road.

VEGETATION:

- The route up until Kempsey is clear of vegetation removal. After Kempsey there will need to be a large amount of vegetation removed.

PAVEMENT:

- The pavement up to Bellbrook is of a highway standard and suitable for these types of loads. After Bellbrook the road is a mix of Asphalt and gravel and varies dramatically in condition. Sections of this road will require pavement modifications.

ROADWORKS:

- The project will need to start discussions with government authorities at least 18 months prior to transport to understand if the project would conflict with any upcoming roadworks. Once a TMP has been approved for the transport of the turbines, then the exact movement dates need to be communicated with transport NSW to make all road stakeholders aware of the

CONCLUSION OF ROUTE:

- After reviewing the Site access options, we are under the opinion that the loads hypothetically could be delivered along Route 1 with road modifications required to suit the swept path and dimension of the largest loads.
- A civil design needs to be undertaken from Bellbrook to Ovens Mountain based on the swept path and dimensions of the largest load.
- A full vegetation assessment is required along the Armidale/Kempsey Road.
- A full bridge assessment is required along the Armidale/Kempsey Road including all pipes and culverts.
- Discussions with government authorities required to understand if they have concerns with loads of this physical size along the Armidale/Kempsey Road.
- We recommend that the listed actions in this report are undertaken at a minimum.

11.0 Approvals:

At a minimum, the following are required for approval to access these routes.

- NHVR
- TfNSW
- Newcastle Council
- Kempsey Shire Council
- Armidale Regional council
- NSW Police
- Ausgrid
- Essential Energy
- Telstra
- CRN JHG (Rail)
- ARTC (Rail)

12.0 References:

Rex J Andrews Route survey # 334
SMEC
Google Earth/Maps
Nearmaps
Six Maps
NHVR
NHVAS Maintenance Management (NHVAS21193)
NHVAS Basic Fatigue Management (NHVAS21193)

Disclaimer: This route study is a guide only; government approvals would be required before these routes could be deemed suitable for transporting the components over the listed routes.

Any, and all parties using information contained this submission do so at own risk.

RJA accept no responsibility for the use of all information contained within this report.

Proposed routes may change subject to approvals from authorities.

This study was undertaken using data supplied by Rex J Andrews P/L. Equipment and swept paths might vary if using transport methodology other than the data supplied by Rex J Andrews.

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