Merimbula Sewage Treatment Plant Upgrade and Ocean Outfall

Appendix K

Traffic and Transport Report

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Traffic and Transport Report

Client: Bega Valley Shire Council

ABN: 26 987 935 332

Prepared by

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Executive Summary

Bega Valley Shire Council is proposing an upgrade to the Merimbula Sewage Treatment Plant (STP) including a new ocean outfall in Merimbula Bay (the Project). The Project would be located between Merimbula and Pambula, within the Bega Valley Shire local government area (LGA). The Merimbula STP is bounded by the Pambula Merimbula Golf Club (PMGC) to the south, Merimbula Lake to the west, Merimbula Airport to the north and Arthur Kaine Drive to the east. The Merimbula STP is accessed via Arthur Kaine Drive, which links to Princes Highway to the west and providing direct access to Merimbula Airport in the north.

The Project would involve an upgrade of sewage treatment at the Merimbula STP and replacement of the existing beach face outfall and dunal exfiltration ponds with an ocean outfall in Merimbula Bay. Specifically, the Project would involve:

- upgrade of the STP to improve the quality of treated wastewater (including for beneficial re-use);
- decommissioning of the beach-face outfall, as well as an STP effluent pond;
- discontinuing the use of the dunal exfiltration ponds;
- installation of a secondary disposal mechanism - an ocean outfall pipeline about 3.5 km in length to convey treated wastewater to a submerged diffuser;
- installation of upgraded pumps; and
- continuation of the beneficial re-use irrigation scheme at the PMGC grounds and the Oaklands agricultural area, with treated wastewater of improved quality.

The Project area comprises the existing Merimbula STP site and ocean outfall alignment, as well as areas required for construction, including laydown areas within the adjacent PMGC grounds and on Merimbula Beach (with access via Pambula Beach).

The Project is aimed at reducing the environmental and health impacts of current operations, by providing a higher level of treatment and a superior mode of discharge/ dispersion of the treated wastewater via an ocean outfall in Merimbula Bay. The upgraded STP would be operated with the additional treatment processes which would improve the quality of the treated wastewater.

This Traffic and Transport Report is one of a number of technical documents that forms part of the Environmental Impact Statement (EIS) for the Project. This assessment addresses the relevant Secretary's Environmental Assessment Requirements (SEARs), aiming to identify potential impacts of the Project and to outline performance outcomes and mitigation and management measures relating to traffic and transport during detailed design, construction and operation of the Project.

Existing traffic and transport environment

Merimbula STP is located in the suburb of Merimbula, around 450 km south of the Sydney Central Business District (CBD) and 370 km south of Wollongong. Merimbula is bounded by Tura to the north and Pambula to the south. The Port of Eden is located around 27 km to the south.

The key road network surrounding Merimbula STP includes Arthur Kaine Drive, Toallo Street and the Princes Highway. These are local roads except for Princes Highway which is a State road. Additional roads to be used as haulage routes and access to the ocean outfall pipeline for the Project include Coraki Road in Pambula and Imlay Street in Eden.

Impacts during construction

The Project, including haulage routes and access locations during construction, is unlikely to affect bus services in the vicinity of the Project area. Bus services along Arthur Kaine Drive, Imlay Street and Coraki Road would continue to operate as normal during construction activities. There would be no changes to bus stop locations as a result of the Project.

During construction, works would be undertaken within designated construction sites and in a manner that would maintain pedestrian/cyclist routes surrounding the construction areas. As such, the construction of the Project is not anticipated to impact the shared path facilities fronting the Merimbula STP site, except for temporary disruptions due to construction traffic entering and exit the site. Walking and cycling facilities near the construction access at Pambula Beach and at the Port of Eden are also expected to remain open during construction of the Project. Impacts during construction would arise from increased heavy/light vehicle volumes, potentially increasing safety risks for pedestrians and cyclists.

The expected peak volume of construction vehicles of 10 heavy vehicles and 20 light vehicles per day for delivery of materials, including loading of spoil and waste and concreting activities, would create negligible traffic impacts in the surrounding road network. In the worst-case scenario considered for this assessment (i.e. all the vehicles arriving in a single peak hour), the traffic volumes are still considered low as the existing intersection performance at all of the modelled intersection sites would be Level of Service (LoS) A, representing unimpeded and free traffic flow. The additional traffic volumes would result in minimal impacts on existing traffic conditions.

Impacts during operation

The upgrade of the Merimbula STP facilities would retain the existing shared path facilities and would not result in any changes to the road network for buses or private property access. The upgrade of the STP is likely to result in a marginal increase in traffic (from people accessing the site by car), however this would be a negligible impact on the surrounding road network.

Environmental management

Potential transport impacts from construction activities would be mitigated through a range of management and mitigation measures. These measures, alongside a suite of performance outcomes, would be met through the development of a Construction Traffic Management Plan, which would form part of an overarching Construction Environmental Management Plan for the Project.

1.0 Introduction

Bega Valley Shire Council (BVSC) is proposing an upgrade to the Merimbula Sewage Treatment Plant (STP) including a new ocean outfall in Merimbula Bay (the Project). The Project would be located between Merimbula and Pambula, within the Bega Valley Shire local government area (LGA) (refer **Figure 2-1**).

This Traffic and Transport Report has been prepared to assess the potential impacts of the Project, during construction and operation, on traffic and transport.

1.1 Project overview

The Project would involve an upgrade of sewage treatment processes at the Merimbula STP, decommissioning of an existing effluent storage pond, and replacement of the existing beach-face outfall and dunal exfiltration ponds with an ocean outfall pipeline in Merimbula Bay.

When operational, the Project would involve continuation of the beneficial re-use irrigation scheme at the Pambula Merimbula Golf Club (PMGC) grounds and the nearby Oaklands agricultural area, with improved treated wastewater quality from the upgraded STP.

The Project would reduce the environmental and health impacts of the current operations, by providing a higher level of treatment and a superior mode of discharge/dispersion of the treated wastewater via the ocean outfall offshore in Merimbula Bay.

The Project is described in further detail in **Section 2.0**, and an overview of the Project area is provided in **Figure 2-1**. A full Project description is provided in the EIS (refer **Chapter 2 Project description**).

1.2 Purpose of this technical report

This Traffic and Transport Report is one of a number of technical documents that forms part of the EIS. The aim of this technical report is to address the relevant Secretary's Environmental Assessment Requirements (SEARs) provided by the NSW Department of Planning Industry and Environment (DPIE), which were reissued for the Project (Application number SS1 7614).

1.2.1 Secretary's environmental assessment requirements

The SEARs relating to traffic and transport, and where these requirements are addressed in this report, are outlined in **Table 1-1**.

Table 1-1 Secretary's environmental assessment requirements – Traffic and transport

Secretary's Environmental Assessment Requirements	Where addressed in report
10. Transport and Traffic	
1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	
(a) a considered approach to route identification and scheduling of transport movements;	Traffic management measures, haulage routes and construction traffic and access are discussed in **Section 5.0**
(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	Details of construction related vehicles are presented in **Section 2.2** and **Section 5.1.4**
(c) construction vehicle access arrangements to Merimbula Beach;	Construction access arrangements to Merimbula Beach are outlined in **Section 5.1**
(d) construction worker parking;	Construction parking arrangements are discussed in **Section 5.1.3**

Secretary's Environmental Assessment Requirements	Where addressed in report
10. Transport and Traffic	
(e) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	The existing network performance is presented in **Section 4.6**
(f) access constraints and impacts on public transport, pedestrians and cyclists; and	Construction impacts on public transport, pedestrians and cyclists are presented in **Section 5.1.1** and **Section 5.1.2**
(g) the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project.	Construction impacts on the road network and cycle network are presented in **Section 5.1.2** to **Section 5.1.4**

1.2.2 Structure of this report

This report is structured as follows:

- **Section 1.0: Introduction** – provides and introduction to the Project.
- **Section 2.0**: Project description – describes the Project including the anticipated construction activities.
- **Section 3.0: Methodology** – discusses the methodology adopted for the traffic and transport assessments, including key data sources and assumptions.
- **Section 4.0: Existing environment** – establishes the existing traffic and transport environment in the vicinity of the Project, including consideration of the existing road network, public transport features and traffic volumes. This section further provides an overview of the future transport context with regard to transport policy and infrastructure in the study area.
- **Section 5.0: Impact assessment** – provides an overview of the impact of the additional construction-related traffic on the study area, including consideration of proposed heavy vehicle access and egress construction routes and construction worker movements. This section also presents an assessment of the operational traffic and transport impacts of the Project and the cumulative impacts due to the Project and other major transport projects.
- **Section 6.0: Mitigation and management measures** – describes the identified mitigation and management measures.
- **Section 7.0: Conclusion** – concludes the traffic and transport assessment.

2.0 Project description

This chapter outlines the existing operations at the Merimbula STP and provides a summary of the Project description. A full Project description is provided in **Chapter 2 Project description** of the EIS.

The Project would be located between Merimbula and Pambula on Arthur Kaine Drive, within the Bega Valley LGA approximately 3.5 kilometres (km) south of the Merimbula town centre and 2.5 km north of Pambula village, as shown on **Figure 2-1**. The Merimbula STP is bounded by the PMGC to the south, Merimbula Lake to the west, Merimbula Airport to the north and Arthur Kaine Drive to the east. The Merimbula STP is accessed via Arthur Kaine Drive, which links to Princes Highway to the west and provides direct access to Merimbula Airport in the north.

2.1 Existing operations

The existing operations at the Merimbula STP consist of:

- sewage treatment at the Merimbula STP; and
- disposal of treated wastewater via:
  - a beach-face outfall;
  - dunal exfiltration ponds; and
  - a beneficial re-use scheme at the adjacent PMGC grounds, and at Oaklands agricultural area.

The STP is an intermittently decanted extended aeration (IDEA) activated sludge plant designed to serve an equivalent population of 15,500. The STP has a capacity to accommodate an average dry weather flow of up to 3.72 megalitres per day (ML/day) and a peak wet weather flow of seven times the average dry weather flow, or 26 ML/day. It handles an average of 790 megalitres (ML) of treated wastewater per year .

The current strategy for managing treated wastewater from the Merimbula STP comprises a combination of:

- beneficial re-use (the preferred disposal option): use of treated wastewater to irrigate the adjacent PMGC grounds and ‘Oaklands’ agricultural area (approximately 25% of annual treated wastewater), located on the Pambula River flats at South Pambula; and
- disposal: discharge of excess treated wastewater to the environment, via dunal exfiltration ponds located within the sand dunes east of the STP between the ocean and Merimbula Lake (approximately 25% of annual treated wastewater), or via the existing beach-face outfall east of the STP at Merimbula Beach (approximately 50% of annual treated wastewater).

2.2 The Project

The Project would involve:

- upgrade of the STP to improve the quality of treated wastewater (including for beneficial re-use);
- decommissioning of the beach-face outfall, as well as an STP effluent storage pond;
- discontinuing the use of the dunal exfiltration ponds;
- installation of a secondary disposal mechanism - an ocean outfall pipeline about 3.5 km in length to convey treated wastewater to a submerged diffuser;
- installation of upgraded pumps; and
- continuation of the beneficial re-use irrigation scheme at the PMGC grounds and nearby Oaklands agricultural area with treated wastewater of improved quality.

Upgrades to the STP and the ocean outfall would reduce the environmental and health risks and impacts of the current operations, by providing a higher level of treatment and a superior mode of discharge/ dispersion of the treated wastewater via an ocean outfall offshore in Merimbula Bay.

A summary of the proposed Project elements is provided in **Table 2-1**.

The Project area comprises the existing Merimbula STP site and the proposed outfall pipeline alignment. The Project construction areas would include areas within the Merimbula STP, temporary laydown areas on the adjacent PMGC grounds and on Merimbula Beach (with associated access from Pambula), as shown in **Figure 2-1**.

The EIS is based on a concept design for the Project. It is noted that during subsequent design stages, and subsequent to a design and construction contractor(s) being engaged, details of the Project may change or be refined (e.g. specific locations of some elements or infrastructure within the existing STP site; materials to be used in plant construction and technology).

Table 2-1 Project elements

Project element	Summary
STP upgrade	The STP upgrade would involve additional treatment processes incorporated into the existing STP site, including two stage poly aluminium chloride (PAC) dosing, ultraviolet (UV) disinfection, chlorine dosing and tertiary filtration (if required). The indicative physical layout of the proposed STP upgrade is shown in **Figure 2-2**. The new treatment processes would be incorporated into the following existing STP phases (refer **Chapter 2 Project description** for further information): *Phase two: secondary treatment* Addition of: • two stage PAC dosing for phosphorous removal. *Phase three: disinfection* A change to the existing disinfection (chlorine dosing) treatment, involving: • addition of ultraviolet (UV) treatment; • chlorine dosing would continue to be applied to treated wastewater, however wastewater would be divided into two separate streams: - wastewater to be beneficially re-used would be dosed with chlorine; and - wastewater to be discharged via the ocean outfall would no longer be subject to chlorine dosing. • the chlorine dosing proposed would involve installation of a new chlorine dosing unit (including two 920 kg drum storage of chlorine, and a new pump system). The chlorine dosing unit would be stored at a dedicated storage facility within the STP (either the existing chlorine storage shed would be upgraded to house the increased volume of chlorine required for the Project, or a new shed would be built on or near to the site of the existing shed); and • tertiary filtration could also be installed (if required).

Project element	Summary
	The Project would also require the following within the existing STP site: • a new storage tank and new chlorine contact tank; • installation of up to four additional pump stations: - ocean outfall pump station – to pump treated wastewater through the outfall pipeline; - storage tank pump station – to pump treated wastewater to the new storage tank; - chemical sludge pump station (if tertiary filters required) – to pump sludge and treated wastewater; and - pump station – to pump from wet weather overflow back into the STP treatment train. • installation of ancillary infrastructure (including new sheds/structures to house new treatment processes, above-ground storage tanks, pipes, pits, power supply and additional low voltage (LV) connection (including transformer, cabling and distribution board), control kiosks, a retaining wall and internal access roads); and • relocation and upgrade of utilities to accommodate the additional features proposed.
Existing STP effluent storage pond	The existing 17 ML effluent storage pond within the STP site would be decommissioned, including dewatering and sediment/sludge removal.
New ocean outfall pipeline and effluent diffuser, and associated pump station	*Phase four: Disposal and beneficial re-use* New additions would involve: • installation of a 3.5 km outfall pipeline – the pipeline would travel from the STP in an east-south-easterly direction to a location approximately 2.7 km offshore in Merimbula Bay; • the pipeline would involve two construction methods for different sections of the pipeline as follows: - 'Section one' – STP to a location beyond surf zone: underground trenchless drilling method (refer **Figure 2-3**); and - 'Section two' – Location beyond surf zone to offshore pipeline termination point: laying of pipeline on sea floor and covering with rock or concrete mattresses (refer **Figure 2-4**). • Section one of the pipeline (the onshore component) would be about 0.8 km and below ground. installation of the underground section would be via a trenchless method (e.g. horizontal direction drilling or direct drive tunnelling), followed by pipeline insertion via pulling or pushing; • Section two (the above ground section of the pipeline) would be installed via direct placement on the sea floor in 600 m to 800 m pipe lengths. This would also involve progressive protection and stabilisation works for the pipeline (e.g. potentially using concrete or rock mattresses) held together with ropes/ slings/ cables; • the terrestrial component of the outfall pipeline would be laid between about -9.3 m and -19.5 m AHD, with greater depth largely depending on the nature of the overlying sand dunes; • a multi-port pipeline diffuser would be located at the end of the pipeline at a depth of approximately 30 m; the diffuser would be approximately 80 m in length; • the pipeline would have an outer diameter of up to 450 mm (366 mm internal diameter) and consist of pipeline lengths welded together; • a transition riser may be required to connect the underground pipeline with the above ground section of pipeline on the sea floor (if required, the riser would be located beyond the surf zone); and • the pipeline would contain valves along its length for mitigating against air entrapment.

Project element	Summary
Existing exfiltration ponds	The existing exfiltration ponds within the adjacent sand dunes (east of the STP site) would cease to be used under the Project.
Existing beach-face outfall	The existing public beach-face outfall pipeline would be decommissioned. The exposed end of the outfall pipeline would be removed, and the remainder of the pipeline would remain in-situ (i.e. would remain buried underground).
Water use	The STP would continue to use potable town water for kitchen and amenities on site. Apart from these water inputs, the Project would not require any other ongoing water source during operation.
Construction	
Construction footprint	The construction footprint includes temporary compound and laydown areas as shown in **Figure 2-5**. The location of laydown areas would be confirmed during detailed design and would depend on the method and location/s proposed to be used for directional drilling by the construction contractor. Temporary construction laydown areas would be located: • within the STP site; • within a portion of the adjacent PMGC grounds; and • on Merimbula Beach (if required, for pipe stringing and potentially an intermediate drill rig site for directional drilling). A total of approximately 2,800 square metres (m^2) (or 0.28 hectares) of vegetation removal / trimming would be required in the following locations: • approximately 217 m^2 at the Pambula Beach access track; and • approximately 2,464 m^2 of regrowth scrub within the existing STP site and for construction access from the construction laydown area within the PMGC grounds; and • approximately 47 m^2 at the existing beach face outfall pipeline (to be decommissioned).
Construction timing, hours and workforce	Pending Project approval, it is proposed to commence construction in 2022, with construction anticipated to be undertaken over a period of 24 months. Construction would be staged and there would be times when some construction stages overlap. Works would typically be limited to standard daytime hours, which include: • 7:00 am to 6:00 pm Monday to Friday; • 8:00 am to 1:00 pm Saturday; and • no work on Sundays, public holidays. Certain works may need to occur outside standard construction hours for the safety of workers, in accordance with transport licence requirements, or for constructability reasons. Activities to be carried out during out of hours periods may include oversized load deliveries and pipeline pulling as part of the directional drilling (which would need to be undertaken continuously until completed, which may take up to 48 hours). Construction works in Merimbula Bay could occur seven days a week to maximise works during favourable offshore weather conditions. Approval from BVSC would be required for any out of hours work and the affected community would be notified. Construction of the Project would require a workforce of around 20 workers, with peak construction periods requiring up to 30 workers.

Project element	Summary
Traffic, construction vehicle types and workforce	Construction traffic would indicatively comprise: • 5 to 10 heavy vehicles per day (e.g. truck and dogs); and • 10 to 20 light vehicles per day. Vehicles transporting machinery or oversized materials such as prefabricated units may be required from time to time, and oversized vehicles would require escort to and from site. The largest truck expected as part of construction is the directional drilling rig truck (the exact size would be confirmed by the construction contractor). The construction phase of the Project would require construction vehicles to transport materials and equipment along the existing road network to the construction compound/laydown areas at the Merimbula STP and PMGC grounds and, if required, at the Merimbula Beach laydown area via Pambula Beach. In facilitating these construction activities, various plant and equipment would be required, including: • small, medium and large excavators (3 to 25 tonne) (tracked and wheeled); • compaction plant (e.g. roller/s, plate compactor); • grader; • bulldozer; • directional drilling rig truck and associated infrastructure (i.e. drilling fluid recovery and recovery unit); • pumps for dewatering (if required); • vacuum truck; • bobcat; • concrete trucks and pumps; • mobile cranes (e.g. franna crane, scissor lift, forklift); • semi-trailers and tipper truck; • telehandlers; • micro-piling rig (on barge); • water carts; • hand tools and welding equipment; • barges (e.g. 55 m and 73 m barges, jack-up barge) and tugs; • small, self-propelled vessel; • demolition saw, jackhammer, grinder; • generator/s, lighting tower; • forklift; • light vehicles and light trucks; and • heavy vehicles. The size of vehicles used for haulage would be consistent with the access route constraints, safety and any worksite constraints. Some construction activities (such as the delivery of precast sections) may require truck and trailer combinations or semi-trailers. Access arrangements for these vehicles would be defined in the Construction Traffic Management Plan (CTMP) prepared by the contractor during subsequent design stages.

Project element	Summary
Access	Construction vehicles would access/egress the STP site via the following accesses: • Arthur Kane Drive, via either the northern end of the STP site, and/or the existing main STP entrance. Construction of the outfall pipeline would also utilise the following accesses: • Coraki Drive, Pambula (construction vehicles would enter the temporary beach access track from the end of Coraki Drive, before traversing the beach access track to the laydown area on Merimbula Beach); and • Port of Eden, Twofold Bay (barge/s would transport materials and equipment northward to the location of the proposed outfall pipeline alignment). Construction site accesses at Arthur Kaine Drive and Pambula Beach are shown in **Figure 2-5**. Construction materials and equipment could also be delivered to the Port of Eden using shipping containers, with construction vehicles expected to haul these containers to the construction sites via the Princes Highway (refer **Figure 2-6**).
Construction vehicle haulage routes	**Figure 2-7** presents potential access routes to each construction site, as well as the Transport for NSW (TfNSW) approved B-double routes surrounding the Project area. Proposed construction sites within the Project area are located near the Princes Highway, which is an approved B-double route. This route provides high clearances and sufficient road widths to accommodate larger vehicles, making it ideal for the construction haulage routes. However, some sections may be subject to sign-posted restrictions. The proposed access from Princes Highway onto Toallo Street via the roundabout at this location is expected to be adequate for truck and dogs, however depending on the size of the directional drill rig truck selected (i.e. the largest vehicle expected for construction), an upgrade to the roundabout may be required. This access would be tested for access adequacy for the construction vehicles expected, and to identify any infrastructure upgrade required, as part of the CTMP for the Project. An application would need to be made to the National Heavy Vehicle Regulator (NHVR) for an access permit during subsequent design stages prior to the commencement of the construction works.

2.3 Operational stage

The Project would be operated with the additional treatment processes which would improve the quality of the treated wastewater. Levels of total phosphorus, total suspended solids, biological oxygen demand, virus, bacteria and other pathogens would be managed to be within discharge limits. Treated wastewater would be tested for quality prior to discharge via the ocean outfall pipeline or via beneficial re-use offsite (to existing land application areas at the Oaklands agricultural area or the adjacent PMGC grounds). Maintenance activities for the STP and ocean outfall would also be undertaken and would continue until the STP is decommissioned or further upgraded in the future.

FIGURE 2-1: PROJECT AREA

Legend

- Project area
- Project area (temporary construction area)

N

0 500 1,000 m

AECOM

Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 2-2: PROPOSED STP LAYOUT (INDICATIVE)

N 0 50 100 m

AECOM

Legend

- Project area
- Project area (temporary construction area)

Proposed Project Upgrades

- PAC dosing, UV disinfection, tertiary treatment
- Pump stations, storage, chlorine disinfection
- PAC dosing (second unit)
- Effluent storage pond to be decommissioned

Source: Nearmap, 2019

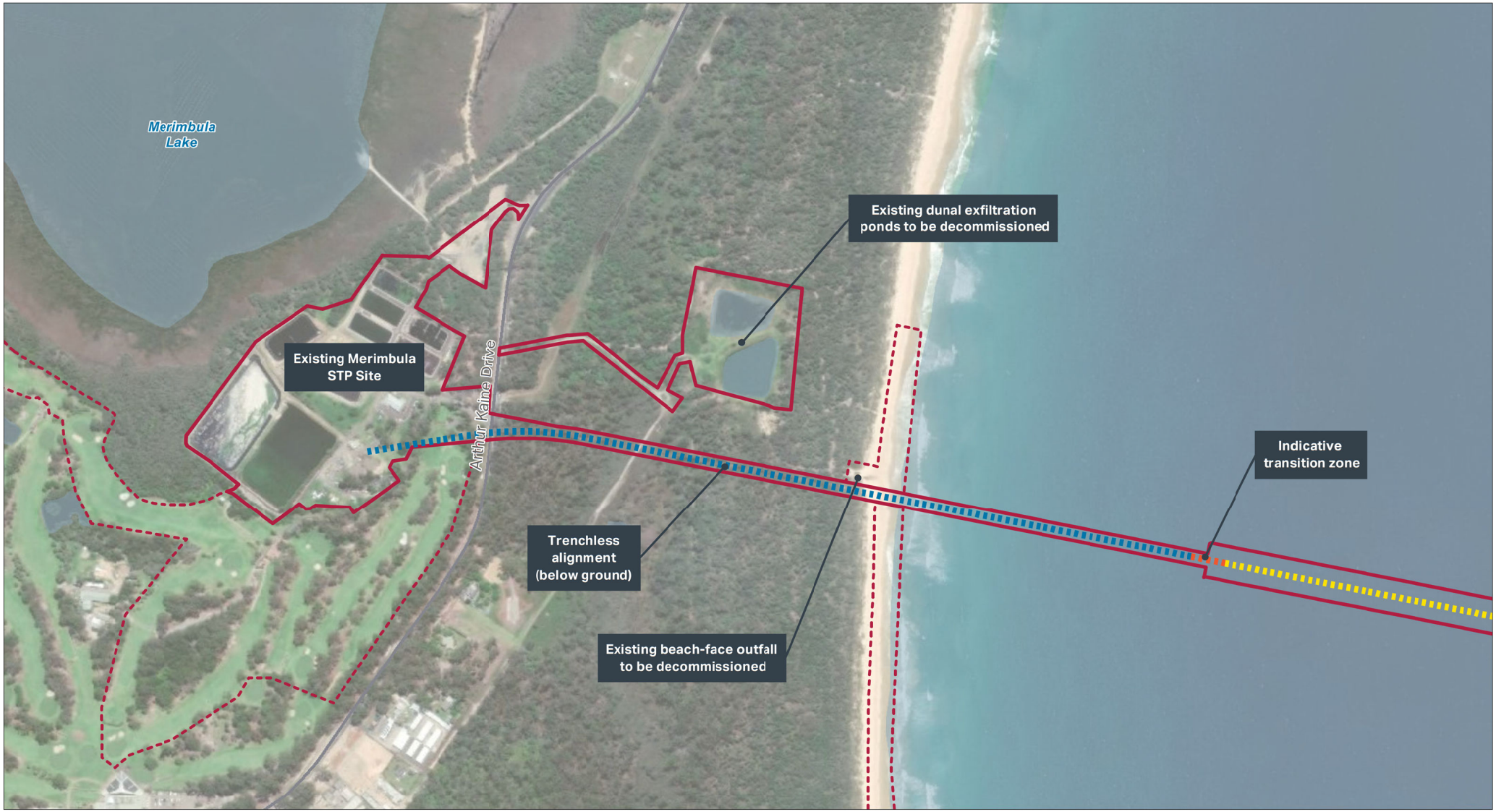


FIGURE 2-3: OCEAN OUTFALL PIPELINE - SECTION 1 (BELOW GROUND)

N

0 100 200 m

AECOM

Legend

- Project area
- Project area (temporary construction area)
- Outfall pipeline – Section 1 (below ground)
- Transition Zone
- Outfall pipeline – Section 2 (above seafloor)

Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 2-4 : OCEAN OUTFALL PIPELINE – SECTION 2 (ABOVE SEAFLOOR)

Legend

- Project area
- Project area (temporary construction area)
- Outfall pipeline – Section 1 (below ground)
- Transition Zone
- Outfall pipeline – Section 2 (above seafloor)
- Diffuser (above seafloor)

N

0 200 400 m

AECOM

Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 2-5: CONSTRUCTION COMPOUND/LAYDOWN AREAS

N

0 300 600 m

AECOM

Legend

- Project area
- Temporary project area for construction
- Construction access
- Construction compound/laydown area
- Construction laydown area and potential intermediate drilling site
- Construction laydown area at Pambula-Merimbula Golf Club grounds

Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

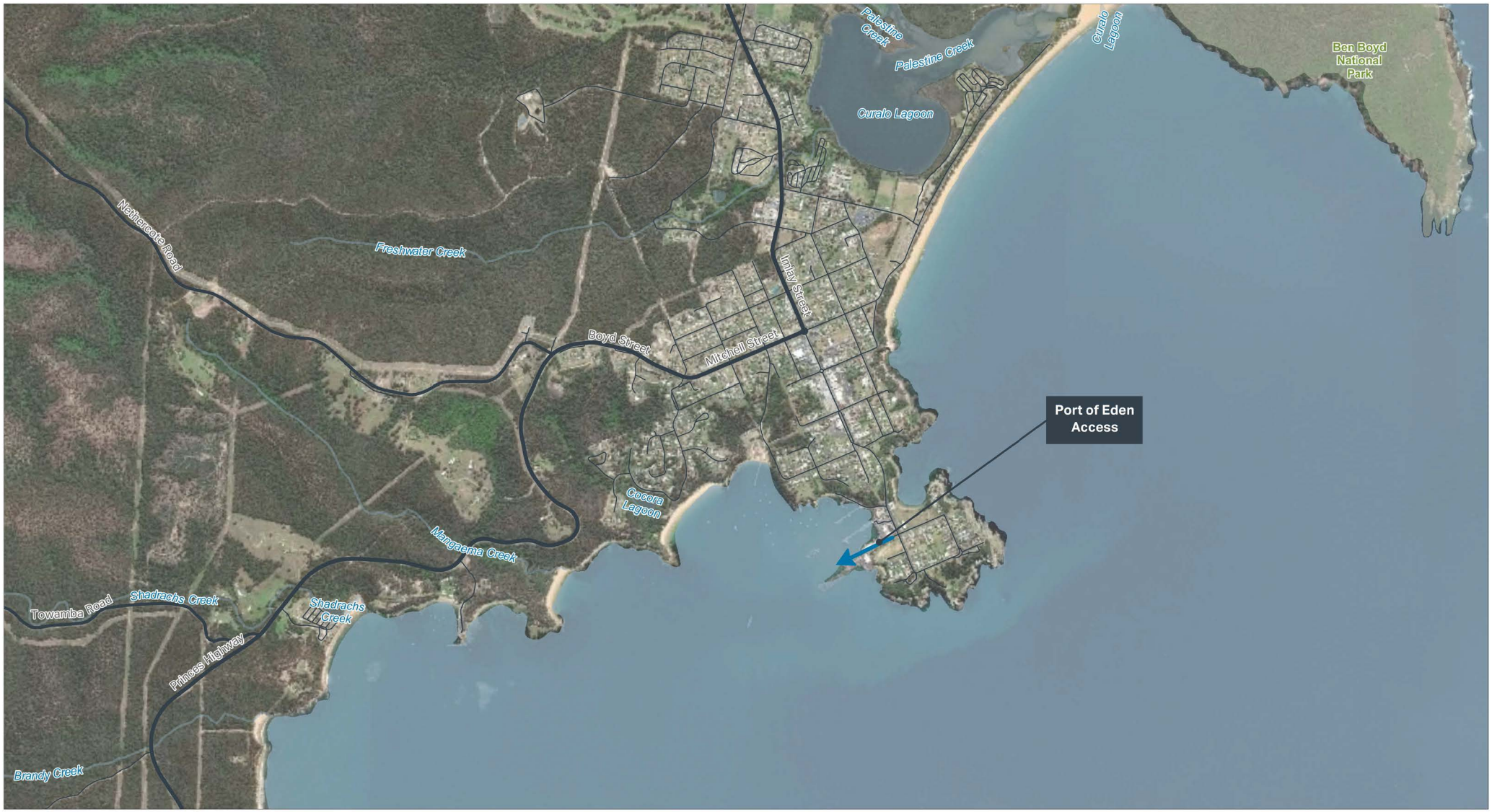


FIGURE 2-6: PROPOSED CONSTRUCTION ACCESS VIA PORT OF EDEN

N

0 500 1,000 m

AECOM

Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Department of Customer Service, 2020

Legend

Construction Access

FIGURE 2-7: PROPOSED HAULAGE ROUTES

N 0 2 4 km

AECOM

Legend

- Project area
- Project area (temporary construction area)
- Approved B-Double Route
- Road Sections that Require Approval

Source: Department of Customer Service, 2020; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

3.0 Methodology

3.1 Relevant guidelines

The following guidelines were considered during the preparation of this Traffic and Transport Report:

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads, 2017);
- *Guide to Traffic Generating Developments Version 2.2* (RTA, 2002);
- *Technical Direction TDT2013/4a – Guide to Traffic Generating Developments* (Roads and Maritime Services, 2013); and
- *Guide to Traffic Management Part 12* (Austroads, 2020) and the complementary Roads and Maritime Supplement (*RMS Austroads Guide Supplements*, RMS, 2013).

These guidelines provide an overview of available methods for undertaking transport studies and analysis, aspects of traffic generation considerations relating to developments as well as guidance on identifying, assessing and mitigating traffic impacts, which have been used to inform this assessment.

3.2 Local planning context

The following planning instruments apply to the Bega Valley Shire, in which the Project area is located:

- *Bega Valley Local Environmental Plan 2013* (Bega Valley LEP 2013); and
- *Bega Valley Development Control Plan 2013* (Bega Valley DCP 2013).

Bega Valley LEP 2013 outlines the planning requirements and considerations for development at Council level, whilst the Bega Valley DCP 2013 supplements this and outlines several objectives and controls. Although the Project is to be determined by the Department of Planning, Infrastructure and Environment (DPIE) as a State Significant Infrastructure project (refer to **Chapter 5 Statutory context** of the EIS for further information), the local planning guidelines have been considered and compliance with these policies would be considered beneficial to the Project.

3.3 Study area

The study area for this assessment is a broad area encompassing the road network and land uses in its vicinity of the Project area, which may be impacted by the transport and access requirements of the Project. This includes:

- areas surrounding the Merimbula STP, in particular Arthur Kaine Drive;
- at Pambula Beach, particularly along Coraki Drive;
- near Port of Eden, particularly along Imlay Street.

The study area for this Traffic and Transport Report is shown on **Figure 3-1**.

FIGURE 3-1: STUDY AREA

N 0 2 4 km

AECOM

Legend

- Project area
- Project area (temporary construction area)
- Motorways and Primary roads
- Arterial, Sub-Arterial and Distributor roads
- Local roads

Source: Department of Customer Service, 2020; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

3.4 Data sources and assumptions

3.4.1 Data sources

The following data/ information was used to inform this assessment:

- a desktop assessment of the Project area and its surrounds based on publically available aerial photography and other GIS mapping information;
- intersection turning movement counts, undertaken (by the company Matrix Traffic and Transport Data) in July 2020, between 06:00 - 09:00 and 16:00 - 19:00 on weekdays and 10:00 – 14:00 on weekends;
- mid-block tube counts undertaken by BVSC over a seven-day period during February 2020;
- mid-block tube counts undertaken by Matrix Traffic and Transport Data over period in July coinciding with the intersection counts to adjust for the traffic impacts of the COVID-19 pandemic;
- construction information for the Project including construction traffic numbers and access arrangements, staging of construction works, work hours and workforce numbers;
- plans for the proposed STP upgrades and ocean outfall pipeline; and
- other documents and data as referenced in this report.

3.4.2 Assumptions

The assessment of the traffic and transport impacts were based on the following assumptions:

- intersection layouts were prepared based on a desktop review of publically available aerial photography and other GIS mapping information;
- intersections were assessed as standalone sites using a computer-based modelling package (i.e. SIDRA INTERSECTION));
- calibration and validation of the base year models were completed based on available traffic data, aerial photography and the assessment methodology outlined in **Section 3.4.3**;
- assessment of the construction impacts was based on peak construction volumes and assumes that all construction works requiring vehicle movements would be carried out during standard construction hours; and
- assessment of cumulative impacts was undertaken based on publicly available information for major projects in the study area.

3.4.3 Traffic volume adjustments due to the impacts of the COVID-19 pandemic

The COVID-19 pandemic led to changes in the traffic volumes as a result of public health orders in NSW and/ or personal choices made in response to Government recommendations to minimise the risk of exposure to and potential spread of the virus. The following adjustments to the surveyed traffic volumes were made:

- midblock counts along Arthur Kaine Drive were obtained for February 2020 and were surveyed before social distancing policies and other impacts of COVID-19;
- midblock counts were conducted at the same location on Friday 3 July 2020 and Saturday 4 July 2020 in order to align with the intersection counts;
- midblock volumes surveyed in July 2020 were divided by the volumes obtained in February 2020 to determine a scaling factor; and
- intersection counts conducted in July 2020 were then multiplied by the scaling factor to adjust for the impacts of COVID-19 and obtained scaled volumes that are more realistic and representative of traffic volumes in the area outside of COVID-19 impacts.

Adjustments to traffic volumes are further discussed and presented in detail in **Section 4.6.1**.

3.5 Impact assessment criteria

The impact assessment for traffic and transport included establishment of appropriate assessment criteria, review of mid-block performance with and without the Project, and review of intersection performance with and without the Project.

3.5.1 Assessment criteria

Traffic operational performance can be assessed in several ways. A midblock assessment, lane capacity and performance against vehicle speed, headway and congestion along a road link. An intersection assessment examines the performance of an intersection against delay and queue lengths.

The assessment criteria adopted for this report are outlined in the following sections.

3.5.2 Mid-block performance

The *Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis* provides typical mid-block capacities for urban roads generally providing a conservative assessment. These are summarised in **Table 3-1**.

Table 3-1 Typical mid-block capacities for urban roads with interrupted flows

Type of lane	One way mid block capacity per lane (pcu/h)[1]
Median or inner lane	
Divided road	1,000
Undivided road	900
Median lane (of a three-lane carriageway)	
Divided road	900
Undivided road	1,000
Kerb lane	
Adjacent to parking lane	900
Occasional parked vehicles	600
Clearway conditions	900

Notes:
[1] pcu/h = passenger car unit per hour. This accommodates the road space differing types of vehicles use, with heavy vehicles or buses taking up more space than cars or light commercial vehicles. A standard car equates to 1 pcu.
Source: Table 5.1 of Austroads Guide to Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis.

The volumes provided in **Table 3-1** are theoretical capacities for mid-block, with the level of service experienced by drivers' subject to the exact quantum of traffic, which can be influenced by downstream conditions and vehicles queuing back from intersections.

Analysis of mid-block level of service (LoS) was conducted based on criteria set out in **Table 3-2**.

Table 3-2 Mid-block level of service criteria

Level of service (LoS)	Interrupted flow facilities (arterial and collector roads)	Volume to capacity ratio (VCR) range
A	Primarily free flow operations at average travel speeds, usually about 90% of the free flow speed (FFS) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is minimal.	≤ 0.34
B	Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted and control delays at signalised intersections are not significant.	0.35 to 0.50
C	Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LoS B, and longer queues, adverse signal coordination or both may contribute to lower average travel speeds of about 50% of the FFS for the street class.	0.51 to 0.74
D	A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LoS D may be due to adverse signal progression, inappropriate signal timing, high volumes or a combination of these factors. Average travel speeds are about 40% of FFS.	0.75 to 0.89
E	Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections and inappropriate signal timing.	0.90 to 0.99
F	Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays, high volumes and extensive queuing.	1.0 or greater

Source: Based on Austroads Guide to Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis

3.5.3 Intersection performance

Intersection performance has been assessed using SIDRA INTERSECTION, a computer-based modelling package that calculates intersection performance. The commonly used measure of intersection performance, as defined by TfNSW, is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 3-3 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

Table 3-3 SIDRA Intersection level of service criteria

Level of service (LoS)	Average delay per vehicle (seconds/ vehicle)	Traffic signals, roundabout	Give way and stop sign
A	Less than 14	Good operation	Good operation
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	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents would cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Source: Roads and Traffic Authority Guide to Traffic Generating Developments (RTA, 2002)

4.0 Existing environment

4.1 Regional context

The town of Merimbula is located within the Bega Valley Shire LGA, around 450 km south of the Sydney Central Business District (CBD) and 370 km south of Wollongong. Merimbula is bounded by Tura to the north and Pambula to the south. The Port of Eden is located around 27 km to the south.

Figure 4-1 and **Figure 4-2** illustrate the road network surrounding the Project area, including south of the Project area at Eden.

4.2 Road network

The road network in the vicinity of the Project area (including the construction access via Port of Eden) includes Arthur Kaine Drive, Toallo Street, Princes Highway, Coraki Road and Imlay Street as shown in **Figure 4-1** and **Figure 4-2**.

Arthur Kaine Drive

Arthur Kaine Drive is an arterial regional road running in a north-south direction and providing direct access to the STP. The road generally provides one traffic lane in each direction and has a number of turning lanes. Near the Project area, the road has one lane in each direction. Arthur Kaine Drive also provides direct access to Merimbula Airport to the north, and links Merimbula in to north to Pambula in the south. The posted speed limit is 70 km per hour and kerbside parking is not permitted on either side of the road.

A shared path is provided on the western side of the road, and crosses the main entrance to the STP site. The shared path extends between the Pambula Town Centre in the south and Merimbula Airport to the north. No footpaths are provided on the eastern side of the road. Bicycle and pedestrian facilities are discussed further in **Section 4.5**.

Toallo Street

Toallo Street is a regional road running off Arthur Kaine Drive in an east-west direction and intersecting with the Princes Highway to the west. The road provides one traffic lane in each direction. The posted speed limit is 50 km per hour. Kerbside parking with a two-hour (2P) parking restriction (08:30 – 18:00 Monday to Friday and 08:30 – 12:30 on Saturday) is provided on both sides of the road, for approximately 190 m between the Princes Highway and Merimbula Street.

Footpaths are only provided on the west side of the road and connect to the shared facilities running along the west side of Arthur Kaine Drive.

Princes Highway

Princes Highway is a State road running in the north-south direction west of the Project, intersecting with Toallo Street. The road generally provides one traffic lane in each direction and an additional parking lane in each direction near Toallo Street. The posted speed limit near the Project is 50 km per hour.

Footpaths are provided on both sides of the road south of Toallo Street. North of Toallo Street, footpaths are only provided on the west side of the road, with most areas requiring pedestrians to walk on the grass nature strip, with no formal footpaths on the eastern side.

Coraki Drive

Coraki Drive is a local road running in an east-west direction and connecting to Pambula Beach Road in the west and Pambula Beach in the east, terminating in a car park. The road provides one traffic lane in each direction and would serve as a construction access route for the Project at Pambula Beach. The posted speed limit is 50 km per hour near Pambula Beach.

Footpaths are not provided on either side of Coraki Drive between Pambula Beach Road and Pambula Beach.

Imlay Street

Imlay Street is a local connector road in Eden running in a north-south direction. It connects to Princes Highway in the north and runs through the Eden town centre, providing direct access to the Port of Eden in the south. South of Princes Highway, the road generally provides one traffic lane in each direction and an additional parking lane in each direction. The road has a posted speed limit of 50 km per hour.

Footpaths are provided on both sides of the road, with crossing opportunities generally provided along the road corridor.

FIGURE 4-1: PROJECT AREA AND SURROUNDING ROAD NETWORK

N

0 500 1,000 m

AECOM

Legend

- Project area
- Project area (temporary construction area)
- Motorways and Primary roads
- Arterial, Sub-Arterial and Distributor roads
- Local roads

Source: Department of Customer Service, 2020; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

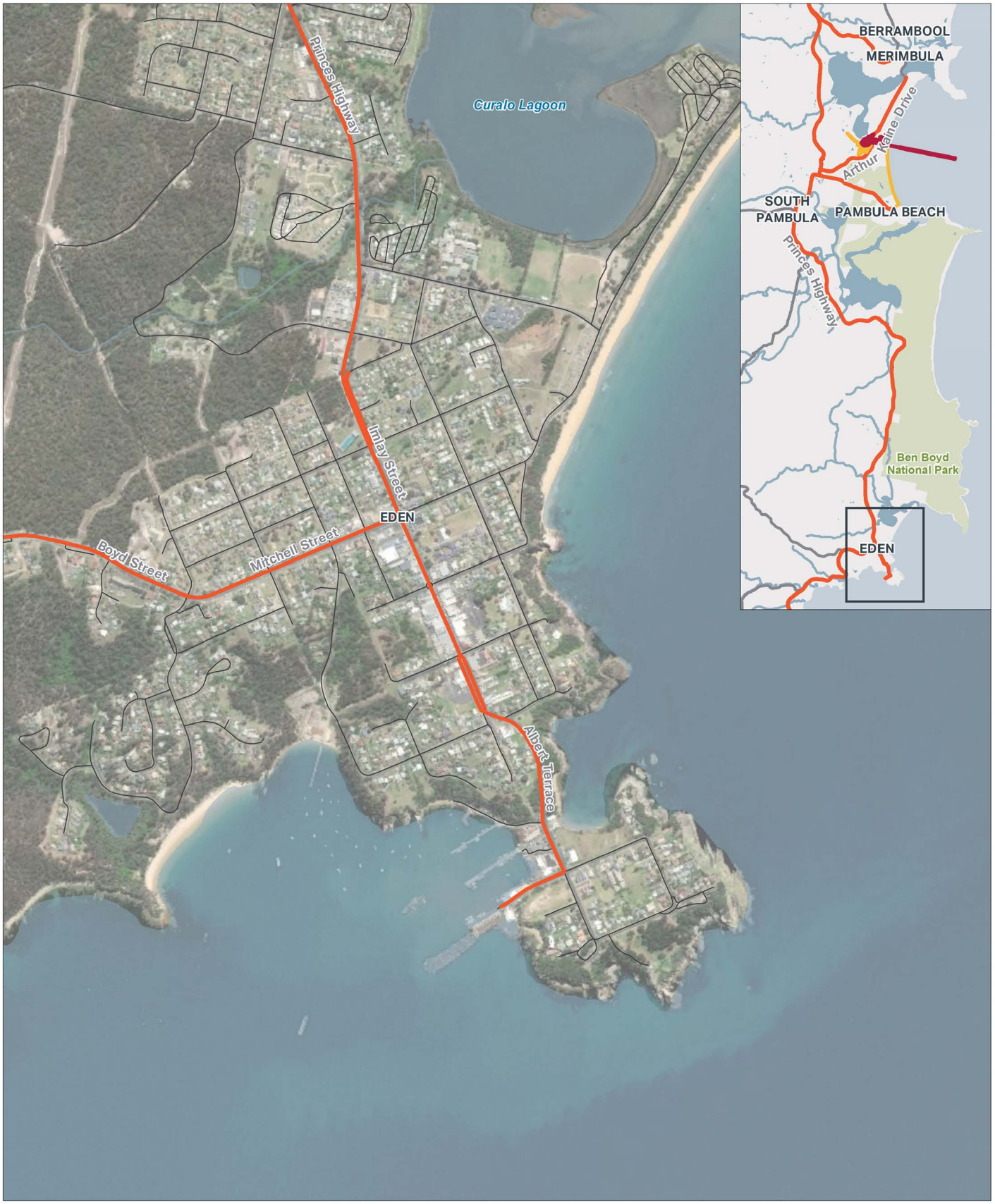


FIGURE 4-2: EDEN AND SURROUNDING ROAD NETWORK

N

0 300 600 m

AECOM

Legend

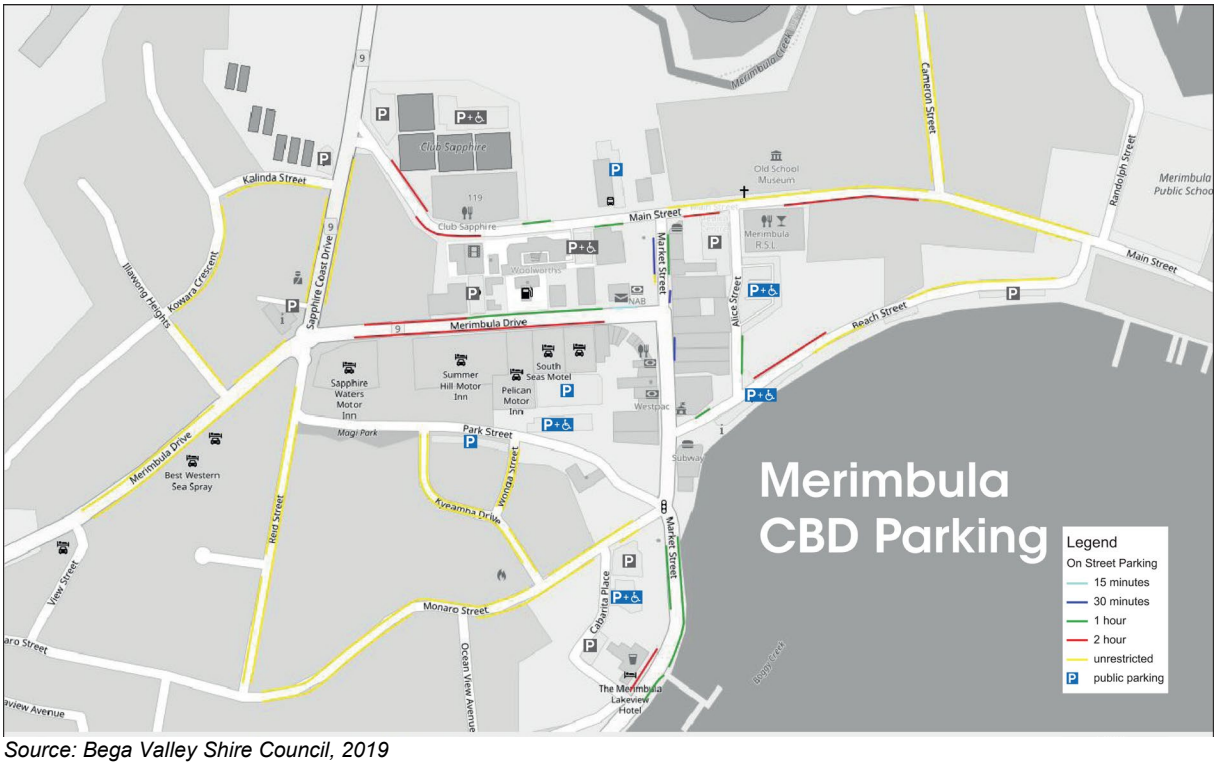
- Project area
- Project area (temporary construction area)
- Roads of interest

Source: Department of Customer Service, 2020; Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

4.3 Car parking

Car parking facilities are currently provided for workers and visitors within the existing STP site, and comprise 14 spaces located near the entrance to the STP.

Other nearby parking facilities in the Merimbula CBD are shown in **Figure 4-3**.



Source: Bega Valley Shire Council, 2019

Figure 4-3 Car parking provisions in the Merimbula CBD

4.4 Existing public transport

4.4.1 Regional and local bus services

Sapphire Coast Buslines operates several bus routes in the area. The regular bus services that operate in Merimbula are:

- Route 790/890: Bega to Eden via Wolumla and Merimbula;
- Route 790/890: Bega to Eden via Kalaru and Tura Beach; and
- Route 790/890: Merimbula to Pambula Beach via Pambula (Loop Service).

The buses that operate in Merimbula are shown in **Figure 4-4**, while buses that operate in Pambula are shown in **Figure 4-5**.

Bus routes operate along Arthur Kaine Drive near the Project with the closest bus stops to the Project located at PMGC, 850 m (or 11 minutes' walk) south of the Project area, and at Merimbula Airport, 1.2 km (or 14 minutes' walk) south of the Project area. These routes connect the Project to the surrounding local area and can be used to access the site during the construction and operation stages of the Project.

The frequency of public bus services in Merimbula is relatively limited, as shown in **Table 4-1**.

Source: Sapphire Coast Buslines, 2019

Figure 4-4 Bus services in Merimbula

Source: Sapphire Coast Buslines, 2019

Figure 4-5 Bus services in Pambula

Table 4-1 Frequency of bus services in Merimbula

Route no.	Route description	Weekday number of services			Weekend Number of Services
		AM Peak (6:00 am 9:00 am)	Off Peak (9:00 am 3:00 pm)	PM Peak (3:00 pm 6:00 pm)	
890/ 790	Bega to Eden via Wolumla and Merimbula	-	2	2	2
	Eden to Bega via Merimbula and Wolumla	1	2	-	3
891/ 791	Bega to Eden via Kalaru and Tura Beach	1	-	-	-
	Eden to Bega via Kalaru and Tura Beach	2	-	1	-
892/ 792	Merimbula to Pambula Beach via Pambula (Loop Service)	1	1	1	2

Source: Transport for NSW, 2019

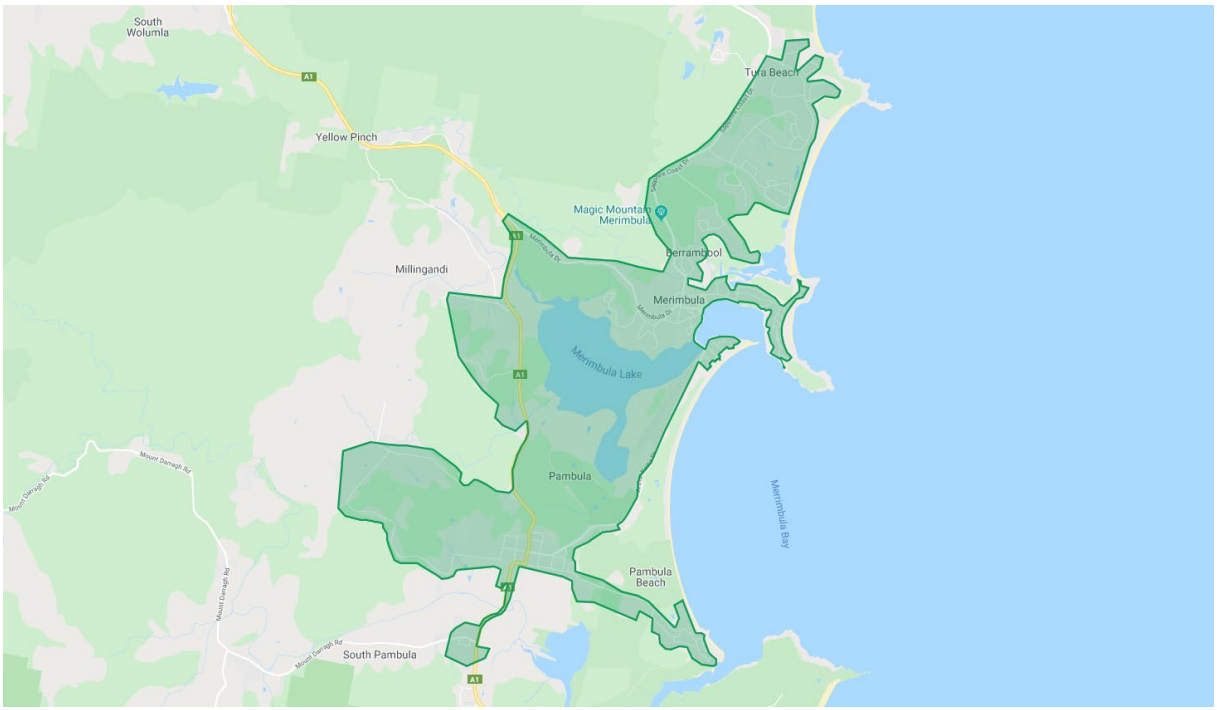
4.4.2 On-demand bus services

The ‘On-demand Transport’ program aims to identify and pilot creative new ways to deliver transport services and to provide flexible alternate transport services to improve connectivity to the existing public transport network.

A trial of On Demand bus services named Flexi-bus was launched on the Sapphire Coast in November 2018 by Transport for NSW. The service is operated by Sapphire Coast Buslines, which runs three services:

- Bega service;
- Tura Beach/Merimbula/Pambula service; and
- Eden service.

The On-Demand bus service in Merimbula provides customers the ability to book a service to pick them up at a convenient nearby location within 20 minutes prior to their trip. In Merimbula, the service operates between 9:30 am to 2:45 pm Monday to Friday, 9:30 am to 3:35 pm on Saturday with no services on Sunday or Public holidays. The existing on-demand bus service trial area in Merimbula is shown in **Figure 4-6**. The catchment area of the service covers anywhere within 6 km of the town centre, with one-way trips starting from $2.30. These services cover the Project area and provide construction workers and staff with alternative access between the Project and the wider road network.



Source: Flexibus, 2019

Figure 4-6 On-Demand bus service area in Merimbula

4.4.3 Coach services

Coach services operate from Eden to Canberra Civic via Merimbula. The coach stop in Merimbula for this service is currently located at Merimbula Drive, between Sapphire Coast Drive and Market Street. In addition, coach services also operate between Eden and Bomaderry via Merimbula, with the coach stop in Merimbula located at Park Street, also between Sapphire Coast Drive and Market Street.

These services provide links between the Project and the wider regional area, via Merimbula. The regional coach network is shown in **Figure 4-7** and the frequencies of the coach services are presented in **Table 4-2**.

Source: Sydney Trains, 2019

Figure 4-7 Regional coaches servicing Merimbula

Table 4-2 Frequency of coach services in Merimbula

Route no.	Route description	Number of services	
		Weekday	Weekend
771	Canberra Civic to Eden	1	1
772	Eden to Canberra Civic	1	1
700-1	Bomaderry to Eden	2	2
700-1	Eden to Bomaderry	2	2
V-Line	Batemans Bay to Melbourne via Mallacoota and Genoa in Victoria	5	2

Source: Sydney Trains, 2019

4.5 Existing active transport provision

4.5.1 Cycling routes and facilities

There are several cycling facilities in the study area which include on-road and off-road cycle routes, as shown in **Figure 4-8**. The Bike Way, an off-road shared path traverses through Merimbula, providing links between Merimbula Airport, Merimbula Beach and Merimbula town centre.

The cycleway continues along Arthur Kaine Drive providing links to Pambula town centre in the south, extending to south Pambula and Pambula Beach and links to the Bega Valley Cycleway in Merimbula in the north. Near the Project area, the shared path runs along the western side of Arthur Kaine Drive. The Bega Valley Bike Plan promotes cycling as an alternate mode of transport and recreation and outlines several planned on-road and off-road cycleways for the LGA. Near the Project area, a shared path (Lake Street Shared Path) is proposed adjacent to Lake Street in Merimbula, from Rotary Park to Merimbula Wharf via Bar Beach.

Source: Bega Valley Shire Council, 2019

Figure 4-8 Pambula-Merimbula cycleway network map

4.5.2 Pedestrian routes and facilities

Pedestrian access is generally provided via off-road shared paths near the STP. These facilities are provided along the western side of Arthur Kaine Drive, linking to Merimbula town centre in the north and Pambula town centre in the south. Pedestrian crossings are generally confined to the townships of Merimbula and Pambula.

Pambula Beach (near the Project area), and Eden Town Centre and Eden Wharf (south of the Project area) are high activity pedestrian areas, especially during summer.

The Bega Valley Bike Plan outlines the strategy to improve pedestrian facilities, increase the number of walking trips and encourage active travel in the study area.

4.6 Existing traffic conditions and road network performance

Traffic count surveys were undertaken by Matrix Traffic and Transport Data during the morning peak period (07:00 to 09:00) and afternoon peak period (15:00 to 17:00) on Friday 3 July 2020, and during the weekend peak period (10:00 to 14:00) on Saturday 4 July 2020 at the following intersections:

- Toallo Street/Princes Highway;
- Coraki Drive/Pambula Beach Road/Culgoa Crescent; and
- Imlay Street/Mitchell Street.

Mid-block counts were undertaken on Arthur Kaine Drive near the Project on 17 February 2020 (provided by BVSC) and 3 July 2020 to assess the current capacity of the road. These counts were also used to adjust the intersection counts to account for the impacts of the COVID-19 pandemic on traffic volumes in the vicinity of the Project.

The location of the intersections and midblock counts is shown in **Figure 4-9**.

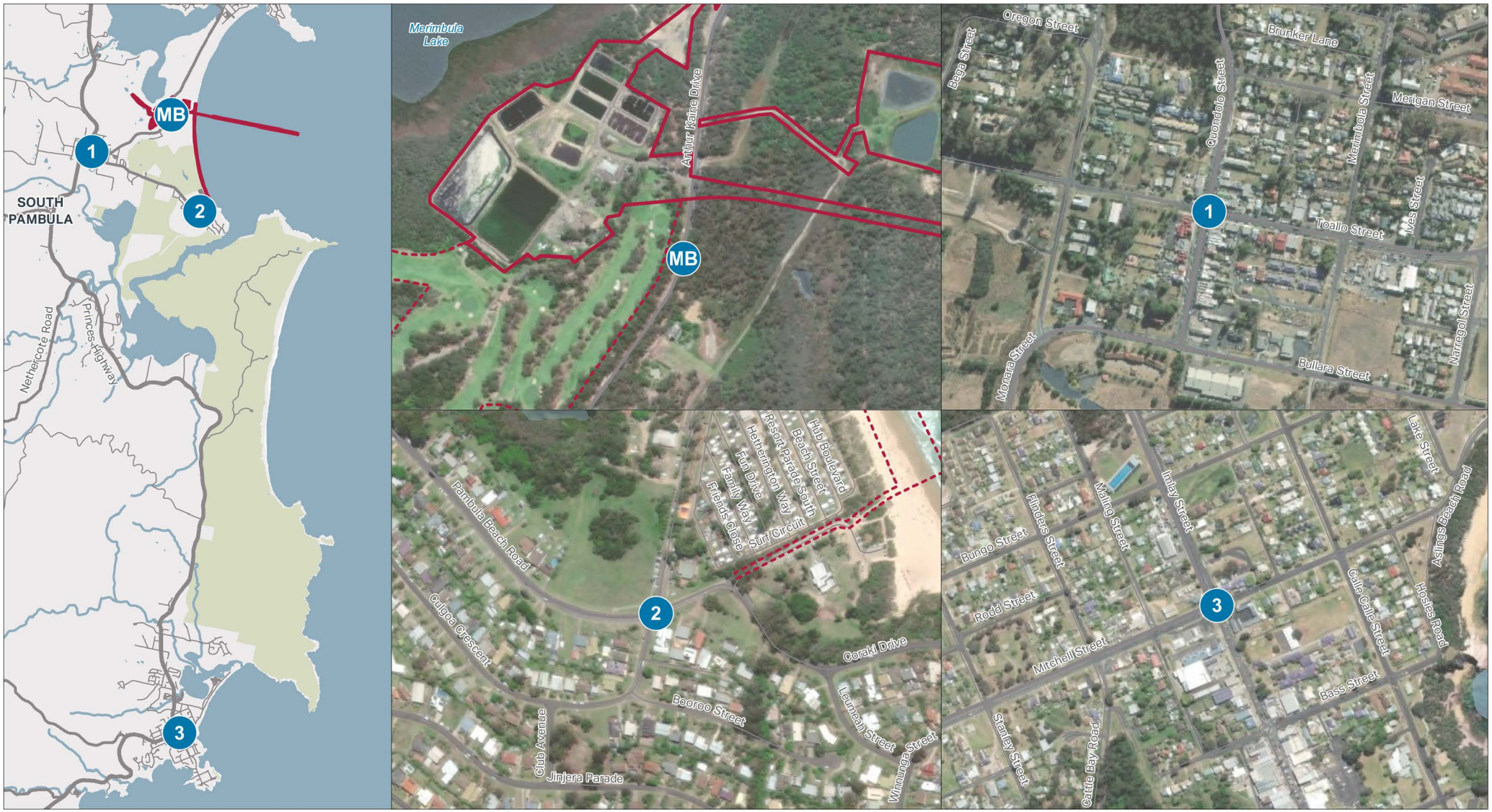


FIGURE 4-9: TRAFFIC COUNT SURVEY LOCATIONS

Legend

- Project area (overview)
- Project area
- Project area (temporary construction area)
- Traffic Count Location
- MB: Midblock Count Location

Analysis of the traffic surveys indicated that the morning peak hour occurred between 08:00 and 09:00 while the afternoon peak hour was between 15:00 and 16:00. The weekend peak hour occurred between 11:00 and 12:00.

4.6.1 Traffic volumes adjustment for COVID-19 pandemic

As discussed in **Section 3.4.3**, to accommodate the effects of the community response to COVID-19, scaling factors have been calculated and applied to the surveyed intersection volumes to provide more realistic and representative traffic volumes. This was achieved by collecting midblock counts on Arthur Kaine Drive on the same dates as the intersection counts were undertaken in July 2020. A comparison with midblock counts provided by BVSC for a week in February 2020 for the same location was undertaken. The difference between the traffic volumes was then calculated to determine which scaling factor should be applied to the raw survey data.

It is noted that in February 2020 (typically the shoulder of the tourist season) traffic volumes were likely lower than average traffic volumes for the same period in previous years due to the bushfires that impacted the study area. However, historic traffic count data along Arthur Kaine Drive for previous years is not available to use. The assessment presented in **Section 4.6.1.1** and **Section 4.6.1.2** would be more representative of local traffic volumes rather than those during peak tourist season, which in fact would be more characteristic of 'standard' traffic patterns throughout the rest of the year where the majority of the construction work would be undertaken. Furthermore, the assessment as presented in **Section 4.6.1.1** and **Section 4.6.1.2** indicates that there is sufficient capacity on the road network to accommodate additional traffic volumes within the study area. As such, the scaling factor adjustments identified in **Table 4-3** have been applied to the intersection traffic volumes and are considered sufficient for the purposes of this assessment.

Table 4-3 COVID-19 scaling factor adjustment

Road	Date	Traffic Volumes		
		Weekday 3 Hour AM Peak (NB/SB)	Weekday 3 Hour PM Peak (NB/SB)	Weekend 3 Hour Peak (NB/SB)
Arthur Kaine Drive	February 2020	2,144	2,747	3,224
	July 2020	2,057	2,507	3,331
Scaling Factor		**104%**	**110%**	**97%**

Table 4-3 indicates that the weekday intersection counts would be scaled by 104% and 110% for the AM and PM peaks respectively. However, the weekend peak counts would not be scaled given the July 2020 mid-block counts were greater than those collected during February 2020.

As such the scaling factors obtained represent minor increases during the weekday peak periods, with an increase of 4% and 10% during the morning and evening peak periods. No increase in traffic volumes is assumed during the weekend peak periods.

4.6.1.1 Midblock analysis

Table 4-4 shows the midblock traffic flows at each location alongside the estimated road capacity. The February 2020 volumes were used for this assessment as they generally represent Pre-COVID traffic conditions. Capacity of the one-lane two-way configuration of Arthur Kaine Drive was based on the Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, outlined in **Section 3.5.2**.

Table 4-4 Midblock analysis

Location	Direction	Theoretical capacity (pcu/h)	AM Peak		PM Peak	
			Volume (pcu/h)	LOS	Volume (pcu/h)	LOS
Arthur Kaine Drive near the Project	NB	900	358	B	616	C
	SB	900	588	C	505	C

The midblock assessment of the traffic volumes presented in **Table 4-4** indicates there is currently spare capacity along the Arthur Kaine Drive in the vicinity of the Project during typical weekday peak hours.

4.6.1.2 Existing intersection performance

Table 4-5 presents a summary of the existing operation of the intersection using the scaled traffic volumes. The full results are presented in Annexure A of this report.

Table 4-5 Existing intersection performance

Intersection	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
AM Peak				
Toallo Street/Princes Highway	0.26	6	9	A
Coraki Drive/Pambula Beach Road/Culgoa Crescent	0.04	2	1	A
Imlay Street/Mitchell Street	0.25	5	10	A
PM Peak				
Toallo Street/Princes Highway	0.46	7	19	A
Coraki Drive/Pambula Beach Road/Culgoa Crescent	0.07	2	1	A
Imlay Street/Mitchell Street	0.38	6	19	A
Weekend Peak				
Toallo Street/Princes Highway	0.33	6	11	A
Coraki Drive/Pambula Beach Road/Culgoa Crescent	0.07	2	1	A
Imlay Street/Mitchell Street	0.29	6	13	A

Note: For traffic signals, the average movement delay and level of service over all movements is taken. For roundabouts and priority control signals intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is taken.

Table 4-5 indicates that all intersections analysed currently operate well at LOS A during all peak periods, with spare capacity.

5.0 Impact assessment

5.1 Construction impacts

5.1.1 Public transport

Bus services in the vicinity of the Project are unlikely to be affected during construction, given all construction activities would be within the construction sites. Bus services along Arthur Kaine Drive would continue to operate as normal during construction activities. Bus routes operating at Port of Eden along Imlay Street and at Pambula Beach along Coraki Road would not be impacted during the construction of the Project, given construction activities would be limited within the construction sites.

There are no changes to bus stop locations anticipated as a result of the Project. Given the relatively low number and frequency of bus services, any unexpected changes would be temporary and minor. Traffic management around access points to the Project area would be managed as discussed below in **Section 5.1.2**.

5.1.2 Pedestrians and cyclists

During construction, works would be undertaken within the construction sites in a manner that would maintain pedestrian and cyclist routes around the Project area.

Increased heavy vehicle volumes would access the site during construction, potentially causing temporary disruptions to the existing shared path facilities fronting the STP site and located on the west side of Arthur Kaine Drive. This has the potential for increased risk to the safety of pedestrians and cyclists due to potential interactions with construction plant and vehicles.

On-road cycle lanes are provided on Pambula Beach Road. These facilities terminate at Coraki Drive and link Pambula Town Centre to Pambula Beach. Pambula Beach, Eden Town Centre and Eden Wharf are high activity pedestrian areas, especially during summer. While the Project is not anticipated to impact the operation of existing cycling or walking facilities at Pambula Beach and the Port of Eden, there is a potential for increased interactions with construction vehicles during the construction stage, which represents a risk to safety in these areas.

Appropriate signs and/or traffic controllers would be positioned to notify pedestrians and cyclists of any temporary arrangements during construction. Any interaction between construction vehicles and users of the existing walking and cycling networks would be managed and controlled by traffic controllers. Impacts during construction would be managed through the development of a Construction Traffic Management Plan (CTMP). Wherever possible, the community would be notified in advance of any planned works which may impact pedestrian/cyclist movements.

Mitigation and management measures would be subject to further consideration during construction planning in consultation with the relevant authorities.

5.1.3 Parking

The Project would not impact public car parking facilities in the vicinity of the Project during the construction phase. All existing car parking facilities would remain open during the construction of the Project.

At Pambula Beach, construction vehicles would be required to access the construction site via the existing car park off Coraki Drive. No impacts are anticipated to this car park as a result of the Project.

Construction worker parking

Construction worker parking would be provided for construction workers within the Project area. Construction of the Project would require a workforce of around 20 workers, with peak construction periods requiring up to 30 workers. Construction workers would be encouraged to car-pool or drive to the STP and car-pool to construction locations outside of the STP (for example on Merimbula Beach).

A small number of construction workers would require access to the Port of Eden, with no car parking facilities provided specifically for the Project at this location. However, due to low parking requirements, it is anticipated that construction worker parking can be accommodated within on-street parking available nearby. In addition, construction workers would be encouraged to access the site via car-pooling to minimise impacts on car parking facilities near the site.

Parking impacts associated with construction worker parking are anticipated to be limited, due to the low number of construction workers expected at any one time, and the number of offsite parking spaces required would be low (as parking would be provided within construction sites). In addition, the CTMP would contain provisions to manage construction worker parking and minimise parking impacts in the wider area. Construction workers would also be encouraged to park away from residential areas where possible.

5.1.4 Traffic

Traffic generated by construction vehicles, including worker vehicles, is likely to be low given the nature of the works proposed, and would fluctuate dependant on the construction stage. Up to 20 light vehicles and up to 10 heavy vehicles would be generated per day during peak construction periods, primarily for worker transport, delivery of equipment/materials, loading of spoil/waste and concreting activities. Intersection modelling is based on hourly traffic volumes, which is likely to be negligible considering the forecast daily volumes generated by the Project. In the worst-case scenario of all the vehicles arriving in a single peak hour, the traffic volumes are still considered low. The impacts of these additional traffic volumes have not been included in the traffic model as such small changes in traffic volumes would have an insignificant impact to the performance and results of the model, especially considering the existing intersection performance at all of the modelled intersection sites are LoS A. Therefore, it is expected that the additional traffic volumes would result in minimal impacts on existing traffic conditions.

Construction vehicles would access construction sites at the STP site from Arthur Kaine Drive (via Toallo Street), at Pambula Beach along Coraki Drive (via Pambula Beach Road and Bullara Street) and at Port of Eden via Imlay Street. These sections of the road network are not approved for use by B-doubles. As such, approval would be required by relevant authorities prior to the start of construction.

The size of vehicles used for haulage would be consistent with the access route constraints, safety and any worksite constraints. As mentioned in **Section 2.2**, the largest truck requiring access to the Project area would be the directional drilling rig truck, with the next largest being truck and dogs for delivery of materials, loading/unloading of spoil and waste removal. Concrete trucks would also be required. While the proposed access from Princes Highway onto Toallo Street via the roundabout is expected to be adequate for truck and dogs, depending on the size of the rig truck, upgrades to the roundabout at Princes Highway and Toalla Street may be required, or otherwise an alternative access route may be required. Access arrangements, including testing access routes, setting in place driver protocols to be observed and investigating whether infrastructure upgrades are required, would be defined in the CTMP prepared for the Project. An application would need to be made to the National Heavy Vehicle Regulator (NHVR) for an access permit during subsequent design stages prior to the commencement of the construction works.

No temporary diversions have been identified to accommodate the construction of the Project. Traffic control plans (TCP) would be prepared as part of the CTMP, which would also present the traffic mitigation and management measures applicable for the Project. The CTMP would provide details of construction vehicle activity, accredited site personnel, traffic, pedestrian and cyclist management and any required signage.

5.1.5 Property access

The Project would not impact access to private properties near the Project area during the construction phase. Property access at Port of Eden would also be maintained at all times.

At Pambula Beach, construction vehicles would traverse the car parking facilities located at the end of Coraki Drive, down a temporary track and onto the beach. However, it is anticipated that public access to the beach as well as the car park would not be impacted at any time.

5.1.6 Emergency vehicle access

Access for emergency vehicles would be maintained at the construction sites in accordance with emergency vehicle requirements. Emergency services would be advised of all planned changes to traffic arrangements prior to applying the changes.

5.2 Operational impacts

5.2.1 Public transport

The Project does not include changes to bus or coach services as part of the works and would not impact on the operation (service operation or timetabling) of public transport in the vicinity of the Project. The Project includes improved operations of the STP, with no forecast increase to workforce numbers. As such, increased bus patronage on the services operating near the Project is not expected.

5.2.2 Pedestrians and cyclists

The Project would retain the existing shared path facilities fronting the STP site on the western side of Arthur Kaine Drive. The Project would not result in changes to the operation of these facilities.

Consideration should be given to providing additional bicycle racks at the STP site as Arthur Kaine Drive is a key desire line for cyclists with an off-road cycle route providing connectivity to adjacent town centres. This would reflect the objectives of BVSC, which aims to encourage walking and cycling trips in the area.

5.2.3 Parking

The Project does not impact on the provision of public parking spaces in areas surrounding the Project.

5.2.4 Traffic

It is anticipated that the Project is likely to result in a marginal increase in traffic (from people accessing the STP site by car), with a negligible impact on the surrounding road network.

Given traffic generated during operations would only slightly increase, the construction impact assessment presented in **Section 5.1.4** constitutes an assessment of the worst-case scenario for traffic generated during the construction and operation stages of the Project. Therefore, operational traffic would have an insignificant impact on the local and wider road network.

5.2.5 Property access

No changes to private property access would be required as part of the operation of the Project.

5.3 Cumulative impacts

Several projects in the area were identified in the cumulative impact assessment undertaken for the EIS (refer **Chapter 27 Cumulative impacts)**, however it was found that these are not expected to contribute to cumulative impacts with the Project, either due to their location, size or timing.

There are no additional major projects, future planned road or public transport changes identified that would impact traffic conditions within the immediate vicinity of the Project area.

As such, the construction impact assessment of the Project presented in **Section 5.0** constitutes a worst-case scenario assessment of the Project-related impacts. During the construction stages, it is expected that up to 20 light vehicles and up to 10 heavy vehicles would be generated per day during peak construction periods. There would be minimal impact on existing traffic conditions from these volumes of construction-related traffic.

6.0 Mitigation and management measures

6.1 Overview

This chapter describes the management approach for traffic, transport and access during construction and operation of the Project, including performance outcomes. The mitigation and management measures described would be included in a CTMP developed for the Project, and included as part of the Construction Environmental Management Plan (CEMP) for the Project. Mitigation and management measures would also be implemented during operation as relevant.

6.2 Performance outcomes

The traffic and transport performance outcomes for the Project are as follows:

- public access routes are maintained for pedestrians, cyclists and road users, including buses during construction;
- public access is maintained for all road users to Pambula Beach;
- access to residences and commercial properties is maintained;
- Project construction worker parking is contained to the STP site and construction laydown areas; and
- no road or cycle diversions or closures are required as a result of the Project.

6.3 Mitigation and management measures

Table 6-1 outlines the mitigation and management measures that would be implemented to minimise transport and access impacts during construction of the Project.

The Project does not generate any transport and access impacts on the road network during the operation stage. As such, no mitigation and management measures have been identified.

Table 6-1 Mitigation and management measures

ID	Mitigation and management measure	Applicable location(s)
Construction		
T1	Ongoing consultation would be carried out between BVSC, Transport for NSW, emergency services, bus operators and other relevant authorities to minimise transport impacts during construction.	The Project area
T2	Community consultation would be carried out and notifications would be issued in advance for any proposed road and pedestrian network changes or disruptions through appropriate channels and forms of communication.	The Project area
T3	Access to pedestrian routes and cycle paths would be maintained during construction. Where this is not possible, alternative routes would be provided. Appropriate signage would also be provided to guide pedestrians and cyclists past the Project area and on the surrounding network where required.	The Project area
T4	Vehicle access to and from the Project area would be managed to minimise safety risk to pedestrians, cyclists and motorists. All trucks would enter and exit construction sites within the Project area in a forward direction, where possible. At Pambula Beach, appropriate delineation, and/or traffic control measures would be used to direct and guide pedestrians, cyclists and motorists past the entrance to the Project area during oversized delivery and high usage times. Further arrangements for construction vehicle access at Pambula Beach would be identified in the CTMP during subsequent design stages.	The Project area

ID	Mitigation and management measure	Applicable location(s)
T5	Access to existing properties and buildings would be maintained at all times in consultation with property owners.	The Project area
T6	The Project area would be managed to minimise construction worker parking on surrounding streets. Workers would be encouraged to carpool. Parking facilities would be provided.	The Project area
T7	Construction traffic would be managed to minimise traffic impacts during the peak periods through scheduling construction vehicle movements outside of peak hours.	The Project area
T8	The proposed access from Princes Highway onto Toallo Street via the roundabout at this location would be tested for access suitability for the construction vehicles expected (including an adequate turning path), and to determine whether infrastructure upgrades are required. Alternative routes would be investigated in the event that upgrade works are required at the roundabout. These alternative haulage routes would be identified and confirmed in consultation with relevant authorities prior to the commencement of construction works. Testing would be carried out as part of the CTMP once plant and equipment and vehicles required to transport them are determined by the contractor.	Princes Highway / Toallo Street intersection
T9	Public access to the beach as well as the car park (off Coraki Drive) would be maintained.	Project area

7.0 Conclusion

This Traffic and Transport Report has been prepared to support the EIS and to address the relevant SEARs issued for the Project. Specifically this report has been prepared to identify potential impacts of construction and operation of the Project on road, public transport and active transport networks and to identify appropriate mitigation and management measures to address the impacts identified.

Assessment of the existing road network indicates all intersections analysed currently operate well during all peak periods, with spare capacity. The midblock assessment of the traffic volumes presented further indication that there is currently spare capacity near the Project area along Arthur Kaine Drive during typical weekday peak hours.

Construction and operational traffic and transport impact assessments were undertaken for the Project. Key outcomes of these assessments are outlined below.

7.1 Construction impacts

The potential construction impacts of the Project include:

- Up to 20 light vehicles and up to 10 heavy vehicles would be generated per day during peak construction periods for worker transport, equipment/material delivery, concreting activities and removal of spoil and waste. This is anticipated to result in negligible impacts on the surrounding road network near the Project area. Temporary diversions are not required as part of the Project.
- The Project would not impact on any existing public car parking facilities in the Project area or nearby areas during construction. Construction worker parking would require the use of some nearby on-street parking spaces (e.g. in the Port of Eden area), however parking would be provided onsite within the Project area (e.g. within the STP site). Construction workers would be encouraged to car-pool.
- There would be an increase in heavy vehicle volumes accessing the Project area. This may cause temporary disruptions to walking and cycling routes surrounding the Project area, especially along the shared path facilities fronting the site on the western side of Arthur Kaine Drive, and the walking and cycling facilities near the construction access at Pambula Beach and at the Port of Eden. Construction traffic entering and exiting the Project area also presents a safety risk that would be mitigated with appropriate traffic management.
- Appropriate signs and/or traffic control measures would be in place to notify pedestrians and cyclists of the temporary construction traffic activity.
- The Project (including proposed haulage routes) is not anticipated to impact on existing bus services in the vicinity of the Project area.
- Access to private properties as well as emergency vehicle access would be maintained at all times during construction of the Project.
- The construction impact assessment of the Project presents a worst-case scenario assessment. It determined there would be minimal impacts on existing traffic conditions from construction-related traffic.

7.2 Operational impacts

The potential operational impacts of the Project are outlined below.

- During operation, the Project is not anticipated to generate significant additional vehicular traffic, and negligible impacts to traffic flows around the Project area are expected.
- The Project is not anticipated to impact public transport services or operations in the study area. Similarly, no impacts are anticipated on existing pedestrian and cycle facilities surrounding the Project area.

- The Project does not anticipate any impacts to public parking in surrounding areas as the Project only includes improved operations of the STP facility, with no forecast increase to workforce numbers.
- There would also be no impact to surrounding property access during operation of the Project.

8.0 References

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Sydney Trains, 2019. *North Coast NSW timetable.*

Transport for NSW (TfNSW), 2019. *Sapphire Coast On Demand service.*

9.0 Glossary and abbreviations

Term	Description
Average Delay	Duration, in seconds, of the average vehicle waiting time at an intersection
BVSC	Bega Valley Shire Council
COVID-19	COVID-19 (SARS-CoV-2) is a type of coronavirus that can affect lungs or airways.
DCP	Development Control Plan
EIS	Environmental Impact Statement
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System
LEP	Local Environmental Plan
LGA	Local Government Area
LOS	Level of Service – An index of the operational performance of traffic on a given traffic lane, carriageway or road when accommodating various traffic volumes under different combinations of operating conditions
Mid-block performance	A capacity assessment of a road against typical mid-block capacities for urban roads
NSW	New South Wales
PCU	Passenger Car Unit
Roads and Maritime	Roads and Maritime Services, now TfNSW
SEARs	Secretary's Environmental Assessment Requirements
STP	Sewerage Treatment Plant
The Project	The Merimbula Sewage Treatment Plant Upgrade and Ocean Outfall project, which comprises the upgrade of existing facilities, the installation of a 3.5 km outfall pipeline and the decommissioning of the existing beach-face outfall pipeline and other works as described in **Section 1.1**
TfNSW	Transport for NSW
VCR	Volume-to-capacity ratio or degree of saturation is the ratio of demand or arrival flow to capacity, and can be larger than 1, representing oversaturation

Appendix A

SIDRA Results

MOVEMENT SUMMARY

Site: 101 [AM Princes Hwy / Toallo St]

Roundabout intersection of Princes Highway and Toallo St in Pambula
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway												
1	L2	30	29.6	0.263	4.6	LOS A	1.1	8.6	0.26	0.56	0.26	40.8
2	T1	138	11.1	0.263	4.2	LOS A	1.1	8.6	0.26	0.56	0.26	42.8
3	R2	139	3.1	0.263	7.4	LOS A	1.1	8.6	0.26	0.56	0.26	42.7
3u	U	13	0.0	0.263	10.2	LOS A	1.1	8.6	0.26	0.56	0.26	45.4
Approach		320	8.9	0.263	5.9	LOS A	1.1	8.6	0.26	0.56	0.26	42.7
East: Toallo Street												
4	L2	120	4.5	0.215	4.9	LOS A	1.0	7.3	0.39	0.59	0.39	41.8
5	T1	58	1.9	0.215	4.7	LOS A	1.0	7.3	0.39	0.59	0.39	43.3
6	R2	44	15.0	0.215	8.3	LOS A	1.0	7.3	0.39	0.59	0.39	42.6
6u	U	9	0.0	0.215	10.9	LOS A	1.0	7.3	0.39	0.59	0.39	45.7
Approach		231	5.7	0.215	5.7	LOS A	1.0	7.3	0.39	0.59	0.39	42.4
North: Princes Highway												
7	L2	67	1.6	0.241	4.5	LOS A	0.9	6.5	0.30	0.53	0.30	42.2
8	T1	181	12.1	0.241	4.5	LOS A	0.9	6.5	0.30	0.53	0.30	43.8
9	R2	22	0.0	0.241	7.6	LOS A	0.9	6.5	0.30	0.53	0.30	43.5
9u	U	3	0.0	0.241	10.5	LOS A	0.9	6.5	0.30	0.53	0.30	46.2
Approach		273	8.4	0.241	4.8	LOS A	0.9	6.5	0.30	0.53	0.30	43.4
West: Toallo Street												
10	L2	19	0.0	0.116	5.8	LOS A	0.6	4.8	0.54	0.62	0.54	40.5
11	T1	55	6.0	0.116	6.0	LOS A	0.6	4.8	0.54	0.62	0.54	41.9
12	R2	31	10.7	0.116	9.5	LOS A	0.6	4.8	0.54	0.62	0.54	41.5
12u	U	1	0.0	0.116	12.0	LOS A	0.6	4.8	0.54	0.62	0.54	44.1
Approach		105	6.3	0.116	7.0	LOS A	0.6	4.8	0.54	0.62	0.54	41.6
All Vehicles		928	7.7	0.263	5.7	LOS A	1.1	8.6	0.34	0.57	0.34	42.7

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [AM Coraki Dr / Pambula Beach Rd / Culgoa Cres]

Priority intersection of Coraki Drive, Pambula Beach Road and Culgoa Crescent in Pambula Beach
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Culgoa Crescent												
1	L2	12	0.0	0.013	4.7	LOS A	0.0	0.3	0.15	0.49	0.15	44.3
2	T1	2	0.0	0.013	3.7	LOS A	0.0	0.3	0.15	0.49	0.15	36.1
3	R2	3	0.0	0.013	5.1	LOS A	0.0	0.3	0.15	0.49	0.15	35.5
Approach		18	0.0	0.013	4.7	LOS A	0.0	0.3	0.15	0.49	0.15	42.9
East: Coraki Drive												
4	L2	2	0.0	0.035	4.6	LOS A	0.0	0.1	0.01	0.03	0.01	46.6
5	T1	66	1.7	0.035	0.0	LOS A	0.0	0.1	0.01	0.03	0.01	49.6
6	R2	2	0.0	0.035	4.7	LOS A	0.0	0.1	0.01	0.03	0.01	45.1
Approach		70	1.6	0.035	0.3	NA	0.0	0.1	0.01	0.03	0.01	49.5
North: Pambula Beach Access Road												
7	L2	2	0.0	0.019	4.7	LOS A	0.1	0.5	0.18	0.51	0.18	35.2
8	T1	4	0.0	0.019	3.7	LOS A	0.1	0.5	0.18	0.51	0.18	36.1
9	R2	13	8.3	0.019	5.3	LOS A	0.1	0.5	0.18	0.51	0.18	43.6
Approach		20	5.6	0.019	4.9	LOS A	0.1	0.5	0.18	0.51	0.18	42.3
West: Pambula Beach Road												
10	L2	10	22.2	0.030	4.9	LOS A	0.1	0.5	0.08	0.19	0.08	46.2
11	T1	34	12.9	0.030	0.1	LOS A	0.1	0.5	0.08	0.19	0.08	47.8
12	R2	10	0.0	0.030	4.8	LOS A	0.1	0.5	0.08	0.19	0.08	46.8
Approach		54	12.2	0.030	1.8	NA	0.1	0.5	0.08	0.19	0.08	47.3
All Vehicles		161	5.4	0.035	1.8	NA	0.1	0.5	0.07	0.19	0.07	47.2

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [AM Mitchell St / Imlay St]

Roundabout intersection of Mitchell Street and Imlay Street in Eden
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Imlay Street												
1	L2	48	2.3	0.145	4.3	LOS A	0.5	3.8	0.25	0.49	0.25	40.3
2	T1	113	1.9	0.145	4.2	LOS A	0.5	3.8	0.25	0.49	0.25	44.2
3	R2	8	0.0	0.145	7.5	LOS A	0.5	3.8	0.25	0.49	0.25	42.3
3u	U	4	0.0	0.145	9.0	LOS A	0.5	3.8	0.25	0.49	0.25	46.5
Approach		173	1.9	0.145	4.5	LOS A	0.5	3.8	0.25	0.49	0.25	43.3
East: Mitchell Street												
4	L2	31	14.3	0.076	5.3	LOS A	0.3	2.3	0.39	0.59	0.39	39.2
5	T1	28	11.5	0.076	5.1	LOS A	0.3	2.3	0.39	0.59	0.39	37.5
6	R2	12	54.5	0.076	9.3	LOS A	0.3	2.3	0.39	0.59	0.39	39.5
6u	U	1	0.0	0.076	9.7	LOS A	0.3	2.3	0.39	0.59	0.39	29.7
Approach		72	19.7	0.076	5.9	LOS A	0.3	2.3	0.39	0.59	0.39	38.6
North: Imlay Street												
7	L2	11	10.0	0.249	4.3	LOS A	0.9	6.8	0.23	0.53	0.23	39.2
8	T1	187	1.8	0.249	4.0	LOS A	0.9	6.8	0.23	0.53	0.23	43.5
9	R2	114	9.6	0.249	7.4	LOS A	0.9	6.8	0.23	0.53	0.23	40.7
9u	U	1	0.0	0.249	8.8	LOS A	0.9	6.8	0.23	0.53	0.23	46.0
Approach		313	4.9	0.249	5.2	LOS A	0.9	6.8	0.23	0.53	0.23	42.5
West: Mitchell Street												
10	L2	112	11.8	0.210	4.7	LOS A	1.3	9.6	0.38	0.56	0.38	38.9
11	T1	32	3.4	0.210	4.6	LOS A	1.3	9.6	0.38	0.56	0.38	37.5
12	R2	90	4.9	0.210	8.0	LOS A	1.3	9.6	0.38	0.56	0.38	40.2
12u	U	2	0.0	0.210	9.4	LOS A	1.3	9.6	0.38	0.56	0.38	27.9
Approach		235	7.9	0.210	6.0	LOS A	1.3	9.6	0.38	0.56	0.38	39.2
All Vehicles		794	6.5	0.249	5.4	LOS A	1.3	9.6	0.29	0.53	0.29	41.5

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [PM Princes Hwy / Toallo St]

Roundabout intersection of Princes Highway and Toallo St in Pambula
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway												
1	L2	45	20.5	0.458	5.2	LOS A	2.5	18.5	0.45	0.63	0.45	40.3
2	T1	234	6.4	0.458	4.8	LOS A	2.5	18.5	0.45	0.63	0.45	42.2
3	R2	227	0.5	0.458	8.0	LOS A	2.5	18.5	0.45	0.63	0.45	42.0
3u	U	16	0.0	0.458	10.9	LOS A	2.5	18.5	0.45	0.63	0.45	44.6
Approach		522	4.9	0.458	6.5	LOS A	2.5	18.5	0.45	0.63	0.45	42.0
East: Toallo Street												
4	L2	142	5.7	0.330	5.2	LOS A	1.7	12.7	0.47	0.64	0.47	41.0
5	T1	80	2.9	0.330	5.1	LOS A	1.7	12.7	0.47	0.64	0.47	42.5
6	R2	115	6.1	0.330	8.4	LOS A	1.7	12.7	0.47	0.64	0.47	42.1
6u	U	9	0.0	0.330	11.2	LOS A	1.7	12.7	0.47	0.64	0.47	44.9
Approach		346	5.0	0.330	6.4	LOS A	1.7	12.7	0.47	0.64	0.47	41.8
North: Princes Highway												
7	L2	109	2.1	0.318	5.1	LOS A	1.3	9.9	0.42	0.61	0.42	41.5
8	T1	181	9.6	0.318	5.1	LOS A	1.3	9.9	0.42	0.61	0.42	43.1
9	R2	41	0.0	0.318	8.2	LOS A	1.3	9.9	0.42	0.61	0.42	42.8
9u	U	6	20.0	0.318	11.5	LOS A	1.3	9.9	0.42	0.61	0.42	42.3
Approach		336	6.2	0.318	5.6	LOS A	1.3	9.9	0.42	0.61	0.42	42.5
West: Toallo Street												
10	L2	39	8.8	0.250	8.6	LOS A	1.6	11.7	0.75	0.79	0.75	38.4
11	T1	94	6.2	0.250	8.6	LOS A	1.6	11.7	0.75	0.79	0.75	39.8
12	R2	41	5.7	0.250	11.9	LOS A	1.6	11.7	0.75	0.79	0.75	39.6
12u	U	1	0.0	0.250	14.5	LOS A	1.6	11.7	0.75	0.79	0.75	41.8
Approach		175	6.6	0.250	9.4	LOS A	1.6	11.7	0.75	0.79	0.75	39.4
All Vehicles		1379	5.5	0.458	6.6	LOS A	2.5	18.5	0.48	0.65	0.48	41.7

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [PM Coraki Dr / Pambula Beach Rd / Culgoa Cres]

Priority intersection of Coraki Drive, Pambula Beach Road and Culgoa Crescent in Pambula Beach
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Culgoa Crescent												
1	L2	21	0.0	0.021	4.8	LOS A	0.1	0.5	0.17	0.51	0.17	44.1
2	T1	1	0.0	0.021	4.2	LOS A	0.1	0.5	0.17	0.51	0.17	35.8
3	R2	6	0.0	0.021	5.6	LOS A	0.1	0.5	0.17	0.51	0.17	35.2
Approach		28	0.0	0.021	4.9	LOS A	0.1	0.5	0.17	0.51	0.17	43.0
East: Coraki Drive												
4	L2	8	0.0	0.050	4.8	LOS A	0.1	0.5	0.05	0.09	0.05	44.8
5	T1	82	0.0	0.050	0.0	LOS A	0.1	0.5	0.05	0.09	0.05	48.9
6	R2	8	0.0	0.050	4.9	LOS A	0.1	0.5	0.05	0.09	0.05	43.3
Approach		98	0.0	0.050	0.8	NA	0.1	0.5	0.05	0.09	0.05	48.6
North: Pambula Beach Access Road												
7	L2	8	0.0	0.023	4.8	LOS A	0.1	0.6	0.23	0.53	0.23	34.6
8	T1	2	0.0	0.023	4.1	LOS A	0.1	0.6	0.23	0.53	0.23	35.5
9	R2	14	0.0	0.023	5.7	LOS A	0.1	0.6	0.23	0.53	0.23	43.5
Approach		24	0.0	0.023	5.2	LOS A	0.1	0.6	0.23	0.53	0.23	41.5
West: Pambula Beach Road												
10	L2	28	0.0	0.073	4.7	LOS A	0.2	1.3	0.09	0.19	0.09	46.9
11	T1	88	2.6	0.073	0.1	LOS A	0.2	1.3	0.09	0.19	0.09	47.7
12	R2	24	0.0	0.073	4.8	LOS A	0.2	1.3	0.09	0.19	0.09	46.7
Approach		140	1.7	0.073	1.8	NA	0.2	1.3	0.09	0.19	0.09	47.4
All Vehicles		291	0.8	0.073	2.1	NA	0.2	1.3	0.10	0.21	0.10	46.9

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [PM Mitchell St / Imlay St]

Roundabout intersection of Mitchell Street and Imlay Street in Eden
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Imlay Street												
1	L2	130	4.5	0.346	4.5	LOS A	1.6	11.3	0.32	0.52	0.32	39.6
2	T1	255	1.8	0.346	4.3	LOS A	1.6	11.3	0.32	0.52	0.32	43.8
3	R2	31	0.0	0.346	7.6	LOS A	1.6	11.3	0.32	0.52	0.32	41.7
3u	U	7	0.0	0.346	10.5	LOS A	1.6	11.3	0.32	0.52	0.32	46.0
Approach		423	2.5	0.346	4.7	LOS A	1.6	11.3	0.32	0.52	0.32	42.6
East: Mitchell Street												
4	L2	31	7.4	0.092	5.4	LOS A	0.4	2.9	0.43	0.62	0.43	38.8
5	T1	35	16.7	0.092	5.4	LOS A	0.4	2.9	0.43	0.62	0.43	36.4
6	R2	19	25.0	0.092	9.0	LOS A	0.4	2.9	0.43	0.62	0.43	39.9
6u	U	1	0.0	0.092	11.3	LOS A	0.4	2.9	0.43	0.62	0.43	29.3
Approach		86	14.9	0.092	6.3	LOS A	0.4	2.9	0.43	0.62	0.43	38.1
North: Imlay Street												
7	L2	9	0.0	0.284	4.3	LOS A	1.2	8.4	0.28	0.55	0.28	39.6
8	T1	213	2.7	0.284	4.1	LOS A	1.2	8.4	0.28	0.55	0.28	43.2
9	R2	124	3.7	0.284	7.4	LOS A	1.2	8.4	0.28	0.55	0.28	40.8
9u	U	1	0.0	0.284	10.3	LOS A	1.2	8.4	0.28	0.55	0.28	45.6
Approach		347	3.0	0.284	5.3	LOS A	1.2	8.4	0.28	0.55	0.28	42.4
West: Mitchell Street												
10	L2	213	10.9	0.378	6.4	LOS A	2.6	19.3	0.63	0.70	0.63	37.6
11	T1	23	0.0	0.378	6.2	LOS A	2.6	19.3	0.63	0.70	0.63	35.9
12	R2	113	1.0	0.378	9.5	LOS A	2.6	19.3	0.63	0.70	0.63	38.9
12u	U	1	0.0	0.378	12.3	LOS A	2.6	19.3	0.63	0.70	0.63	26.8
Approach		351	6.9	0.378	7.4	LOS A	2.6	19.3	0.63	0.70	0.63	37.9
All Vehicles		1207	4.8	0.378	5.8	LOS A	2.6	19.3	0.41	0.59	0.41	40.9

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [Weekend Princes Hwy / Toallo St]

Roundabout intersection of Princes Highway and Toallo St in Pambula
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway												
1	L2	46	2.3	0.330	4.4	LOS A	1.5	11.1	0.32	0.59	0.32	41.1
2	T1	138	4.6	0.330	4.3	LOS A	1.5	11.1	0.32	0.59	0.32	42.6
3	R2	189	1.7	0.330	7.6	LOS A	1.5	11.1	0.32	0.59	0.32	42.4
3u	U	28	0.0	0.330	10.4	LOS A	1.5	11.1	0.32	0.59	0.32	45.1
Approach		402	2.6	0.330	6.3	LOS A	1.5	11.1	0.32	0.59	0.32	42.5
East: Toallo Street												
4	L2	173	0.0	0.280	4.8	LOS A	1.4	9.7	0.39	0.60	0.39	41.7
5	T1	54	0.0	0.280	4.7	LOS A	1.4	9.7	0.39	0.60	0.39	43.1
6	R2	77	1.4	0.280	8.0	LOS A	1.4	9.7	0.39	0.60	0.39	42.7
6u	U	13	0.0	0.280	10.9	LOS A	1.4	9.7	0.39	0.60	0.39	45.5
Approach		316	0.3	0.280	5.8	LOS A	1.4	9.7	0.39	0.60	0.39	42.3
North: Princes Highway												
7	L2	78	0.0	0.223	4.8	LOS A	0.8	5.9	0.35	0.57	0.35	41.9
8	T1	137	3.8	0.223	4.6	LOS A	0.8	5.9	0.35	0.57	0.35	43.6
9	R2	32	0.0	0.223	7.9	LOS A	0.8	5.9	0.35	0.57	0.35	43.2
9u	U	3	0.0	0.223	10.8	LOS A	0.8	5.9	0.35	0.57	0.35	45.8
Approach		249	2.1	0.223	5.2	LOS A	0.8	5.9	0.35	0.57	0.35	43.0
West: Toallo Street												
10	L2	28	0.0	0.159	6.5	LOS A	0.9	6.6	0.61	0.68	0.61	40.0
11	T1	67	1.6	0.159	6.7	LOS A	0.9	6.6	0.61	0.68	0.61	41.4
12	R2	40	0.0	0.159	9.9	LOS A	0.9	6.6	0.61	0.68	0.61	41.2
12u	U	1	0.0	0.159	12.8	LOS A	0.9	6.6	0.61	0.68	0.61	43.5
Approach		137	0.8	0.159	7.7	LOS A	0.9	6.6	0.61	0.68	0.61	41.1
All Vehicles		1104	1.6	0.330	6.1	LOS A	1.5	11.1	0.38	0.60	0.38	42.4

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [Weekend Coraki Dr / Pambula Beach Rd / Culgoa Cres]

Priority intersection of Coraki Drive, Pambula Beach Road and Culgoa Crescent in Pambula Beach
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Culgoa Crescent												
1	L2	12	0.0	0.016	4.8	LOS A	0.1	0.4	0.18	0.51	0.18	44.1
2	T1	1	0.0	0.016	4.1	LOS A	0.1	0.4	0.18	0.51	0.18	35.8
3	R2	6	0.0	0.016	5.6	LOS A	0.1	0.4	0.18	0.51	0.18	35.2
Approach		19	0.0	0.016	5.0	LOS A	0.1	0.4	0.18	0.51	0.18	42.2
East: Coraki Drive												
4	L2	5	0.0	0.047	4.8	LOS A	0.1	0.4	0.04	0.07	0.04	45.4
5	T1	81	0.0	0.047	0.0	LOS A	0.1	0.4	0.04	0.07	0.04	49.1
6	R2	6	0.0	0.047	4.9	LOS A	0.1	0.4	0.04	0.07	0.04	43.9
Approach		93	0.0	0.047	0.6	NA	0.1	0.4	0.04	0.07	0.04	48.9
North: Pambula Beach Access Road												
7	L2	7	0.0	0.026	4.8	LOS A	0.1	0.6	0.24	0.53	0.24	34.4
8	T1	2	0.0	0.026	4.1	LOS A	0.1	0.6	0.24	0.53	0.24	35.3
9	R2	17	0.0	0.026	5.6	LOS A	0.1	0.6	0.24	0.53	0.24	43.4
Approach		26	0.0	0.026	5.3	LOS A	0.1	0.6	0.24	0.53	0.24	41.8
West: Pambula Beach Road												
10	L2	22	0.0	0.071	4.7	LOS A	0.1	1.0	0.07	0.16	0.07	47.4
11	T1	97	1.1	0.071	0.1	LOS A	0.1	1.0	0.07	0.16	0.07	48.1
12	R2	19	0.0	0.071	4.8	LOS A	0.1	1.0	0.07	0.16	0.07	47.1
Approach		138	0.8	0.071	1.5	NA	0.1	1.0	0.07	0.16	0.07	47.9
All Vehicles		276	0.4	0.071	1.8	NA	0.1	1.0	0.09	0.19	0.09	47.3

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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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 [Weekend Mitchell St / Imlay St]

Roundabout intersection of Mitchell Street and Imlay Street in Eden
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Imlay Street												
1	L2	126	0.8	0.270	4.4	LOS A	1.1	8.0	0.30	0.53	0.30	40.0
2	T1	167	0.6	0.270	4.3	LOS A	1.1	8.0	0.30	0.53	0.30	43.9
3	R2	19	0.0	0.270	7.6	LOS A	1.1	8.0	0.30	0.53	0.30	41.8
3u	U	14	0.0	0.270	10.4	LOS A	1.1	8.0	0.30	0.53	0.30	46.2
Approach		326	0.6	0.270	4.8	LOS A	1.1	8.0	0.30	0.53	0.30	42.6
East: Mitchell Street												
4	L2	46	0.0	0.103	5.4	LOS A	0.4	3.0	0.44	0.61	0.44	39.2
5	T1	42	2.5	0.103	5.3	LOS A	0.4	3.0	0.44	0.61	0.44	37.9
6	R2	14	0.0	0.103	8.5	LOS A	0.4	3.0	0.44	0.61	0.44	41.0
6u	U	1	0.0	0.103	11.4	LOS A	0.4	3.0	0.44	0.61	0.44	24.8
Approach		103	1.0	0.103	5.8	LOS A	0.4	3.0	0.44	0.61	0.44	38.9
North: Imlay Street												
7	L2	8	0.0	0.287	4.3	LOS A	1.2	8.2	0.28	0.55	0.28	39.6
8	T1	213	2.5	0.287	4.2	LOS A	1.2	8.2	0.28	0.55	0.28	43.1
9	R2	129	0.0	0.287	7.4	LOS A	1.2	8.2	0.28	0.55	0.28	41.0
9u	U	2	0.0	0.287	10.3	LOS A	1.2	8.2	0.28	0.55	0.28	45.6
Approach		353	1.5	0.287	5.4	LOS A	1.2	8.2	0.28	0.55	0.28	42.4
West: Mitchell Street												
10	L2	151	4.2	0.288	5.2	LOS A	1.9	13.4	0.50	0.61	0.50	38.6
11	T1	33	0.0	0.288	5.2	LOS A	1.9	13.4	0.50	0.61	0.50	37.1
12	R2	118	0.0	0.288	8.5	LOS A	1.9	13.4	0.50	0.61	0.50	39.8
12u	U	4	0.0	0.288	11.4	LOS A	1.9	13.4	0.50	0.61	0.50	27.5
Approach		305	2.1	0.288	6.6	LOS A	1.9	13.4	0.50	0.61	0.50	38.8
All Vehicles		1087	1.4	0.288	5.6	LOS A	1.9	13.4	0.36	0.57	0.36	41.2

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.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.