Bayswater Water and Other Associated Operational Works Project

Appendix J – Traffic and Transport Assessment report

Bayswater Water and Other Associated Works

AGL Macquarie Pty Limited

Traffic and Transport Assessment Report

IA215400 | Final

24 October 2019

Bayswater Water and Other Associated Works

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Document history and status

Revision	Date	Description	By	Review	Approved
A	16/09/2019	Draft Report	C. Li	D. Lowe	D. Lowe / K. Flynn
B	16/10/2019	Final Draft Report	C. Li	D. Lowe	D. Lowe / K. Flynn
C	24/10/2019	Final Report (non-technical updates)	C. Li	K. Flynn	K. Flynn

Contents

1. Introduction

Jacobs Group (Australia) Pty Ltd has been commissioned by AGL Macquarie to undertake a traffic and transport assessment of improvement works at the Bayswater Power Station (the Project). This assessment forms part of the Environmental Impact Statement for the Project and responds to the Secretary's Environmental Assessment Requirements (SEARs) issued on 30th November 2018.

Table 1 provides details of the SEARs for traffic and transport and identifies where in this Technical Paper they are addressed.

Table 1 Secretary's Environmental Assessment Requirements – Traffic and transport

Environmental Assessment Requirement	Where addressed
An assessment of the peak and average traffic generation, including over-dimensional vehicles and construction worker transportation	Section 3.2 Section 4.3.1
An assessment of the likely transport impacts to the site access route, site access point and any Crown land, particularly in relation to the capacity and condition of the roads	Section 4
A cumulative impact assessment of traffic from nearby developments	Section 4.1
A description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required)	Section 4
A description of the measures that would be implemented to mitigate any transport impacts during construction and operation	Section 4

1.1 Background

Bayswater Power Station (Bayswater) is located approximately 16 kilometres south-east of Muswellbrook, 25 kilometres north-west of Singleton and approximately 165 kilometres north-west of Sydney in NSW. The total area of the AGL Macquarie landholding is approximately 10,000 hectares, including Liddell Power Station, the Ravensworth rehabilitation area, Lake Liddell and surrounding buffer lands. Bayswater's operational area occupies approximately 300 hectares and is shown in Figure 1.1.

Existing developments neighbouring Bayswater include the former Drayton and Liddell coal mines, Liddell Power Station and the Main Northern Railway Line. The New England Highway runs parallel to Bayswater and access from the highway is provided by a dedicated interchange and access road. Agricultural clearing is also present within and surrounding the AGL Macquarie landholding. The closest residential area is the Antiene subdivision, which is located approximately five kilometres north of the Project.

Data sources

Jacobs 2019,
AGL 2019,
NSW Spatial Services 2019

GDA94 MGA56

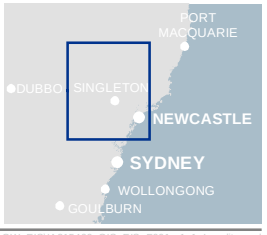

Figure 1 - 1 Project location

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1.2 Report structure

The report structure is as follows:

- **Section 2** defines the existing conditions and access arrangements
- **Section 3** provides a description of the proposed works and the likely traffic generation
- **Section 4** assesses the impact of the proposed works
- **Section 5** summarises the study findings and recommendations

1.3 Key assumptions

The key assumptions that have been made in this assessment include:

- The proposed construction works will occur between 2019 and 2023. Bayswater will operate until 2035 with up to an additional five years for decommissioning and rehabilitation works
- All elements of the Project would be undertaken concurrently
- The majority of works would be undertaken during standard construction hours (Monday to Friday 7:00am – 6:00pm, Saturday 8:00am – 1:00pm and no Sunday or public holiday work). Some ash harvesting activities will take place outside of these hours.
- Traffic data collected in 2018 is indicative of typical operations at Bayswater
- The traffic generation rate in the peak periods is expected to be one light vehicle per worker. It is assumed each worker would arrive and leave during the peak hour periods
- Heavy vehicle movements are distributed evenly throughout operating hours
- Oversized and over-mass vehicles, where required, would be transported outside of peak traffic periods to minimise impacts on the road network
- The internal road network and parking at Bayswater has sufficient capacity to accommodate the increased vehicle movements

2. Existing conditions

2.1 Road network and access

The site is connected to the surrounding road network via an access road and grade-separated interchange to and from the New England Highway, as shown in Figure 2.1. The key surrounding roads are:

New England Highway – The New England Highway is a Federal Highway that links Newcastle to Brisbane. The highway connects with the Pacific Highway and the D'Aguilar Highway, facilitating access to Sydney and Queensland, respectively. Near the site, the New England Highway is dual carriageway with two lanes in each direction and a central median. The speed limit is 100km/h in the section of road near the power stations.

Bayswater Access Road – Bayswater is accessed from the New England Highway via an interchange that is shared with Liddell Power Station. The interchange connects with the power stations via an unnamed east-west access road. The access road is single carriageway with one lane in each direction. The road has no sign posted speed limit; however, given that the road network is only used for site access, it is reasonable to assume that the maximum operating speed is 60km/h.

No public transport services operate on the road network near the Project.

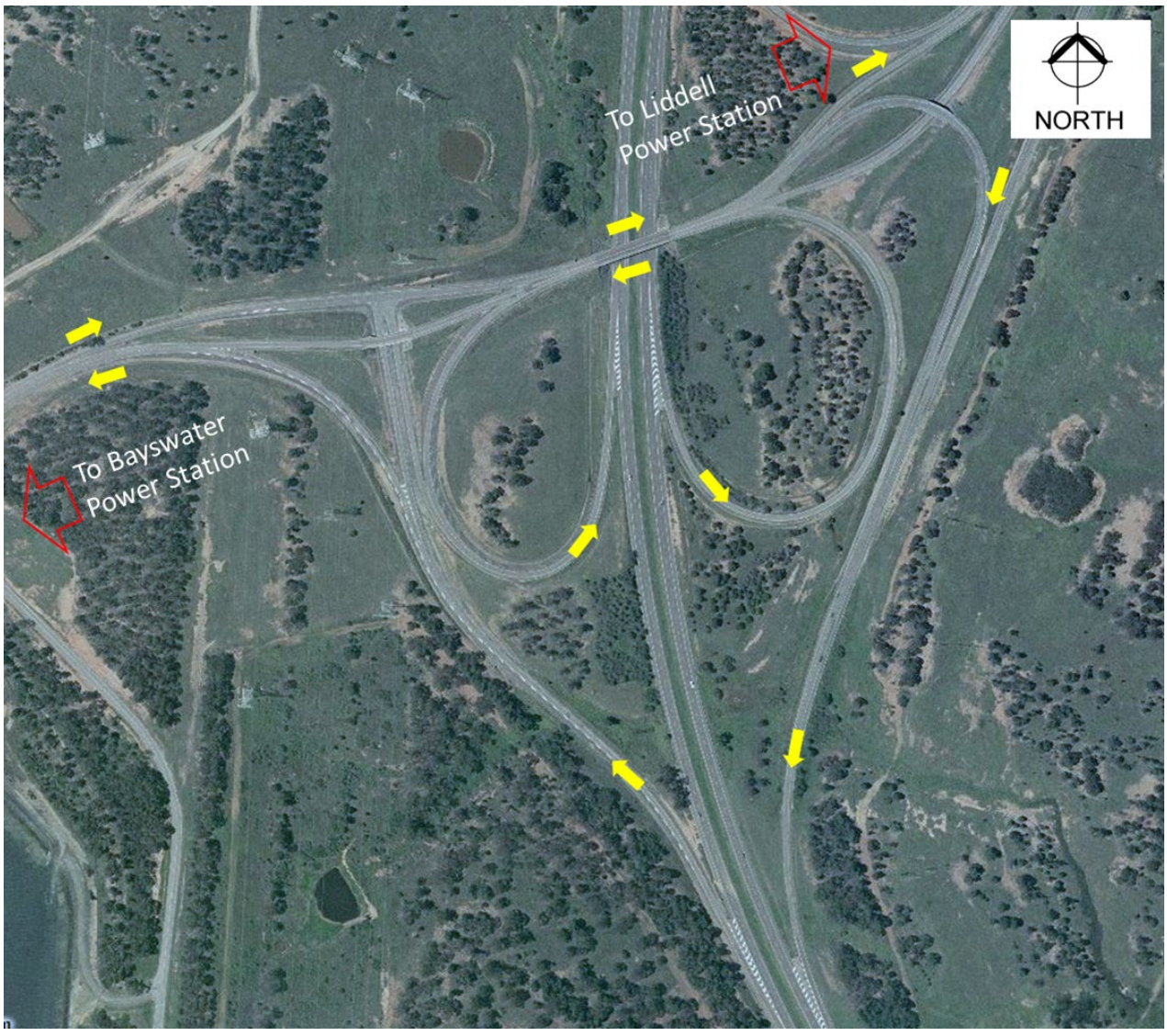


Figure 2.1: Interchange with the New England Highway

2.2 Traffic volumes and generation

2.2.1 New England Highway

Traffic volumes for the New England Highway were obtained from the Roads and Maritime Services (Roads and Maritime) permanent count station (ID 6154) located to the north of Bayswater, 1.64 kilometres south of Muscle Creek Road, Muswellbrook. The average annual weekday traffic volumes are shown in Table 2.1.

Table 2.1: Average annual weekday traffic volumes

	2017	2018	2019*
Northbound	4,632	4,654	4,710
Southbound	4,694	4,710	4,756
Total	**9,326**	**9,364**	**9,466**

**Up until August 2019*

Source: Roads and Maritime, Traffic Volume Viewer, 16 September 2019

The average weekday traffic volumes are approximately 9,400 vehicles per day with 30 per cent of these volumes being heavy vehicles. The hourly traffic volume profile for an average weekday in 2018 is shown in Figure 2.2.

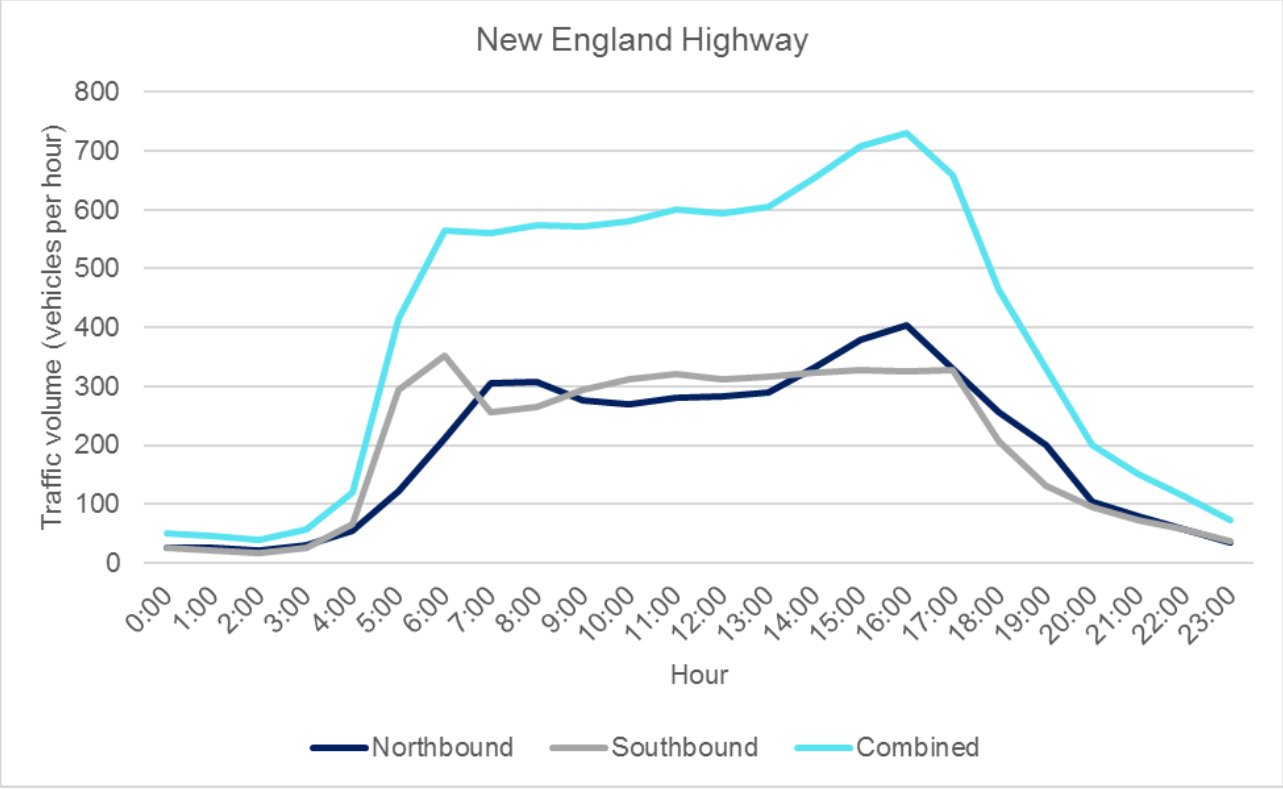


Figure 2.2: Hourly traffic volumes (2018) average weekday

The data indicates that peak traffic periods occur in the hours starting 8:00am and 4:00pm for the morning and evening peaks respectively. Between 5:00am and 6:00pm, traffic volumes are similar to volumes during the peak hours.

Table 2.2: Peak hour traffic volumes on the New England Highway (2018)

	Morning peak hour 8:00am – 9:00am	Evening peak hour 4:00pm – 5:00pm
Northbound	309	405
Southbound	264	326
Total	**573**	**731**

Source: Roads and Maritime, Traffic Volume Viewer, 26 August 2019

2.2.2 Interchange and access road

Traffic volumes for the Bayswater interchange and access road were commissioned from traffic surveys which were undertaken on Tuesday 22 May 2018. At this time, the power station was operating during its annual maintenance shutdown period where an additional 400 staff were on site. It has been assumed for the purposes of this assessment that the recorded traffic volumes are indicative of typical operation at Bayswater.

At the interchange, the morning peak hour was 6:00am – 7:00am and the evening peak hour was 5:30pm – 6:30pm. Figure 2.3, Figure 2.4 and Figure 2.5 show the daily traffic, morning peak hour and evening peak hour traffic volumes respectively. Most of the traffic generated by the site travels to and from the south, with only a small volume of traffic travelling between Bayswater and Liddell Power Stations.

Heavy vehicle volumes at the interchange make up between 5 and 10 per cent of the total volume of traffic.

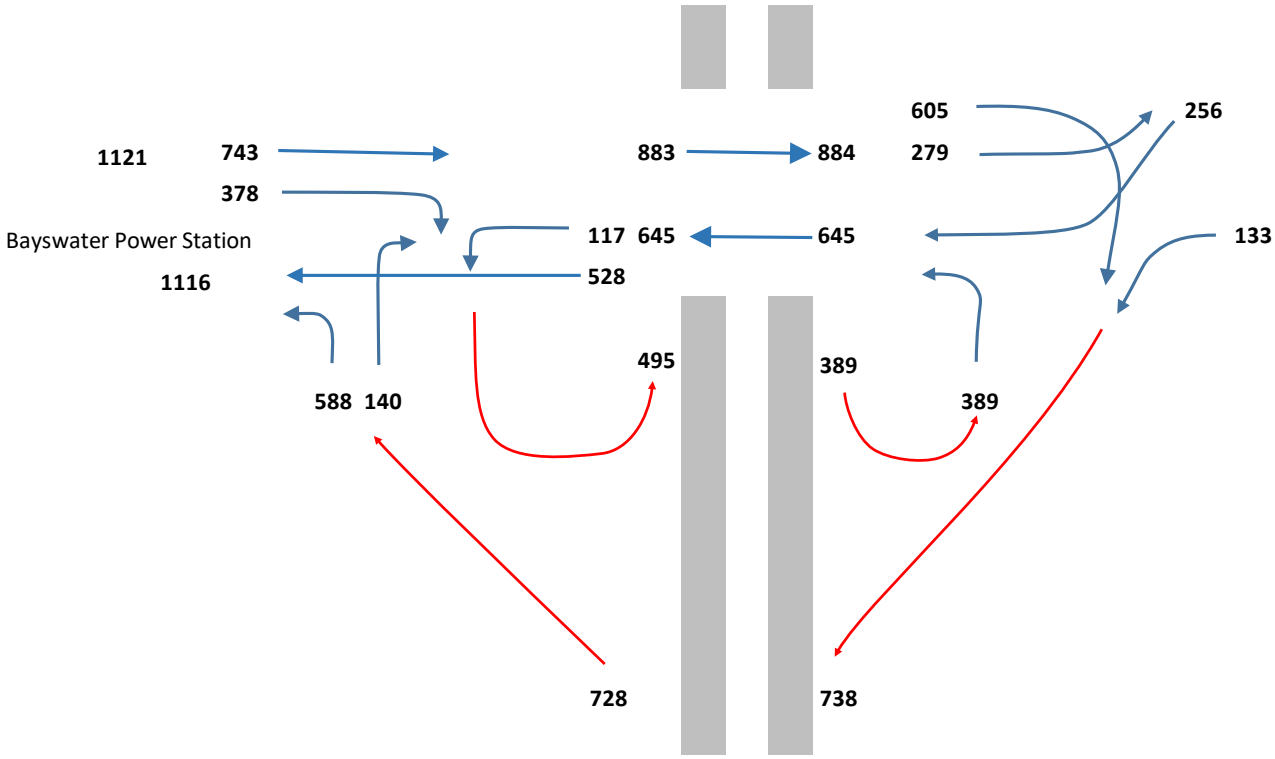


Figure 2.3: Bayswater access road daily traffic volumes

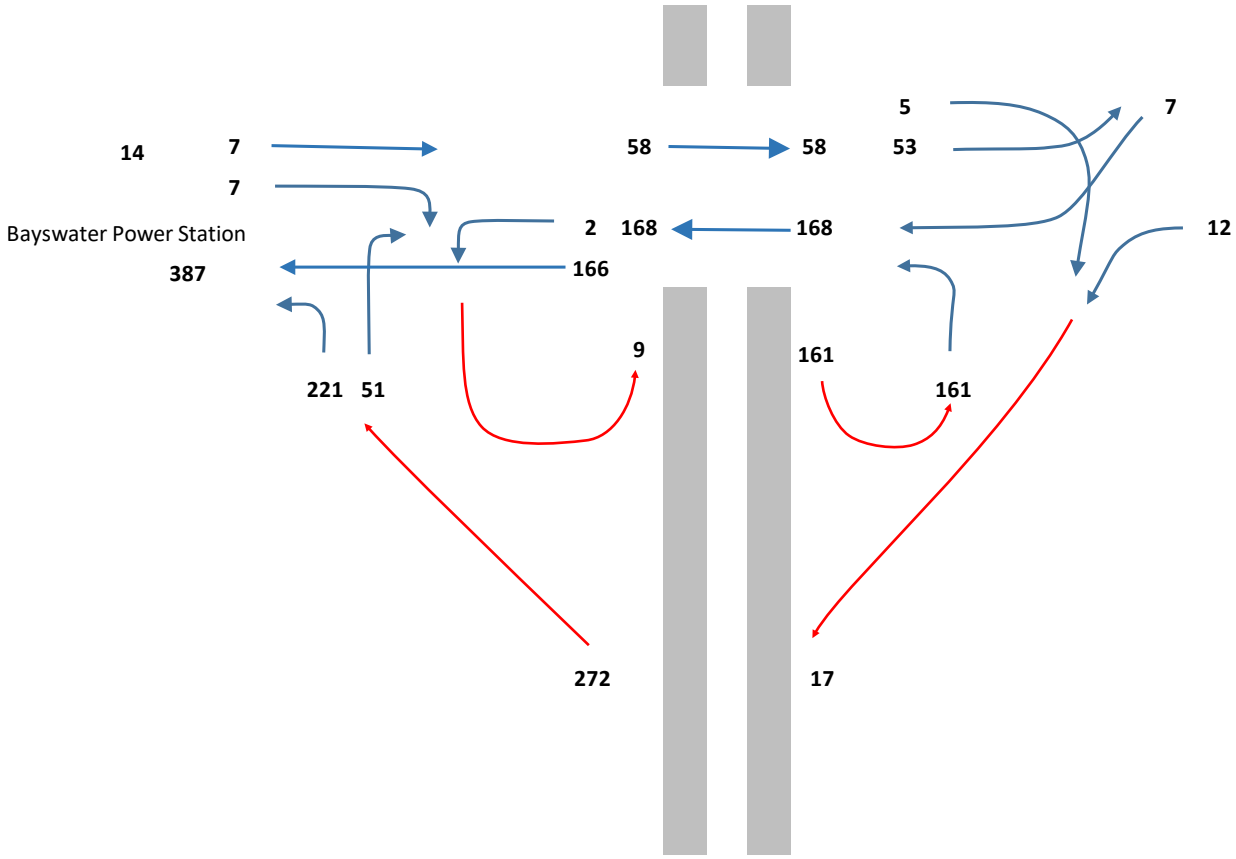


Figure 2.4: Bayswater access road morning peak hour traffic volumes (6:00am - 7:00am)

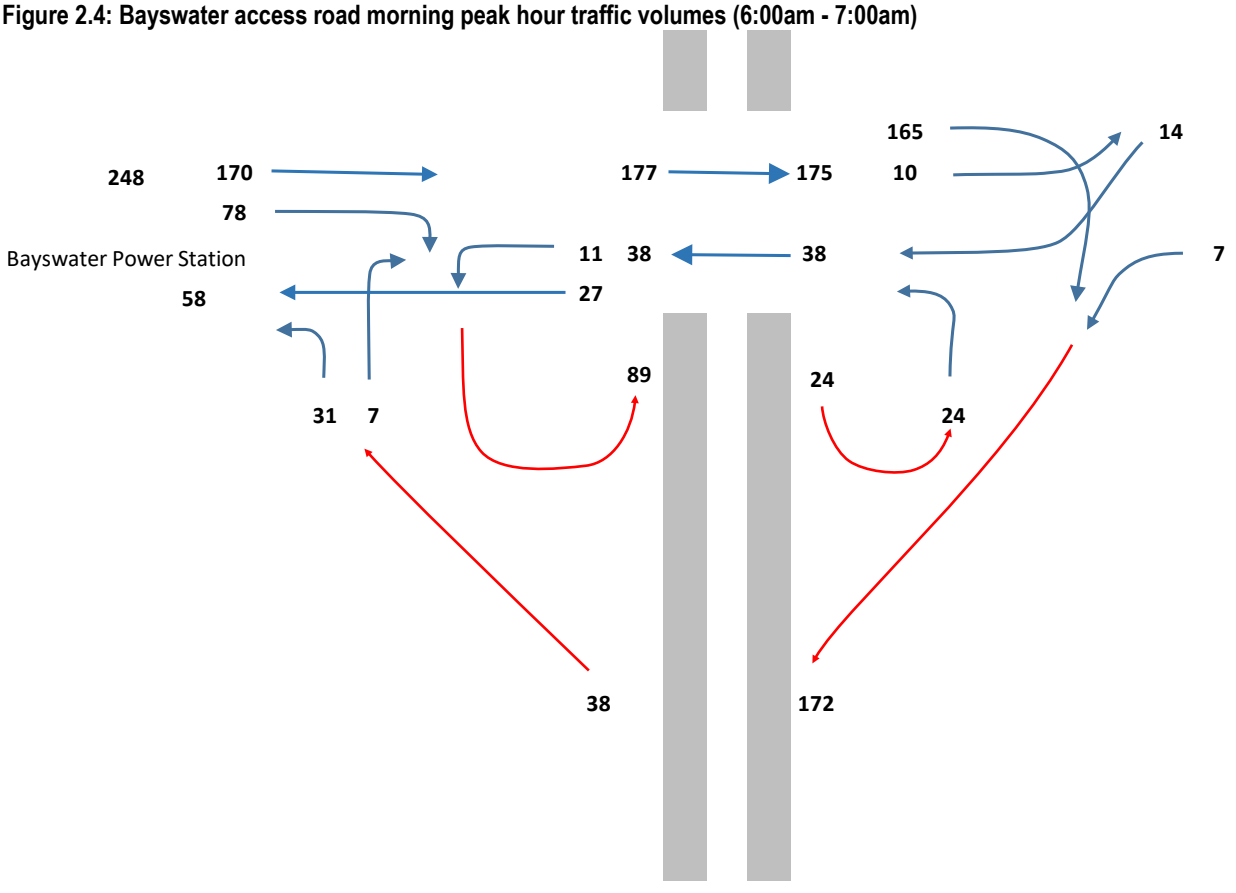


Figure 2.5: Bayswater access road evening peak hour traffic volumes (5:30pm - 6:30pm)

The existing traffic generated by Bayswater during the morning and evening peak hours is summarised in Table 2.3.

Table 2.3: Existing traffic generation

	To the site (vehicles)	From the site (vehicles)	Total
Morning peak hour (6:00am – 7:00am)	387	14	401
Evening peak hour (5:30pm – 6:30pm)	58	248	306
Daily traffic volume	1,116	1,121	2,237

2.3 Crash history

Crash data was provided by Roads and Maritime in August 2019 for the most recent five-year period from October 2013 to September 2018. During this period, five crashes occurred near the site and are shown in Figure 2.6.

Key findings include:

- Three crashes occurred on the New England Highway and two crashes occurred on the interchange;
- The most common crash type, with three crashes, involved striking a kangaroo or straying stock; and
- Two crashes occurred in darkness or when raining.

Figure 2.6: Bayswater access road five-year crash history

3. Proposal

3.1 Description of works

Bayswater was commissioned in 1985 to utility standards of the time and has a current technical life up to 2035. The site has a current generation capacity of 2,640 megawatts (MW) and approval for efficiency upgrades that will increase its capacity to 2,740 MW. The site employs technology common to other NSW coal-fired power stations.

Ancillary activities arising out of coal fired power generation at Bayswater include:

- Receipt, storage and transfer of coal within the coal handling and preparation plant area;
- Pumping of water from the Hunter River under existing water entitlements and storage and treatment of this water, including the management of salt and other impurities, to supply boilers and for cooling purposes; and
- The management of incombustible coal residue, in the form of bottom ash and fly ash, which is collected and transported to ash disposal areas or recycled.

The purpose of the Project is to improve the management of these ancillary processes over the remaining operating life of Bayswater and to facilitate an improved rehabilitation outcome for the ash disposal area.

The construction of the Project would include:

- Augmentation of the existing Bayswater ash dam to provide additional ash storage capacity;
- Improvements to water management structures and systems to ensure continued collection and reuse of process water and return waters from the Bayswater ash dam;
- Improvements to the management of water and waste materials within the coal handling plant sediment basin and associated drainage system;
- Increasing coal ash recycling activities to produce up to 1,000,000 tonnes per annum of ash derived product material and reuse of coal ash;
- Upgrades to existing fly ash harvesting infrastructure including the installation of weighbridges, construction of a new 240 tonne silo, tanker wash facility and additional truck parking;
- Construction of a new coal ash pipeline to Ravensworth Void No. 3 for ash emplacement;
- Construction of a salt cake landfill facility to dispose of salt cake waste;
- Construction of up to four borrow pits to facilitate the improvements proposed for the Project and other works on AGL Macquarie land; and
- Routine clearance of vegetation along the alignments of the Lime Softening Plant (LSP) Sludge Line and High Pressure (HP) Pipeline to provide ongoing access for maintenance and management.

The operational phase of the Project would include the following activities, that would generate additional vehicle movements:

- Additional ash recycling activities to reduce ash volumes requiring disposal;
- Salt cake delivery via existing internal roads; and
- Transport of borrow pit material to point of use via existing internal roads.

Following the retirement of Bayswater, decommissioning and rehabilitation works would continue for approximately five years until the works are completed. Works in this phase include:

- Rehabilitation of the Ash Dam to integrate with the existing landform;
- Removal of built infrastructure and rehabilitation of site;

- Final capping of salt cake landfill cells; and
- Recontouring of the proposed borrow pits. It is assumed that materials for rehabilitation would be sourced from the Ravensworth Compost Facility.

The majority of works would be undertaken during standard construction hours (Monday to Friday 7:00am – 6:00pm, Saturday 8:00am – 1:00pm and no Sunday or public holiday work). Some ash harvesting activities will take place outside of these hours. The location of works and other project elements are shown in Figure 3.1.

3.2 Traffic generation

Traffic generated by the Project would involve personnel and transportation of containers and construction materials. The majority of traffic movements would occur between 6:00am to 6:00pm within the operating hours of the site, with some ash harvesting activities to occur outside of these hours. It is assumed that heavy vehicle movements would be distributed evenly throughout the day across these operating hours.

3.2.1 Construction

During peak construction, the project would provide employment for up to 90 workers, generating an expected 90 two-way light vehicle movements per day. Furthermore, an additional 25 two-way heavy vehicle movements are expected to be generated per day for construction.

It should be noted that this assessment is conservative as it assumes that construction of all project elements would be undertaken concurrently. The finalised construction schedule would be further developed as part of design refinements, based on AGL operational requirements and in consultation with delivery contractors. Some works may be staged and it is anticipated that staging would result in a reduction of cumulative construction-related traffic impacts.

3.2.2 Operation

During operation, an additional 25 operational personnel are expected on site. Personnel are expected to travel to and from the site using personal light vehicles, generating approximately 25 two-way light vehicle movements per day. Furthermore, an additional 180 two-way heavy vehicle movements are expected to be generated per day for the transportation of ash.

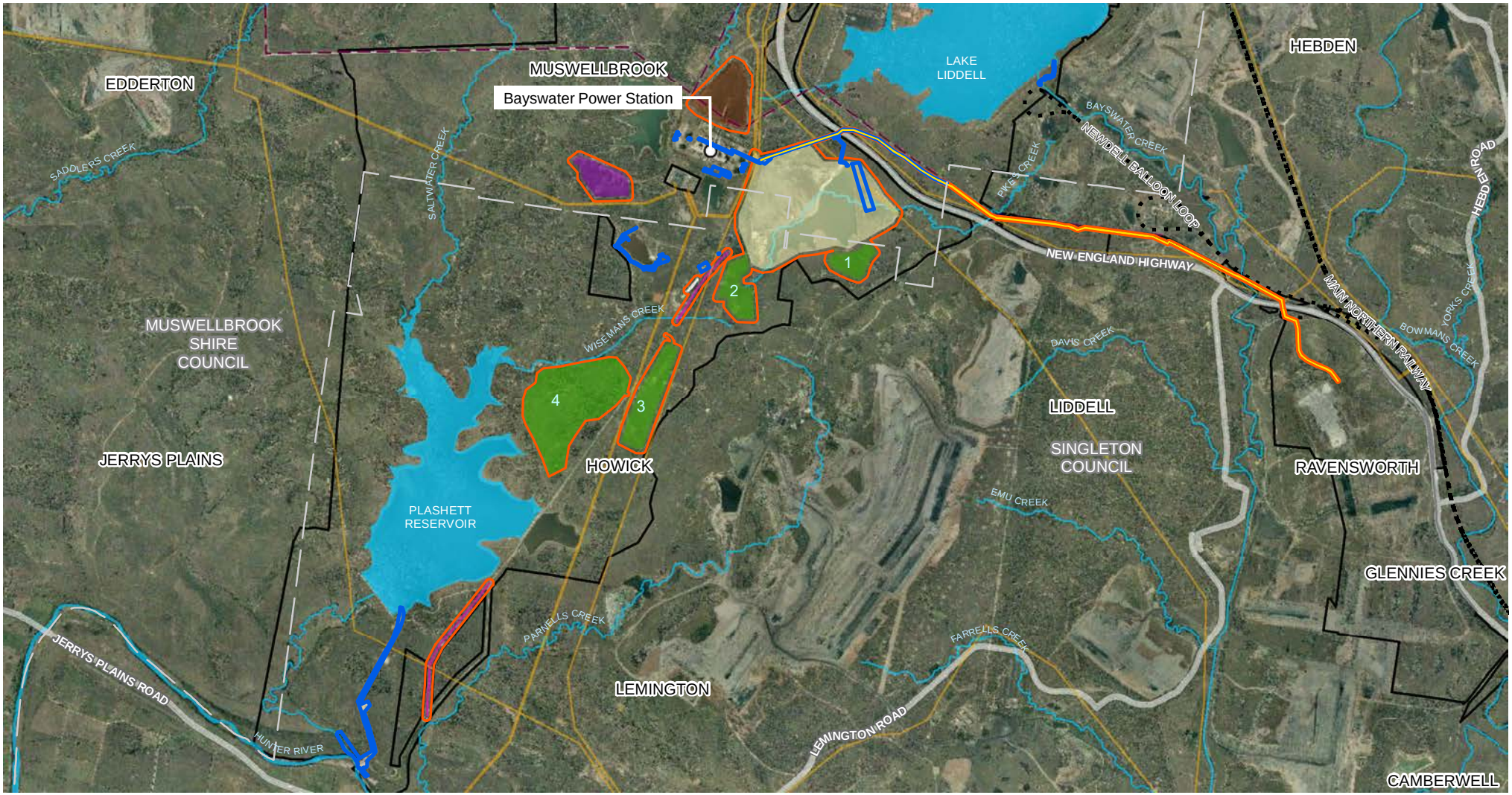
3.2.3 Decommissioning and rehabilitation

During decommissioning and rehabilitation, delivery of materials would be required from the Ravensworth Composting Facility for the remediation of the proposed Ash Dam. It is estimated that approximately 15 two-way heavy vehicle movements per day would be required from 2035 until rehabilitation works are completed (up to 2040).

In addition, there would be up to 15 two-way heavy vehicle movements a day associated with the delivery of over 150,000 tonnes of organics required for progressive rehabilitation works of other elements of the Project. These progressive works would continue over the life of the Project until rehabilitation works are completed. For the purposes of this assessment it is assumed that these works would be undertaken concurrently over five years from 2035. However, in reality rehabilitation works may not occur simultaneously. It is assumed that there is sufficient capacity within the existing internal road network within Bayswater. As noted, vehicle movements associated with the Ravensworth Composting Facilities on the road network are approved under the existing development consent for the facilities (DA140/2016 and DA173/2016).

3.3 Traffic distribution

Traffic distribution during construction, operation and rehabilitation is based on the proportion of vehicles travelling to the site each day. As shown in Figure 2.3, 588 vehicles (approximately 60 per cent) accessed the site from the south and 389 vehicles (approximately 40 per cent) accessed the site from the north. It is assumed that this distribution would be similar for traffic generated by the Project.



- Study area
- Local Government Area boundary
- Footprints of approvals to be surrendered
- AGL owned land
- Railway
- Electricity transmission line
- Coal supply conveyor

Project elements:

- Ash Dam Augmentation, Ash Harvesting and Water Management Works
- Ravensworth Ash Line
- Coal Handling Plant Water and Wastewater Infrastructure Upgrades
- HP Pipe Clearing
- LSP Sludge Line Clearing
- Clay Borrow Pits
- Salt Cake Landfill

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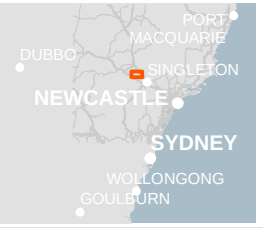

Data sources
Jacobs 2019
AGL 2019
NSW Spatial Services 2019

GDA94 MGA56

Figure 3 - 1 AGL Site Plan and Project Elements

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4. Traffic impact assessment

4.1 Nearby developments

Three nearby developments at Bayswater and Liddell Power Station would operate concurrently with the various stages of the Project. The traffic generation associated with these developments is considered cumulatively alongside the Project in the traffic impact assessment. As with the Project, the majority of heavy vehicle traffic movements of nearby developments are assumed to be distributed evenly throughout the day from 6:00am to 6:00pm.

The general activities, location, timing, duration and traffic generation of these developments are described below.

4.1.1 Bayswater Turbine Efficiency Upgrade

The Bayswater Turbine Efficiency Upgrade involves the replacement of four turbines over a four-year period commencing in 2019. One turbine will be replaced per year with works over 50 days per year. These works commenced in August 2019 and are expected to be undertaken during the annual shut down periods of Bayswater. During the upgrade, the following traffic generation and distribution is expected:

- 70 light vehicles arriving and leaving Bayswater during the morning and evening peak hours, respectively. This will generate 70 two-way traffic movements per day. As discussed in Section 3.3, 40 and 60 per cent of these vehicles are assumed to travel to and from the north and south, respectively.
- An assumed five heavy vehicles arriving and leaving Bayswater during the morning and evening peak hours. These vehicles are assumed to travel to and from the south.
- 10 over-sized and over-mass deliveries to and from Newcastle Port to Bayswater during the off-peak period. These vehicles are assumed to travel to and from the south.

4.1.2 Ravensworth Composting Facility

AGL Macquarie currently host the Ravensworth Composting Facilities, composting operations are undertaken by Bettergrow Pty Ltd and Loop Organics Pty Ltd. These facilities are located at Ravensworth. The facilities process up to a combined 126,000 tonnes of compost materials a year. Vehicle movements associated with the ongoing operation of these facilities are approved under the development consents for the facilities (DA140/2016 and DA173/2016).

Composted material is transferred to other AGL sites, including the Liddell Ash Dam. The facilities are is approved for a maximum allowable 35 two-way heavy vehicle movements per day from the Ravensworth Composting Facility, south of the site.

4.1.3 Liddell Power Station closure and rehabilitation

Liddell Power Station, to the east of Bayswater, is expected to commence closure works in April 2023. Access to and from Liddell Power Station is shared with Bayswater, with vehicles using the same interchange from the New England Highway. The expected heavy vehicle traffic generation during closure is 50 to 100 two-way heavy vehicle movements per day for approximately two years following retirement.

Rehabilitation works will be dependent on the proposed future land use of the site and is yet to be agreed upon. It is likely that the rehabilitation of Liddell Power Station would include demolition or partial demolition and reuse of plant facilities and power generation. Rehabilitation works are expected to generate 35 two-way heavy vehicle movements per day for approximately two years following retirement.

The traffic distribution of vehicles associated with Liddell Power Station closure and rehabilitation works is expected to be to and from Ravensworth, south of the site.

4.1.4 Cumulative additional traffic generation

The cumulative traffic generation, in passenger car units (pcu), of the Project and nearby developments is shown in Figure 4.1.

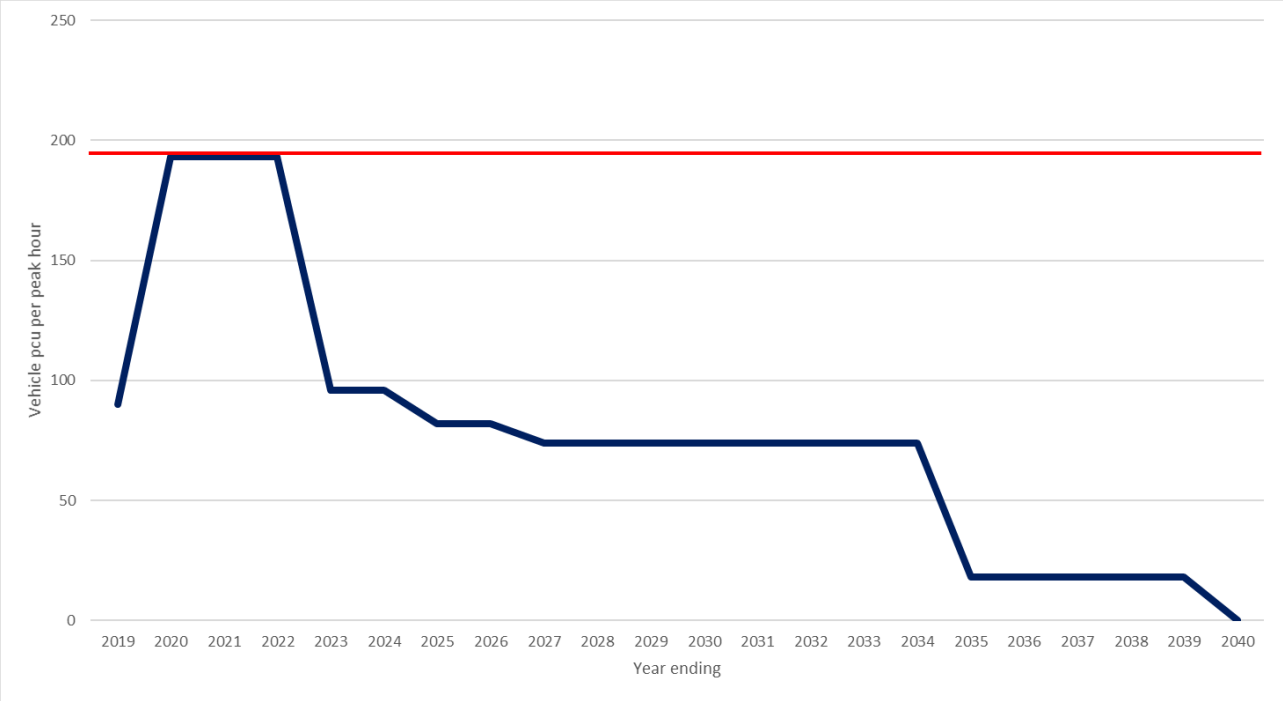


Figure 4.1 Cumulative traffic generation

Based on a peak of 193 pcu between 2020 and 2022, the expected additional traffic generation of the Project and nearby developments is:

- 160 light vehicles to or from Bayswater during the morning and evening peak, respectively
- 10 heavy vehicles to and from Bayswater
- 3 heavy vehicles to and from Liddell Power Station

The distribution of light and heavy vehicles is shown in Figure 4.2 and Figure 4.3.

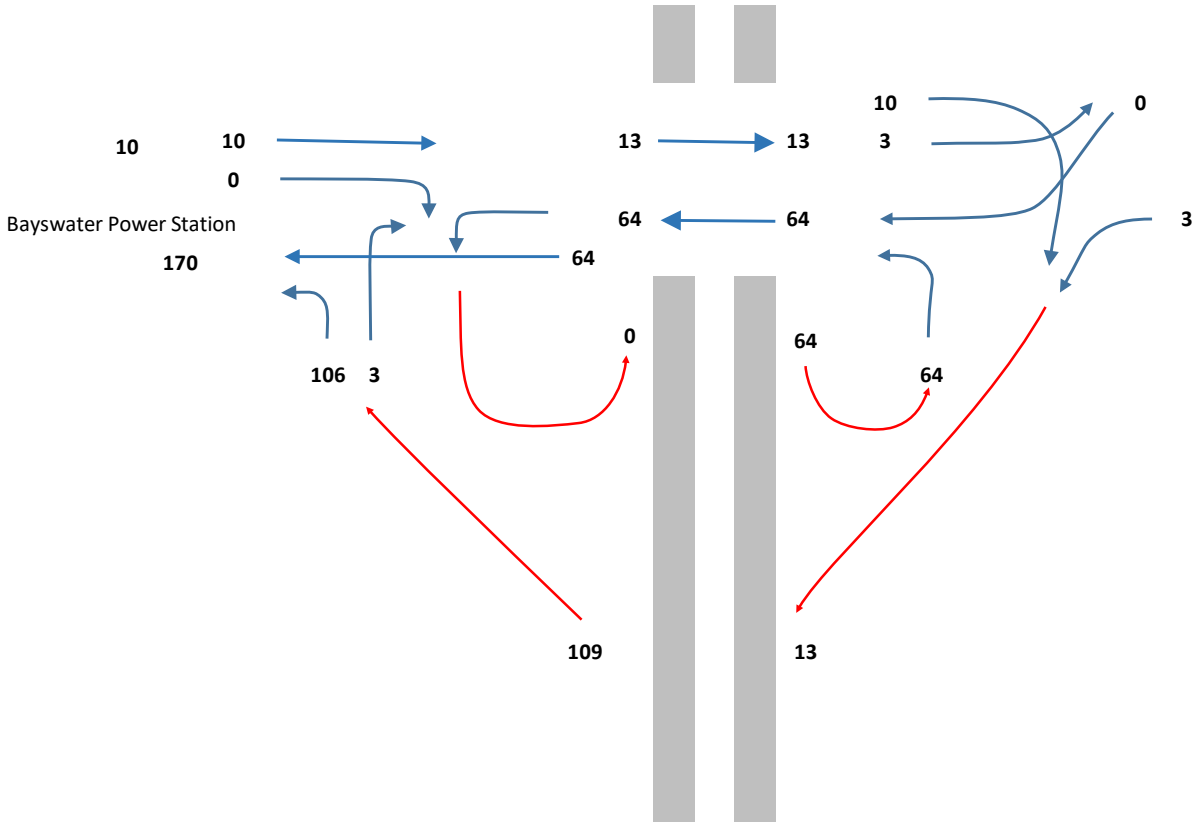


Figure 4.2 Bayswater access road cumulative morning peak traffic generation volumes (6:00am – 7:00am)

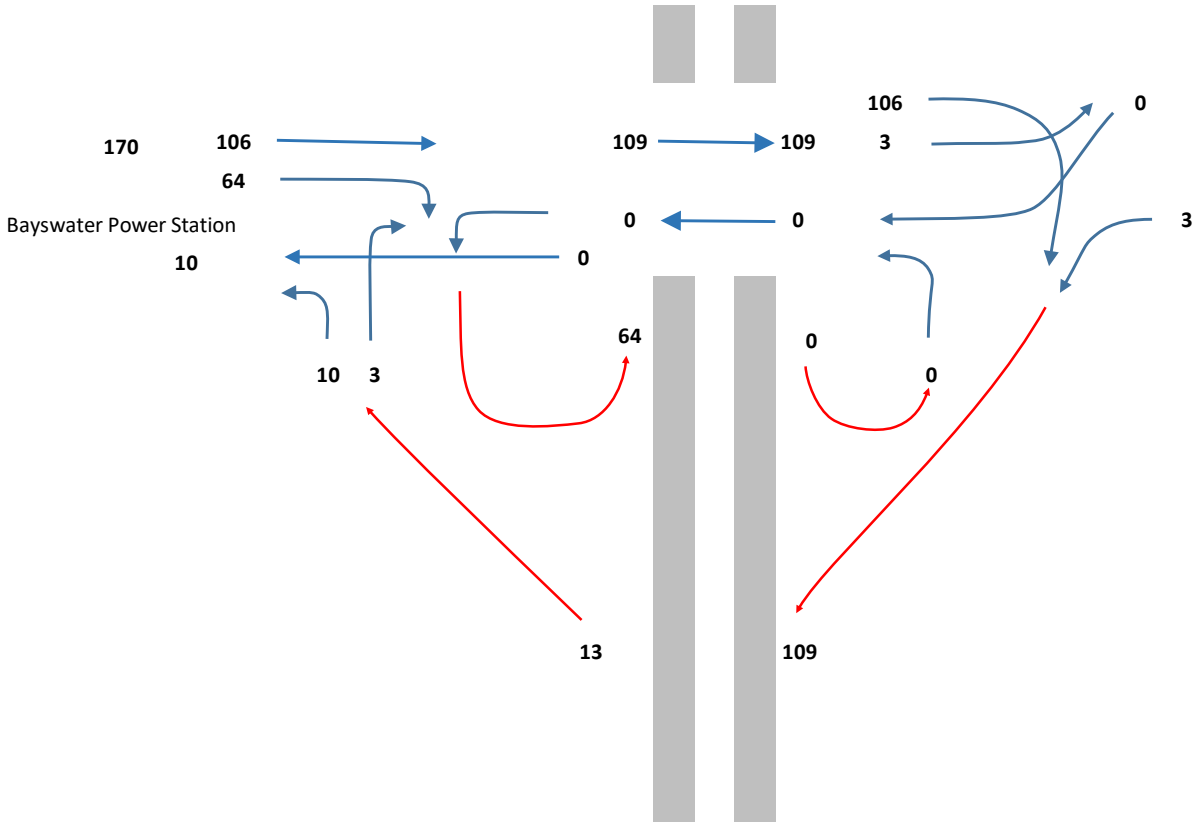


Figure 4.3 Bayswater access road cumulative evening peak traffic generation volumes (5:30pm – 6:30pm)

4.2 Road network performance

4.2.1 Desired level of service criteria

The criteria for evaluating the operational performance of intersections is defined in Table 4.1 and comes from Roads and Maritime's *Guide to Traffic Generating Developments (2002)*. For priority (sign-controlled) intersections, the criteria for evaluating the performance of intersections is based on the worst delay across all legs of the intersection during the peak hour. This average vehicle delay is equated to a corresponding level of service (LoS) from A (best) to F (worst). For rural roads, the desired LoS is LoS C.

Table 4.1: Level of service definitions

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

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

4.2.2 Intersection level of service and queue length

SIDRA Intersection 7 was used to model the existing and project scenarios of two key constraint intersections at the interchange. A target LoS of C was adopted for the modelled intersections as consistent with Section 4.2.4 of the RTA *Guide to Traffic Generating Developments.* Furthermore, queue lengths were modelled to determine whether safety on the New England Highway would be affected by queue spillback onto the highway.

It should be noted that this assessment is conservative as it assumes that construction of all Project elements would be undertaken concurrently. Some works may be staged and it is anticipated that staging would result in a reduction of cumulative construction-related traffic impacts.

The modelled locations are shown in Figure 4.4 and the existing and future peak year traffic modelling results of the T-intersection and merge are shown in Table 4.2.

The modelling indicates that the interchange currently operates at excellent LoS with abundant spare capacity. In the future peak year, the cumulative impact of the Project and nearby developments is not expected to significantly impact the operation of the interchange. This is mostly due to the grade separation of most conflicting movements and the provision of low angle merges.

The length of the exit ramp from the New England Highway to the T-intersection is approximately 750 metres. The future year peak scenario queue lengths are expected to be very low and not expected to extend into nor impact motorway operation.

Figure 4.4: Intersection model locations

Table 4.2: SIDRA results – T-intersection

Scenario	Intersection and peak period	Average delay (seconds)	Degree of Saturation	LoS	Queue length (metres)
Existing scenario	Merge Morning peak	4.4	0.130	A	0
	T-intersection Evening peak	2.4	0.095	A	0.2
Future peak year scenario	Merge Morning peak	4.5	0.194	A	0
	T-intersection Evening peak	2.6	0.156	A	0.4

4.2.3 New England Highway capacity

The New England Highway has a divided carriageway and two lanes in each direction. As shown in Figure 2.2, the peak hour traffic volumes on the highway are approximately 400 vehicles per hour in each direction across the two lanes.

To assess the capacity of the motorway, Exhibit 10-5 of the *Highway Capacity Manual 2010* specifies the base capacity of a freeway based on the free-flow speed and is shown in Table 4.3.

Table 4.3: Base capacity of a freeway

Free flow speed (kilometres/hour)	Base capacity (pcu/hour/lane)
120	2,400
113	2,400
105	2,350
97	2,300
89	2,250

Source: Highway Capacity Manual 2010

For a free flow speed of 100 km/h, the base capacity of the New England Highway is 4,600 passenger car units (pcu) per hour. This indicates that there is excess capacity to accommodate the cumulative additional traffic generation on the New England Highway without significantly impacting the operation of the highway.

4.2.4 Merge and diverge analysis

To assess the capacity of the entry ramp from the Bayswater access road to the New England Highway in the southbound direction, the *Highway Capacity Manual 2010* specifies the LoS criteria for merge segments on a freeway. Merge LoS is defined in terms of density with a target LoS of C for rural roads.

Table 4.4: Level of service definitions

LoS	Density (pcu/kilometres/lane)	Comments
A	Less than 6.2	Unrestricted operations
B	6.2 to 12.4	Merging and diverging manoeuvres noticeable to drivers
C	12.4 to 17.4	Influence area speeds begin to decline
D	17.4 to 22.7	Influence area turbulence becomes intrusive
E	Over 22.7	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

Source: Highway Capacity Manual 2010

As discussed in Section 4.1.4, an additional 106 light vehicles and 3 heavy vehicles are expected to merge from the interchange to the New England Highway in the southbound direction during the evening peak. The calculated density on the entry ramp influence area is 5.2 pcu per kilometre per lane, which corresponds to LoS A. This indicates that there is excess capacity on the entry ramp to accommodate the cumulative additional traffic generation without significantly impacting the operation of the entry ramp.

4.3 Heavy vehicle access routes

Heavy vehicle routes to and from Bayswater will only use the existing oversized and over-mass load approved road network as shown in Figure 4.5. This includes the use of New England Highway and the Bayswater access road.

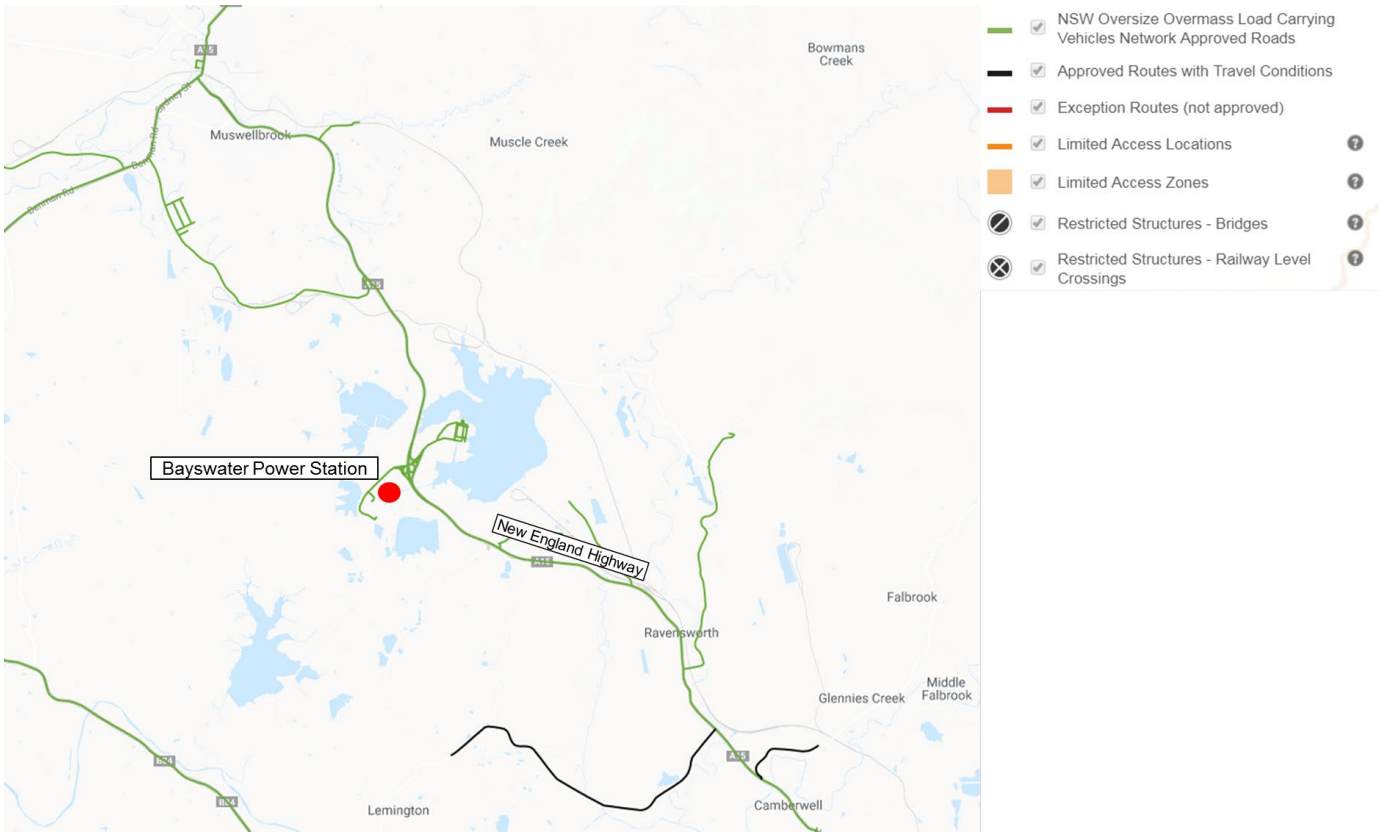


Figure 4.5: Over-size over-mass load carrying network

Source: Roads and Maritime, 16 September 2019

4.3.1 Oversized vehicles

Up to four two-way oversized vehicle movements are expected throughout the duration of the Project works for the delivery of three weighbridges and an ash silo. The scheduling of these oversized vehicles will be confirmed when subcontractors have been finalised.

If oversized vehicles are required for the Project, an oversized vehicle permit would be sought for these movements. Oversized vehicles would be escorted by an appropriately qualified subcontractor and would travel outside of peak traffic periods.

It is recommended that a detailed traffic management plan for the movement of these oversized vehicles be undertaken to identify risks and minimise impacts to the wider road network. The plan would cover:

- Identification of route
- Measures to provide an escort for the loads
- Times of transporting to minimise impacts on the road network
- Communication strategy and liaising with emergency services and police

4.4 Access and internal roads

4.4.1 Internal roads

It is assumed that the internal road network within Bayswater has sufficient capacity to accommodate the increased vehicle movements and that no additional upgrades to the internal road network are required.

4.4.2 Lane and shoulder width

Lane and shoulder widths of public roads servicing Bayswater conform with the Austroads *Guide to Road Design.*

4.4.3 Stopping sight distance

Stopping sight distance was assessed at the westbound approach to the Bayswater access road intersection, west of the northbound exit ramp. The access road is a horizontal curve with the grade and vegetation obstructing sight on the inside of the curve. Vehicle line of sight is shown in Figure 4.6.

Figure 4.6: Stopping sight distance to access road intersection

Table 5.6 of the Austroads *Guide to Road Design Part 3: Geometric Design* specifies the stopping sight distances for single unit trucks, semi-trailers and B-doubles. For an assumed operating speed of 60 km/h and an assumed reaction time of 2.5 seconds, the required stopping sight distance is 91 metres. The provided stopping sight distance is approximately 195 metres, which satisfies the Austroads requirement.

4.5 Crash assessment

As outlined in Section 2.3, five crashes occurred near the site in the most recent five-year period from October 2013 to September 2018. The low frequency of crashes indicates that additional traffic generation is unlikely to have an impact on future crash frequency. However, it should be noted that the majority of observed crashes involved striking an animal. To mitigate this risk, personnel should be notified of the risk of collisions, particularly with animals during rain or periods of low light.

5. Conclusion

Jacobs has been commissioned to undertake a traffic and transport assessment of improvement works at the Bayswater Power Station. Cumulative traffic generation by the Project and nearby developments, including the Bayswater Turbine Efficiency Upgrade, Ravensworth Composting Facilities and Liddell Power Station closure and rehabilitation is expected to generate 160 light vehicles and 13 heavy vehicles during the morning and evening peak hours.

Modelling using SIDRA Intersection 7 indicates that the interchange currently operates at excellent levels of service with abundant spare capacity. The cumulative impact of the Project and nearby developments would increase delay slightly but will not significantly impact the operation of the interchange. This is mostly due to the grade separation of most conflicting movements and the provision of low angle merges. Queue lengths are expected to be very low and would not extend into nor impact the operation of the New England Highway. It should be noted that the assessment is conservative as it assumes that construction of all project elements would be undertaken concurrently. Some works may be staged and it is anticipated that staging would result in a reduction of cumulative construction-related traffic impacts.

The New England Highway and the southbound entry ramp from the interchange have excess capacity to accommodate the additional cumulative traffic generation.

Stopping sight distance at the westbound approach to the Bayswater access road intersection satisfies the Austroads requirement. Lane and shoulder widths of public roads servicing Bayswater conform with the Austroads *Guide to Road Design.*

Up to four oversized vehicle movements are expected throughout the duration of the Project works. Oversized vehicle permits would be sought for these movements and appropriate timing and escort arrangements would be in place for these transports. It is recommended that a detailed traffic management plan for the movement of these oversized vehicles be undertaken to identify risks and minimise impacts to the wider road network.

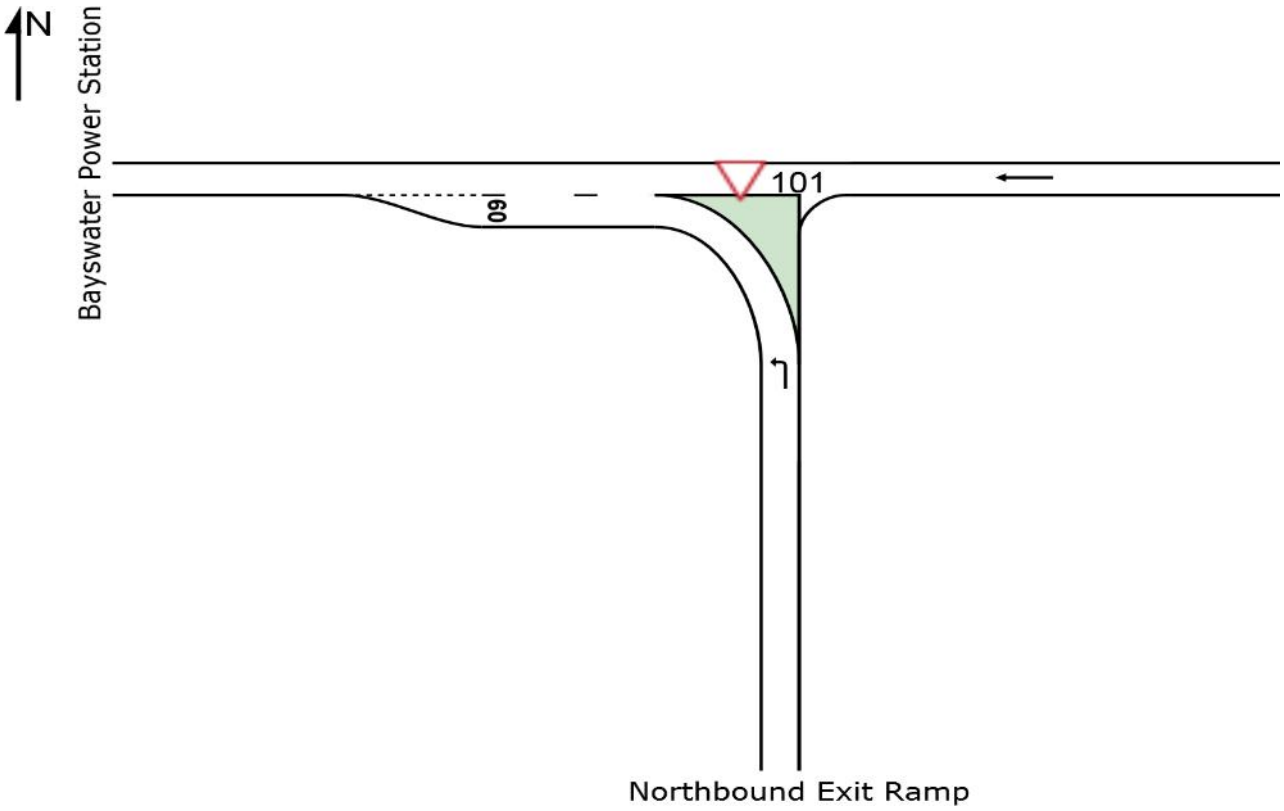
A crash assessment found five crashes that occurred near the site in the most recent five-year period. The low frequency of crashes indicates that additional traffic generation is unlikely to have an impact on future crash frequency, but it is recommended that personnel should be notified of the risk of collisions, particularly with animals during rain or periods of low light.

Appendix A. SIDRA Model Outputs

SITE LAYOUT

Site: 101 [2018 base AM Peak merge]

New Site
Giveway / Yield (Two-Way)



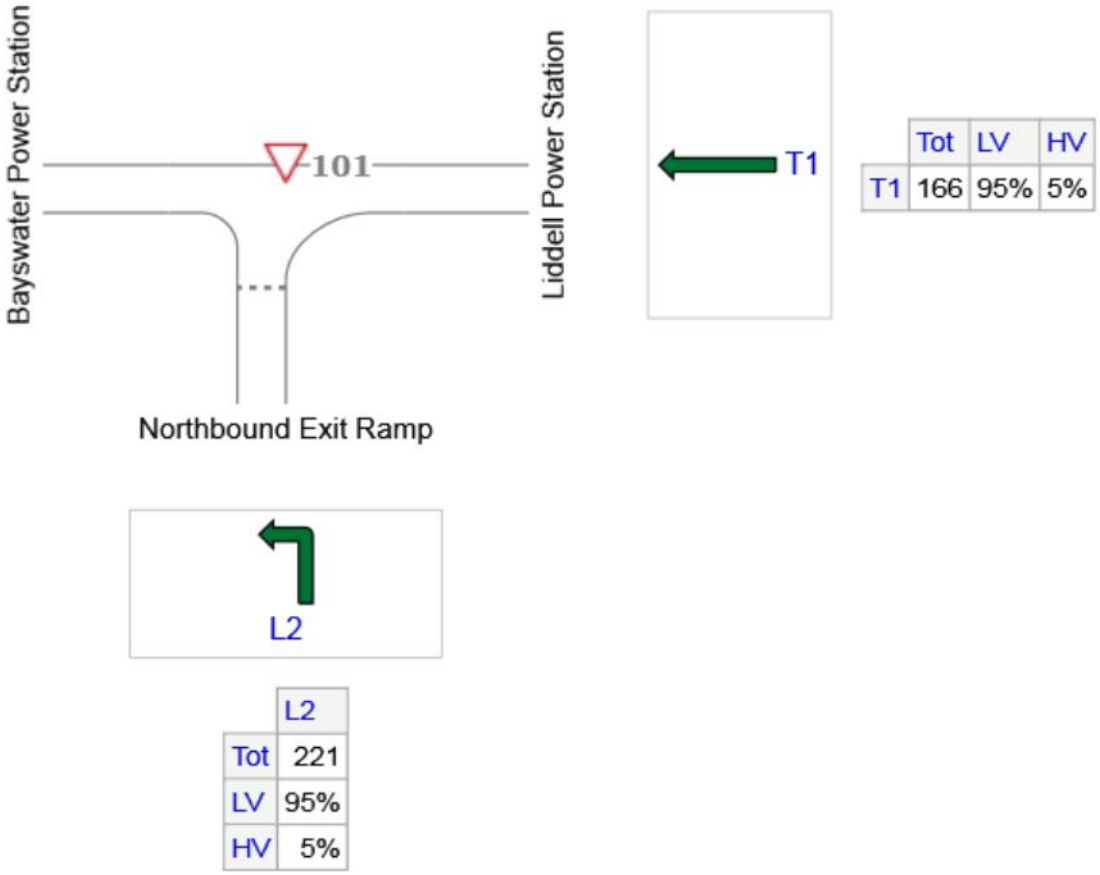
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [2018 base AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	Tot	LV	HV
T1	166	95%	5%

	L2
Tot	221
LV	95%
HV	5%

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Northbound Exit Ramp	221	210	11
E: Liddell Power Station	166	158	8
Total	387	368	19

LANE SUMMARY

Site: 101 [2018 base AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

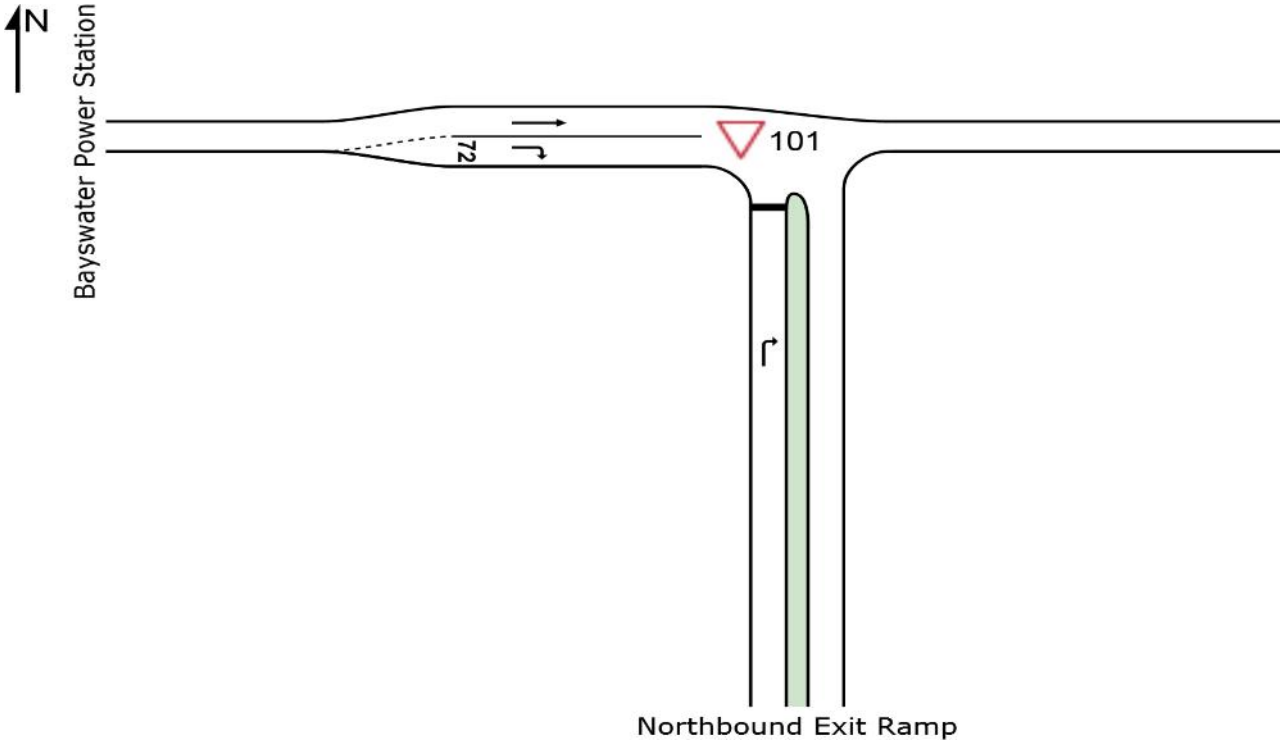
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit Ramp													
Lane 1	233	5.0	1793	0.130	100	7.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	233	5.0		0.130		7.7	NA	0.0	0.0				
East: Liddell Power Station													
Lane 1	175	5.0	1889	0.093	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	175	5.0		0.093		0.0	NA	0.0	0.0				
Intersection	407	5.0		0.130		4.4	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
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.

SITE LAYOUT

Site: 101 [2018 base PM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)



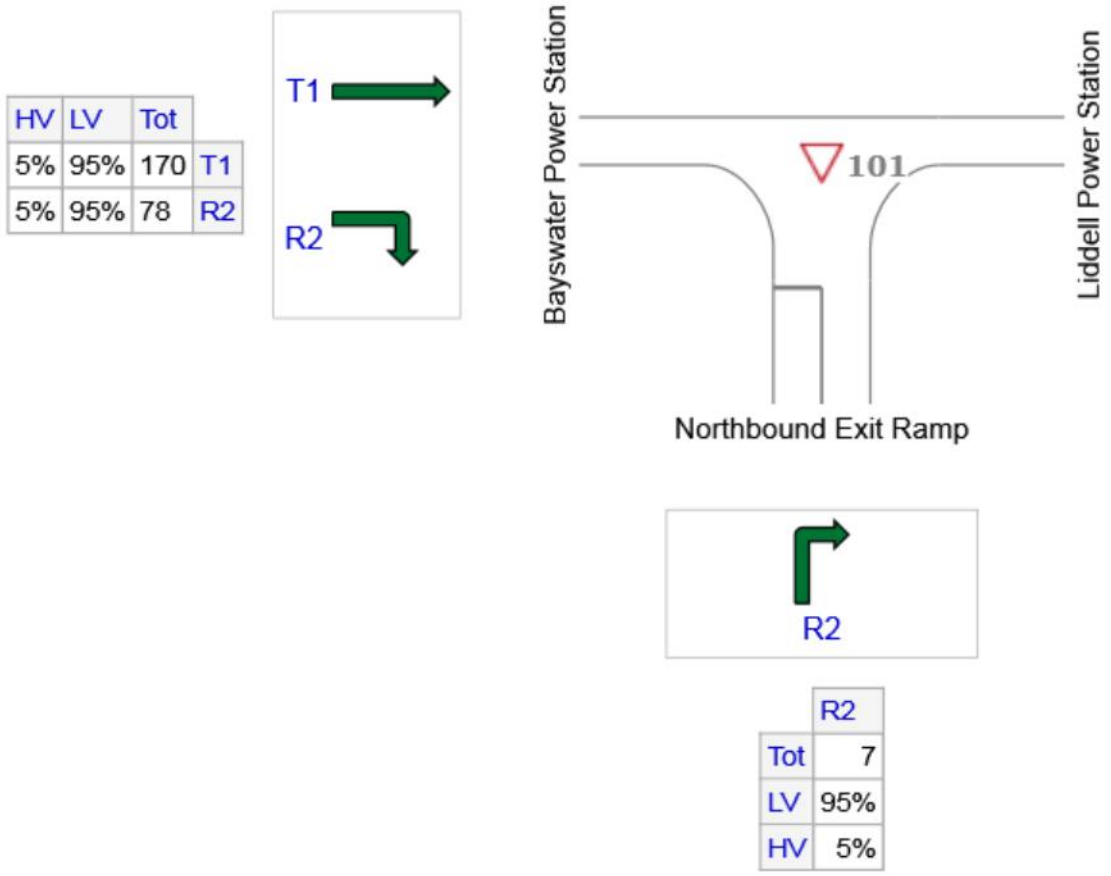
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [2018 base PM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Northbound Exit Ramp	7	7	0
W: Bayswater Power Station	248	236	12
Total	255	242	13

LANE SUMMARY

Site: 101 [2018 base PM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Northbound Exit Ramp													
Lane 1	7	5.0	986	0.007	100	9.4	LOS A	0.0	0.2	Full	500	0.0	0.0
Approach	7	5.0		0.007		9.4	LOS A	0.0	0.2				
West: Bayswater Power Station													
Lane 1	179	5.0	1889	0.095	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	82	5.0	1793	0.046	100	6.9	LOS A	0.0	0.0	Short	72	0.0	NA
Approach	261	5.0		0.095		2.2	NA	0.0	0.0				
Intersection	268	5.0		0.095		2.4	NA	0.0	0.2				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
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.

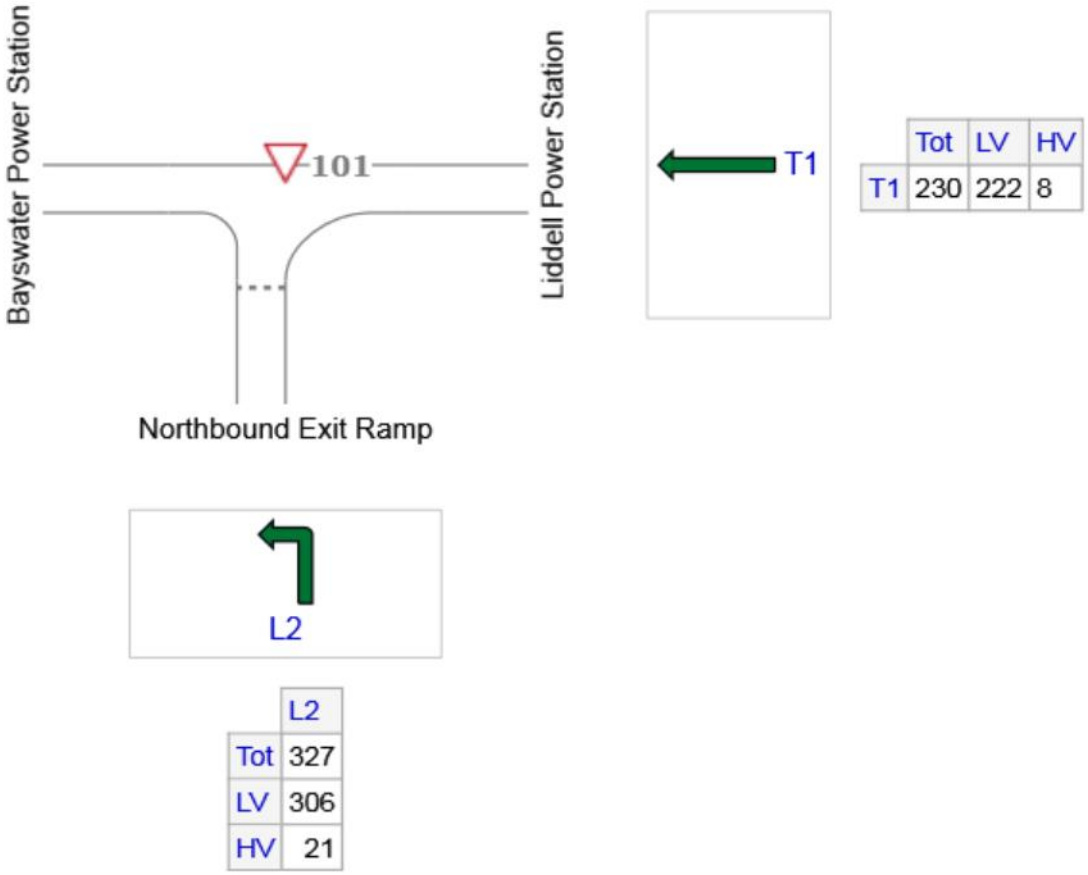
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [2020 future peak AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Volume Display Method: Separate



	Tot	LV	HV
T1	230	222	8

	L2
Tot	327
LV	306
HV	21

	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Northbound Exit Ramp	327	306	21
E: Liddell Power Station	230	222	8
Total	557	528	29

LANE SUMMARY

Site: 101 [2020 future peak AM Peak merge]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Northbound Exit Ramp													
Lane 1	344	6.4	1776	0.194	100	7.7	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	344	6.4		0.194		7.7	NA	0.0	0.0				
East: Liddell Power Station													
Lane 1	242	3.5	1907	0.127	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	242	3.5		0.127		0.0	NA	0.0	0.0				
Intersection	586	5.2		0.194		4.5	NA	0.0	0.0				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
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.

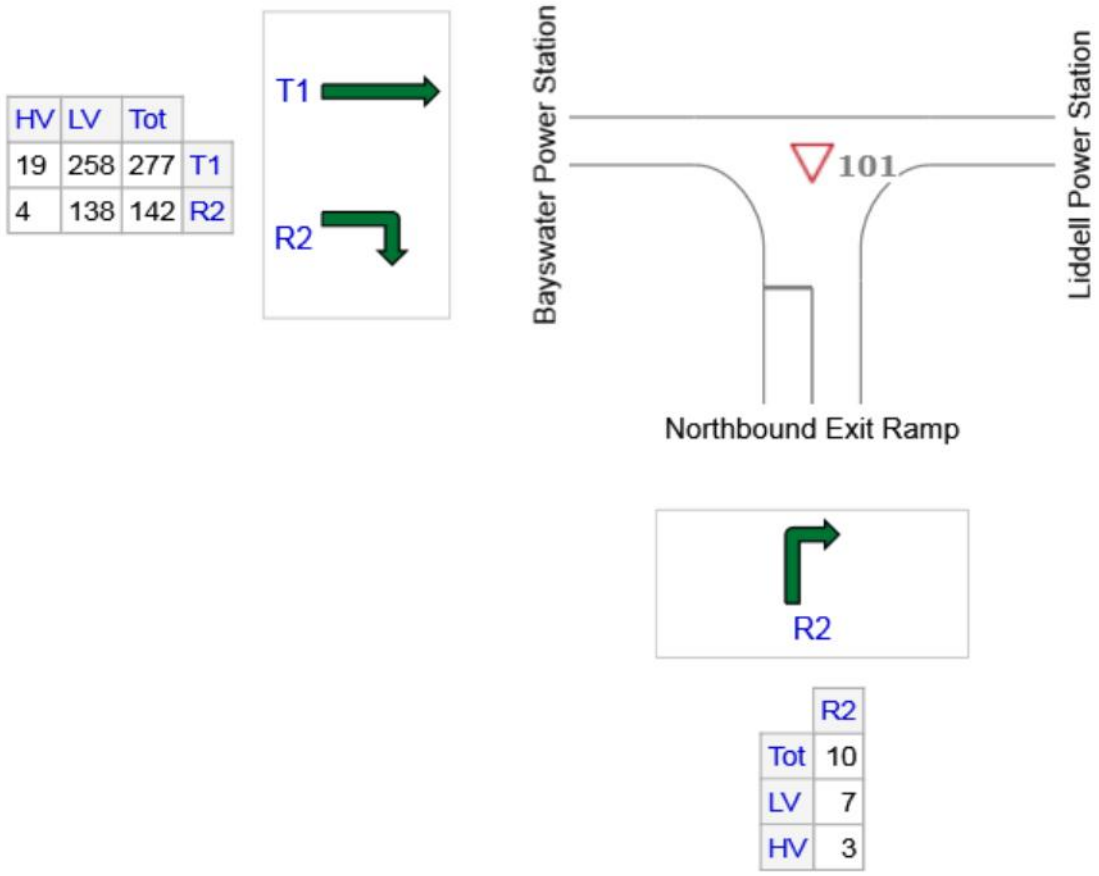
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 101 [2020 future peak PM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)

Volume Display Method: Separate



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Northbound Exit Ramp	10	7	3
W: Bayswater Power Station	419	396	23
Total	429	403	26

LANE SUMMARY

Site: 101 [2020 future peak PM Peak T Intersection]

New Site
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Northbound Exit Ramp													
Lane 1	11	30.0	686	0.015	100	12.0	LOS A	0.0	0.4	Full	500	0.0	0.0
Approach	11	30.0		0.015		12.0	LOS A	0.0	0.4				
West: Bayswater Power Station													
Lane 1	292	6.9	1867	0.156	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	149	2.8	1821	0.082	100	6.9	LOS A	0.0	0.0	Short	72	0.0	NA
Approach	441	5.5		0.156		2.3	NA	0.0	0.0				
Intersection	452	6.1		0.156		2.6	NA	0.0	0.4				

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
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.