Stolthaven Australia Pty Ltd
20-Aug-2015

Traffic Impact Assessment

Stolthaven Mayfield Fuel Terminal - SSD_6664 MOD1 - Throughput Increase to 1,300ML

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Client: Stolthaven Australia Pty Ltd

ABN: 26 075 030 992

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

20-Aug-2015

Job No.: 60326869

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Quality Information

Document	Traffic Impact Assessment
	60326869
Ref	\\auntl1fp001\projects\60326869_stolthaven\4. tech work area\4.3 traffic\60326869_stolthaven_traffic impact assessment_rev c_20150820.docx
Date	20-Aug-2015
Prepared by	Eric Wu edits C Smith
Reviewed by	Nick Bernard

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	31-Jul-2015	Draft for Client Review	Simon Murphy Project Manager	
B	06-Aug-2015	Draft for Consistency Review	Simon Murphy Project Manager	
C	20-Aug-2015	Final	Simon Murphy Project Manager	

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1.0 Introduction

1.1 Background and Scope

This report presents a Traffic Impact Assessment (TIA) of a proposed modification to the Bulk Liquid Fuels Storage Facility (the Facility) at Mayfield. The TIA has been prepared to support the Environmental Assessment being prepared for the Proposed Modification. The Proposed Modification would see an increase in the throughput of the Facility from the approved 1,010Megalitres (ML) per annum up to 1,300ML per annum.

This report provides an assessment of the impact on the surrounding road network of the Proposed Modification operation. The TIA includes:

- An assessment of the existing and future road conditions, in particular at the Industrial Drive/Ingall Street as part of the Port Terminal Facilities Mayfield Concept Plan, consistency of the Proposed Modification intersection that provides access to the site;
- An evaluation of potential impacts to the intersection, associated with the Proposed Modification; and
- Consideration of measures to mitigate traffic impacts, if required.

The TIA has only assessed impacts on the road network in the morning and evening peak hours of a typical weekday. No rail movements are proposed as part of the Proposed Modification. Shipping movement impacts have not been assessed as part of this TIA.

1.2 Standards and Guidelines

In the preparation of this TIA, the Roads and Maritime Services' Guide to Traffic Generating Developments (2002) and the Road Design Guide Supplements to Austroads Guides (2009), have been used.

1.3 Structure of Report

The remainder of the report has been structured as follows:

- **Section 2** summarises the existing traffic conditions in the area surrounding the site and the existing Facility operations.
- **Section 3** considers the likely future traffic conditions in the area without the Proposed Modification.
- **Section 4** provides a description of the Proposed Modification in terms of its operation, trip generation and distribution.
- **Section 5** provides an assessment of the traffic impact associated with the Proposed Modification on the local road network and parking arrangements.
- **Section 6** provides the study conclusions.

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2.0 Existing Conditions

2.1 Existing Site

The site is located on part of the former BHP Steelworks Site, approximately 5 km north-west of Newcastle CBD, as shown in **Figure 1**. The land on which the Facility is located is currently subject to concept approval 09_0096 by the Newcastle Port Corporation (Port Terminal Facilities Mayfield Concept Plan).

As the site is located within the Port of Newcastle, the area surrounding the proposed facility is characterised by a mixture of port related activities, industrial uses and residential and commercial areas.

2.2 Existing Facility Operations

The existing facility operates in accordance with State Significant Development Approval SSD_6664 issued on 16 April 2015 under Part 4 of the EP&A Act. A number of modifications have since been submitted for approval, which would allow the Facility to operate to an upper limit of 1,010ML per annum.

Based on a throughput of 1,010ML per annum and a B-double tanker capacity of 50,000L, a total of 20,200 tankers would be generated per annum. Operating 365 days a year, yields an average daily requirement of 56 tankers, which equates to 112 tanker movements per day (56 in and 56 out). Despite this, due to changes in customer demand requirements and the use of B-single tankers that make up approximately 15% the required tanker fleet, the Facility may need to increase movements on any given day up to 224 movements. Across a year, this would mean total traffic movements would average out to a lower number in accordance with the Facility's 1,010ML per annum capacity limit.

Using the 224 movements per day provided a worst case conservative assessment from which to examine impacts for the existing Facility. This scenario was assessed in the *Traffic Impact Assessment, Stolthaven Mayfield Terminal – State Significant Development* (AECOM, 2014), which concluded there would be no major impacts to the operation of the road network, specifically to the Ingall Street / Industrial Drive intersection.

As part of previous assessment, 60% of these heavy vehicle trips have been concentrated from 7am to 4pm; therefore there is an AM arrival peak and PM departure peak. Based on a nine-hour peak operation, this equates to a worst case of average of 15 tanker movements per peak hour. Seven staff vehicle movements would also be present in the peak hours – seven in in the AM peak hour and seven out in the PM peak hour. For the peak hour analysis undertaken in this TIA, the base case has assumed that the Facility is operating to this worst case scenario.

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SITE LOCATION

Stolthaven State Significant Development Modification 1

FIGURE 1

2.3 Surrounding Road Network

The key strategic and local road network features relevant to the Proposed Modification are shown on **Figure 1** and described below.

2.3.1 Strategic Road Network

M1 Pacific Motorway (previously known as the F3 Sydney – Newcastle Freeway)

The M1 Pacific Motorway is a 127km motorway linking Sydney to the Central Coast, Newcastle and Hunter Regions. The motorway alternates between two and three lanes in each direction for its length. The northern section of the motorway in the vicinity of the site, from north of Wyong to its terminus at John Renshaw Drive, has two lanes in each direction. The motorway has a speed limit varying between 80 and 110km/h.

A1 Pacific Highway

The A1 Pacific Highway is a 1,025km major transport route which links Sydney and Brisbane along the east coast of Australia. The section of the A1 Pacific Highway in the vicinity of Mayfield is a four-lane, dual carriageway with a speed limit that varies between 60km/h and 80km/h. The Hexham Bridge carries the A1 Pacific Highway over the Hunter River and has two lanes in the southbound direction and three lanes in the northbound direction.

A43 New England Highway

The A43 New England Highway connects to the A1 Pacific Highway at Hexham and travels west towards Maitland. It is an alternative inland route to the A1 Pacific Highway travelling between Sydney and Brisbane. The majority of the route is a single carriageway, two-lane, two-way road; however, between Hexham and Maitland, it has two lanes in each direction. For most of its length, the A43 New England Highway has a 100km/h speed limit.

Cormorant Road

Cormorant Road is located on Kooragang Island, the site of a deep water port for the export of coal, and a major heavy industry area in the Newcastle area. Cormorant Road is predominantly a single carriageway, two-lane, two-way road; the eastern section of the road widens into a dual carriageway. There is a speed limit of 60km/h in the westbound direction and 80km/h in the eastbound direction.

Tourle Street

Tourle Street is the continuation of Cormorant Road over the south arm of the Hunter River. Tourle Street provides a direct route between Newcastle, the industrial area and Newcastle Port facilities on Kooragang Island. The new Tourle Street Bridge opened in May 2009, and consists of one lane in each direction, with 2m shoulders. Tourle Street has a speed limit of 60km/h in both directions.

2.3.2 Local Road Network

The site is located in the existing Mayfield industrial area on the south arm of the Hunter River. Access to the Facility is via Ingall Street, off Industrial Drive.

Industrial Drive

Industrial Drive is a major four-lane, dual carriageway providing connections to the A1 Pacific Highway and to the north bank of the South Arm of the Hunter River. It is used as a major link between Maitland and Newcastle CBD providing access to the Honeysuckle Precinct and is the preferred alternative to the A1 Pacific Highway for southbound traffic. It is a B-Double approved vehicle route signed at 80km/h and operates as a public transport corridor for Bus Routes 104 and 118.

Ingall Street

Ingall Street provides access to the site from Industrial Drive. To the south of Industrial Drive, it is a single carriageway, two-lane, two-way collector road connecting Industrial Drive to the Pacific Highway through a predominantly residential area. It is signposted at 50km/h and 40km/h to the north and south of Industrial Drive respectively.

Steelworks Road / Concept Plan Area Access Road

Steelworks Road, which turns into the internal Concept Plan Area Access Road, connects the Facility to Ingall Street and ultimately the wider road network. Steelworks Road is a wide, undivided road that has been designed for industrial traffic (large vehicles). Currently, Arrium (formerly OneSteel) is the only other user of this road. There are no other projects or development currently proposed that would use this access and there is no through traffic connection via Steelworks Road.

2.3.3 Daily Traffic Volumes

Traffic volume data has been obtained to determine the historical traffic growth and current mid-block traffic flows in the surrounding study area. **Table 2.1** shows historical Average Annual Daily Traffic (AADT) volumes at two Roads and Maritime Services (RMS) traffic stations in the vicinity of the site.

Table 2.1 Average Annual Daily Traffic (AADT) on Adjacent Road Network

Station Number	Station Location	AADT Volumes - Year				Annual Growth Rate (1998 – 2004)
		1995	1998	2001	2004	
5.953	Industrial Drive – North of Woodstock Street	29,746	29,549	30,334	30,717	0.36%
5.979	Industrial Drive – West of Werribi Street	22,952	21,608	21,559	23,339	0.19%

Source: RTA Traffic Volume Data for Hunter and Northern Regions 2004

The data shows that between 1995 and 2004, there has been an average annual growth rate of 0.27% in the surrounding area. No more recent comparable AADT data is available from RMS.

2.3.4 Peak hour Traffic Volumes

To provide a better understanding of peak hour traffic conditions, a classified intersection traffic count was commissioned on 6 September 2012 at Industrial Drive / Ingall Street. The survey was conducted for two hours in the AM peak (7:00-9:00am) and the PM peak (4:00pm-6:00pm). The survey identified peak hours of 7:30-8:30am and 4:30-5:30pm.

The 2012 peak hour survey data was used as a base and was factored to provide 2015 background traffic by applying a background growth rate. While the available data indicated a historical average annual growth rate of 0.27%, a growth rate of 1% was specified by RMS in the Port Terminal Facilities Mayfield Concept Plan assessment and this rate has been used in the assessment.

Figure 2 illustrates the 2012 traffic movements at Industrial Drive / Ingall Street

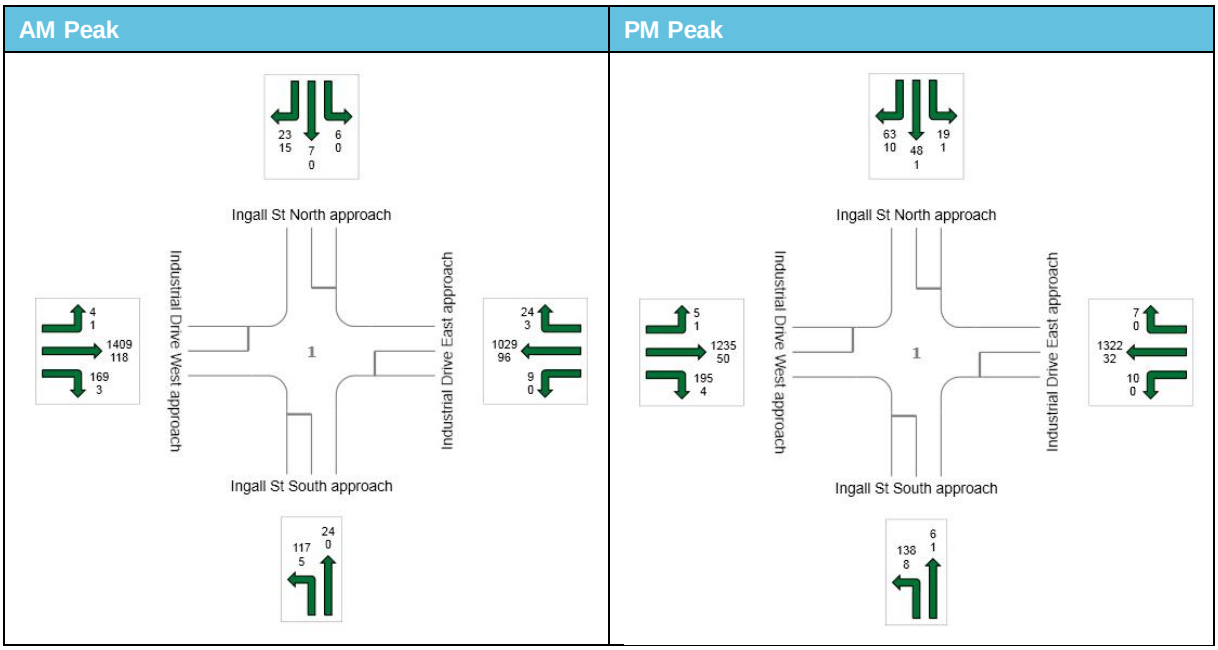


Figure 2 2012 Traffic Volume at Industrial Drive/Ingall Street Intersection Source: AECOM

2.4 Existing Operational Performance

The performance of the Industrial Drive / Ingall Street intersection has been evaluated using SIDRA Intersection 5.1, a computer-based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA 5.1 include:

- Degree of Saturation (DoS) – measure of the ratio between traffic volumes and capacity of the intersection is used to measure the performance of isolated intersections. As DoS approaches 1.0, both queue length and delays increase rapidly. Satisfactory operations usually occur with a DoS range between 0.7-0.8 or below;
- Average Delay – duration, in seconds, of the average vehicle waiting at an intersection; and
- Level of Service (LoS) – a measure of the overall performance of the intersection (this is explained further in **Table 2.2).**

Table 2.2 Performance Criteria for Intersections

Level of Service	Average Delay (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
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	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, RTA, 2002

The existing intersection has been modelled in SIDRA as a signalised intersection as per the existing geometric layout. A schematic of the current layout is illustrated in **Figure 3**.

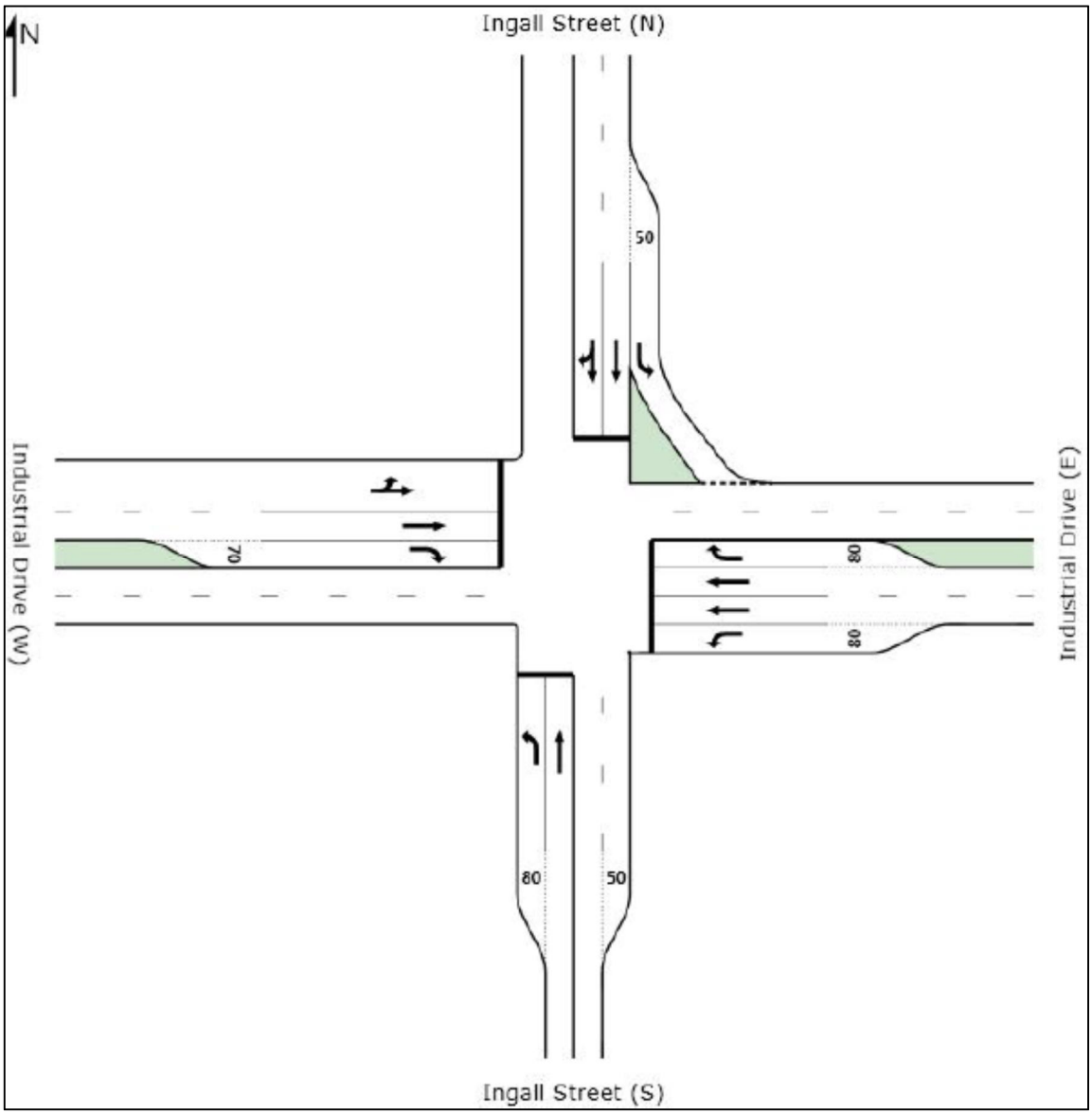


Figure 3 Existing layout of Industrial Drive / Ingall Street intersection

Source: AECOM

Table 2.3 provides a summary of the intersection analysis in 2012 for both AM and PM peak, while detailed outputs are provided in **Appendix A**.

Table 2.3 SIDRA Results for 2012

Intersection	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
Industrial Drive / Ingall Street	3,062	0.660	15.3	B	3,156	0.652	17.3	B

Source: Appendix A

The analysis indicates that the intersection operated at LoS B during the AM peak and PM peak hour periods, with spare capacity of approximately 34% and 35% in AM and PM peaks respectively.

3.0 Future Year Base Case Traffic Conditions

This section presents the future operational performances of Industrial Drive / Ingall Street intersection considering background traffic growth, without any roject-related traffic. The future performance and capacity assessment of the intersection has been undertaken to provide a base case and benchmark for the impact assessment.

A future base year of 2015 has been chosen, as explained further in **Section 4.0**. In the future year base case scenario, the Facility could be operating at a worst case of eight tanker movements and seven staff vehicle movements per peak hour, as explained in **Section 2.2**. These traffic movements have been included in the base year traffic.

A cement terminal proposed by Independent Cement and Lime Pty Ltd as part of the Mayfield Concept Plan (General Purpose Precinct) was approved for development in June 2013. However, is it noted that maximum operational levels are not expected to be reached until at least 10 years of operation and this maximum traffic volume would be approximately 58 laden trucks trips per day[1]. As this is within the development envelope for the General Purpose Precinct of 112 laden truck trips per day, and the fact that it is unlikely to generate any significant traffic by 2015, it has not been included in the future year base case. Furthermore, advice from the Port of Newcastle (PON) is that this project is unlikely to proceed.

3.1 Future Road Upgrades

It is understood that no major road upgrades are proposed in proximity to the site by 2015. The nearest road project of significance to the Proposed Modification is the proposed duplication of the Tourle Street Bridge. This project is still in the design development phase and a construction or opening date is not yet known. Regardless, this project is unlikely to have a significant impact on the operation of Industrial Drive in proximity to the Ingall Street intersection.

3.2 Intersection Performance (without Proposed Modification)

As identified in **Section 2.3.3**, while the historical average annual growth rate on Industrial Drive in the vicinity of the study area was 0.27%, a growth rate of 1% was specified by RMS in the Port Terminal Facilities Mayfield Concept Plan assessment and this rate has been used in the assessment.

The 2012 peak hour survey data was used as a base and was factored to provide 2015 background traffic. **Figure 4** shows the traffic movement for the peak hour scenario during 2015 without the Proposed Modification.

The intersection has been assessed for the future base year scenario, with existing layout as illustrated in **Figure 3**. A summary of peak hour intersection performances is provided in **Table 3.1** for 2015 forecast flows without the Proposed Modification, while the detailed outputs are provided in **Appendix B**.

[1] Umwelt, Environmental Assessment: Cement and Slag Receival and Dispatch Terminal, Mayfield North, February 2013

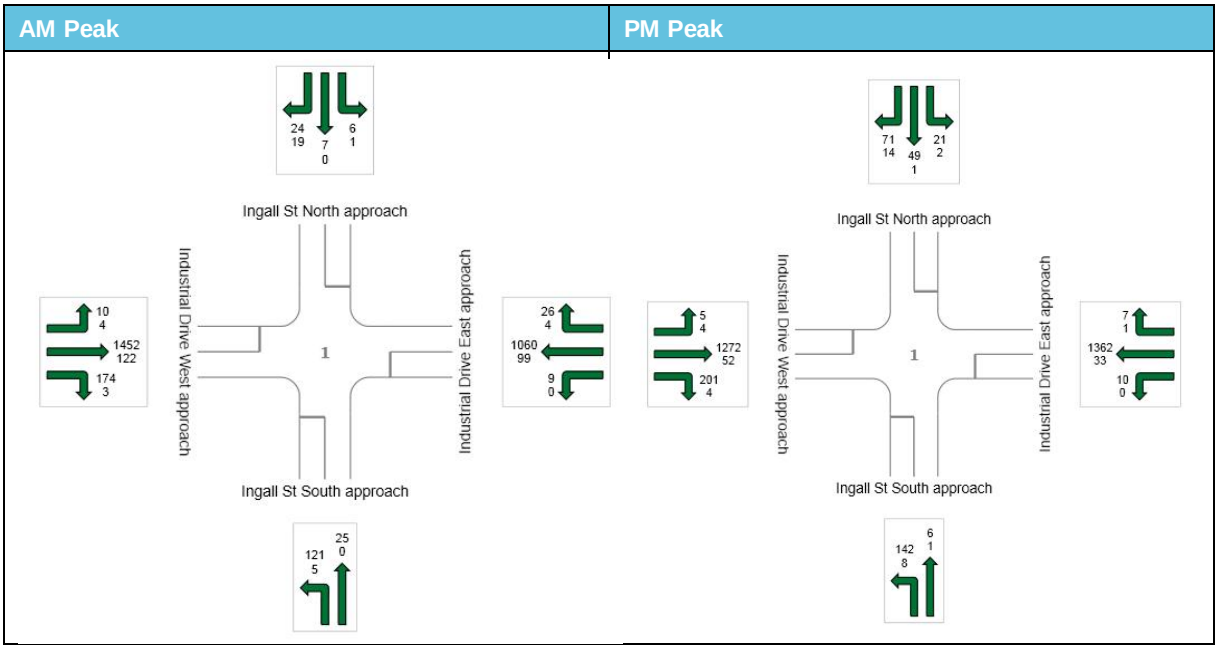


Figure 4 2015 without Proposed Modification Traffic Volume at Industrial Drive / Ingall Street Intersection

Source: AECOM

Table 3.1 SIDRA Results for 2015 without Proposed Modification

Intersection	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
Industrial Drive / Ingall Street	3,171	0.690	15.4	B	3,266	0.672	17.6	B

Source: Appendix B

The analysis indicates that the intersection would operate remain LoS B during both AM and PM peaks in 2015. The forecast average delays at the intersection are approximately 16 seconds and 18 seconds with spare capacities of approximately 31%and 33% in the AM and PM peak hours respectively.

4.0 Proposed Modification

4.1 Nature of Proposed Modification

The Proposed Modification seeks approval for the increase of through of the Facility from an approved 1,010ML per year to 1,300ML per year. With regard to traffic movements, the Proposed Modification would involve increased distribution of fuels by road (increased vehicle movements). The Proposed Modification does not require additional construction on site. Therefore, a construction phase has not been assessed as part of this TIA. It will also not require any additional full time staff to operate the Facility's increased throughput. Furthermore, truck drivers would be transient, although driver facilities will be provided for when they are on site loading.

Whilst the Proposed modification itself represents a relatively small increase in overall truck movements, this TIA assessed the overall impacts of total traffic movements from the Terminal.

4.2 Operations Phase

4.2.1 Hours and Workforce

Operational activity would take place 24 hours a day, 7 days a week. The Proposed Modification is not expected to change the number of employees at the Facility, hence, staff vehicles would remain at 7 movements in the peak hours.

4.2.2 Trip Generation and Distribution

Based on a throughput of 1,300ML per annum, an 85%/15% B-Double/B-Single truck split and a tanker capacity of 50,000L for B-Double and 36,000L for B-Singles, a combined total of 54,750 tankers would be generated per annum. Operating 365 days a year, yields an average daily requirement of 150 tankers, which equates to 300 tanker movements per day (150 in and 150 out). It should also be noted that the theoretical maximum turnaround capacity of the bays is two tankers per bay per hour. With 4 bays, this gives a maximum of 8 tankers per peak hour or 16 tanker movements per peak hour. Typically, the Facility throughput would be lower than this, once transition of trucks in and out, driver breaks and other operational requirements are factored in. No extra loading bays are to be provided as part of this upgrade. Therefore, the required loading is to be accommodated within the 4 existing bays. Therefore, the arrival and departure of vehicles will be managed so that at no more than 8 tanker movements are undertaken in any one hour. To achieve this, the percentage of vehicles entering during the peak period of between 7am and 4pm will be decreased from 60% to 48% (equating to 72 trucks).

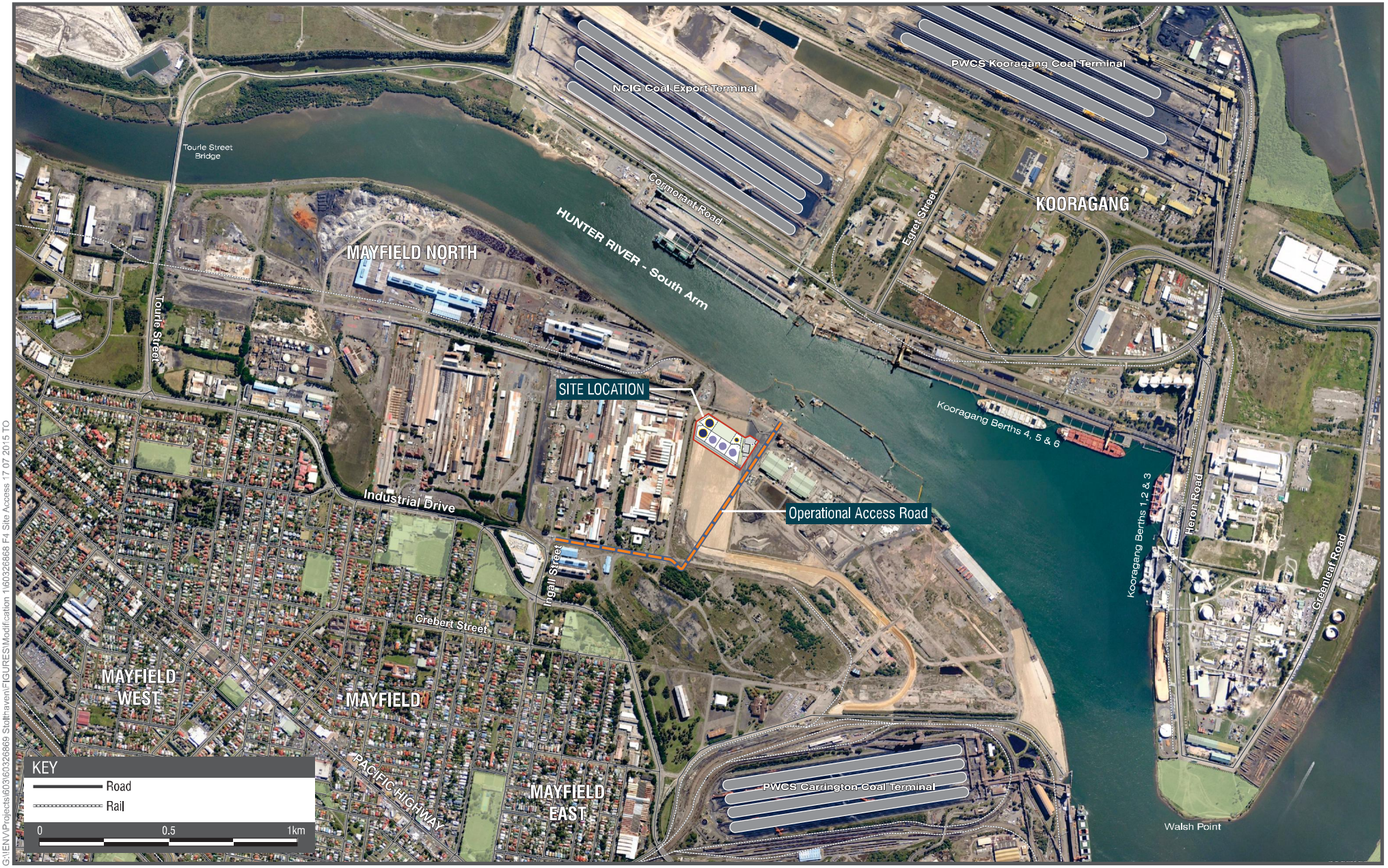
The existing access at Ingall Street would be used during operation with 80% of the traffic coming from the north and 20% from the south. Again, this is consistent with the Port Terminal Facilities Mayfield Concept Plan submission.

Table 4.1 summarises operational traffic at the site (based on maximum tanker bay capacity), while **Figure 5** illustrates the Proposed Modification's access route.

Table 4.1 Operational Traffic

Direction Split	AM Peak				PM Peak			
	In		Out		In		Out	
	LV	HV	LV	HV	LV	HV	LV	HV
From/to North	6	7	--	7	--	7	6	7
From/to South	1	1	--	1	--	1	1	1
Total	**7**	**8**	**0**	**8**	**0**	**8**	**7**	**8**

Source: Stolthaven, 2014



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SITE ACCESS

Stolthaven State Significant Development Modification 1

FIGURE 5

5.0 Impact of Proposed Modification

5.1 Traffic Movement

To assess the impact of the Proposed Modification's operational traffic on intersection performance, the operational traffic expected to be generated was applied to the 2015 forecast base traffic flows.

The existing operational traffic was removed from the base traffic, as the operational traffic expected to be generated, as described in **Section 4.0** includes both existing and future operations.

Figure 6 presents the traffic movements for the peak hour scenarios.

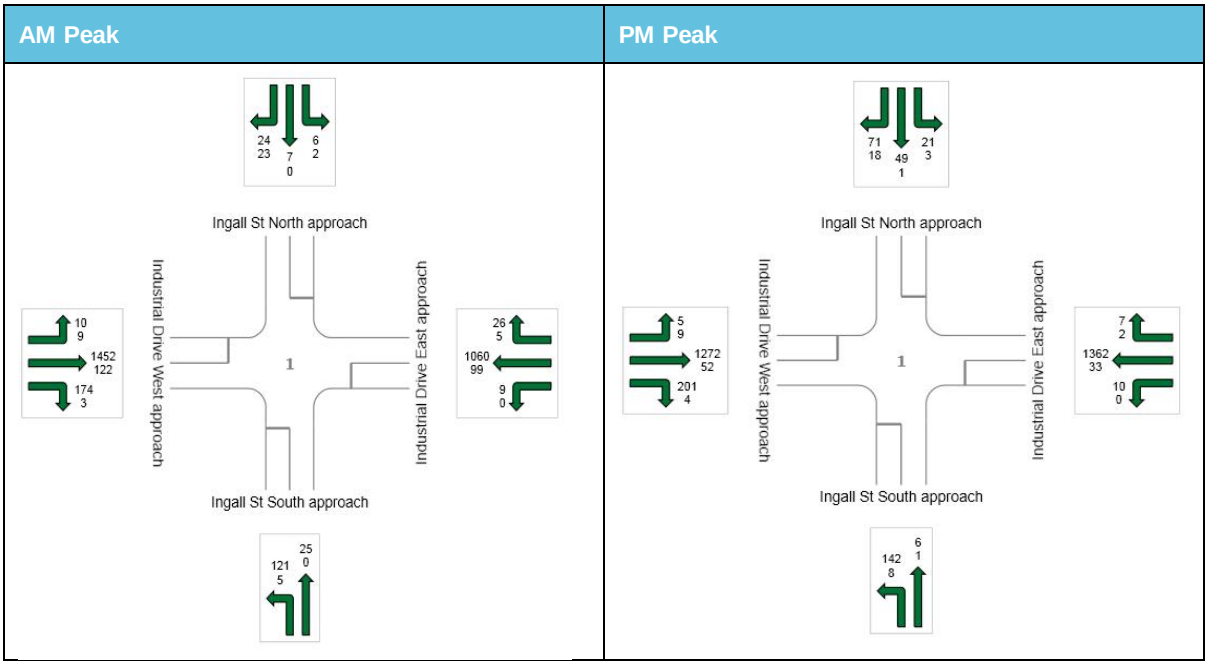

Figure 6 2015 traffic volumes including operational traffic at Industrial Drive / Ingall Street intersection

Source: Appendix D

5.1.1 Impact of Operations Traffic

Table 5.1 summarises AM and PM peak intersection performances at the Industrial Drive / Ingall intersection for 2015 with Proposed Modification's traffic.

Table 5.1 SIDRA Results including Operational Traffic – 2015

Intersection	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
Industrial Drive / Ingall Street	3,182	0.693	15.7	B	3,277	0.685	18.2	B

Source: Appendix D

Results indicate that operational traffic associated with the throughput increase would have a negligible impact on the intersections in the peak hours compared to the 2015 base case. The intersections would continue to operate at LoS B in both AM and PM peaks.

5.1.2 Impact of Future Operations Traffic

In accordance with RMS requirements, a 10 year after opening scenario has been tested. The same annual growth rate of 1% has been applied to generate background traffic at the Industrial Drive / Ingall Street intersection in 2025.

Figure 7 illustrates the 2025 without Proposed Modification traffic movement at Industrial Drive / Ingall Street intersection, while **Table 5.2** summarises AM and PM peak intersection performances at the intersection for 2025 without Proposed Modification operational traffic.

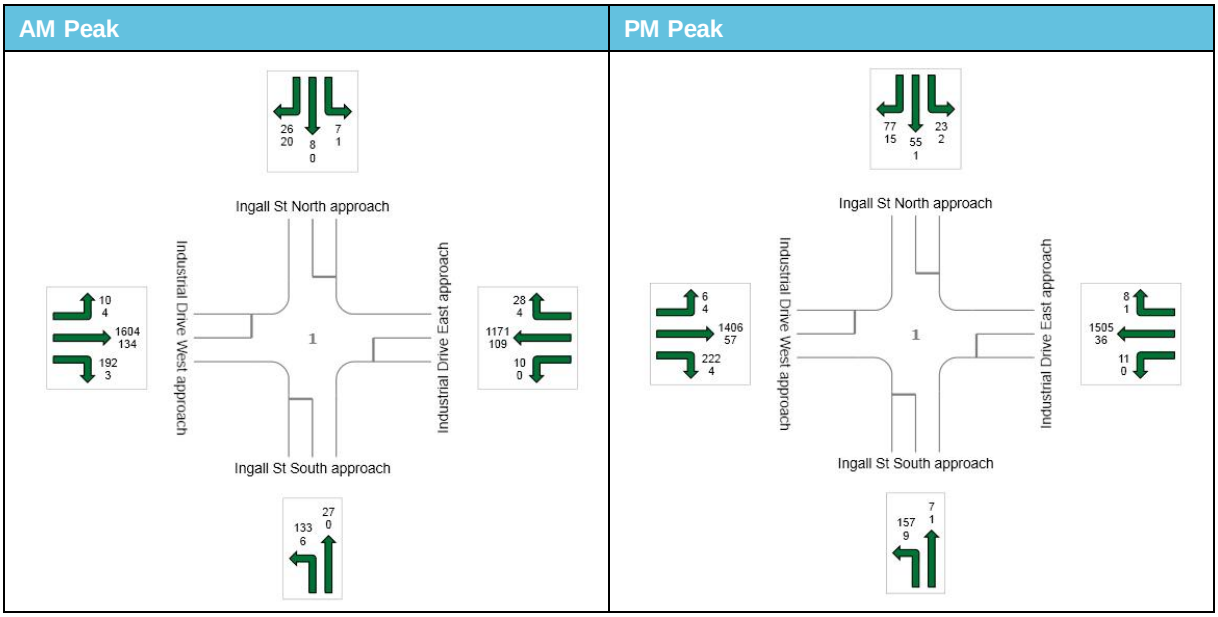

Figure 7 2025 without Proposed Modification traffic volume at Industrial Drive/Ingall Street intersection

Table 5.2 SIDRA Results for Future Year 2025 without Proposed Modification

Intersection	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
Industrial Drive / Ingall Street	3,497	0.760	16.1	B	3.607	0.741	18.5	B

Source: Appendix E

Operational traffic was then added to the intersection flows and **Figure 8** shows the traffic movements in the peak hours. **Table 5.3** summarises the AM and PM peak intersection performances at the intersection for 2025 with Proposed Modification operational traffic.

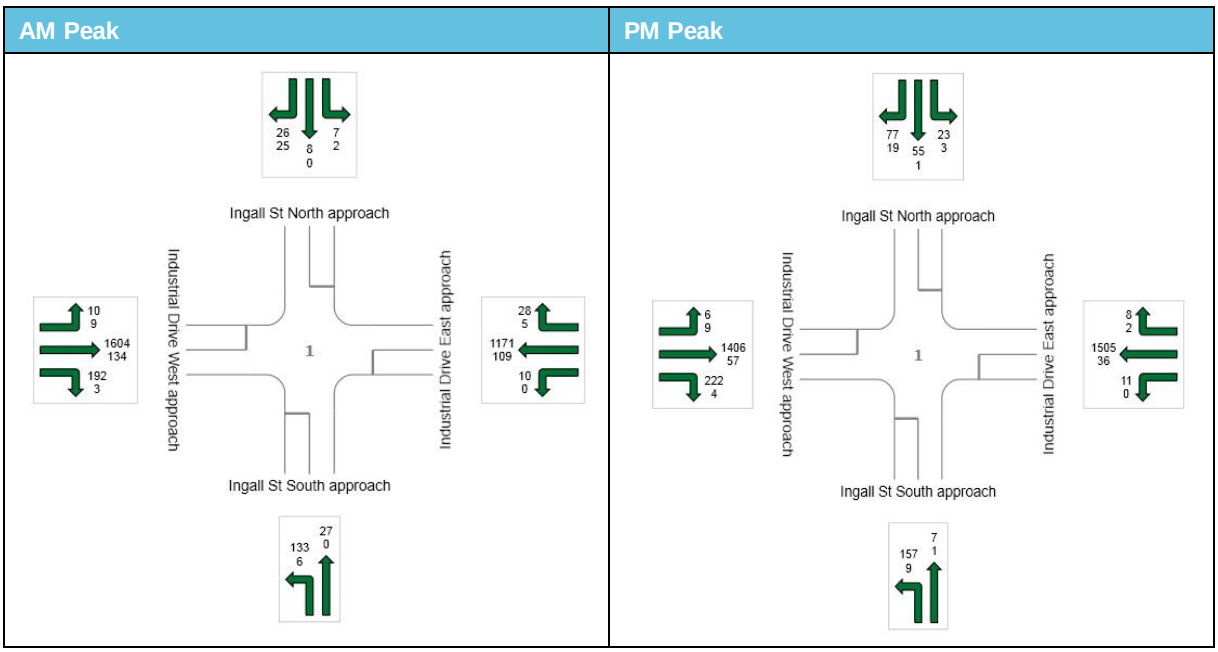

Figure 8 2025 with Proposed Modification Traffic Volume at Industrial Drive/Ingall Street Intersection

Table 5.3 SIDRA Results including Operational Traffic – 2025

Intersection	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
Industrial Drive / Ingall Street	3,509	0.764	16.2	B	3,618	0.757	19.0	B

Source: Appendix F

Results indicate that, by 2025, the intersection would continue to operate at LoS B in both AM and PM peaks with about a 7 to 8% increase in degree of saturation compared to 2015.

5.1.3 Parking during Operations

As previously noted, no increase in employee numbers is proposed as part of the Proposed Modification; hence there is no need for additional operational staff parking. Eight on-site parking spaces are provided for staff parking in a designated area next to the entrance to the Facility.

5.2 Mayfield Concept Plan Approval (09_0096)

5.2.1 Traffic Assessment Trigger Levels

As part of the Mayfield Concept Plan Approval, certain trigger levels were established for the activation of additional traffic studies which may identify the need for further detail assessments, or necessary infrastructure upgrades.

Condition 2.3 of the Concept Plan approvals provides that:

2.3. Projects associated with the Concept Plan shall not exceed the total truck movement limits identified in Table 1, except as identified:

Table 1 – Initial Staging and Total Truck Movement Limits

Total Truck Movements Per Annum	*Total Truck Movements Per day*	*Total Hourly Truck Movements in peak periods*
462,104	*1,268*	*95*

Condition 2.3 then goes on to provide additional requirements for assessment should the total number of trucks from the Concept Plan area exceed the amounts provided in Table 1. As detailed in **Section 4.3**, the Proposed Modification would generate truck movements well within these limits. As there are no other operating projects or proposed projects within the Concept Plan area, the Facility is currently the only source of traffic. Therefore, no additional traffic monitoring or assessment requirements are needed in accordance with the Concept Plan.

5.2.2 Traffic Management Plan

Condition 2.5 of the Concept Plan Approval requires the Port of Newcastle (PON) (formerly the Newcastle Port Corporation) to prepare a Traffic Management Plan to provide for the coordinated management of traffic to and from, and within the Concept plan site.

Condition 2.5 specifies that the Traffic Management Plan needs to be prepared and implemented prior to the operation of any projects associated with the Concept Plan. It is anticipated that PON will have a plan in place prior to the approval of the Proposed Modification, should it be approved. Furthermore, it should be noted that the existing Facility operates in accordance with a site-specific Traffic Management Plan. This plan would be updated to include the additional site elements should the Proposed Modification be approved. This plan has been prepared in accordance with stakeholders, including PON and RMS.

6.0 Conclusions

Table 6.1 provides a summary of the operation of the Industrial Drive / Ingall Street intersection for the years analysed.

Table 6.1 Summary of SIDRA Results for Industrial Drive/Ingall Street Intersection

Year and Stage	AM Peak				PM Peak			
	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service	Vehicles Per Hour	Deg. of Satn.	Avg. Delay	Level of Service
2012	3,062	0.660	15.3	B	3,156	0.652	17.3	B
2015 without Proposed Modification	3,171	0.690	15.4	B	3,266	0.672	17.6	B
2015 with Proposed Modification	3,182	0.693	15.7	B	3,277	0.685	18.2	B
2025 without Proposed Modification	3,497	0.760	16.1	B	3.607	0.741	18.5	B
2025 with Proposed Modification	3,509	0.764	16.2	B	3,618	0.757	19.0	B

Source: AECOM

The Proposed Modifications analysis indicates a negligible impact to the overall intersection performance during the 2015 AM and PM peaks. The intersection would continue to operate at LoS B in both peak hours. The spare capacity of the intersection would reduce slightly.

The background traffic growth in 2025 has a minor impact on the overall intersection performance, which would remain at LoS B in both AM and PM peaks, with a slight reduction in spare capacity. The operational traffic remains the same as in 2015 and it has a negligible impact on the overall intersection performance. As no other elements of the Mayfield Concept Plan are proposed to be developed by 2015, this TIA demonstrates that the facility can operate without triggering intersection upgrades or exceeding the LoS criteria for the Industrial Drive / Ingall Street intersection.

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Appendix A

Base Year SIDRA Outputs – 2012

Appendix A Base Year SIDRA Outputs – 2012

Industrial Drive / Ingall Street 2012 AM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	122	4.1	0.338	38.6	LOS C	4.7	34.1	0.90	0.77	35.6
2	T1	24	0.0	0.185	45.4	LOS D	1.1	7.4	0.98	0.69	30.9
Approach		146	3.4	0.338	39.7	LOS C	4.7	34.1	0.91	0.76	34.7
East: Industrial Drive East approach											
4	L2	9	0.0	0.009	16.3	LOS B	0.2	1.2	0.46	0.66	48.0
5	T1	1125	8.5	0.548	13.7	LOS A	15.7	117.9	0.69	0.62	61.6
6	R2	27	11.1	0.235	53.3	LOS D	1.2	9.3	0.98	0.71	32.4
Approach		1161	8.5	0.548	14.6	LOS B	15.7	117.9	0.69	0.62	60.2
North: Ingall St North approach											
7	L2	6	0.0	0.012	9.8	LOS A	0.1	0.6	0.40	0.58	50.6
8	T1	7	0.0	0.054	49.2	LOS D	0.3	2.1	0.96	0.68	35.4
9	R2	38	39.5	0.382	53.0	LOS D	1.8	16.4	1.00	0.73	28.8
Approach		51	29.4	0.382	47.4	LOS D	1.8	16.4	0.92	0.70	31.2
West: Industrial Drive West approach											
10	L2	5	20.0	0.660	16.8	LOS B	21.2	158.0	0.65	0.59	52.3
11	T1	1527	7.7	0.660	9.1	LOS A	21.2	158.0	0.62	0.56	66.7
12	R2	172	1.7	0.527	44.3	LOS D	7.1	50.2	0.96	0.81	35.1
Approach		1704	7.2	0.660	12.7	LOS A	21.2	158.0	0.65	0.59	61.1
All Vehicles		3062	7.9	0.660	15.3	LOS B	21.2	158.0	0.68	0.61	57.7

Source: AECOM

Industrial Drive / Ingall Street 2012 PM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	146	5.5	0.368	37.2	LOS C	5.5	40.6	0.89	0.78	36.0
2	T1	7	14.3	0.044	41.8	LOS C	0.3	2.3	0.94	0.62	31.9
Approach		153	5.9	0.368	37.4	LOS C	5.5	40.6	0.89	0.77	35.8
East: Industrial Drive East approach											
4	L2	10	0.0	0.010	16.8	LOS B	0.2	1.4	0.47	0.66	47.7
5	T1	1354	2.4	0.650	15.4	LOS B	20.9	149.2	0.76	0.68	59.8
6	R2	7	0.0	0.057	51.5	LOS D	0.3	2.1	0.96	0.66	32.9
Approach		1371	2.3	0.650	15.6	LOS B	20.9	149.2	0.76	0.68	59.5
North: Ingall St North approach											
7	L2	20	5.0	0.034	7.8	LOS A	0.2	1.6	0.33	0.58	51.1
8	T1	49	2.0	0.599	49.2	LOS D	3.9	30.3	0.97	0.77	35.2
9	R2	73	13.7	0.599	50.8	LOS D	3.9	30.3	1.00	0.81	31.4
Approach		142	8.5	0.599	44.2	LOS D	3.9	30.3	0.90	0.76	34.5
West: Industrial Drive West approach											
10	L2	6	16.7	0.527	16.4	LOS B	15.1	109.3	0.58	0.53	52.6
11	T1	1285	3.9	0.527	9.2	LOS A	15.1	109.3	0.58	0.53	66.6
12	R2	199	2.0	0.652	46.6	LOS D	8.6	61.0	0.99	0.83	34.3
Approach		1490	3.7	0.652	14.2	LOS A	15.1	109.3	0.64	0.57	59.1
All Vehicles		3156	3.4	0.652	17.3	LOS B	20.9	149.2	0.71	0.64	55.7

Source: AECOM

Appendix B

Future Year SIDRA Outputs without Proposed Modification – 2015

Appendix B Future Year SIDRA Outputs without Proposed Modification – 2015

Industrial Drive / Ingall Street 2015 AM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	126	4.0	0.349	38.7	LOS C	4.9	35.3	0.90	0.78	35.6
2	T1	25	0.0	0.192	45.4	LOS D	1.1	7.7	0.98	0.69	30.9
Approach		151	3.3	0.349	39.8	LOS C	4.9	35.3	0.92	0.76	34.7
East: Industrial Drive East approach											
4	L2	9	0.0	0.009	16.3	LOS B	0.2	1.2	0.46	0.66	48.0
5	T1	1159	8.5	0.565	13.9	LOS A	16.4	123.1	0.70	0.62	61.4
6	R2	30	13.3	0.265	53.6	LOS D	1.3	10.5	0.98	0.72	32.3
Approach		1198	8.6	0.565	14.9	LOS B	16.4	123.1	0.70	0.63	59.9
North: Ingall St North approach											
7	L2	7	14.3	0.016	10.7	LOS A	0.1	0.9	0.43	0.58	47.5
8	T1	7	0.0	0.054	49.2	LOS D	0.3	2.1	0.96	0.68	35.4
9	R2	43	44.2	0.441	53.4	LOS D	2.0	19.3	1.00	0.73	28.4
Approach		57	35.1	0.441	47.6	LOS D	2.0	19.3	0.93	0.71	30.7
West: Industrial Drive West approach											
10	L2	14	28.6	0.690	17.3	LOS B	22.8	171.0	0.67	0.62	51.8
11	T1	1574	7.8	0.690	9.4	LOS A	22.8	171.0	0.64	0.58	66.3
12	R2	177	1.7	0.543	44.4	LOS D	7.3	51.8	0.96	0.81	35.0
Approach		1765	7.3	0.690	13.0	LOS A	22.8	171.0	0.67	0.61	60.8
All Vehicles		3171	8.1	0.690	15.6	LOS B	22.8	171.0	0.70	0.62	57.4

Source: AECOM

Industrial Drive / Ingall Street 2015 PM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	150	5.3	0.377	37.3	LOS C	5.7	41.8	0.89	0.78	36.0
2	T1	7	14.3	0.044	41.8	LOS C	0.3	2.3	0.94	0.62	31.9
Approach		157	5.7	0.377	37.5	LOS C	5.7	41.8	0.90	0.77	35.8
East: Industrial Drive East approach											
4	L2	10	0.0	0.010	16.8	LOS B	0.2	1.4	0.47	0.66	47.7
5	T1	1395	2.4	0.670	15.7	LOS B	21.9	156.4	0.77	0.70	59.6
6	R2	8	12.5	0.070	52.2	LOS D	0.3	2.7	0.96	0.66	32.7
Approach		1413	2.4	0.670	15.9	LOS B	21.9	156.4	0.77	0.70	59.2
North: Ingall St North approach											
7	L2	23	8.7	0.041	8.1	LOS A	0.3	2.0	0.35	0.58	50.1
8	T1	50	2.0	0.667	49.3	LOS D	4.4	34.9	0.97	0.78	35.2
9	R2	85	16.5	0.667	51.7	LOS D	4.4	34.9	1.00	0.84	30.8
Approach		158	10.8	0.667	44.6	LOS D	4.4	34.9	0.90	0.78	34.1
West: Industrial Drive West approach											
10	L2	9	44.4	0.545	17.1	LOS B	15.8	115.1	0.59	0.54	51.9
11	T1	1324	3.9	0.545	9.3	LOS A	15.9	115.1	0.59	0.54	66.4
12	R2	205	2.0	0.672	47.0	LOS D	8.9	63.3	0.99	0.84	34.2
Approach		1538	3.9	0.672	14.4	LOS A	15.9	115.1	0.65	0.58	58.9
All Vehicles		3266	3.7	0.672	17.6	LOS B	21.9	156.4	0.72	0.65	55.3

Source: AECOM

Appendix C

Future Year SIDRA Outputs with Proposed Modification - 2015 Operations

Appendix C Future Year SIDRA Outputs with Proposed Modification – 2015 Operations

Industrial Drive / Ingall Street 2015 AM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	126	4.0	0.349	38.7	LOS C	4.9	35.3	0.90	0.78	35.6
2	T1	25	0.0	0.192	45.4	LOS D	1.1	7.7	0.98	0.69	30.9
Approach		151	3.3	0.349	39.8	LOS C	4.9	35.3	0.92	0.76	34.7
East: Industrial Drive East approach											
4	L2	9	0.0	0.009	16.3	LOS B	0.2	1.2	0.46	0.66	48.0
5	T1	1159	8.5	0.565	13.9	LOS A	16.4	123.1	0.70	0.62	61.4
6	R2	31	16.1	0.279	53.7	LOS D	1.4	11.1	0.98	0.72	32.3
Approach		1199	8.7	0.565	14.9	LOS B	16.4	123.1	0.70	0.63	59.9
North: Ingall St North approach											
7	L2	8	25.0	0.020	10.9	LOS A	0.1	1.1	0.43	0.58	45.7
8	T1	7	0.0	0.054	49.2	LOS D	0.3	2.1	0.96	0.68	35.4
9	R2	47	48.9	0.489	53.7	LOS D	2.2	21.8	1.00	0.74	28.0
Approach		62	40.3	0.489	47.7	LOS D	2.2	21.8	0.92	0.72	30.3
West: Industrial Drive West approach											
10	L2	19	47.4	0.693	17.7	LOS B	23.0	172.7	0.67	0.62	51.4
11	T1	1574	7.8	0.693	9.4	LOS A	23.0	172.7	0.64	0.59	66.3
12	R2	177	1.7	0.543	44.4	LOS D	7.3	51.8	0.96	0.81	35.0
Approach		1770	7.6	0.693	13.0	LOS A	23.0	172.7	0.67	0.61	60.7
All Vehicles		3182	8.4	0.693	15.7	LOS B	23.0	172.7	0.70	0.63	57.2

Source: AECOM

Industrial Drive / Ingall Street 2015 PM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	150	5.3	0.359	36.3	LOS C	5.6	41.1	0.88	0.78	36.3
2	T1	7	14.3	0.039	40.6	LOS C	0.3	2.2	0.93	0.62	32.2
Approach		157	5.7	0.359	36.5	LOS C	5.6	41.1	0.88	0.77	36.1
East: Industrial Drive East approach											
4	L2	10	0.0	0.010	17.3	LOS B	0.2	1.4	0.49	0.66	47.4
5	T1	1395	2.4	0.685	16.5	LOS B	22.5	160.4	0.79	0.71	58.8
6	R2	9	22.2	0.084	52.6	LOS D	0.4	3.3	0.96	0.67	32.6
Approach		1414	2.5	0.685	16.7	LOS B	22.5	160.4	0.79	0.71	58.4
North: Ingall St North approach											
7	L2	24	12.5	0.043	8.5	LOS A	0.3	2.3	0.36	0.59	49.2
8	T1	50	2.0	0.629	47.8	LOS D	4.4	35.8	0.96	0.78	35.8
9	R2	89	20.2	0.629	50.3	LOS D	4.4	35.8	1.00	0.83	30.9
Approach		163	13.5	0.629	43.4	LOS D	4.4	35.8	0.89	0.78	34.2
West: Industrial Drive West approach											
10	L2	14	64.3	0.558	18.1	LOS B	16.4	120.1	0.61	0.56	51.1
11	T1	1324	3.9	0.558	10.0	LOS A	16.6	120.0	0.61	0.56	65.6
12	R2	205	2.0	0.672	47.0	LOS D	8.9	63.3	0.99	0.84	34.2
Approach		1543	4.2	0.672	15.0	LOS B	16.6	120.1	0.66	0.59	58.4
All Vehicles		3277	4.0	0.685	18.2	LOS B	22.5	160.4	0.74	0.66	54.8

Source: AECOM

Appendix D

Future Year SIDRA Outputs without Proposed Modification – 2025 Operations

Appendix D Future Year SIDRA Outputs without Proposed Modification – 2025 Operations

Industrial Drive / Ingall Street 2025 AM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	139	4.3	0.386	39.0	LOS C	5.4	39.4	0.91	0.78	35.4
2	T1	27	0.0	0.208	45.5	LOS D	1.2	8.4	0.98	0.70	30.9
Approach		166	3.6	0.386	40.1	LOS C	5.4	39.4	0.92	0.77	34.6
East: Industrial Drive East approach											
4	L2	10	0.0	0.010	15.8	LOS B	0.2	1.3	0.45	0.66	48.3
5	T1	1280	8.5	0.611	13.8	LOS A	18.5	139.2	0.72	0.64	61.4
6	R2	32	12.5	0.281	53.6	LOS D	1.4	11.2	0.98	0.72	32.3
Approach		1322	8.5	0.611	14.8	LOS B	18.5	139.2	0.72	0.65	60.0
North: Ingall St North approach											
7	L2	8	12.5	0.019	12.8	LOS A	0.1	1.1	0.49	0.60	46.5
8	T1	8	0.0	0.062	49.3	LOS D	0.3	2.4	0.96	0.69	35.4
9	R2	46	43.5	0.477	53.6	LOS D	2.1	20.6	1.00	0.74	28.4
Approach		62	33.9	0.477	47.8	LOS D	2.1	20.6	0.93	0.71	30.7
West: Industrial Drive West approach											
10	L2	14	28.6	0.760	18.3	LOS B	27.6	206.7	0.73	0.68	51.1
11	T1	1738	7.7	0.760	10.2	LOS A	27.6	206.7	0.69	0.64	65.4
12	R2	195	1.5	0.637	46.3	LOS D	8.3	59.1	0.98	0.82	34.4
Approach		1947	7.2	0.760	13.9	LOS A	27.6	206.7	0.72	0.66	59.9
All Vehicles		3497	8.0	0.760	16.1	LOS B	27.6	206.7	0.73	0.66	57.0

Source: AECOM

Industrial Drive / Ingall Street 2025 PM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	166	5.4	0.418	37.6	LOS C	6.4	46.8	0.90	0.79	35.8
2	T1	8	12.5	0.050	41.9	LOS C	0.3	2.6	0.94	0.63	31.9
Approach		174	5.7	0.418	37.8	LOS C	6.4	46.8	0.91	0.78	35.6
East: Industrial Drive East approach											
4	L2	11	0.0	0.011	16.8	LOS B	0.2	1.5	0.47	0.67	47.7
5	T1	1541	2.3	0.741	16.7	LOS B	25.7	183.5	0.82	0.75	58.6
6	R2	9	11.1	0.078	52.2	LOS D	0.4	3.0	0.96	0.67	32.7
Approach		1561	2.4	0.741	16.9	LOS B	25.7	183.5	0.82	0.75	58.2
North: Ingall St North approach											
7	L2	25	8.0	0.049	10.1	LOS A	0.4	2.8	0.42	0.60	48.9
8	T1	56	1.8	0.734	49.7	LOS D	4.9	38.9	0.97	0.79	35.1
9	R2	92	16.3	0.734	53.1	LOS D	4.9	38.9	1.00	0.89	30.5
Approach		173	10.4	0.734	45.8	LOS D	4.9	38.9	0.91	0.82	33.8
West: Industrial Drive West approach											
10	L2	10	40.0	0.602	17.6	LOS B	18.6	134.9	0.63	0.58	51.6
11	T1	1463	3.9	0.602	9.9	LOS A	18.6	134.9	0.63	0.57	65.7
12	R2	226	1.8	0.739	48.7	LOS D	10.2	72.2	1.00	0.87	33.6
Approach		1699	3.8	0.739	15.1	LOS B	18.6	134.9	0.68	0.61	58.2
All Vehicles		3607	3.6	0.741	18.5	LOS B	25.7	183.5	0.76	0.69	54.7

Source: AECOM

Appendix E

Future Year SIDRA Outputs with Proposed Modification - 2025 Operations

Appendix E Future Year SIDRA Outputs with Proposed Modification – 2025 Operations

Industrial Drive / Ingall Street 2025 AM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	139	4.3	0.386	39.0	LOS C	5.4	39.4	0.91	0.78	35.4
2	T1	27	0.0	0.208	45.5	LOS D	1.2	8.4	0.98	0.70	30.9
Approach		166	3.6	0.386	40.1	LOS C	5.4	39.4	0.92	0.77	34.6
East: Industrial Drive East approach											
4	L2	10	0.0	0.010	15.8	LOS B	0.2	1.3	0.45	0.66	48.3
5	T1	1280	8.5	0.611	13.8	LOS A	18.5	139.2	0.72	0.64	61.4
6	R2	33	15.2	0.295	53.8	LOS D	1.5	11.8	0.99	0.72	32.3
Approach		1323	8.6	0.611	14.8	LOS B	18.5	139.2	0.72	0.65	59.9
North: Ingall St North approach											
7	L2	9	22.2	0.023	12.9	LOS A	0.2	1.4	0.49	0.60	44.9
8	T1	8	0.0	0.062	49.3	LOS D	0.3	2.4	0.96	0.69	35.4
9	R2	51	49.0	0.538	54.1	LOS D	2.4	23.9	1.00	0.77	27.9
Approach		68	39.7	0.538	48.1	LOS D	2.4	23.9	0.93	0.73	30.2
West: Industrial Drive West approach											
10	L2	19	47.4	0.764	18.7	LOS B	27.8	208.7	0.74	0.69	50.8
11	T1	1738	7.7	0.764	10.2	LOS A	27.8	208.7	0.69	0.64	65.3
12	R2	195	1.5	0.637	46.3	LOS D	8.3	59.1	0.98	0.82	34.4
Approach		1952	7.5	0.764	13.9	LOS A	27.8	208.7	0.72	0.66	59.8
All Vehicles		3509	8.3	0.764	16.2	LOS B	27.8	208.7	0.74	0.66	56.8

Source: AECOM

Industrial Drive / Ingall Street 2025 PM Peak

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed km/h
South: Ingall St South approach											
1	L2	166	5.4	0.398	36.6	LOS C	6.3	46.0	0.89	0.79	36.2
2	T1	8	12.5	0.044	40.6	LOS C	0.3	2.5	0.93	0.62	32.2
Approach		174	5.7	0.398	36.8	LOS C	6.3	46.0	0.89	0.78	36.0
East: Industrial Drive East approach											
4	L2	11	0.0	0.011	17.3	LOS B	0.2	1.5	0.49	0.67	47.4
5	T1	1541	2.3	0.757	17.5	LOS B	26.4	188.3	0.84	0.77	57.8
6	R2	10	20.0	0.092	52.6	LOS D	0.4	3.6	0.97	0.67	32.6
Approach		1562	2.4	0.757	17.8	LOS B	26.4	188.3	0.84	0.76	57.4
North: Ingall St North approach											
7	L2	26	11.5	0.050	10.2	LOS A	0.4	3.0	0.42	0.60	48.3
8	T1	56	1.8	0.692	48.1	LOS D	4.9	39.6	0.97	0.79	35.7
9	R2	96	19.8	0.692	51.4	LOS D	4.9	39.6	1.00	0.87	30.7
Approach		178	12.9	0.692	44.3	LOS D	4.9	39.6	0.90	0.80	34.0
West: Industrial Drive West approach											
10	L2	15	60.0	0.616	18.6	LOS B	19.3	140.6	0.65	0.60	50.8
11	T1	1463	3.9	0.616	10.6	LOS A	19.4	140.5	0.65	0.59	64.9
12	R2	226	1.8	0.739	48.7	LOS D	10.2	72.2	1.00	0.87	33.6
Approach		1704	4.1	0.739	15.7	LOS B	19.4	140.6	0.70	0.63	57.7
All Vehicles		3618	3.9	0.757	19.0	LOS B	26.4	188.3	0.78	0.70	54.2

Source: AECOM

AECOM
AECOM Australia Pty Ltd
17 Warabrook Boulevard
Warabrook NSW 2304
PO Box 73
Hunter Region MC NSW 2310
Australia
T +61 2 4911 4900
F +61 2 4911 4999
www.aecom.com
ABN 20 093 846 925