AECOM

ROAD AND RAIL NETWORK

Environmental Assessment

Mayfield Site Port-Related Activities Concept Plan

Figure 9-2

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AM and PM Peak Intersection Counts

In 2008, NPC commissioned Mark Waugh Pty Ltd to undertake Traffic Impact Statements (TIS) associated with proposed industrial developments at Mayfield. As part of the TIS, traffic count data was collected at the two key intersections providing access to the site from Industrial Drive, namely:

- Industrial Drive / Ingall Street; and
- Industrial Drive / George Street.

Based on these reports, the AM peak and PM peak periods occur between the hours of 7.30 AM to 8.30 AM and 4.45 PM to 5.45 PM respectively.

Existing Intersection Performance

Intersection performance assessments have been evaluated using SIDRA Intersection 3.2, a computer based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA Intersection 3.2 include:

- **Degree of Saturation (DoS)** – a 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;
- **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 (refer to **Table 9-2**).

Table 9-2: Level of Service and Average Delay Performance Criteria for Intersections

Level of Service	Average Delay (secs/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	<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

Industrial Drive / George Street

The intersection of Industrial Drive and George Street is a signalised intersection with a pedestrian crossing on the northern leg. All turning movements are permitted. **Table 9-3** and **Table 9-4** summarise the intersection performance based on the 2008 traffic flows for the AM and PM peak hours.

Table 9-3: 2008 AM Peak Hour Base Case Intersection Performance (Industrial Drive / George Street)

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	810	B	0.475	18.0	93
George St (E)	34	B	0.036	27.4	7
Industrial Drive (N Leg)	1,219	B	0.722	19.8	151
George St (W)	89	C	0.140	34.4	17
All Vehicles	**2,152**	**B**	**0.722**	**19.9**	**151**

Source: AECOM, 2010

Table 9-4: 2008 PM Peak Hour Base Case Intersection Performance (Industrial Drive / George Street)

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,145	B	0.748	23.5	154
George St (E)	32	B	0.029	28.3	5
Industrial Drive (N Leg)	1,016	B	0.658	20.9	128
George St (W)	51	C	0.065	31.4	9
All Vehicles	**2,244**	**B**	**0.748**	**22.6**	**154**

Source: AECOM, 2010

The intersection of Industrial Drive / George Street is shown to operate within capacity during the AM and PM peak and at LOS B. The longest 95th percentile queue occurs on Industrial Drive in both peaks. The queue reaches 151 metres on the northern approach in the AM peak and 154 metres on the southern approach in the PM peak.

Industrial Drive / Ingall Street

The Industrial Drive / Ingall Street intersection is a signalised intersection with a banned right turn from the south, and a left slip lane from the north. **Table 9-5** and **Table 9-6** summarise the intersection performance based on the 2008 traffic flows for the AM and PM peak hours.

Table 9-5: 2008 AM Peak Hour Base Case Intersection Performance (Industrial Drive / Ingall Street)

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	153	D	0.541	47.9	46
Industrial Drive (E Leg)	1,106	B	0.575	19.5	129
Ingall St (N Leg)	100	D	0.585	42.5	31
Industrial Drive (W Leg)	1,714	B	0.651	15.9	160
All Vehicles	**3,073**	**B**	**0.651**	**19.6**	**160**

Source: AECOM, 2010

Table 9-6: 2008 PM Peak Hour Base Case Intersection Performance (Industrial Drive / Ingall Street)

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	164	D	0.528	45.6	61
Industrial Drive (E Leg)	1,508	B	0.817	24.7	223
Ingall St (N Leg)	186	D	0.818	47.8	54
Industrial Drive (W Leg)	1,283	B	0.811	24.1	134
All Vehicles	**3,141**	**B**	**0.818**	**26.9**	**223**

Source: AECOM, 2010

The results show that the intersection operates satisfactorily at LOS B during both the AM and PM peak. During the AM peak the largest 95th percentile queue occurs on Industrial Drive (western leg) and is indicated in the order of 160 metres, while during the PM peak, a 95th percentile queue in the order of 223 metres is indicated on Industrial Drive (eastern leg).

Future Intersection Performance

This section reviews the likely impacts of changes to the traffic flows on the road network for the future assessment years (2024 and 2034) without development of the proposed concept. These future assessment years have been chosen as they represent the estimated timeframes for:

- 2024 - The initial stage of development with the Container Terminal Precinct operating at a capacity of 600,000 TEU per annum.
- 2034 - The final stage of development with the Container Terminal Precinct operating at a capacity of 1 million TEU per annum.

A growth rate of 0.27 percent per annum has been determined based on historical RTA traffic volume data. This yearly growth rate has been applied to the existing intersection flows to determine the future traffic conditions in 2024 and 2034, without the proposed concept.

The intersections of Industrial Drive / George Street and Industrial Drive / Ingall Street have been assessed using SIDRA Intersection 3.2 for the two future year scenarios. The intersection layouts were tested unchanged from the base layouts.

Industrial Drive / George Street

The 2024 AM and PM peak hour performance results for the intersection of Industrial Drive / George Street are presented in **Table 9-7** and **Table 9-8**, respectively.

Table 9-7: 2024 AM Peak Intersection Performance, Industrial Drive / George Street – Without Development

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	846	B	0.496	18.2	98
George St (E)	35	B	0.038	27.3	7
Industrial Drive (N Leg)	1,273	B	0.754	21.2	164
George St (W)	92	C	0.145	34.5	18
All Vehicles	**2,246**	**B**	**0.754**	**20.7**	**164**

Source: AECOM, 2010

Table 9-8: 2024 PM Peak Intersection Performance, Industrial Drive / George Street – Without Development

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,196	B	0.781	25.2	167
George St (E)	33	C	0.030	28.8	5
Industrial Drive (N Leg)	1,061	B	0.687	21.3	135
George St (W)	53	C	0.068	31.5	9
All Vehicles	**2,343**	**B**	**0.785**	**23.6**	**167**

Source: AECOM, 2010

The results indicate that in 2024 the intersection is likely to continue performing at LOS B in both AM and PM peak hours. The additional back ground traffic growth has a minor impact on the performance of the intersection of Industrial Drive / George Street. However, in both peaks, the intersection has spare capacity.

The 2034 AM and PM peak hour performance results for the intersection of Industrial Drive / George Street are presented in **Table 9-9** and **Table 9-10**, respectively.

Table 9-9: 2034 AM Peak Intersection Performance, Industrial Drive / George Street – Without Development

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	867	B	0.508	18.3	100
George St (E)	37	B	0.039	27.5	8
Industrial Drive (N Leg)	1,305	B	0.773	22.2	172
George St (W)	95	C	0.151	34.5	18
All Vehicles	**2,304**	**B**	**0.773**	**21.3**	**172**

Source: AECOM, 2010

Table 9-10: 2034 PM Peak Intersection Performance, Industrial Drive / George Street – Without Development

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,224	B	0.800	26.3	175
George St (E)	37	C	0.034	28.8	6
Industrial Drive (N Leg)	1,088	B	0.704	21.5	139
George St (W)	55	C	0.070	31.5	10
All Vehicles	**2,404**	**B**	**0.800**	**24.3**	**175**

Source: AECOM, 2010

The results indicate that in 2034 the intersection is likely to continue performing at LOS B in both AM and PM peak hours. The additional back ground traffic growth has a minor impact on the performance of the intersection of Industrial Drive / George Street. However, in both peaks, the intersection has spare capacity.

Industrial Drive / Ingall Street

The 2024 AM and PM peak hour performance results for the intersection of Industrial Drive / Ingall Street are presented in **Table 9-11** and **Table 9-12**, respectively.

Table 9-11: 2024 AM Peak Intersection Performance, Industrial Drive / Ingall Street

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	160	D	0.628	49.7	49
Industrial Drive (E Leg)	1,154	B	0.600	19.8	136
Ingall St (N Leg)	104	D	0.708	44.3	33
Industrial Drive (W Leg)	1,790	B	0.668	15.5	166
All Vehicles	**3,208**	**B**	**0.708**	**19.7**	**166**

Source: AECOM, 2010

Table 9-12: 2024 PM Peak Intersection Performance, Industrial Drive / Ingall Street

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	171	D	0.517	44.6	62
Industrial Drive (E Leg)	1,575	C	0.873	32.1	268
Ingall St (N Leg)	194	D	0.806	47.5	55
Industrial Drive (W Leg)	1,340	B	0.844	25.4	144
All Vehicles	**3,280**	**C**	**0.873**	**30.9**	**268**

Source: AECOM, 2010

The results indicate that in 2024, the intersection is likely to perform at LOS B and C in the AM and PM peak, respectively. Similar to the intersection of Industrial Drive / George Street, the additional background traffic growth between the existing traffic flows and 2024 traffic flows appears to have a minor impact on the intersection. The PM peak hour experiences a higher degree of saturation than the AM peak hour, particularly on Industrial Drive, but still performs satisfactorily.

The 2034 AM and PM peak hour performance results for the intersection of Industrial Drive / Ingall Street are presented in **Table 9-13** and **Table 9-14**, respectively.

Table 9-13: 2034 AM Peak Intersection Performance, Industrial Drive / Ingall Street

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	163	D	0.579	48.2	49
Industrial Drive (E Leg)	1,183	B	0.615	20.0	140
Ingall St (N Leg)	107	D	0.646	43.0	33
Industrial Drive (W Leg)	1,834	B	0.696	16.4	177
All Vehicles	**3,287**	**B**	**0.714**	**20.2**	**177**

Source: AECOM, 2010

Table 9-14: 2034 PM Peak Intersection Performance, Industrial Drive / Ingall Street

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	176	D	0.531	44.7	64
Industrial Drive (E Leg)	1,614	C	0.894	36.2	293
Ingall St (N Leg)	199	D	0.841	49.0	58
Industrial Drive (W Leg)	1,372	B	0.865	25.9	148
All Vehicles	**3,361**	**C**	**0.894**	**33.2**	**293**

Source: AECOM, 2010

The results indicate that in 2034, the intersection is likely to perform at LOS B and C in the AM and PM peak, respectively. Similar to the intersection of Industrial Drive / George Street, the additional background traffic growth between the existing traffic flows and 2034 traffic flows appears to have a minor impact on the intersection. The PM peak hour experiences a higher degree of saturation than the AM peak hour, particularly on Industrial Drive, but still performs satisfactorily.

9.1.3 Impact Assessment

Construction Traffic

The impact of construction traffic has not been assessed as part of this assessment due to details of the exact nature of the infrastructure required on site being unknown, and as the construction work is likely to be staged across the timeframe of the proposed concept.

It is anticipated that daily construction traffic would not exceed daily traffic predicted for the proposed 2024 initial operations, which are 148 truck movements and 60 employee vehicle movements in the worst case peak hour (refer to **Table 9-17 and Table 9-18**). This level of traffic movement is shown to be within the capacity of the two main access intersections and is not predicted to have a significant impact on the local or broader road network.

Further detailed assessment should be dealt with as part of the future Project applications for the construction of the individual precincts, when these are made by the prospective operators of the facilities. Construction Management Plans should be implemented to ensure impact of construction traffic on the road network is limited.

Proposed Initial Operations (2024)

Precinct Trade Forecast and Likely Landside Modal Split

Table 9-15 shows the proposed initial operations for each precinct within the site, as well as the proposed landside transportation modes.

Table 9-15: Proposed Initial Operations (2024)

Precinct	Trade and Type	Approximate Volume	Likely Landside Transport Requirements
NPC Operations (Berth 1)	NCP offices	N/A	N/A
Bulk & General Purpose (Berth 2)	Dry Bulk storage (feed grain, rice, canola etc)	0.4 MTPA	70% Road, 30% Rail
	Coke	0.25 MTPA	70% Road, 30% Rail
	Cement	0.7 MTPA	100% Road
	Boutique coal	0.5 MTPA	70% Road, 30% Rail
	Soda ash	0.1 MTPA	100% Road
	Fertiliser	0.25 MTPA	100% Road
	Meals	0.1 MTPA	100% Road
	Sand	0.1 MTPA	100% Road
	Total	**2.4 MTPA**	-
General Purpose (Berth 3 and may share Berth 4 with the Container Terminal Precinct)	Heavy machinery	0.1 MTPA	100% Road
	Roll on roll off cargo	0.1 MTPA	100% Road
	Project cargo	0.05 MTPA	100% Road
	Steel products	0.4 MTPA	70% Road, 30% Rail
	Timber products	0.1 MTPA	70% Road, 30% Rail
	Ammonia Nitrate	0.1 MTPA	100% Road
	Scrap Metal	0.2 MTPA	70% Road, 30% Rail
	Pine logs	0.3 MTPA	70% Road, 30% Rail
	Total	**1.35 MTPA**	-

Precinct	Trade and Type	Approximate Volume	Likely Landside Transport Requirements
Container Terminal (Berths 4, 5 and 6)	**Containers**	**600,000 TEU**	80% Road, 20% Rail
Bulk Liquid (Berth 7)	**Fuels and other bulk liquids**	**1,010 ML**	100% Road

Source: NPC, May 2009

Of the initial proposed operation and associated truck movements, it is assumed that 75 percent are to take place during the day time, with the remaining 25 percent taking place at night.

The assumptions which underpin this assessment have been prepared based on:

- Detailed discussions with NPC in relation to expected cargo volumes and types and the likely timeframe for their introduction to the site.
- Experience of how other major ports, such as Port Botany, operate in respect to the intensity of operations over a 24 hour period (eg. day vs night and AM/PM peaks) and the characteristics of how they manage the road and rail transport of cargos.
- The likely direction of traffic flow having regard to the geographic location of the potential markets for the various cargo types, the structure of the local and regional road networks, and the capacity of the two main local intersections.
- The limited capacity of the freight rail network between Newcastle and Sydney which means that only limited train paths will be available to the site in the short/medium term until such time as the upgrade of the North Sydney Freight Corridor is completed.
- There is limited landside area available at the site to support the number of rail sidings needed to allow for a significantly higher proportion of cargo movement by rail. This could change in the future depending on how the adjoining land to the south (the IIP) is developed but at this stage the detail of this development is unknown.

Road Traffic Access, Generation and Distribution

For the purposes of this assessment, it has been assumed that the site would be accessed via two intersections:

- Industrial Drive / George Street; and
- Industrial Drive / Ingall Street.

As an initial assumption, the Container Terminal and Bulk Liquids Precincts are assumed to gain access from the Industrial Drive / Ingall Street intersection. The remaining precincts (General Purpose Precinct, Bulk and General Precinct and NCP Operations Precinct) are assumed to gain access from Selwyn Street via the Industrial Drive / George Street intersection.

This assumption would be tested in the intersection analysis and, if the intersections are found to not operate satisfactorily, alternative access arrangements would be recommended.

The following additional assumptions have been made in order to assess the road network impact:

- 24 hour per day, 7 days a week operation (365 days per year);
- 75 percent of the proposed operations and associated truck movements would take place during the day, 25 percent taking place at night;
- Container trade forecasts: 600,000 TEUs – 80 percent transported by road / 20 percent by rail;
- 70 percent truck traffic enters and 30 percent exits the site in the AM peak hour;
- 40 percent truck traffic enters and 60 percent exits the site in the PM peak hour;
- 40 percent of all employee traffic enters and exits in the traffic peak hours;
- Of the above, all employee traffic enters in the AM peak hour and exits in the PM peak hour; and
- 80 percent of all traffic (trucks and vehicles) travels to/from the north and 20 percent travels to/from the south.

The road trips generated by each mode are based on the landside transport requirements, as shown in **Table 9-15.** Loading assumptions for road vehicles are summarised in **Table 9-16**.

Table 9-16: Average Loading Assumptions per Truck

Per Truck	Unit	Quantity
Bulk	Tonnes	35
General Cargo	Tonnes	25
Containers	TEU	2
Bulk Liquid	ML	18

Source: AECOM, 2010 / Mark Waugh Pty Ltd, 2008

All trade transported to the Bulk and General Precinct is assumed to be 'bulk'. All trade transported to/from the General Purpose Precinct, with the exception of AN, is assumed to be 'general cargo' and all trade transported to/from the Container Terminal Precinct is assumed to be transported by 'containers'.

The number of trucks transporting the fuels and other bulk liquids from the Bulk Liquid Precinct is based on 1 truck being able to transport 18 mega litres of liquid per day (Mark Waugh, 2008).

Table 9-17 indicates the number of trucks required to transport containers, bulks, general cargo and liquids to/from the various precincts based on a 24 hours per day, 7 days a week operation with 75 percent of truck movements occurring during the day time and 25 percent of truck movements occurring at night.

The number of trucks predicted is based on the percentage of material to be transported by road, as shown in **Table 9-15**. The number of associated truck movements is based on two movements per truck (one movement into the site and one movement out). The peak hour truck movements are assumed to be 50 percent higher than a normal hour and these have been used for the peak hour assessment of the road network and intersections.

Table 9-17: Proposed Initial Operations (2024) Truck Movements

Precinct	Trucks per Year	Trucks per Day	Trucks per Daytime Hour	Truck Movements per Daytime Hour	Truck Movements per Daytime Peak Hour
Bulk and General	58,714	161	8	16	24
General Purpose	40,857	112	5	11	16
Container Terminal	240,000	657	33	66	99
Bulk Liquid	20,481	56	3	6	9
Total	**360,052**	**986**	**49**	**99**	**148**

Source: AECOM, 2010

It is estimated that in 2024 there would be a total of approximately 200 employees on-site at any one time. The assumption that 75 percent of movements would occur during the day and 25 percent at night has also been applied to employee movements. Of the 75 percent of movements during the daytime, it has been assumed that 40 percent of employee movements associated with all precincts would occur during the peak hours. This is on the basis that employees are likely to work a shift pattern with start / finish times occurring outside the peak hours experienced on the wider road network (NPC, 2010).

While employee access to the site by means other than private car should be actively encouraged, a scenario of a vehicle occupancy rate of 1.0 has been assumed, that is, one car for every employee, in order to test the worst case for the impact on intersections.

Workplace travel planning should be considered in the future Project applications for the individual precincts and facilities, when these are made by the prospective operators of the facilities. Access by walking, cycling and public transport should be considered.

Table 9-18 summarises the employee vehicles movements associated with the proposed concept in 2024.

Table 9-18: Proposed Initial Operations (2024) Employee Movements

Employees per day	Employee vehicles during daytime	AM Peak Hour		PM Peak Hour	
		In	Out	In	Out
200	150	60	0	0	60

Source: AECOM, 2010

For the peak hour vehicle movements, it has been assumed that 70 percent of traffic would be entering the site and 30 percent would be leaving the site in the AM peak and 40 percent would be entering the site and 60 percent would be leaving the site in the PM peak. Of the vehicles entering the site in both peak hours, it has been assumed that 80 percent would come from the north and 20 percent would come from the south. The same directional split has been assumed for vehicles exiting the site in both peak hours (NPC, 2010).

The current geometry of the left turn from the Bull Street slip road into Ingall Street, which includes the level crossing arrangement of the railway line, appears to be too tight for large trucks to make this turn, and so it has been assumed that trucks travelling from the north accessing the Container Terminal and Bulk Liquid Precincts would not use Bull Street to access the site, but would rather use the Industrial Drive / Ingall Street intersection. This is a worst case scenario and will be discussed later in this section.

Trucks accessing the General Purpose and Bulk and General Precincts are assumed to use the Industrial Drive / George Street intersection. When exiting these precincts heading south, it has been assumed that vehicles would use the slip lane adjacent to Selwyn Drive to access Industrial Drive; therefore no trucks would turn left from George Street at the intersection of Industrial Drive / George Street.

It has also been assumed that the employee vehicles accessing the site would be evenly distributed between the two intersections with 50 percent of employee vehicles using the Industrial Drive / Ingall Street intersection and 50 percent using the Industrial Drive / George Street intersection.

Intersection Impacts

It is expected that the proposed concept would generate 148 truck movements and 60 vehicle movements in the peak hours, based on the likely modal split indicated in **Table 9-15**, and shown in **Table 9-17** and **Table 9-18**.

The truck and vehicle movements generated by the development have been added to the forecast 2024 traffic flows at the intersections of Industrial Drive / George Street and Industrial Drive / Ingall Street. The intersections have again been assessed using SIDRA Intersection 3.2 using the base layouts. It should be noted that the distribution is based on the assumption that the Container Terminal Precinct traffic, which makes up approximately 65 percent of the generated traffic, is loaded onto the Industrial Drive / Ingall Street intersection. This intersection is therefore impacted to a greater degree than the Industrial Drive / George Street intersection.

Industrial Drive / George Street

The results of the assessment for the AM and PM peak hour in 2024 with the inclusion of the proposed concept traffic associated with the proposed concept is shown in **Table 9-19** and **Table 9-20**, respectively.

Table 9-19: 2024 AM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	926	B	0.533	18.9	105
George St (E)	49	C	0.054	30.6	9
Industrial Drive (N Leg)	1,441	B	0.823	25.5	198
George St (W)	91	C	0.149	34.5	18
All Vehicles	**2,507**	**B**	**0.823**	**23.5**	**198**

Source: AECOM, 2010

Table 9-20: 2024 PM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,310	C	0.848	30.6	202
George St (E)	79	C	0.140	33.7	17
Industrial Drive (N Leg)	1,174	B	0.750	23.3	154
George St (W)	56	C	0.071	31.4	10
All Vehicles	**2,619**	**B**	**0.851**	**27.4**	**201**

Source: AECOM, 2010

The results show that in 2024, the development traffic is likely to have a negligible impact on the Industrial Drive / George Street intersection, as the intersection is likely to perform at LOS B in both peaks. There is a minimal change in the spare capacity between the future scenario without the proposed concept and the future scenario with the proposed concept and therefore no specific mitigation measures would be required.

Based on the degree of saturation, the intersection operates with approximately 17 percent and 15 percent spare capacity in the AM and PM peak hours, respectively. If an internal road was present linking the various precincts it would enable a higher distribution of trips from the site to the Industrial Drive / George Street intersection. Assuming that trips generated by the Container Terminal Precinct use the Industrial Drive / George Street intersection as opposed to the Industrial Drive / Ingall Street intersection, the Industrial Drive / George Street intersection is likely to continue to perform at LOS B in the AM and PM peaks, as shown in **Table 9-21** and **Table 9-22**, respectively.

Table 9-21: 2024 AM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	949	B	0.538	19.5	106
George St (E)	72	C	0.139	34.6	14
Industrial Drive (N Leg)	1,469	B	0.823	25.6	198
George St (W)	91	C	0.149	34.5	18
All Vehicles	**2,608**	**B**	**0.823**	**23.9**	**198**

Source: AECOM, 2010

Table 9-22: 2024 PM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,318	C	0.848	30.8	202
George St (E)	126	C	0.304	36.8	36
Industrial Drive (N Leg)	1,206	B	0.750	23.4	154
George St (W)	56	C	0.071	31.4	10
All Vehicles	**2,706**	**B**	**0.851**	**27.8**	**201**

Source: AECOM, 2010

Industrial Drive / Ingall Street

The results of the assessment for the AM and PM peak hour in 2024 for the Industrial Drive / Ingall Street with the inclusion of the proposed concept traffic are shown in **Table 9-23** and **Table 9-24**, respectively.

Table 9-23: 2024 AM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	171	D	0.428	43.3	47
Industrial Drive (E Leg)	1,258	B	0.764	23.6	156
Ingall St (N Leg)	145	D	0.830	49.1	58
Industrial Drive (W Leg)	2,004	B	0.841	25.3	268
All Vehicles	**3,578**	**B**	**0.841**	**26.6**	**268**

Source: AECOM, 2010

Table 9-24: 2024 PM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	183	C	0.419	36.7	59
Industrial Drive (E Leg)	1,699	F	1.085	213.9	785
Ingall St (N Leg)	303	F	1.076	159.1	221
Industrial Drive (W Leg)	1,472	C	1.000	42.4	213
All Vehicles	**3,657**	**F**	**1.085**	**131.5**	**785**

Source: AECOM, 2010

The results show that in 2024 in the AM peak, the Industrial Drive / Ingall Street Intersection is likely to operate satisfactorily at LOS B, however it is not likely to operate satisfactorily in the PM peak with a LOS F. The intersection is over capacity and long delays and queuing would result.

In order to alleviate the impact on the Industrial Drive Ingall Street intersection, diverting a proportion of trucks to the George Street intersection was considered. Analysis indicated that the George Street intersection had spare capacity before the diversion.

An internal road network with a link road connecting all the precincts would ensure a strategic distribution of trucks between the two intersections. Trips generated by the Container Terminal Precinct could then use the Industrial Drive / George Street intersection as opposed to the Industrial Drive / Ingall Street intersection and this scenario has been tested below.

This mitigation measure would have the greatest impact on the Ingall Street / Industrial Drive intersection in terms of improved performance and spare capacity, with this intersection likely to operate at LOS B in the AM and PM peaks, as shown in **Table 9-25** and **Table 9-26**, respectively.

Table 9-25: 2024 AM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	171	D	0.600	48.3	51
Industrial Drive (E Leg)	1,244	B	0.657	21.4	150
Ingall St (N Leg)	115	D	0.738	44.9	37
Industrial Drive (W Leg)	1,949	B	0.740	17.0	196
All Vehicles	**3,479**	**B**	**0.745**	**21.0**	**196**

Source: AECOM, 2010

Table 9-26: 2024 PM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	183	D	0.800	54.5	74
Industrial Drive (E Leg)	1,691	B	0.854	26.5	264
Ingall St (N Leg)	244	B	0.542	28.3	46
Industrial Drive (W Leg)	1,440	B	0.839	23.1	145
All Vehicles	**3,558**	**B**	**0.854**	**26.7**	**264**

Source: AECOM, 2010

Road Network and Railway Crossing Impact Analysis

The impact of the proposed concept on the local and broader road network and the impact associated with the two rail crossings (Selwyn Street crossing and new western crossing) have not been assessed for the initial operations scenario in 2024. However, these impacts have been assessed for the final operations scenario in 2034 which is effectively the worst case scenario.

Proposed Final Operations (2034)

Precinct Trade Forecast and Likely Landside Modal Split

Table 9-27 shows the proposed final operations for each precinct within the site, as well as the likely landside transportation modes. The difference between the final and initial operations is the increase in the amount of containers from 600,000 TEUs to 1 million TEUs per annum, the increase in number of precinct employees from 200 to 300 employees, and the future year for completion of 2034.

Table 9-27: Proposed Final Operations (2034)

Precinct	Trade and Type	Approximate Volume	Likely Landside Transport Requirements
NPC Operations (Berth 1)	NCP offices	N/A	N/A
Bulk & General Purpose (Berth 2)	Dry Bulk storage (feed grain, rice, canola etc)	0.4 MTPA	70% Road, 30% Rail
	Coke	0.25 MTPA	70% Road, 30% Rail
	Cement	0.7 MTPA	100% Road
	Boutique coal	0.5 MTPA	70% Road, 30% Rail
	Soda ash	0.1 MTPA	100% Road
	Fertiliser	0.25 MTPA	100% Road
	Meals	0.1 MTPA	100% Road
	Sand	0.1 MTPA	100% Road
	Total	**2.4 MTPA**	**-**
General Purpose (Berth 3 and may share Berth 4 with the Container Terminal Precinct)	Heavy machinery	0.1 MTPA	100% Road
	Roll on roll off cargo	0.1 MTPA	100% Road
	Project cargo	0.05 MTPA	100% Road
	Steel products	0.4 MTPA	70% Road, 30% Rail
	Timber products	0.1 MTPA	70% Road, 30% Rail
	Ammonia Nitrate	0.1 MTPA	100% Road
	Scrap Metal	0.2 MTPA	70% Road, 30% Rail
	Pine logs	0.3 MTPA	70% Road, 30% Rail
	Total	**1.35 MTPA**	**-**
Container Terminal (Berths 4, 5 and 6)	**Containers**	**1,000,000 TEU**	80% Road, 20% Rail
Bulk Liquid (Berth 7)	**Fuels and other bulk liquids**	**1,010 ML**	100% Road

Source: NPC, May 2009

Road Traffic Access, Generation and Distribution

The loading assumptions and landside modal split for the proposed final operations are unchanged from the proposed initial operations (2024).

Table 9-28 shows the number of truck movements associated with the proposed concept at final operation. The main change has been the increase in the container terminal truck movements from 148 to 214 per peak hour. Employee vehicle movements have increased from 60 to 90 per peak hour as shown in **Table 9-29**.

As the intersection of Industrial Drive / Ingall Street only performed satisfactorily with the addition of an internal road link under the 2024 scenario with development, the 2034 with development scenario for both intersections has only been modelled with the link road in place. The assumptions with regards to distribution associated with the link road remain unchanged from the 2024 scenario, namely that all of the Container Terminal Precinct truck movement access and egress through the Industrial Drive / George Street intersection.

It has been assumed that the road traffic distribution pattern would remain unchanged to that of the proposed initial operations i.e., 80 percent of all traffic travels to/from the north and 20 percent travels to/from the south.

Table 9-28: Proposed Final Operations (2034) Truck Movement Scenarios

Precinct	Trucks per year	Trucks per day	Trucks per daytime hour	Truck movements per daytime hour	Truck movements per daytime peak hour
Bulk and General	58,714	161	8	16	24
General Purpose	40,857	112	5	11	16
Container Terminal	400,000	1,096	55	110	165
Bulk Liquid	20,481	56	3	6	9
Total	**520,052**	**1,425**	**71**	**142**	**214**

Source: AECOM, 2010

Table 9-29: Proposed Final Operations (2034) Employee Vehicle Movements

Employee vehicles per day	Employee vehicles during daytime	AM Peak Hour		PM Peak Hour	
		In	Out	In	Out
300	225	90	0	0	90

Source: AECOM, 2010

Intersection Impacts

It is expected that the proposed concept would generate 214 truck movements and 90 vehicle movements in the peak hours.

The truck and vehicle movements generated by the proposed concept have been added to the forecast 2034 traffic flows at the intersections of Industrial Drive / George Street and Industrial Drive / Ingall Street. The intersections have again been assessed using *SIDRA Intersection 3.2* using the base layouts.

Industrial Drive / George Street – With Link Road

The results of the assessment for the AM and PM peak hour in 2034 with the inclusion of the proposed concept traffic and internal link road are shown in **Table 9-30** and **Table 9-31** respectively.

Table 9-30: 2034 AM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	988	B	0.553	20.1	109
George St (E)	90	C	0.200	36.2	21
Industrial Drive (N Leg)	1,584	B	0.845	27.7	213
George St (W)	94	C	0.154	34.5	19
All Vehicles	**2,756**	**B**	**0.845**	**25.5**	**213**

Source: AECOM, 2010

Table 9-31: 2034 PM Peak Intersection Performance, Industrial Drive / George Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,358	C	0.871	33.8	218
George St (E)	172	C	0.436	38.1	51
Industrial Drive (N Leg)	1,260	B	0.770	24.4	162
George St (W)	58	C	0.074	31.4	10
All Vehicles	**2,848**	**C**	**0.871**	**29.9**	**217**

Source: AECOM, 2010

The results show that inclusion of traffic associated with the proposed concept is likely to have a negligible impact on the Industrial Drive / George Street intersection as the intersection is likely to perform at LOS B and LOS C in the AM and PM peak respectively. The intersection continues to operate with spare capacity in the future scenarios with development and the internal link road and therefore no specific mitigation measures would be required.

Industrial Drive / Ingall Street – With Link Road

The results of the assessment for the AM and PM peak hour in 2034 with the inclusion of traffic associated with the proposed concept are shown in **Table 9-32** and **Table 9-33**, respectively.

Table 9-32: 2034 AM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	176	D	0.622	48.6	53
Industrial Drive (E Leg)	1,282	B	0.660	21.0	153
Ingall St (N Leg)	118	D	0.767	45.3	37
Industrial Drive (W Leg)	2,013	B	0.765	17.6	207
All Vehicles	**3,589**	**B**	**0.769**	**21.2**	**207**

Source: AECOM, 2010

Table 9-33: 2034 PM Peak Intersection Performance, Industrial Drive / Ingall Street – With Development Traffic and Link Road

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	190	D	0.563	49.9	79
Industrial Drive (E Leg)	1,742	F	0.965	72.4	518
Ingall St (N Leg)	264	F	0.938	73.0	108
Industrial Drive (W Leg)	1,478	C	0.947	34.3	211
All Vehicles	**3,674**	**D**	**0.965**	**56.0**	**518**

Source: AECOM, 2010

The results indicate that the Industrial Drive / Ingall Street intersection is likely to operate satisfactorily at LOS B and with approximately 23 percent spare capacity in the AM peak hour under the future development scenario. In the PM peak, the intersection is likely to perform close to capacity and at LOS D, which is still considered to be operating acceptably, although this would need to be monitored in the future.

To reduce the impact of the development on the Ingall Street intersection, diverting employee vehicles exiting the site in the PM peak to the George Street intersection should be considered. Analysis indicates that the Industrial Drive / George Street intersection has spare capacity and therefore this is a viable option.

With this management system in place the Ingall Street intersection is likely to continue to perform at LOS D in the PM peak, however the Ingall Street northern approach and Industrial Drive eastern approach experience improved level of service and increased spare capacity.

Diverting all employee traffic to the George Street intersection in the PM peak has a negligible impact on the intersection as this intersection continues to perform satisfactorily at LOS C and with spare capacity. **Table 9-34** and **Table 9-35** show the intersection performance results with this additional management system in place in the PM peak hour.

Table 9-34: 2034 PM Peak Intersection Performance, Industrial Drive / George Street – With Link Road and Employee Traffic Diversion

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Industrial Drive (S Leg)	1,358	C	0.871	33.8	218
George St (E)	208	C	0.497	38.3	58
Industrial Drive (N Leg)	1,260	B	0.770	24.4	162
George St (W)	58	C	0.074	31.4	10
All Vehicles	**2,884**	**C**	**0.871**	**30.0**	**217**

Source: AECOM, 2010

Table 9-35: 2034 PM Peak Intersection Performance, Industrial Drive / Ingall Street – With Link Road and Employee Traffic Diversion

Location	Demand Flow (veh/h)	Level of Service	Deg of Satn (v/c)	Aver Delay (sec)	95% Back of Queue (m)
Ingall St (S Leg)	190	D	0.547	50.2	77
Industrial Drive (E Leg)	1,742	D	0.934	51.6	420
Ingall St (N Leg)	228	E	0.916	62.4	81
Industrial Drive (W Leg)	1,478	C	0.922	31.7	189
All Vehicles	**3,638**	**D**	**0.934**	**44.1**	**420**

Source: AECOM, 2010

Broader Road Network Impact Analysis

The proposed concept is expected to generate 1,425 trucks per day (2,850 truck movements per day) and 300 employee vehicles per day (600 employee vehicle movements per day) when complete in 2034.

Table 9-36 shows the additional truck and vehicle movements as a proportion of the 2034 two-way AADT along roads in the broader road network.

The 2034 two-way AADT was calculated by applying the historical growth factor at each count location. **Figure 4-5** in **Appendix D** shows the count location. It has been assumed that 80 percent of truck movements would originate from north of the site and 20 percent of truck movements would originate from south of the site, as per the assumed distribution in the intersection impact assessment. It has also been assumed that 50 percent of traffic would access/egress Kooragang Island via Tourle Street and Cormorant Road.

Table 9-36: Development Traffic Movements as a Proportion of 2034 AADT

No.	Road	Location	2034 Two-way AADT	Development Two-way Vehicle Movements per Day	% of 2034 AADT
1	Pacific Highway	Tomago, 1 km north of Hunter River	101,756	690	0.7
2	Pacific Highway	Hexham, south of New England Hwy	86,768	1,380	1.6
3	Industrial Drive	Mayfield, west of Werribi Street	59,641	1,380	2.3
4	Industrial Drive	Mayfield, north-west of Woodstock St	34,188	2,760	8.1

No.	Road	Location	2034 Two-way AADT	Development Two-way Vehicle Movements per Day	% of 2034 AADT
5	Tourle St / Cormorant Rd	Mayfield, north of Industrial Drive	26,386	1,380	5.2
6	Tourle St / Cormorant Rd	At Stockton Bridge	32,158	1,380	4.3
7	Industrial Drive / Hannell St	Wickham, north of Greenway St	51,307	690	1.3
8	Pacific Highway	Newcastle West, north of Parry St	43,737	690	1.6
9	Pacific Highway	Newcastle West, north of Hebburn St	26,175	690	2.6

Source: AECOM, 2010

The table indicates that the trucks and vehicles generated by the proposed concept would be a small proportion (less than10%) of the AADT on the broader road network in 2034 and so is considered to have a minimal impact on the broader road network.

Local Road Network Impact Analysis

A detailed assessment of the impact of the proposed concept on the condition and geometry of the local road network has not been undertaken at this stage. It is recommended that such an assessment be carried out as part of detailed Project applications and that precinct operators be required to demonstrate the impact of heavy goods vehicles on the pavement condition and geometry of the local road network. This would include swept path testing of the type of heavy vehicles that the operators are proposing to use on the access routes in and out of the site.

In regard to the lane capacities of the local road network, in 2034 the maximum predicted peak hour one way traffic flow is in the order of 240 vehicles (150 trucks and 90 employee vehicles) entering the site in the morning peak hour (assuming 70 percent of truck traffic enters in the AM peak hour). Using Austroads, *Guide to Traffic Management Part 3: Traffic Studies and Analysis 2009*, the theoretical capacity of a single traffic lane on the local road is approximately 1,100 vehicles per hour (assuming level grade, 3.7-metre wide lanes, 2-metre lateral clearance on each side and 62.5 percent Heavy Goods Vehicle traffic composition 150 trucks out of 240 vehicles).

With minimal existing traffic on the local roads such as Selwyn Street, the total predicted volume of traffic generated by the proposed concept in 2034 is within the mid-block capacity of the existing local road network and capacity exists to accommodate additional traffic generated by development of adjoining sites such as IIP that may occur in the future.

Impact on Road Network Due to Rail Crossings

The railway line proposed through the site crosses the local road network at locations on Selwyn Street and a new western road / rail level crossing, which would provide access to the north west portion of the site.

Provided the new western level crossing is located more than 65 metres from the toes of the points for the new rail siding (on the western side), then the locomotives shunting back on the OneSteel road would turn back prior to reaching the level crossing, meaning that the only rail traffic crossing the new level crossing would be OneSteel traffic. This crossing would be closed for approximately two to three minutes while trains enter or leave the OneSteel site.

For the Selwyn Street level crossings, two scenarios are possible. Approximately 80 percent of the time, it is expected that trains entering Mayfield would travel through the level crossing and be broken up in the new rail sidings within the port site. This will mean a closure of approximately five to six minutes while trains enter or leave the Mayfield site. For the other 20 percent of the time, if the new rail sidings are occupied, then trains may have to be held and broken up in the Morandoo Sidings (number 4 and 5 roads) outside of the Mayfield site, and brought in one half at a time.

Queues would build up during these closures; however, the gap between closures is expected to be in excess of 10 to 15 minutes, which would allow the queue to dissipate before the next closure occurs. As a worst case scenario, a maximum closure time of six minutes has been assumed and tested.

The proposed concept is expected to generate a total of 71 truck movements per day time hour and 214 truck movements per peak hour. Of the AM and PM peak hour trucks, 121 and 69 respectively are assumed to use the Ingall Street / Industrial Drive intersection, while 29 truck movements are assumed to use the George Street / Industrial Drive intersection in the AM peak hour and 16 truck movements in the PM peak hour. This is based on the initial assumption that the Container Terminal Precinct truck traffic would use the Ingall Street intersection, which is a worst case scenario for the new western crossing.

As a worst case scenario for the Selwyn Street crossing, it was re-analysed with the link road in place and the Container Terminal truck traffic using the George Street intersection. The impact on the western crossing would be greatly reduced as the traffic volume is greatly reduced by redirection of the Container Terminal truck traffic. **Table 9-37** shows the resulting number of trucks per minute at each intersection during the peak hours and associated queue lengths assuming the rail crossings are blocked for a maximum of six minutes and a standard truck length of 12.5 metres.

Table 9-37: Rail Crossing Queue Lengths

Intersection	Truck Movements Per Peak Hour	Truck Movements Per Minute[1]	Queue Length (Trucks)	Queue Length (m)
New western crossing AM peak hour	121	2	12	150
New western crossing PM peak hour	69	2	12	150
Selwyn Street AM peak hour	29	1	6	75
Selwyn Street PM peak hour	16	1	6	75
Selwyn Street AM peak hour (with link road)	144	3	18	225
Selwyn Street PM peak hour (with link road)	82	2	12	150m

Source: AECOM, 2010

[1] Truck movements per minute are rounded up to the nearest whole truck

From **Table 9-37** the maximum queue length at the Selwyn Street and western crossings are expected to be 75 metres and 150 metres respectively, although the queue length at Selwyn Street would increase to 225 metres if a link road was introduced. On the basis of this analysis the closing of the rail crossings is not expected to have an impact on the George Street / Industrial Drive intersection and Ingall Street / Industrial Drive intersection in either peak hour as they are 600 metres and 750 metres from the rail crossings, respectively.

Queuing within the site would need to be managed within the internal road network. Traffic planning for the future IIP would also need to be cognisant of queuing traffic from the level crossings in terms of access in and out of this site. This may be managed through road markings, lane widening to accommodate truck queues or active traffic management.

9.1.4 Mitigation Measures and Conclusion

The likely future road network impacts are:

- Industrial Drive / George Street intersection appears to operate satisfactorily in the future under both initial (600,000 TEU per annum) and final operations development (1 million TEU per annum) scenarios.
- Industrial Drive / Ingall Street intersection is likely to exceed capacity in the PM peak hour under the proposed initial operations development scenario (2024), while operating satisfactorily in the AM peak hour.
- Industrial Drive / Ingall Street intersection appears to operate satisfactorily in the future under initial and final operation development scenarios (2024 and 2034) if an internal link road between the precincts and a Traffic Management Plan (TMP) is implemented to channel more traffic to the Industrial / George Street intersection which has available capacity.

These conclusions are based on the assumptions on trip generation, distribution and assignment available at the Concept Plan phase. These assumptions can be reviewed to test their appropriateness at the Project application phase once more detailed information is available.

The majority of the impact on the Industrial Drive / Ingall Street intersection is due to all of the Container Terminal Precinct traffic using the intersection for access. It is recommended that a link road in the internal road network be introduced to enable this traffic to be redirected to the Industrial Drive / George Street intersection, allowing use of the available road and intersection capacity. It is recommended that a TMP is developed for the entire site to ensure that this distribution is enforced. Alternative management options may also be viable provided that it can be demonstrated that the intersections can still operate satisfactorily. Project applicants would be responsible for preparing individual TMPs, consistent with the TMP for the overall site.

The volume of traffic from the proposed concept is predicted to be within the mid-block capacity of the local road network. The truck queuing associated with operation of the railway crossings has also been demonstrated to be within the capacity of the local road network, although impacts on the local road network and access to adjoining properties in the area would need to be managed.

It is recommended that as part of detailed Project applications, precinct operators should be required to assess the impact of heavy goods vehicles on the road pavement condition of the local road network and confirm that the types of vehicles proposed for use can be accommodated with the road geometry.

Workplace Travel Plans should be considered in the future Project applications for the individual terminals/precincts, when these are made by the prospective operators of the facilities, with attention given to promoting access by walking, cycling and public transport. This would reduce the impact made by employee traffic.

9.2 Rail Transport

9.2.1 Existing Environment

The detailed rail assessment is included as **Appendix D**.

Newcastle Port is currently served by two distinct rail loops – Kooragang Island and Port Waratah.

Kooragang Island is one of the busiest coal handling facilities in the world, connected via Kooragang Island Junction to the Main North Rail Line, and via Sandgate grade separation to the coal lines leading into coal mining districts in the Hunter Valley. For the purposes of this study, Kooragang Island and the Hunter Valley Coal chain will not be considered, except where it impacts on services to Port Waratah.

Port Waratah Loop is a smaller coal handling facility, but also has a grain export facility that can be very heavily utilised in certain periods of the year. Port Waratah Loop is connected to the Main North Rail Line via Islington Junction. There are a number of sidings and facilities connected to Port Waratah Loop, namely:

- Port Waratah Coal handing facility
- Brambles Sidings
- Bullock Island Grain facility
- Pasminco Siding
- Grain Corp Grain loading facility
- Morandoo Sidings
- OneSteel Sidings

All of the above are connected to the Main North via Islington Junction, and two roads (Arrival Road and Storage Road 1). The Arrival Road services all but the Morandoo sidings and OneSteel, which are accessed via Storage Road 1.

A typical move for trains entering either facility from Sydney, is to head north on the Down Main, through Broadmeadow, moving across Islington Junction, then cross the Clyde Street Level crossing, before turning into the arrival roads for the Port. Trains then cross from the Arrival Road onto Storage Road 1, and then onto Storage Road 2, before entering the Morandoo Sidings.

The Morandoo Arrival Road Links to the old BHP Billiton sidings (currently in use by OneSteel) and the link between the Morandoo and OneSteel Sidings are the subject of this study.

The proposed concept site is connected to Port Waratah Loop via the One Steel Arrival Road (refer to **Figure 9-2**). This siding, which will be used for any rail freight movements from the new berths, is currently used by OneSteel. The OneSteel site appears to be in use as an intermodal, with evidence of steel coils being transferred from rail wagons to trucks. This siding currently operates as a single siding, with no signalling control or separation for trains within the siding, so all operation is at 15 kilometres per hour maximum by shunt manoeuvre. OneSteel currently operates up to three trains in and out of their site per day.

9.2.2 Impact Assessment

Proposed Initial Operations (2024)

Rail Access

Use of the Main North Corridor depends very much on the price of petrol (and hence rail's share of the freight demand), coal, and demand for import and export for goods. The corridor is heavily utilised; however, initial discussions with RailCorp and ARTC indicate that there may currently be 4 available train paths per day. This is likely to be one prior to the morning curfew, one post morning curfew, one prior to the afternoon curfew, and one post the afternoon curfew. This would mean that two trains may arrive at the port in short succession (post morning and prior to afternoon curfew) and a holding road may be required at the port to hold the next incoming train while the loading and unloading takes place.

A joint discussion needs to take place with ARTC and RailCorp, in order to verify the exact paths that would be available on the Main North Corridor.

It is important to note that in the long term, the Northern Sydney Freight Corridor project will create 80 train paths per day, independent of the Metropolitan Passenger Network, and the concept of curfews would disappear. Access to Sydney would then be virtually unrestricted.

Rail Demand Generation and Distribution

For the purposes of this study, the following is assumed:

- Calculations are based on the trade forecasts given in **Table 9-15** in **Section 9.1**. It is assumed 60 percent of containers are exported and 40 percent are imported.
- The source and destination for all trade is Sydney, except for coal which is assumed to be the Hunter Region. At this point no trade from the North Coast or the Hunter Region has been identified, other than boutique coal.
- Train loads are based on the operating manual for the Main North Line. Class 81/82 locomotives would be used, pulling a maximum load of 1,130 tonnes per locomotive. Given the restriction in operating space within the Port, a typical train length of around 800 metres is likely to be operated (this has been discussed and agreed with ARTC).
- The current standard train consist for both Queensland Rail Freight and Pacific National is a 1,244-metre freight train consisting of two 600-metre wagon rakes and two locomotives. Due to the gradients around Cowan Bank, this length of train is not actually achievable on the Main North Line; therefore the facilities would also be designed to cope with shorter more frequent services.

The demand can be split into Bulk, General and Container freight. Bulk freight typically operates at the maximum axle load limit for the rail line, which in this case is 25 tonnes per axle. General freight typically operates at around half that figure. Container freight tends to include a lot of empty container transfers, so the loads are mixed. Typical average container weights are 15 tonnes export, and 10 tonnes import. The number of trips has been assumed based on a typical train consist.

Using the above, the predicted number of train paths required is:

- **Boutique Coal from Hunter Region.** 150,000 tonnes per annum, by rail via the Hunter Region. A typical Hunter Region train is three locomotives and 91 wagons, and can move 6,825 tonnes per train, therefore the number of trains is negligible at 0.08 trains per day (two trains per month).

- **Bulk from Sydney (coke and dry bulk storage).** 187,500 tonnes per annum by rail via Sydney and the Main North Line. A bulk freight train will be shorter than a container train because of the higher axle load per wagon. It is assumed that a bulk train will be made up of three locomotives and 33 wagons (the train consist is limited by the 1,130 tonnes load per locomotive limit on the Cowan Bank), the train length is approximately 700 metres and a freight load is 2,516 tonnes per train, therefore this requires 0.25 trains per day (75 trains per year).
- **General freight from Sydney.** 300,000 tonnes per annum via the Main North Line. Trains are likely to be two locomotives and 39 wagons, for a total length of 787 metres, with a total load per train of 1,462 tonnes. This requires 0.65 trains per day (157 trains per annum).
- **Container Export.** The freight demand for initial operations (2024) is 600,000 TEU, 20 percent are moved by rail. Therefore 120,000 TEU to be imported and exported. Assume 60 percent export, therefore 72,000 TEU per annum move via the Main North Line. Train size is likely to be 766 metres (38 wagons and two locomotives), which can take 114 TEUs per train. Therefore 2.01 trains per day are required to move the containers to and from Sydney (631 trains per annum).
- **Container Import.** 48,000 TEU per annum via the Main North Line. Assuming the same train as before therefore requires 1.33 trains per day. It is assumed that this is incorporated into the units going to Port of Newcastle for exports to save on paths as well as loading and unloading times.

Therefore, the proposed concept would require approximately three trains per day running into the site for the initial operations scenario in 2024. It is important to note, that this has been calculated assuming 315 operating days per year for rail (due to track closures, possessions etc).

Rail Operation

Train loading and unloading time for the proposed concept would be based on the worst case train configuration, which is a 766-metre train. This is as follows:

- Train break in half into two x 520-metre long sidings = 0.5 hours
- Unload 114 containers = 1.2 hour
- Load 76 containers = 0.8 hours
- Inspect Wagons = 1 hour
- Test locomotive = 0.5 hours
- Test brakes = 0.25 hours
- Reform train to 766m = 0.5 hours
- Shunting manoeuvres = 0.5 hours

Therefore, the total time each train would be in the siding is 5.25 hours.

Based on the fact that there are three trains per day required for the initial operations scenario in 2024, and that time must be allowed for OneSteel trains (three per day) to move in and out of their facility, there needs to be a minimum of two new rail sidings provided within the site. In order to cut down the impact on OneSteel, the locomotives need to be stored in the sidings during loading and unloading, so the minimum siding length should be:

Rake length + two x locomotive length + 15 metres = 464 metres minimum.

Figure 9-2 shows the rail network within and immediately adjacent to the site and **Figure 9-3** provides a visual representation of the potential train operation. This shows that two sidings of around 520 metres in length can be accommodated within the site.

The envisaged operation is that a maximum length train of 766 metres would arrive via the number 6 road in the Morandoo Sidings and will cross over to the number 7 road via a new crossover and then onto the old BHP Billiton rail road, now called the OneSteel Arrival Road. Note that the number 7 road is currently disconnected in Morandoo Siding and therefore a new linking crossover would need to be constructed.

The train would enter the first of the loading sidings, such that the back of the train is clear of the Selwyn Street level crossing, but with the break point of the wagons still short of the siding points (i.e. still on the OneSteel access road). The back half of the train would then be broken off and temporarily parked, and the front half would be moved forward clear of the points and into the siding and parked. The locomotives would detach and leave the siding and run back around to pick up the back half of the rake, and that would be moved into the second siding and parked.

This leaves the OneSteel Arrival Road clear for OneSteel trains to enter and leave while the Port train is being loaded and unloaded. Given that there would be two trains in this section at any one time (i.e., one train in the OneSteel facility and one train in the Port sidings), it is possible that the OneSteel Arrival Road would need to be signalled.

The train is then reformed after loading by the reverse move carried out on entry. The entire consist is then reversed back over the Selwyn Street level crossing into the number 6 road in Morandoo Sidings, before leaving via the Port Waratah loop.

The above operation can be undertaken for the initial years of the port operation, while the freight task builds up. Once the freight task requires more than two trains per day (approximately 66 percent of initial capacity and 50 percent of final capacity), an exit road would need to be installed connecting to the Bullock Island Loop in order to deal more efficiently with the increase in train operations without having to make the reversing move back across Selwyn Street to the number 6 road in the Morandoo Sidings.

The Main North Line has limited available paths, and there would increasingly be a risk that trains entering the site are forced to arrive before the loaded trains have left and therefore they would need to be stored in the Morandoo Sidings. This would increase the risk of blockages to OneSteel, grain and coal trains as the entry road to Port Waratah Loop becomes congested and as a result scheduling of these train movements would be needed.

By the time the freight task increases to a point where three trains per day are required, an exit road connecting to the Bullock Island Loop would need to be installed to allow trains to leave the site.

This has two advantages. Firstly, it would reduce train cycling times by 30 minutes as the reversing move is removed, and trains can exit by going straight out of the loop, and secondly it allows two trains to arrive and be held in the Morandoo Sidings. One train would arrive and be broken into its two halves and stored in the number 4 and 5 roads, and the other can then wait on the number 6 (entry) road. This has huge operational advantages for ARTC and for the port, as use of the port loading facility can be maximised by ensuring that there is always a train waiting to enter.

The only issue with holding trains in the number 6 road is that it blocks OneSteel's access to its arrival road. Given that there are some hours between trains entering and leaving, this can be co-ordinated with OneSteel.

Operational Constraints

There are several operational constraints:

- OneSteel requires access to their facility, therefore the Morandoo Arrival Road (road number 13) and the OneSteel Arrival Road need to be kept clear. This means that trains cannot be parked in the number 6 road on arrival for any length of time, as they are too long for the siding and would block access and egress for OneSteel trains. If a Port train needs to be held in Morandoo Sidings for some hours while it waits for entry into the site, then it would be broken in two and parked in the number 4 and 5 roads in the Morandoo Sidings. If it is only a short term park, then the number 6 road can be used and potential conflict with OneSteel trains can be easily managed by scheduling these train movements.
- Selwyn Street level crossing sits between the Morandoo Sidings and the site. The level crossing would be closed for only relatively short periods of time (five to six minutes per train movement) while trains enter and exit the site. The impact on Selwyn Street is that the level crossing would close for five to six minutes at a time, up to 10 times per day. This is three OneSteel trains entering and leaving, and two trains associated with the proposed concept, entering and leaving. This crossing would likely need to become a full barrier as a minimum and an ALCAM assessment should be undertaken once vehicle numbers have been properly identified.

- The new western road crossing of the railway line that would be required to service the Container Terminal and Bulk Liquid Precincts may also require treatment to separate road and rail movements. If this crossing is kept more than 65 metres from the toes of points for the siding (on the western side), then the port train locomotives shunting back on the OneSteel Arrival Road would turn back prior to reaching the level crossing, meaning that the only rail traffic crossing the new level crossing would be OneSteel trains (three trains per day).
- The Main North Line operates under a freight train curfew during the peak hours. This means that running trains between Newcastle and Sydney needs to be carefully planned. It is quite possible that this curfew would cause path restrictions to Newcastle. This issue should be discussed with ARTC and RailCorp.
- This freight train curfew would be removed when the North Sydney Freight Corridor Upgrade project is completed but this is likely to occur in a medium/longer term timeframe.
- Use of the Morandoo Arrival Road would require a discussion to take place with Pacific National to ensure that the siding is available for use.

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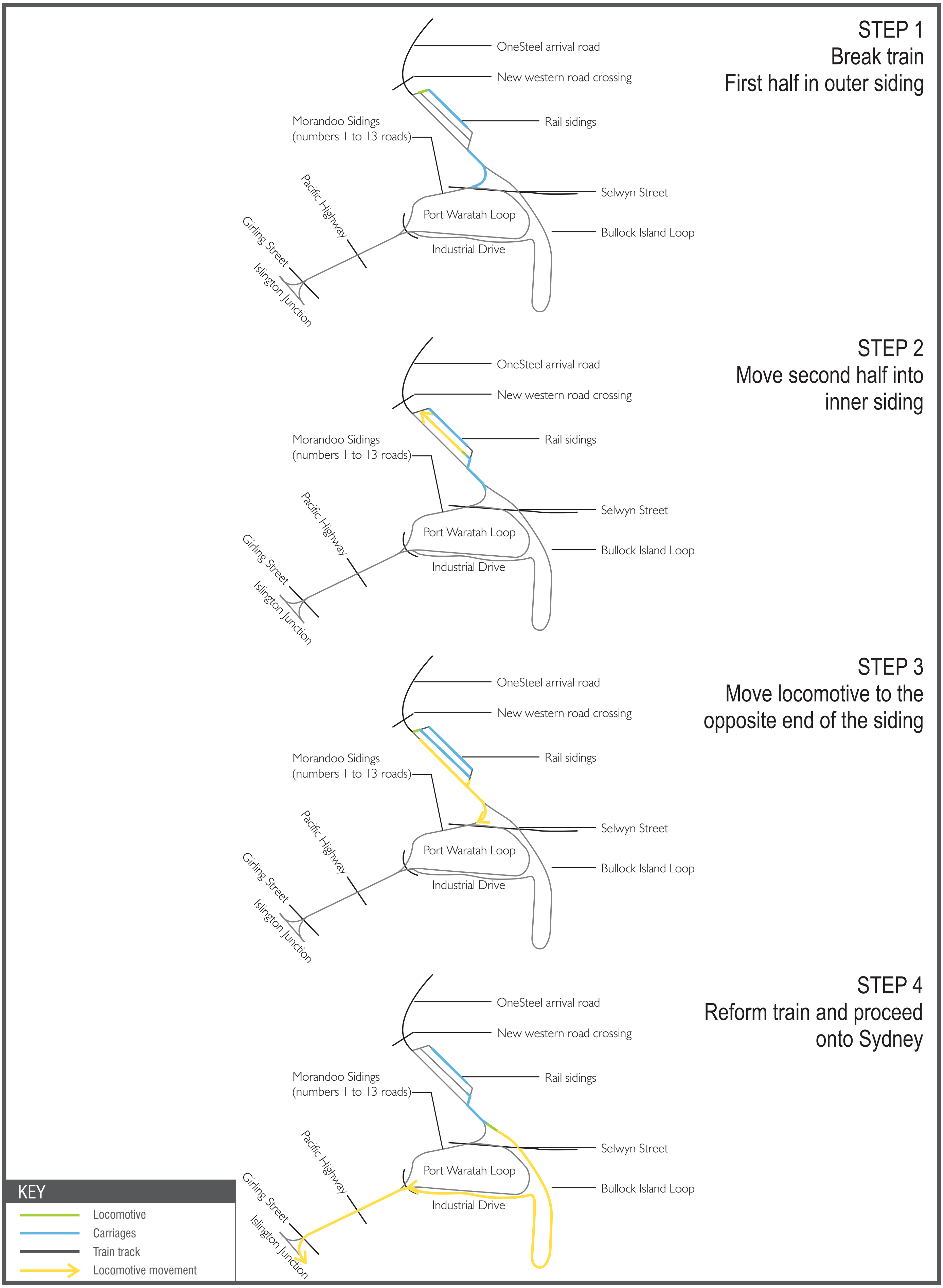

AECOM

TRAIN MOVEMENTS

Environmental Assessment

Mayfield Site Port-Related Activities Concept Plan

Figure 9-3

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Proposed Final Operations (2034)

Rail Demand Generation

The increase in container freight operations to 1 million TEU under the final operations condition (2034) requires the addition of 1.3 additional freight trains per day into the site. The total number of trains now entering the sidings would be 4.4 trains per day. This means that the sidings would be occupied for 21 hours of each day.

There is an increased risk that, due to the curfew on the Main North line, trains would stack up at the site. A likely scenario is that a train arrives before the morning curfew (7 AM) and enters the sidings. A second arrives 4 hours later (11 AM) and holds for 2 hours waiting to enter the sidings. A third then arrives 4 hours later (3 PM) and holds for 2 hours waiting to enter the sidings. This last train of the day would load up and leave after the curfew.

Once the Northern Sydney Freight Corridor (NSFC) is in operation, this would no longer be an issue, as trains can be timetabled to arrive at the correct time of day for entry into the port without holding on the Morandoo Siding.

It is worth noting that the NSFC is currently being implemented, therefore it is likely that this project will be in place before the port facility reaches the 1 million TEU case in 2034.

It is assumed for the purposes of the 2034 case that the NSFC has been built. The number of trains able to access the site becomes (to all intents and purposes) unrestricted, and train lengths improve up to the limit of the siding space available in the site. This is because the gradients on the Cowan Bank will be improved and the trains can be lengthened. This equates to a 12 percent increase in handling capacity per train. Therefore, the base case of 4.4 trains has been improved to 3.9 trains in 2034 due to the above 12 percent increase in handling capacity per train.

Rail Operation

The envisaged operation for the 1 million TEU final operations scenario is essentially the same as that outlined for the 600,000 TEU initial operations (more than two trains per day). The train would be pulled into the site, and then broken into two and shunted into the two 520-metre sidings for loading and unloading. The train is then reformed after loading, in the same manner, before leaving via the new exit road to the Bullock Island Loop.

In this configuration the train can be pulled into the site and internal shunting manoeuvres can occur without unduly impacting on the Selwyn Street railway crossing or the new western road crossing of the railway line that would be required to service the Container Terminal and Bulk Liquid Precincts.

The timeframe for reaching the final operations scenario is likely to be such that the North Sydney Freight Corridor project has been completed and therefore the current curfew restrictions on the operation of the Main North Rail Line would be removed.

At the final operations scenario in 2034 (up to 1 million TEU per annum) and 3.9 trains per day, it may be necessary to use the Morandoo Siding (number 6 road) to park a train while waiting for the above shunting and loading and unloading operations to be completed. As the use of this siding may temporarily block access to OneSteel, it is suggested that this should be discussed and agreed with OneSteel.

9.2.3 Conclusion and Mitigation Measures

The likely future rail impacts are:

- Two new 520-metre rail sidings would be required in the site. The sidings would need to be separated to allow reach stacker movement either side of wagons and connected at both ends to allow shunt manoeuvres;
- A new crossover to be installed between number 6 and 7 roads in the Morandoo Sidings (required for initial operations);
- The existing OneSteel siding may need to be re-signalled to allow multiple train movements (required for initial operations);
- The Selwyn Street railway crossing would need to be assessed for treatment to separate rail and road movements, although a full barrier would likely be required (required for initial operations);
- The new western road crossing of the railway line that would be required to service the Container Terminal and Bulk Liquid Precincts may also require a suitable treatment to separate road and rail movements (required for initial operations); and

- It is likely that an exit road from the site onto the Bullock Island Loop would be required once more than two trains per day can be run.

There is no impact to the current operation of the Port Waratah rail facilities, or to OneSteel, in the initial operations scenario (600,000 TEU per annum), and minor impacts to OneSteel in the final operations scenario (1 million TEU per annum). These impacts can be overcome by agreeing a timetable of operation within the Morandoo Siding and OneSteel Arrival Road, and no further infrastructure is likely to be required.

A Train Operations Plan would be prepared by NPC to manage train operations within the Morandoo Yard and the site.

Should there be changes to the modal splits for freight demand beyond the base cases that have been modelled then further assessment of the rail impacts would be required and further upgrades to rail infrastructure within the site and on the local rail network would in all likelihood be required.

9.3 Noise and Vibration

9.3.1 Existing Environment

Ambient Noise Levels

The noise assessment is presented in **Appendix E**.

The site's surrounding areas of interest with respect to generation of noise are:

- Kooragang Island which has significant heavy industry and port facilities to the north and east;
- Carrington industrial area to the south; and
- Vacant land known as the future IIP to the west.

The nearby residential areas potentially affected by noise from the site are Mayfield, Carrington and Stockton.

Noise monitoring in the Mayfield and Carrington residential areas has been conducted to determine the existing ambient noise levels of these residential areas. Long term ambient noise levels have been monitored at the surrounding residences as detailed in **Table 9-38** and shown on **Figure 9-4**.

Table 9-38: Noise Monitoring Locations

Noise Monitoring Location	Address	Monitoring Period	Comment
A	1 Arthur Street, Mayfield	18 to 24 March 2009	N/A
B	2 Crebert St, Mayfield	24 to 29 September 2009	Subject to traffic noise from Industrial Drive
C	32 Elizabeth Street, Carrington	18 to 26 March 2009	Adjacent to industrial facilities in Carrington

Table 9-39 summarises the noise monitoring results for the daytime, evening and night time periods as defined in the NSW DECCW *NSW Industrial Noise Policy* (INP). The summary values are:

- $L_{Aeq,Period}$ – The overall L_{Aeq} noise level measured over the assessment period. The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is a common measure of environmental noise and road traffic noise; and
- RBL – The Rating Background Level is a measure of typical background noise levels which are used in determining noise criteria.

Table 9-39: Summary of Measured Noise Levels

Noise Monitoring Location	RBL (dBA)			$L_{Aeq,period}$ (dBA)		
	Daytime 7 AM-6 PM	Evening 6PM-10 PM	Night Time 10 PM-7 AM	Daytime 7 AM-6 PM	Evening 6PM-10 PM	Night Time 10 PM-7 AM
A	46	47	46	53	53	50
B	49	42	40	69	65	60
C	44	43	39	57	54	46

Based on previous assessments of noise impacts on Stockton from industry on Kooragang Island, the following RBLs have been determined for Stockton (shown on **Figure 9-4** as Location D):

- Daytime - 41 dBA
- Evening - 43 dBA
- Night - 43 dBA

The following sections describe the noise characteristics of the residential areas near the site.

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