Coal & Allied Industries Limited

Lower Hunter Lands Project

Black Hill & Tank Paddock

Traffic and Transport

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Appendices

1 Introduction

1.1 Background

It is proposed that the entire Coal & Allied Industries Limited (Coal & Allied) owned Black Hill and Tank Paddock sites be rezoned/listed as a 'State Significant Site' (SSS) in Schedule 3 of State Environmental Planning Policy (Major Development). A draft Schedule 3 listing will be prepared with the Concept Plan Application.

The Concept Plan will apply to the entire 183ha Black Hill and the 147ha Tank Paddock sites and 398 ha of the Stockrington site. The key parameters for the future development of the sites are as follows:

- Dedication of 545ha of conservation land to the New South Wales Government (NSWG) that is identified in the Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan, comprising 100% of the Tank Paddock site and 398 ha of the Stockrington site.
- Use of the 183ha Black Hill site as 'employment lands' for a range of employment generating activities.
- Indicative development staging. The number of lots and extent of staging for release areas will be largely dictated by the service infrastructure requirements as well as responding to market forces.
- The provision of associated infrastructure.

Approval will not be sought under the Concept Plan for a specific lot or road layout. An indicative super lot layout will be prepared, which will indicate how subdivision could be achieved that will enable a range of industrial and ancillary activities to be undertaken.

An existing mining consent under the Black Hill site will defer development on the site until post June 2013. Accordingly, a detailed built form layout has not been prepared at this stage. Approval is not sought under the Concept Plan for subdivision or for individual buildings on the site. Urban Design Guidelines will be prepared to inform the Concept Plan in respect of urban form, built form, open space and landscape, access and movement and visual impact for the site.

It is proposed to dedicate land for conservation purposes as part of the Major Project Application via a Voluntary Planning Agreement (VPA) between Coal & Allied and the NSWG in accordance with s.93F of the Environmental Planning & Assessment Act, 1979 (EP&A Act).

The proposed Concept Plan and a Plan showing the proposed development areas and conservation areas is included in the Environmental Assessment (EA) prepared by Urbis.

1.2 Proposal

Black Hill employment lands are located within the boundary of Newcastle City Council. The site is bounded by John Renshaw Drive to the north, F3 Freeway to the east, Catholic Church owned land to the west and privately owned lands to the south. Access to the Black Hill site can be gained from the F3 Freeway using the existing Boral site access (tenants of Coal & Allied). The site is relatively flat. Viney Creek runs south to north, and divides the site in half. There is a major electrical easement along the northern and western portions of the site.

The Black Hill development area consists of approximately 183 hectares adjacent and south west of the intersection of the F3 Freeway and John Renshaw Drive. The proposed development for the site centres on the creation of employment land and a suitable subdivision to achieve this outcome. The estimated gross leasable floor area (GLFA) achievable at Black Hill is approximately 800,000 square metres with the potential to create at least 3,000 full time jobs. Employment uses will be supplemented with suitable retail and recreation facilities, and services to cater for the local employees. It is anticipated that the site will be developed over approximately 17 years depending on market demand for employment land in the Hunter Region. The site is expected to be operational from year 2016.

1.3 Director General's requirement

The Director-General's Requirements (DGRs) for the subject land were issued on the 19th of August 2010 and are summarised as follows:

(1) Detail and justify the site access arrangements for the site, including how the proposed development will proceed and alternatives to the proposed access onto the F3 Freeway.

(2) Include a traffic study prepared in accordance with the RTA Guide to Traffic Generating Developments, which addresses:

(a) All relevant vehicular traffic routes and intersections for access to/from the subject area;

(b) Current traffic counts for all of the above traffic routes and intersections;

(c) Anticipated additional vehicular traffic generated from the proposed development and associated trip distribution on the road network;

(d) Consideration of the traffic impacts on existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicle traffic generated by the proposed development. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area;

(e) Details of the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network;

(f) Intersection analysis as well as a micro simulation model shall be submitted to determine the need for intersection and mid-block capacity upgrades, as well as ensure traffic signal co-ordination,

(g) Consideration of impacts on existing property access.

(h) Impact of Hunter Expressway and the proposed F3 to Raymond Terrace link.

(i) Impacts on regional road networks during construction and operation. Assessment should be based on expected level of employment generation.

(j) Traffic management and proposed access from the wider road network as well the opportunities and constraints of alternative vehicular access points.

(k) Measures to introduce and promote public transport usage and mode share including pedestrian and cycle access within and to the site that connects to all relevant transport services and key off-site locations, having regard to the NSW Planning Guidelines for Walking and Cycling (2004) and the NSW Bike Plan (2010).

(l) Road design to cater for heavy vehicles associated with freight movement.

(3) Assess the proposal against the objectives of the Integrating Land Use and Transport Policy packages.

Coal & Allied commissioned Hyder Consulting Pty Ltd (Hyder) to carry out the traffic study to address the DGR's and examine the traffic and transport issues associated with the concept plan of the subject site. Hyder has consulted the various state and local government planning policies and instruments that may apply to this study. Hyder met with the RTA on 17 September 2010 and discussed issues and traffic works in relation to the above DGRs'.

1.4 Study area

The subject Black Hill site is located in Newcastle local government area. The site is located to the south of Beresfield and has a frontage to the Sydney-Newcastle Freeway (F3) to the east, is located to the south of John Renshaw Drive (the site does not have any frontage to John Renshaw Drive) and Newcastle LGA boundary to the west in Black Hill. Black Hill Road is classified as a local road.

Figure 1-1 shows the regional road network that provides access to the Black Hill site. As an employment area governed by development goals identified in the Lower Hunter Regional Strategy (LHRS), Black Hill site will draw employees from residential areas around Maitland and Newcastle. The LHRS strategy, prepared by the NSW Department of Planning, promotes developing a hierarchy of employment centres for the Lower Hunter area, with associated hierarchies for transport corridors and housing.

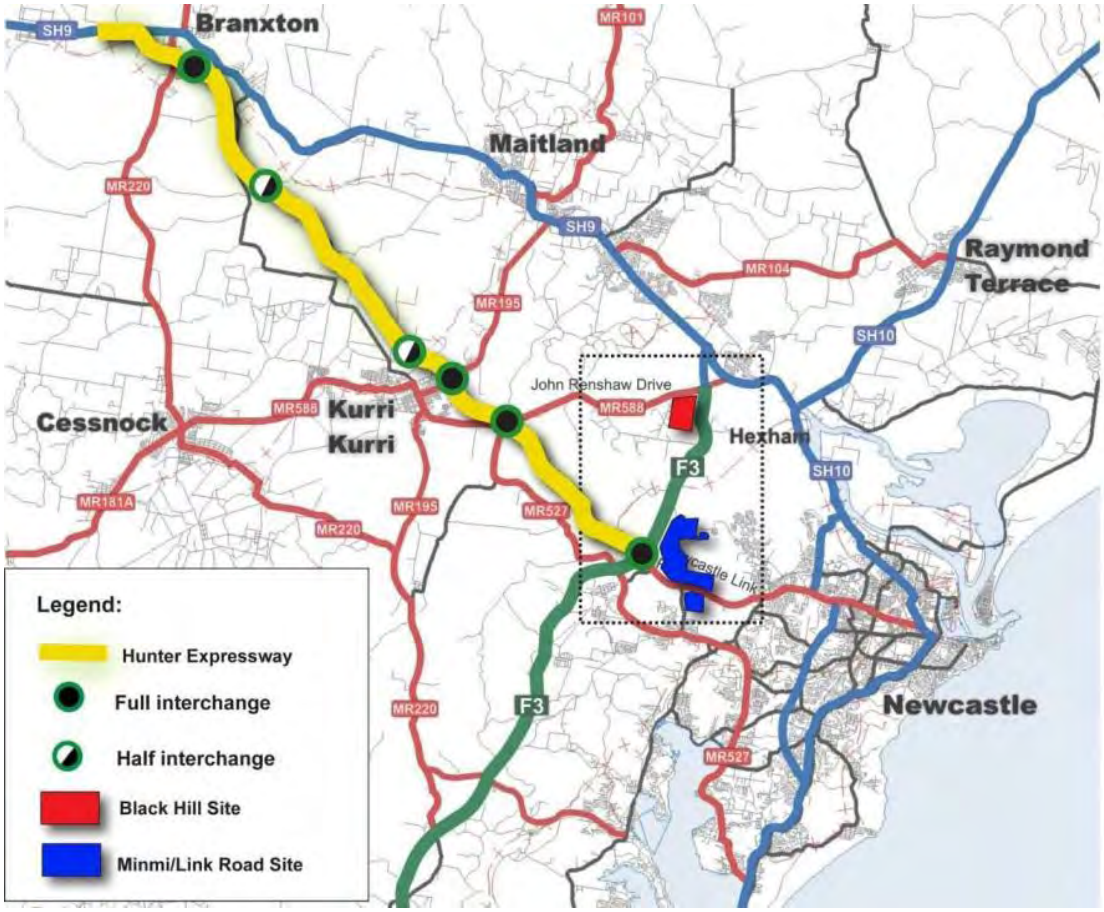

Figure 1-1 Regional road network in the context of Coal & Allied Northern Estates developable

1.5 Study objectives

The purpose of the traffic study is to assess existing traffic patterns, undertake traffic projections for the study area and to assess the traffic implications of the proposed Black Hill development on the surrounding road network. Key specific purposes were to:

- Address the Director-General's Requirements (DGRs) specifically for Traffic and Transport.
- Assess the overall impact of the proposed employment developments on the road network considering traffic data at all relevant vehicular traffic routes and intersections.
- Identify key access points for the proposed development considering the existing constraints and opportunities from the perspective of both traffic and road safety.
- Determine the capacity of key intersections providing access & egress for the proposed development.
- Estimate additional development traffic based on RTA supplied traffic generation rate applicable for the Black Hill site. Hyder also consulted the RTA's Guide to Traffic Generating Developments (2002) and recent trip generation survey data obtained from similar employment sites in the Lower Hunter.
- Use RTA's Lower Hunter Transport Model (LHTM, TransCAD) to estimate impact at key access points with the F3 Freeway and John Renshaw Drive. The assessment considered impact of Hunter Expressway and the proposed F3 to Raymond Terrace Link. Hyder used Paramics and SIDRA modelling software to assess the existing and future intersection performance.
- Analyse the cumulative traffic impact considering other proposed developments assumed in the RTA's traffic model.

1.6 Approach to traffic investigation

Future traffic conditions on the regional road network in the vicinity of Coal & Allied sites will be determined by a number of complex driving factors. They are:

- Lower Hunter Regional Strategy which forecasts a population increase of about 160,000 and an additional 66,000 jobs over a 25 year planning horizon between 2006 and 2031. The forecast population and employment growth was a key input to the RTA's LHTM model. The Newcastle – Lake Macquarie Western Corridor planning strategy is a supporting document.
- Currently, key transport corridors including Newcastle Link Road, F3 Freeway and John Renshaw Drive carry a significant amount of regional traffic. In the future the predicted population and employment growth will have significant impact on traffic operations on these roads and associated intersections. This means that the cumulative impact will have implications for the access strategy adopted for the Coal & Allied site.
- The Hunter Expressway and the proposed F3 to Raymond Terrace Link will have significant contributions in changing the future traffic distributions on the F3 Freeway, John Renshaw Drive and Newcastle Link Road. It is anticipated that the Hunter Expressway will open to traffic by 2013. At present, RTA considers the F3 to Raymond Terrace Link to be a long-term project;

- Due to the complexity of future travel patterns within the corridor, Hyder used RTA's traffic model[1] for assessing Coal & Allied traffic impact on the road network.

1.7 Report structure

This report has the following structure:

- Chapter 1: Introduction – background to the study, outlining the subject area, study objectives and the approach used for traffic investigation;
- Chapter 2: Regional and Local Transport Context – overview of the existing conditions regarding the road network, land use, demographics, public transport, Journey to Work data and traffic growth. The result from traffic survey is included in this section.
- Chapter 3: Impact Assessment – describes the impacts on regional and local road network from proposed development at Black Hill. This section also discusses proposed road and intersection changes, and strategy for non-car modes;
- Chapter 4: Summary of Findings – the summary of findings from the investigations, modelling and analysis. Includes referencing to Director General's requirements.

[1] Lower Hunter Traffic Model (LHTM) was developed by using TransCAD software. Hyder obtained a model licensing agreement from the RTA for this study.

2 Regional and local transport context

2.1 Road hierarchy and network

The RTA Road Design Guide defines the functional road hierarchy in urban areas to establish a consistent basis for traffic management. There are four levels of road and their functions are stated as below:

- Arterial roads – predominantly carry through traffic from one region to another, forming principal avenues of communication for urban traffic movements;
- Sub Arterial Roads – connect the arterial road to areas of development and carry traffic directly from one part of a region to another. They may also relieve traffic on arterial roads in some circumstances;
- Collector Roads – connect the sub-arterial roads to the local road system in developed areas; and
- Local Roads – are the sub-divisional roads within a particular developed area. These are used solely as local access roads.

The key roads provide access to the proposed Black Hill development site are summarised in Table 2-1.

Table 2-1 Road hierarchy in the context of the Black Hill development proposal

Road Names	Road Hierarchy	Speed Limit (kph)	Characteristics
Sydney-Newcastle Freeway (F3)	Arterial	110	The Sydney-Newcastle Freeway (F3) is the main traffic route in the vicinity of the site. There are two lanes north and two lanes south with a median. The speed limit along the freeway is 110 km/h. F3 is a State Road under the care and control of the Roads and Traffic Authority of New South Wales (RTA). As such Sydney-Newcastle Freeway is an important link in the state's highway network and is classified as an arterial road.
John Renshaw Drive (MR588)	Arterial	80	John Renshaw Drive is an east-west arterial road between Tarro and Kurri Kurri. It is an undivided two lane road with a sign posted speed limit of 80 km/h, and reduces to 60 km/h approaching the F3 roundabout in Black Hill.
Weakleys Drive	Arterial	80	Weakleys Drive is a north-south arterial road. It connects with New England Highway as grade separation on its northern end and with F3 and John Renshaw Drive on its south.
Lenaghans Drive	Collector	90	Lenaghans Drive is a north-south collector road parallel with F3. It connects with southbound F3 carriageway, where left in left out movements are permitted approximately 600 m to the south of John Renshaw Drive.
Black Hill Road	Local	60	Black Hill Road is a local road which connects with Lenaghans Drive on its eastern end and with John Renshaw Drive on its north-western end.

Figure 2-1 shows the subject site in relation to regional road network. F3 Freeway provides a major freight route between Sydney and Brisbane. F3 Freeway and Weakleys Drive also provide a major north-south movement between F3 Freeway and traffic accessing Maitland and beyond. John Renshaw Drive provides east west movement between Cessnock and Newcastle. Currently, both roads carry significant amount of regional and local traffic.

Black Hill Road provides access to the south east with connections to Newcastle and Lake Macquarie via Lenaghans Drive. Black Hill Road does provide access to the F3 Freeway on northbound direction only. Alternative access to Black Hill Road from the north can be obtained through the Lenaghans Drive.

Figure 2-1 Road hierarchy in the context of the Black Hill development proposal

2.2 Key intersection

F3 Freeway/John Renshaw Drive/Weakleys Drive roundabout is the key intersection in the vicinity of the Black Hill site. Figure 2-2 shows intersection type and lane configuration of the roundabout.

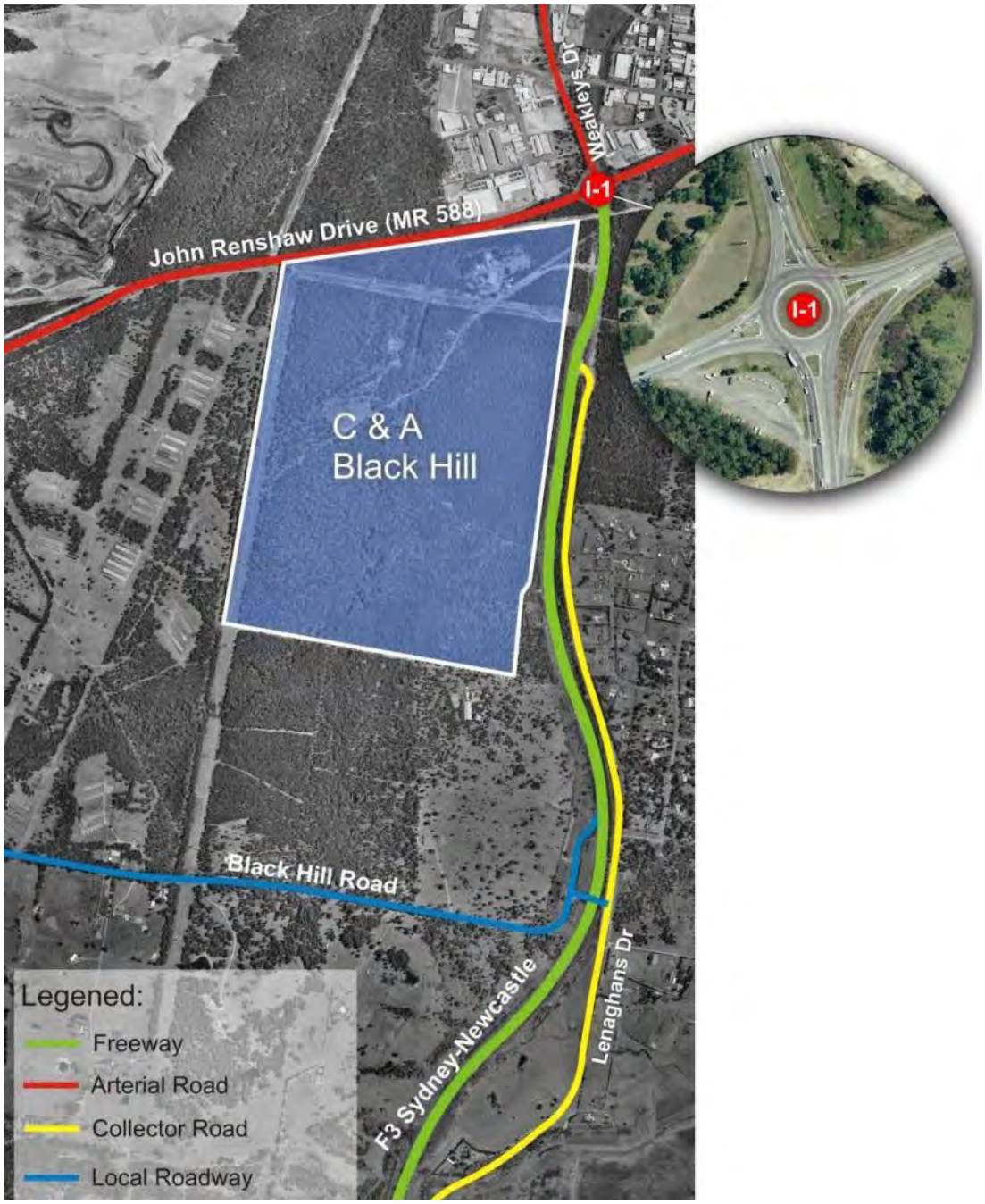

Figure 2-2 Key intersection location and configuration

2.3 Demographics

Black Hill is a small rural suburb on the outskirts of Newcastle. It is approximately 27 km from the Newcastle CBD. According to the 2006 Census, there were approximately 703 persons residing in Black Hill (Suburb): Of that about 50.5% were males and 49.5% were females. There were about 220 occupied private dwellings (100.0% were separate houses) in Black Hill area. Table 2-2 shows a review of the car ownership for the Newcastle and Lake Macquarie LGA's sourced from 2006 Census Journey to Work data (JTW). The analysis included both LGA's due to the close proximity of Coal & Allied sites including Black Hill and Minmi Link Road.

Table 2-2 LGA Car Ownership (ABS Census 2006)

LGA	0 Vehicle	1 vehicle	2 vehicles	3 Vehicles	4 or + Vehicles
Newcastle	15.1%	41.9%	32.6%	7.8%	2.7%
Lake Macquarie	9%	37.9%	37.3%	11%	4.8%

It can be seen from the table above that the majority of households have one or two vehicles. It is noted that the population living around the proposed Northern land development, being in the fringe of the urban area and more likely to have higher car ownership. Also limited public transport in and around the locality lead more people to use private vehicle. The high proportion of households with no vehicle in Newcastle LGA can be explained by the fact that it is a highly urbanised area with fairly good access to public transport. Lake Macquarie, on the other hand, has a more scattered urbanisation with limited public transport services causing a higher reliance on private vehicle.

2.4 Journey to work analysis

An analysis of 2006 Census Journey to Work (JTW) data shows that around 78% of work trips for those working and living in Newcastle and Lake Macquarie LGA's are undertaken by private vehicle. JTW results are shown in Table 2-3.

Table 2-3 Travel to work data Newcastle Outer West and Lake Macquarie North

Place of Work	Car	Public Transport	Other	Total
Newcastle	19,150	705	4,060	23,915
Lake Macquarie	11,379	231	3,860	15,470
Cessnock	577	3	98	678
Port Stephens	1,474	7	197	1,678
Maitland	1,515	33	201	1,749
Central	492	32	89	613

Place of Work	Car	Public Transport	Other	Total
Coast				
Sydney	447	118	180	745
Other – NSW	2,562	57	520	3,139
Other States	73	14	60	147
Total	**37,669**	**1,200**	**9,265**	**48,134**
Percentage	**78.3%**	**2.5%**	**19.2%**	**100%**

The table above shows that only 2.5% of trips within the study area were undertaken by public transport (train and buses) and 78% by private cars (both as drivers or passengers). The actual private cars figure for Black Hill area will be even higher than 90%. That demonstrates the population's high reliance on private vehicles to commute everyday to work. The usual place of work for people, in the study area, is located within the LGA of Newcastle and Lake Macquarie (82%) and to a lesser extent towards the Maitland and Port Stephens areas. Figure 2-3 illustrates the travel to work data from Newcastle Outer West SLA.

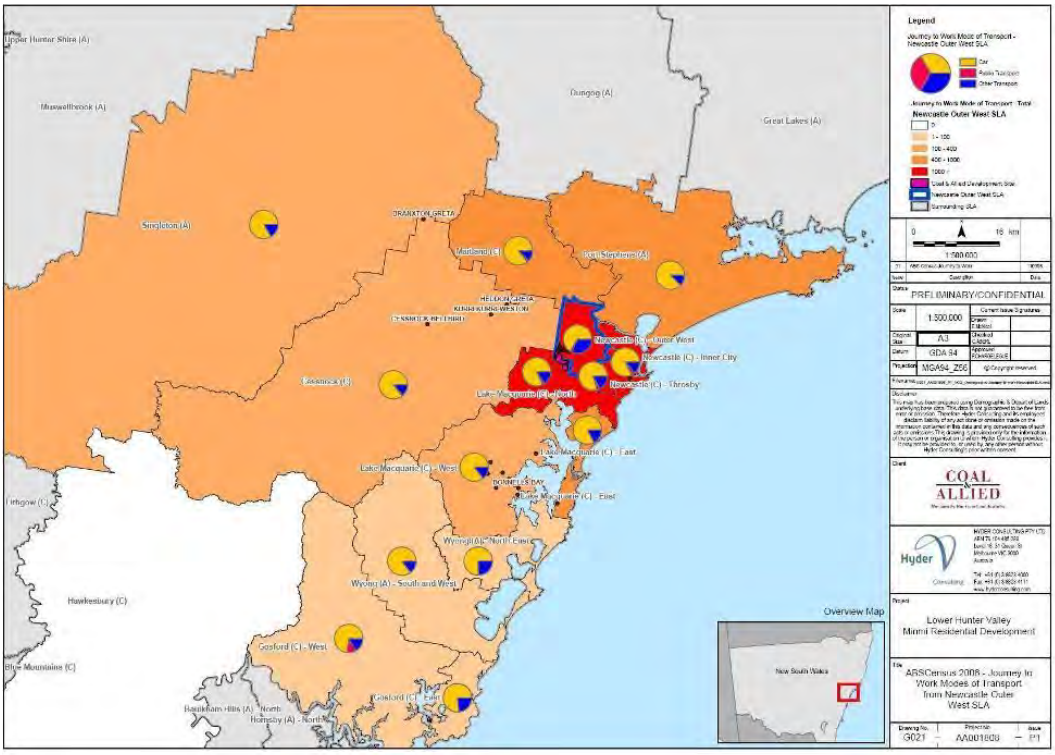

Figure 2-3 Travel to work from Newcastle Outer West

2.5 Public transport network and use

2.5.1 Existing bus services

Local service provider Blue Ribbon Bus Company only provides a school bus service in the Black Hill area and does not currently operate public bus services. Nearby local centres are connected to each other by hourly or half hourly buses operated by Newcastle Buses which provides a majority of bus services in the Newcastle region. At Wallsend, there are connections available to the Newcastle Buses network where bus services connect to destinations such as the University of Newcastle and Newcastle CBD. Most services operate during peak hour to meet rail connections. Other regional routes in the Hunter Valley area are served by private operators. The Blue Ribbon Bus Company operates bus services through the Fletcher/Minmi area. Route 260 (Wallsend Interlink) services from The Meadows – Minmi – Fletcher – Maryland to Wallsend.

2.5.2 Rail services

The nearest rail line to both Coal & Allied Northern developable lands (Black Hill and Minmi/Link Rd) is the Hunter Line. Train services between Muswellbrook/Dungog and Newcastle operate on this line. The nearest rail station to Black Hill is the Beresfield Station.

The Beresfield station could be used to bring employees to the Black Hill site, if the station were connected to the site by a bus that met the trains for the morning peak, and an evening bus returned passengers to the train station in the afternoon peak. Demand for rail might increase if other stations across the Hunter Line implemented a regional “park and ride” strategy. Figure 2-4 illustrates the rail network in the vicinity of the study area.

Figure 2-4 Rail network in the vicinity of the study area

2.6 Pedestrian and cyclist network

The current pedestrian and cyclist network at Black Hill is designated by the Newcastle Council and was developed in 1996 jointly with the Lake Macquarie Council. All local streets are designated as shared cycling and pedestrian zones. With no instances of separate footpaths or cycleways, local trips from nearby residential areas in and around Black Hill can be made via walking and cycling sharing with other general traffic.

2.7 Parking

No parking is permitted on the F3 Freeway and John Renshaw Drive near the Black Hill site.

2.8 Historical traffic growth

Table 2-4 shows the historical Average Annual Daily Traffic (AADT) at RTA count sites. AADT data has been sourced from the RTA Traffic Volumes Data for Hunter Regions, 2004. Traffic data for 2007 and 2010 are also included in Table 2-4. The 2007 count data on John Renshaw Drive and F3 Freeway was obtained from the traffic survey undertaken by Hyder. The 2010 count data on John Renshaw Drive was obtained from the RTA.

Table 2-4 Historic Traffic Volumes-AADT on regional road network

		Year of Counts				
Station	**Road**	**1998**	**2001**	**2004**	**2007***	**2010***
5.057	New England Highway, east of Weakleys Drive	29,844	32,199	30,845	-	-
5.687	Weakleys Drive, south of New England Hwy	13,478	16,826	19,750	-	-
5.682	John Renshaw Drive, east of F3	20,217	22,228	28,020	-	-
5.018	F3 Sydney-Newcastle Freeway, south of John Renshaw Drive	23,514	27,917	32,997	35,110	
5.683	John Renshaw Drive west of Weakleys Drive	6,093	6,501	7,341	7,460	
	John Renshaw Drive east of Buchanan Road					8,067

Note: * One week count data

Historical AADT data analysis from Table 2-4 shows:

- In the 6 years between 1998 and 2004, traffic growth on F3 and John Renshaw Drive was between 3% and 5%.
- Between 2004 and 2010, John Renshaw Drive traffic was grown by about 1.6% per annum.
- The recent growth on the John Renshaw Drive is consistent with the general growth trend observed on other state roads in the Hunter region which is between 1% and 2% per annum.

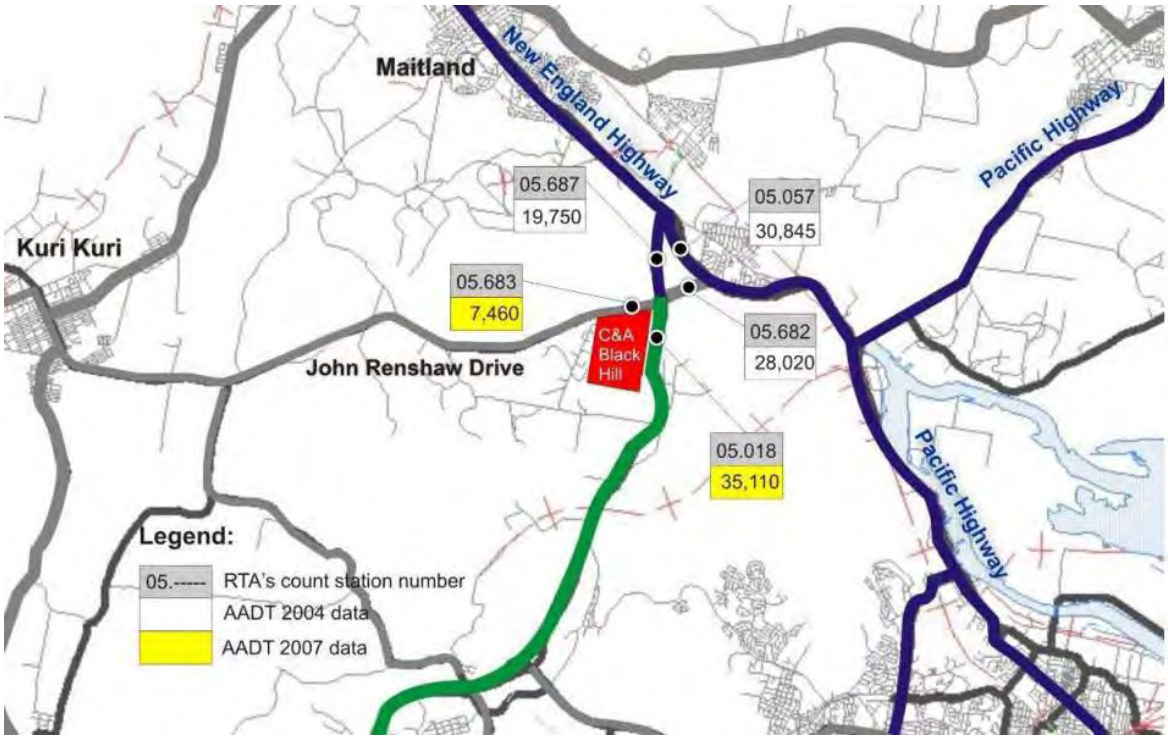

Figure 2-5 AADT data at RTA's count sites in the vicinity of Coal & Allied Black Hill land

2.9 Crash data analysis

This assessment is based on the crash data supplied by the RTA for six years period from October 2004 to September 2010 including the provisional data. Crash data between October 2009 and September 2010 is provisional.

Crash data between 2004 and 2010 indicates that about 109 crashes occurred on the F3 Freeway between John Renshaw Drive and Cedar Hill Road. About 93 crashes occurred on John Renshaw Drive between New England Highway and Black Hill Road. Of that total, two fatal crashes were recorded on F3 Freeway and John Renshaw Drive respectively.

Table 2-5 Summary of the crash data for the period from 10/2004 to 9/2010

Location	Total Number of Crashes	Fatal Crashes	Injury Crashes	Non Injury Crashes	Casualties		
					Killed	Injured	Total
F3 Freeway between John Renshaw Drive and Cedar Hill Road	109	1	51	57	1	54	55
John Renshaw Drive between New England Highway and Black Hill Road	93	1	51	41	1	62	63

Figure 2-6 and Figure 2-7 show the number of crashes by crash type that occurred on the F3 Freeway and John Renshaw Drive. The crash data showed that "Rear-end"

crashes dominated on both F3 Freeway and John Renshaw Drive sections. No pedestrians were involved in any crashes.

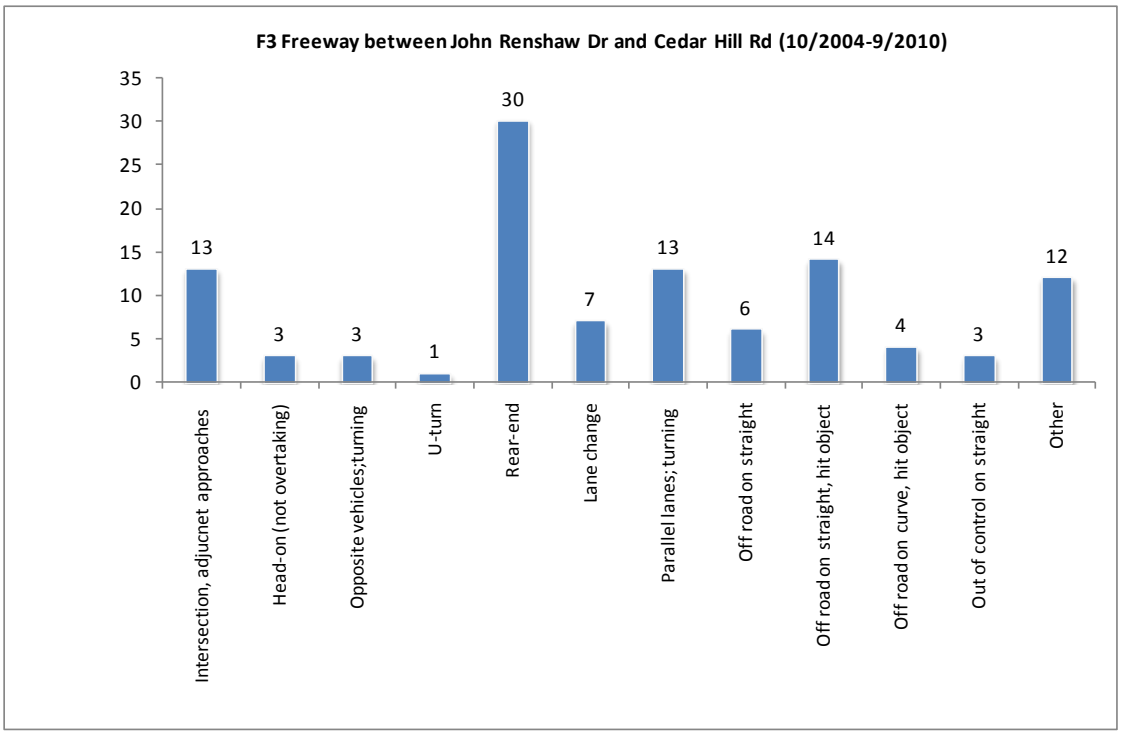

Figure 2-6 F3 Freeway -Number of crashes per crash movement (10/2004-9/2010)

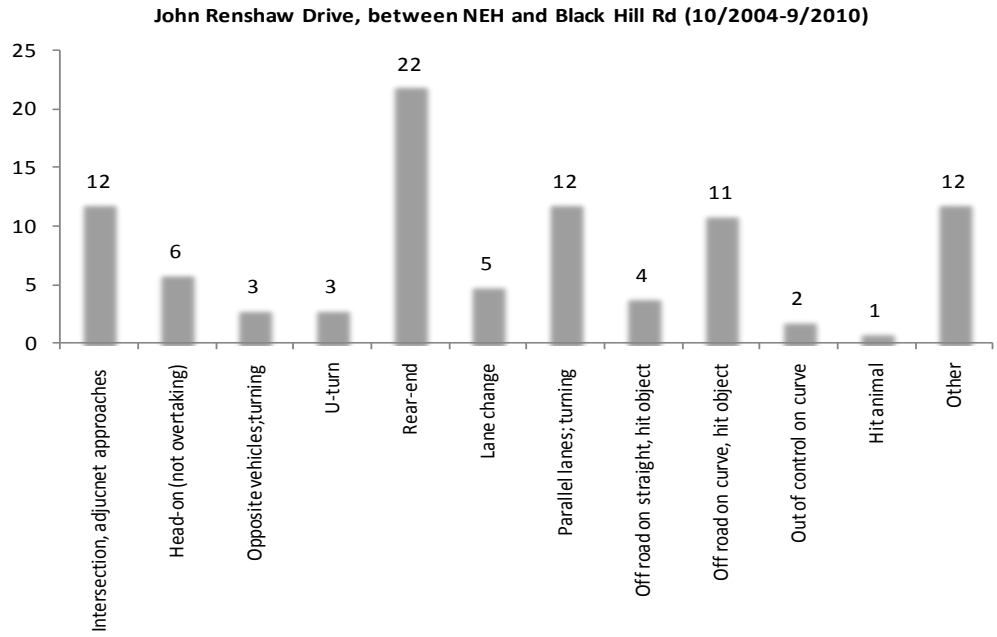

Figure 2-7 John Renshaw Drive -Number of crashes per crash movement (10/2004-9/2010)

Figure 2-8 and Figure 2-9 show crash locations visually along the F3 Freeway and John Renshaw Drive respectively. Crash data on F3 Freeway and John Renshaw Drive show that, in general, crashes occurred along the full length but are more concentrated at the intersection of F3 Freeway with John Renshaw Drive.

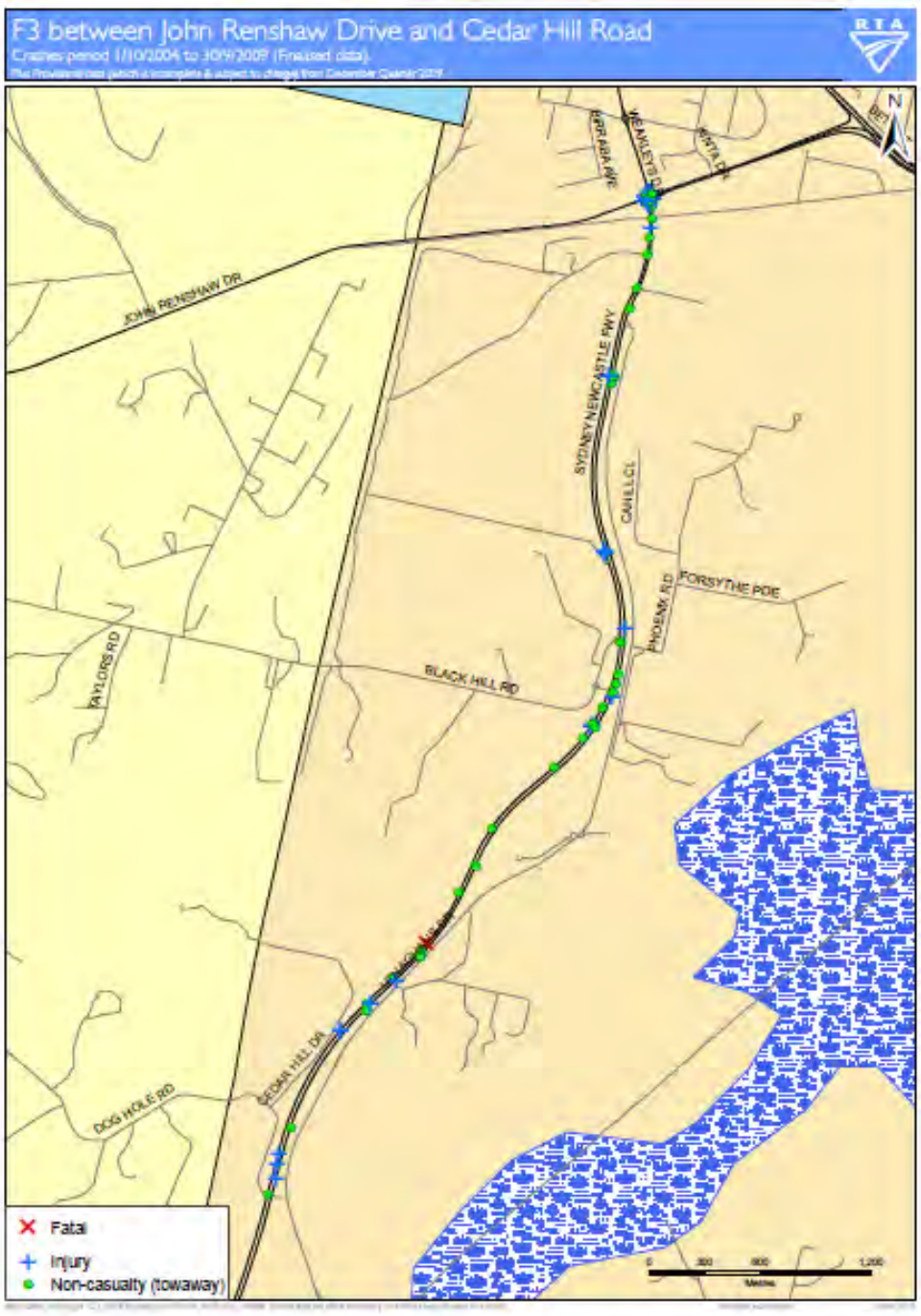

Figure 2-8 F3 Freeway, spatial distribution of crashes (10/2004 to 9/2010)

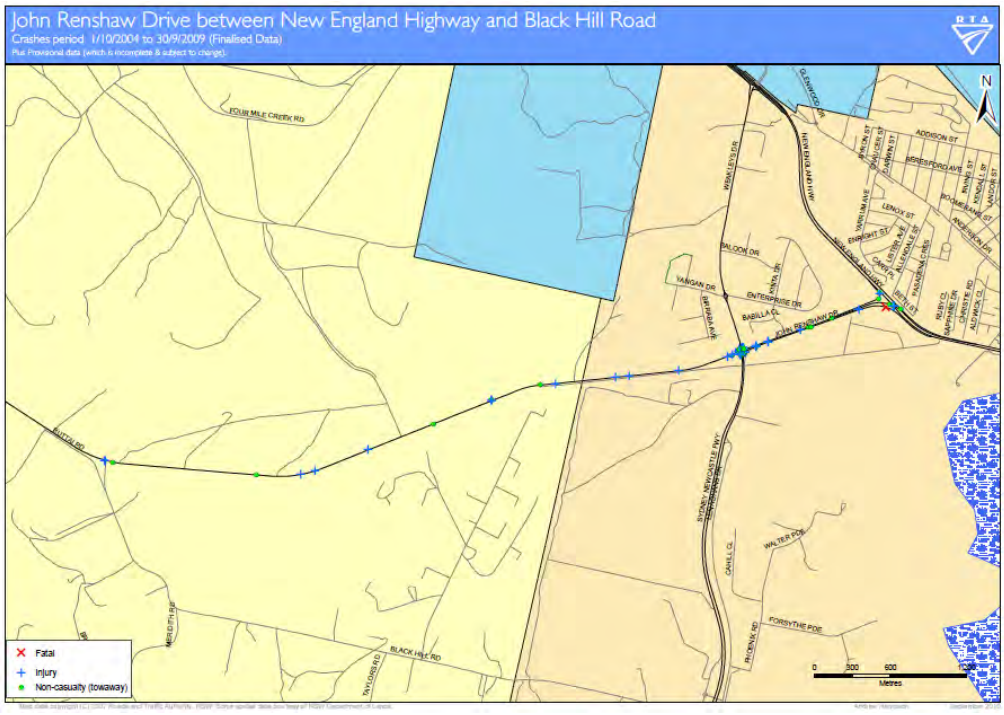

Figure 2-9 John Renshaw Drive, spatial distribution of crashes (10/2004 to 9/2010)

2.10 Traffic data

Coal & Allied previously commissioned traffic count for key roads and intersections for the Northern Estates. These counts were undertaken during February 2007 and August 2008 (see Tables 2-6 and 2-7, below). The 2010 new traffic data on John Renshaw Drive was sourced from the RTA. At RTA's request, Coal & Allied commissioned a new traffic survey at F3 Freeway/John Renshaw Drive roundabout. The following sections summarised findings from traffic survey data.

For Black Hill study area two categories of survey were carried out:

- Mid-block tube counts for periods of at least a week; and
- Intersection turning movement counts during morning and afternoon peak periods;

For the mid-block tube counts, Hyder selected two key sites to be affected by Black Hill development:

Table 2-6 Mid-Block traffic survey location

ID	Location	Survey Period
	John Renshaw Drive, east of Buchanan Road	From 11 June 2010 to 19 June 2010
M-1	John Renshaw Drive, west of Weakleys Drive;	From 23 January 2007 to 21 February 2007
M-2	F3 Freeway, north of Stockrington Rd	From 15 August 2008 to 22 August 2008

From this count data all vehicles were then classified into the twelve Austroad standard vehicle classes. In addition to the mid-block counts, one key location was selected for an intersection count:

Table 2-7 Intersection traffic survey location

ID	Location	Survey Period
	F3/John Renshaw Drive/Weakleys Drive roundabout	Wednesday, 22 September 2010
I-1	F3/John Renshaw Drive/Weakleys Drive roundabout	Friday, 19 October 2007

The intersection surveys were conducted for both AM (7am to 10am) and PM (3pm to 6pm) peak period.

2.10.1 Average weekday and weekend traffic

Daily traffic volumes on F3 Freeway and John Renshaw Drive are shown (see Table 2-8 below) for an 'average weekday' and an 'average weekend' traffic counts. The variations of traffic count are derived from the mid-block survey conducted during a 'typical' week, i.e. not during school holidays.

Table 2-8 Daily traffic volumes on key roads

ID	Location	Average Weekday	Average Weekend	Traffic Changes (Weekend)
	John Renshaw Drive, east of Buchanan Road#	8,866	6072	-32%
M-1	John Renshaw Drive, west of Weakleys Drive;	7,566	5,609	-26%
M-2	F3 Freeway, north of Stockrington Rd	31,536	25,147	-20%

#Note: Traffic data on John Renshaw Drive, east of Buchanan Road was conducted in 2010.

The following points are noted from Table 2-8 traffic result:

- In 2010, John Renshaw Drive east of Buchanan Road carried about 8,800 vehicles per day during a weekday, with weekend traffic approximately 32% lower than an average weekday.
- In 2007, near to Coal & Allied's proposed Black Hill site, John Renshaw Drive (west of Weakleys Drive) carried about 7,600 vehicles per day during a weekday, with weekend traffic approximately 26% lower than an average weekday.
- In 2008, F3 Freeway, north of Stockrington Road carried over 31,500 vehicles per day during a weekday. Weekend volumes are significantly lower (20 %) than the average weekday; and
- In general, the weekend traffic volumes are about 20% to 30% lower than weekday traffic. The traffic data suggested that both F3 Freeway and John Renshaw Drive at these locations carried a high proportion of commuter traffic to/from Newcastle.

2.10.2 Hourly variations

Figure 2-10 and Figure 2-11 show hourly traffic volume variation on F3 Freeway and John Renshaw Drive. The data indicates the evening peak is slightly higher than the morning peak. The highest one hour peak traffic is about 8% to 9% of daily traffic.

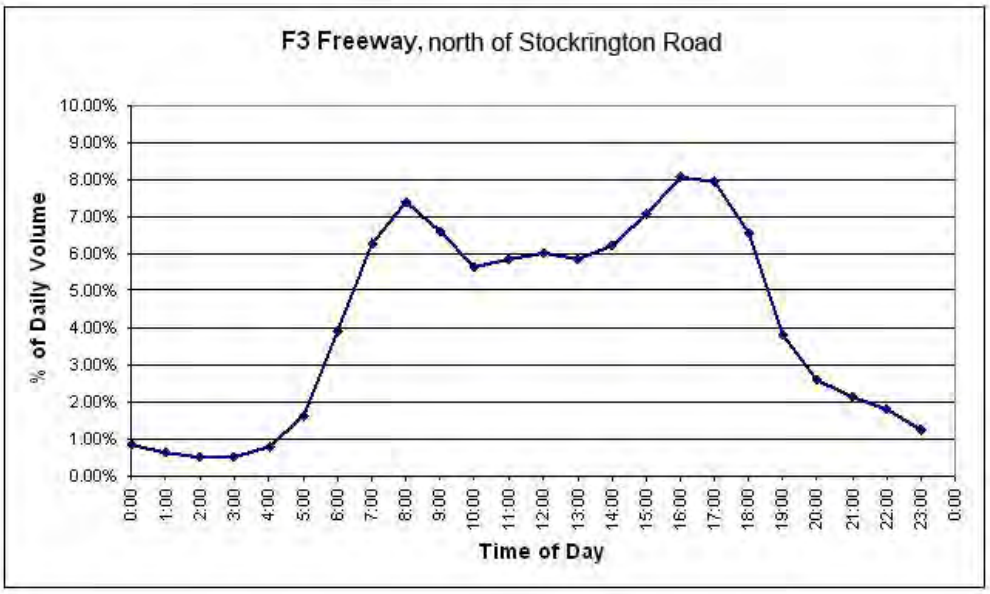

Figure 2-10 Hourly traffic flow variations on F3 Freeway

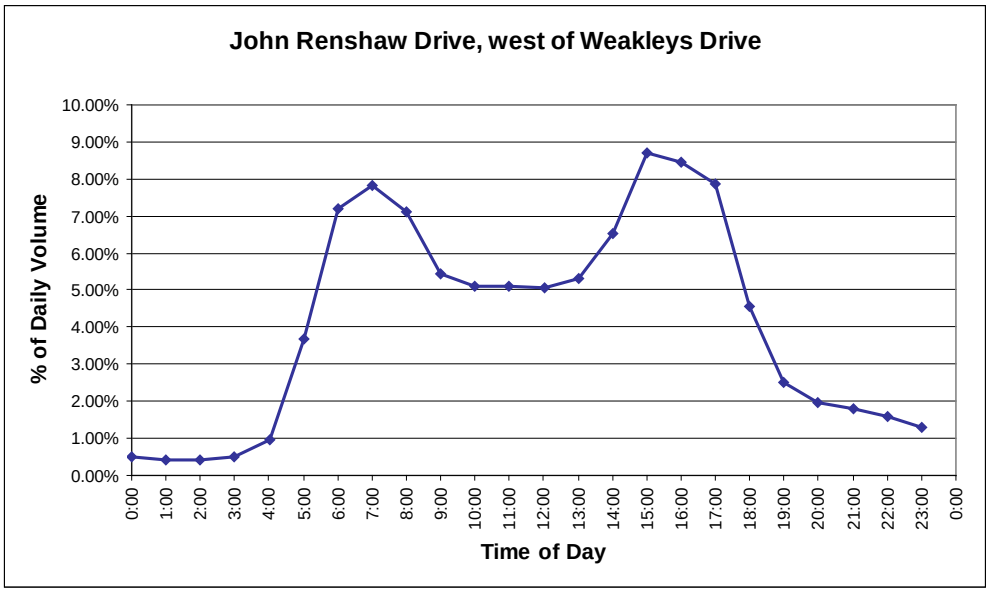

Figure 2-11 Hourly traffic flow variations on John Renshaw Drive, west of Weakleys Drive

2.10.3 Heavy vehicles

According to Austroads vehicle classification system, 'heavy vehicles' include trucks with two or more axles, buses, semi-trailers and B-doubles. The heavy vehicle data showed the following distribution:

- In 2010, on John Renshaw Drive (east of Buchanan Road) about 1006 heavy vehicles were recorded. The heavy vehicle proportion was about 11 % of total traffic.

- In 2007, on John Renshaw Drive (west of Weakleys Drive) about 720 heavy vehicles were recorded. The heavy vehicle proportion was about 9.6 % of total traffic.
- On F3 Freeway (North of Stockrington) about 5750 heavy vehicles were recorded. The heavy vehicle proportion on F3 was higher at about 18.2 % of total traffic.
- In general, the proportion of heavy vehicles on John Renshaw Drive and F3 Freeway was between 10% and 18% of total traffic. Both roads provide access to Coal & Allied's proposed Black Hill site and are regarded as freight routes.

2.10.4 Existing intersection capacity

Hyder used SIDRA for assessing the intersection capacity. Table 2-9 below shows standard level of service (LoS) criteria for intersection assessment.

Table 2-9 LoS Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

Source: RTA Guide to Traffic Generating Developments

The RTA's guideline has recommended that with roundabout, Stop and Give Way sign control intersections, the LoS value is determined by the critical movement with the highest delay per vehicle. With this type of intersection control, some movements suffer high levels of delay while other movements have minimal delay. When the degree of saturation (DoS) exceeds 0.8 – 0.85, overflow queues start to become a problem.

Previously Hyder modelled the F3 Freeway/John Renshaw Drive roundabout using 2007 traffic data. The 2007 peak hour data predicted a LoS B for the worst movement. The peak hour DoS value was predicted between 0.62 and 0.75.

The roundabout was re-analysed using 2010 traffic data (see Figure 2-12, below). The model predicted a LoS between B and C for the worst movement. The peak hour DoS value was predicted between 0.74 and 0.87. The high DoS value (>0.85) indicating higher delays and overflow queues currently being experienced at this roundabout.

Figure 2-12 Turning volumes (AM, PM peak) data at F3/John Renshaw Drive roundabout in 2010

3 Impact assessment

3.1 Overview of modelling approach and assumptions

The current road network in and around the Coal & Allied sites provides a number of route choices or alternative accesses. This implies that motorists will have a number of options on how they will access the Coal & Allied development. Key roads including the F3 Freeway, John Renshaw Drive and Newcastle Link Road carry a significant volume of regional and local traffic. By 2031, the population and employment growth predicted in the Lower Hunter Regional Strategy will impact traffic operations on these roads and associated intersections. The Hunter Expressway (HEX) and proposed F3 to Raymond Terrace Link (F32R) will involve a further traffic redistribution impact on these roads.

According to DGR's, Hyder used following traffic models for assessing the proposed Coal & Allied Black Hill development.

1. RTA's Lower Hunter Traffic Model (LHTM). This model was developed using TransCAD software. Hyder used this model to estimate the future traffic growth from Coal & Allied developments and cumulative growth from other planned development in the Hunter. The impact from HEX and F32R are modelled. The LHTM model covers the entire Lower Hunter Region, comprising the six Statistical Local Areas (SLAs) of Newcastle – inner, Newcastle – Remainder, Lake Macquarie, Cessnock, Maitland and Port Stephens. The model network includes all National, State and Regional roads, and local roads generally down to the level of collector roads. Previously Hyder calibrated the LHTM model for the Coal & Allied study area using 2007 counts data at surveyed locations. The AM peak period model (7- 9) was calibrated with the observed counts within the 10% target. Between 2007 and 2010, AM peak hour traffic change on key roads in the Coal & Allied study area was low (within 5% in 3 years) and is unlikely to affect the calibration target achieved for the Coal & Allied study area.
2. Micro simulation model. This model was developed using Paramics software. Hyder developed a Paramics model for assessing the Coal & Allied traffic impact. The model covers the area bounded by F3 Freeway, Newcastle Link Road and John Renshaw Drive. Key collector and local roads including Woodford Street, Minmi Road, Cameron Park Drive, Northlakes Drive and Lenaghans Drive are included in the Paramics model. Traffic demand from LHTM was used as input to Paramics model. The Paramics model was developed as per relevant guidelines including the "Paramics Micro-Simulation Modelling – RTA Manual Version 1.0. The calibration and validation of base year Paramics model is documented in Appendix A.
3. SIDRA model. This model was developed using SIDRA software.

Hyder updated the RTA's LHTM model to include the Minmi/Link Road residential development of approximately 3,300 dwelling, and the Black Hill employment development with a capacity of 800,000 square metres gross leasable floor area (GLFA). Previously Coal & Allied Northern Estates was assessed for three horizon years 2016, 2026 and 2031 based on land use assumptions predicted in the Lower Hunter Regional Strategy. Traffic forecast for this land use scenario was referred to V12 (V stands for version). By 2016 the V12 land use projection assumed significant growth from greenfield developments. The staging of population and employment growth was revised in V12 land use due to major changes to global economic growth as a result of the Global Financial Crisis (GFC). It is likely that expected growth will be delayed in the region particularly for the short and medium time frame. Noting, the ultimate year 2031 land use projection for this revised land use is unchanged from

previous V12. The revised land use data was used for the Coal & Allied study. Figure 3-1 below shows revised population forecasts for the Hunter region up to 2031.

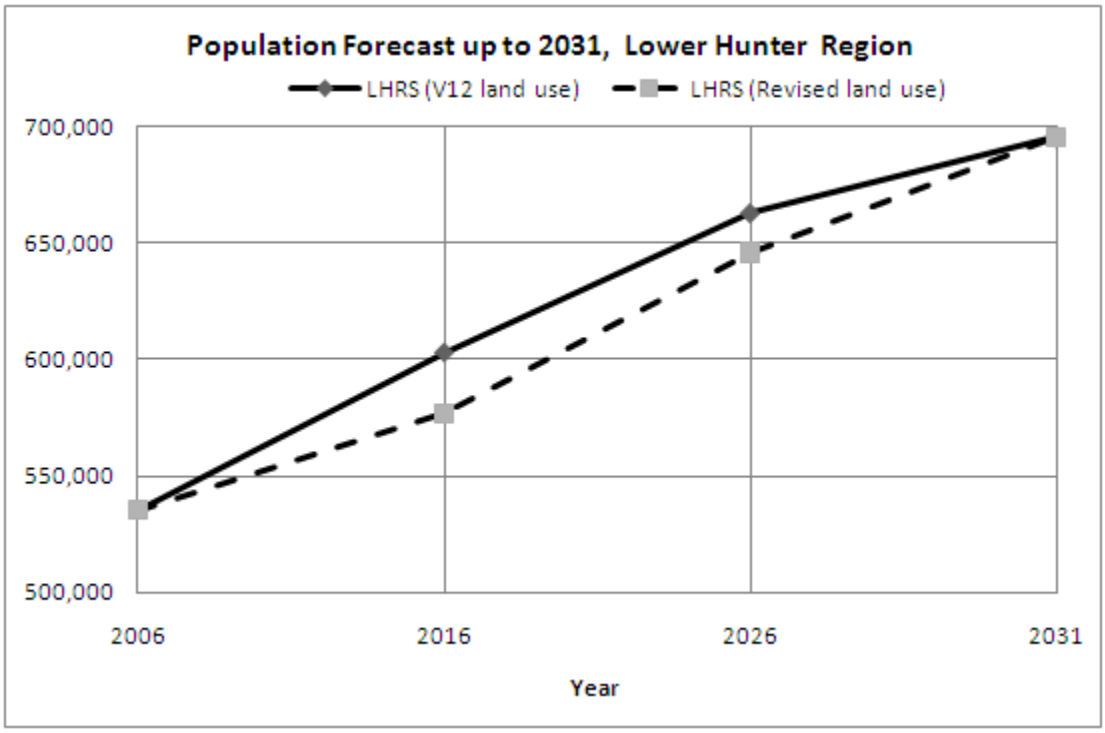

Figure 3-1 Population forecast for the Hunter Region up to 2031

Key modelling assumptions for Black Hill site are summarised as follows

- Inclusion of Hunter Expressway in modelling;
- Deletion of RTA unfunded future roads;
- Inclusion of the proposed F3 to Raymond Terrace Link bearing in mind that construction of the F3 to Raymond Terrace Link is not expected until after 2026;
- No potential upgrade was assumed at F3 Freeway/John Renshaw Drive roundabout;
- Traffic generation rate for Black Hill was 0.58 (AM Peak) and 0.70 (PM peak) trips per 100 square meters GLFA as proposed by the RTA. No self-contained (internal to internal) trip was assumed i.e. above trip generation rate was not discounted.

3.2 Development program

The Black Hill site concept plan included a six stage development program. The gross leasable floor area (GLFA) is estimated to be approximately 800,000 square meters with the potential to create approximately 3,000 jobs. It is anticipated that the site will be developed over 17 years depending on market demand for employment land in the Hunter Region. The site is expected to be operational from year 2016. Approximately 60% of the site is anticipated to be developed by 2026. Table 3-1 shows the projected rate of development assumed in the traffic model.

Table 3-1 Development Program

Year	Staged Development (GLFA)
2026	500,000m^2
2031	800,000m^2

3.3 Traffic generation

In general, traffic generation is a key input to the traffic model and should be examined carefully prior to assessing future network impact. A common source for trip generation rates is the RTA's Guide to Traffic Generating Developments (2002). RTA trip generation guidelines provide a broad peak hour trip generation rate for known industry types including business parks where developments may occur across a range of industrial land use types in an integrated complex. Although SEPP11 recognised the RTA guideline, there are issues in using RTA's trip generation rates for the Black Hill site. They are:

- In recent years employment rates and logistics have changed significantly to what was used in the RTA industry surveys over 10 years ago. The production methods have also improved; this means large industries now have less employees.
- Business parks in the RTA survey ranged between 7,300 square meters and 38,200 square meters of GFA. Black Hill will yield 800,000 square meters of GFA, so it is outside the range of the RTA survey.
- The RTA guide assumes a higher employee density generally 28 employees per hectare of developable land. Recent surveys in the Hunter suggested a typical employee density of 18 to 19 employees per hectare.
- The peak period travel distribution assumed in RTA guideline is different from that observed in the Hunter. Traffic volumes in the Hunter road network are more spread during the peak period (8%-9% in Hunter versus 14% in Sydney) lead to a lower peak hour trip generation rate; and
- Using the RTA guideline for large industrial development can lead to overprovision of transport infrastructure.

Maunsell Australia Pty Ltd identified trip rates for Hunter Lands business Park in a report "*Assessment of Hunter Valley Business Park Trip Rates*"*Final Report, 31 January 2007,* prepared for Hunter Land Pty Ltd. The survey was undertaken at the Thornton, Racecourse, Freeway and Holmwood business parks. The surveys found that industrial trip rates in the Hunter are significantly lower than the RTA guideline, 2002. The survey found that peak hour trip rates varied between 0.47 and 0.56 per 100 GLFA for a business park in the Hunter.

The RTA provided trip generation rates for Black Hill site. The traffic generation rate for the Black Hill site is proposed to be 0.58 (AM Peak) and 0.70 (PM peak) trips per 100 square metres GLFA respectively. The RTA's proposed trip rate for Black Hill site is about 23% to 25% higher than the above mentioned trip generation rate estimated from existing business parks in the Hunter. Table 3-2 shows the estimated trip generation from the Black Hill site for the critical AM and PM peak hour based on the RTA's proposed trip generation rate. The result shows that the Black Hill site could generate between 4,600 and 5,600 peak hour trips when the site is fully developed.

Table 3-2 Traffic Generation for Black Hill site

Black Hill Yields (GLFA, m^2)	Peak Hour Trip Rate/100 m^2 GLFA		Total Trips (One Hour)	
	AM	PM	AM	PM
800, 000	0.58	0.70	4,640	5,600

3.4 Proposed site access

In general a range of broad control principles were followed in regard to traffic and transport management for development of the Black Hill site. The following principles were considered during the concept design phase to ensure effective transport management is achieved:

- Provide two points of road access to dissipate the traffic generated by the Black Hill site on to the road network;
- Recognise existing external network constraints when considering new traffic generating developments,
- Providing two accesses will allow balance impact on the road network. This will also provide a good option for emergency events such as bushfire, and to improve the viability of any bus services through the site;
- Support bus/transport/cycleway linkages between sub-regional residential areas and employment lands at Black Hill;
- Support the development of a sub-regional plan (Newcastle-Lake Macquarie Western Corridor Planning Strategy) and coordinate the access and movement with major landowners in the Black Hill employment lands area;
- Make provision for a possible access from Coal & Allied employment lands to the adjoining lands to the south. Ensure effective access off John Renshaw Drive. Coal & Allied consulted adjoining landowners of Hunter Land, Catholic Church and neighbouring landowners to the south.
- Investigate a new link road along the western boundary from John Renshaw Drive to the existing Black Hill Road or alternative east–west feeder road. Investigate a possible F3 exit onto Black Hill Road and possible east-west feeder road parallel to Black Hill Road from the F3 to the west;
- Minimise the transportation distance of goods to freight hubs;
- Design access and the internal road network for heavy vehicles associated with freight movement in accordance with the Council and RTA standards.
- Investigate longer-term access opportunities to the site as the F3 to Raymond Terrace Link is implemented;
- Maintain existing access from the F3 Freeway through negotiations with the RTA.

Coal & Allied assessed the following six access options for Black Hill site.

- Option 1: Left In Left Out at both John Renshaw Drive and F3. Access on F3 (at current Boral access) is proposed as per RTA publication of F3 to Raymond Terrace Link.
- Option 2: Left In Left Out access on John Renshaw Drive and Left In Left Out access on F3 (Approximately 1.2 km south of F3/JRD roundabout).
- Option 3: Left In Left Out on John Renshaw Drive. Access on F3 is proposed via existing interchange at Black Hill Road.
- Option 4: No access onto the F3. A full access on John Renshaw Drive is proposed via a signalised T junction.
- Option 5: Left in Left out on the F3 (location is as per Option 1). A full access on John Renshaw Drive is proposed via a signalised T junction;
- Option 6: Left in only on the F3 (location is as per Option 1). A full access on John Renshaw Drive is proposed via a signalised T junction.

During the concept plan study, a broader assessment was undertaken for access options 1 to 3. In February 2009, a meeting was held with the RTA and Department of Planning (DoP). Traffic issues in association with access options 1 to 3 were discussed. The analysis identified that none of access options 1 to 3 would provide adequate benefit to Coal & Allied's Black Hill traffic. The opportunities and constraints of access options 1 to 3 are included in Appendix B. At that time, the RTA requested Hyder to investigate three additional access options 4, 5 and 6. The analysis indicated that a single access/egress on the John Renshaw Drive (option 4) is unlikely to accommodate additional trips from full Black Hill development. The traffic model identified the need for additional ingress/egress on to the F3 Freeway.

3.5 Black Hill trip distribution

The distribution of the additional trips generated by the proposed Coal & Allied development is a key factor in determining its impact on the road network. The trip distribution on John Renshaw Drive and F3 Freeway for the Black Hill site was estimated using the traffic model. The AM peak future traffic distribution to and from the proposed Coal & Allied development is shown in the Figure 3-2. The traffic distribution assumed Coal & Allied access as per option 5 (ie. access/egress on the John Renshaw Drive via a signalised T-junction, a left in left out on the F3 Freeway). The future traffic distribution for year 2031 assumes that Black Hill site is fully developed. The result suggests strong inbound distribution patterns from the south – F3 (40%), east – New England Highway / proposed F3 to Raymond Terrace Link (25%), north –Weakleys Drive (20%), west – John Renshaw Dr (15%). With the Hunter Expressway, the traffic model suggests strong inbound and outbound trips to and from the west of John Renshaw Drive providing access with Cessnock, Lake Macquarie, Maitland/Lochinvar, Branxton and the Upper Hunter.

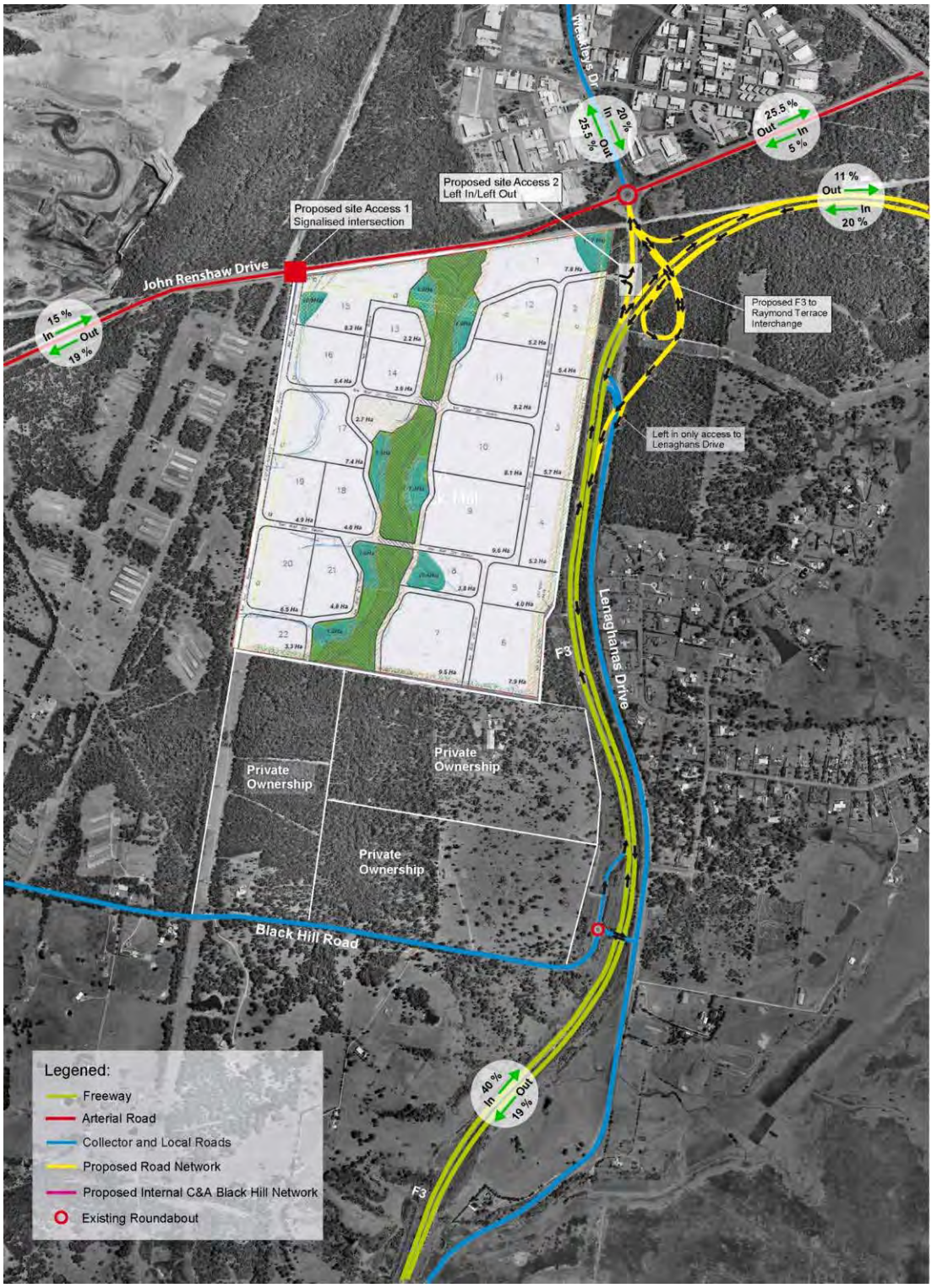

Figure 3-2 Future 2031 AM peak traffic distribution of Black Hill site traffic (full development)

3.6 Future growth

Future traffic conditions on the F3 Freeway and John Renshaw Drive corridor will be influenced by a combination of background growth, redistribution traffic effect from the Hunter Expressway and the proposed F3 to Raymond Terrace Link. This means future traffic on the F3 Freeway and John Renshaw Drive will be influenced not only by the traffic generated from Coal & Allied's proposed Black Hill development, but background growth and redistribution traffic effect will also impact future corridor flows. Traffic growth was estimated for year 2031 with and without Coal & Allied's proposed Black Hill development. In both cases, redistribution traffic effect from Hunter Expressway and proposed F3 to Raymond Terrace Link was included. The future growth is estimated for daily traffic. The growth is calculated in terms of the cordon traffic. Noting the cordon traffic includes six roads including John Renshaw Drive (west), F3 Freeway (south), Lenaghans Drive (south), proposed F32R Link (east), John Renshaw Drive (east) and Weakleys Drive (north). Figure 3-3 shows the location of the cordon line.

With background traffic alone, the model forecasts corridor growth in the order of 1.6% per annum until 2031. The full Black Hill development is forecast to increase the corridor growth up to 3.3% per annum, primarily driven by the higher trip generation rate used for Black Hill estate. Noting, RTA's proposed trip generation rate used for Black Hill estate is about 23% to 25% higher than surveyed trip generation estimated from the existing business parks in the Lower Hunter.

Figure 3-3 Coal & Allied Black Hill land traffic cordon line

3.7 Modelling result and access strategy

The development capacity of the Black Hill area is directly related to the traffic capacity at the critical intersection of the F3 Freeway/John Renshaw Drive roundabout. The Hunter Expressway is forecast to redistribute traffic across the regional network accessing the Black Hill site. The model predicts a traffic reduction of up to 20% on the F3 Freeway near the Black Hill site. The Hunter Expressway and proposed F3 to Raymond Terrace Link is expected to reduce traffic flows through the roundabout, but that reduction is likely to be discounted by background traffic increases from other planned infill and greenfield developments in the Hunter. The predicted background traffic growth (1.6 % per annum) until 2026 is expected to take up some additional capacity available at the roundabout. The traffic model predicts a lower LoS during peak periods for background growth alone. Figure 3-4 shows output from the Paramics modelling showing queues at the F3 Freeway/John Renshaw Drive roundabout. The modelling result represents AM peak traffic for access Option 6 (ie. access/egress on the John Renshaw Drive via a signalised T-junction, a left in on the F3 Freeway). The Paramics model predicts overflow queues on the F3 Freeway during peak period.

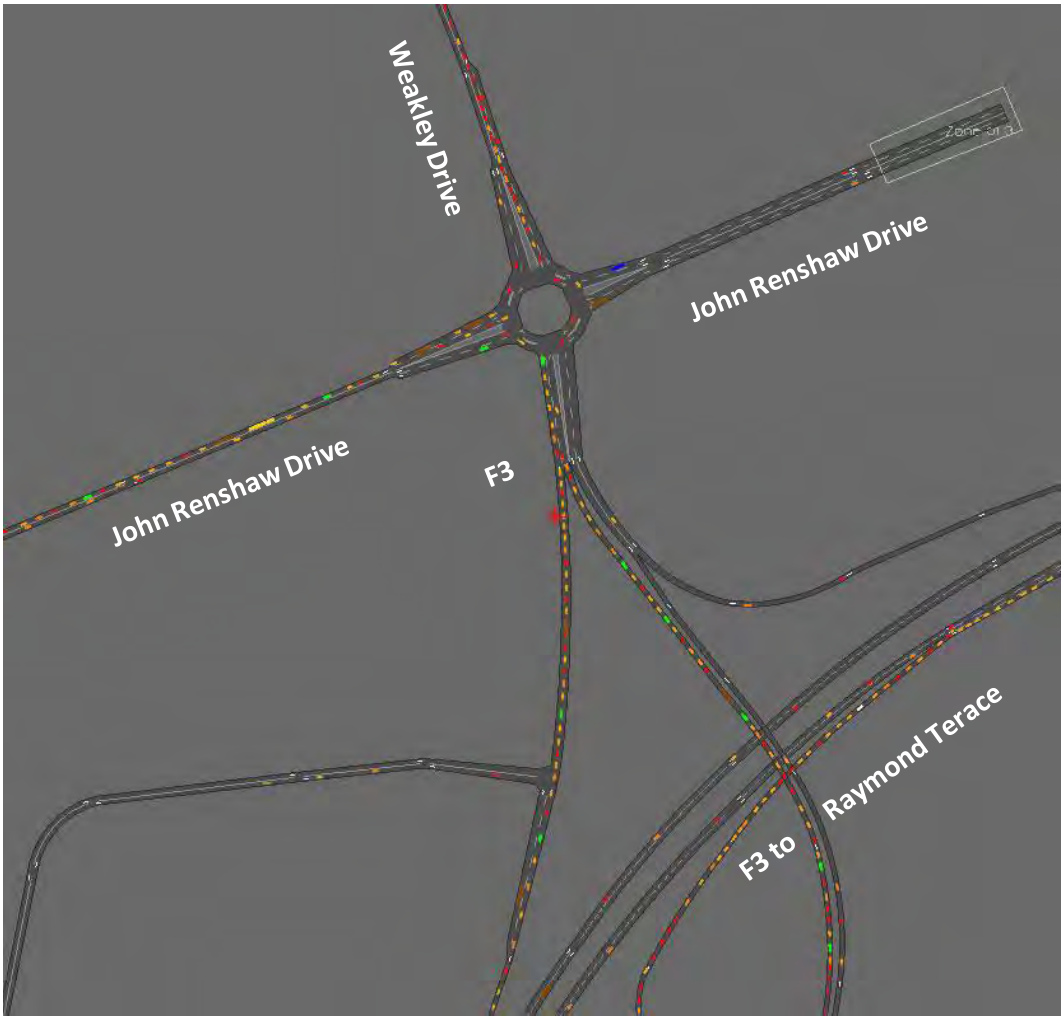

Figure 3-4 Predicted AM peak queues at F3/John Renshaw Drive roundabout (Coal & Allied staged development up to 500,000sm, access option 6)

Hyder identified four scenarios on how this roundabout could be upgraded.

- Scenario 1 involves reconfiguring F3 to Raymond Terrace (F32R) Black Hill base interchange- F3 Off ramp to join F3/John Renshaw Drive (JRD) roundabout as a separate leg and form a five leg roundabout.

- Scenario 2 involves reconfiguring F32R Black Hill base interchange - Northbound On Ramp and Southbound Off ramp to join with existing intersection on JRDr east of Weakleys Dr.

- Scenario 3 involves grade separation of North-South movements at JRD/F3 Roundabout; and

- Scenario 4 is the variation of scenario 2. New signals to replace F3/JRD roundabout. The new intersection on JRD will be a signalised T-Junction. The two sets of signals could be co coordinated.

Of the four scenarios Hyder identified a single or a combination of scenarios could provide adequate capacity at the F3 and John Renshaw Drive intersection. Detailed modelling will be required to confirm the preferred scenario that meets the RTA requirements. Appendix C summarised network configurations for each scenario. Potential pros and cons for each scenario are also included in Appendix C.

Hyder re-analysed Black Hill access performance for the following options:

- Option 4: No access onto the F3. A full access on John Renshaw Drive is proposed via a signalised T junction.
- Option 5: Left in Left out on the F3. A full access on John Renshaw Drive is proposed via a signalised T junction;
- Option 6: Left in only on the F3. A full access on John Renshaw Drive is proposed via a signalised T junction.

Table 3-3 below presents SIDRA modelling results for development yields of 500,000 square metres and 800,000 square metres respectively. Figure 3-5 shows an indicative layout of the proposed signalised T-junction on the John Renshaw Drive.

Table 3-3 Modelling results at signalised T-junction for access options

Options	Year	Coal &Allied Development (GLFA)	Avg. Delay AM	LoS	Avg. Delay PM	LoS
Option 4	2026	500,000sm	32.2	**C**	40.5	**C**
Option 5	2031	800,000sm	23.7	**B**	57.7	**E**
Option 6	2031	800,000sm	40.6	**D**	>100	**F**

Note: Traffic modelling result in Table 3-3 assumed JRD/Black Hill access/egress as per Figure 3-5.

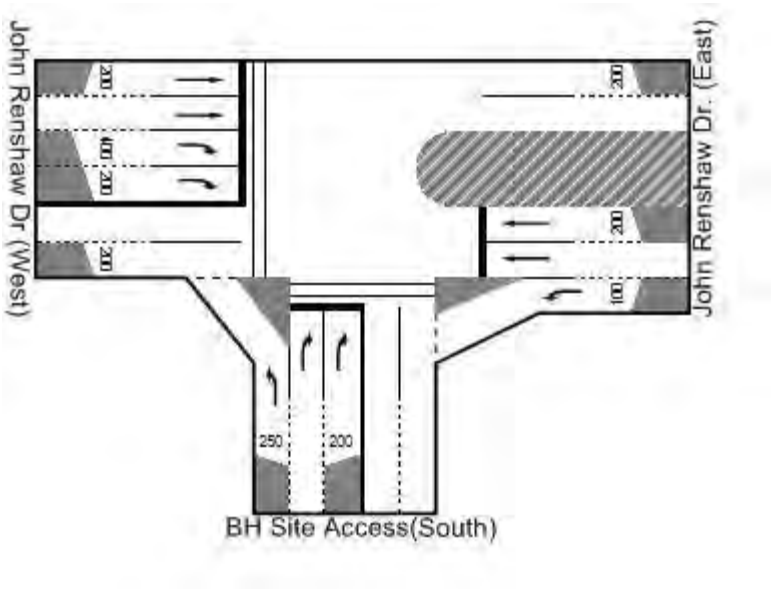

Figure 3-5 Indicative layout of John Renshaw Drive/ Coal & Allied access/egress

The modelling results were examined for the above three access options (options 4, 5 and 6) and a LoS was estimated for a signalised T-junction on the John Renshaw Drive. By 2026, with 500,000 square metres completed development at Black Hill, single access/egress via a signalised T-junction on the John Renshaw Drive is forecast to provide a LoS C (option 4).

With full 800,000 square metres development, access option 6 (ie. ingress/egress on John Renshaw Drive and one ingress on F3) is forecast a lower LoS F for PM peak. Beyond 500,000 square metres Black Hill development, the analysis identified the need for an additional egress onto the F3 Freeway. The model predicts LoS E for one ingress/egress on the F3 Freeway (option 5). The forecast LoS E for option 5 is marginally better than option 6 which predicts a LoS F. Figure 3-6 shows predicted queues at John Renshaw Drive signalised T-junctions for up to 500,000 square metres Black Hill development.

Figure 3-6 Predicted AM peak queues at John Renshaw Drive signals for a 500,000sm development yield

Using the RTA's trip generation rate for Black Hill site, the analysis suggests that a maximum of 500,000 square metres GLFA can be developed with one ingress on the F3 Freeway and one signalised ingress/egress on the John Renshaw Drive (option 6). The LoS during the PM peak is forecast to reduce due to one egress from the Black Hill estate. Hyder recommends that RTA consider an additional egress on the F3 Freeway. The current Boral site access on the F3 Freeway should be considered for such egress arrangement until RTA finalises the concept design of the F3 to Raymond Terrace Link.

3.8 Non-car modes strategy

Table 3-4 summarises broader assessment of the proposal against the objectives of the Integrating Land Use and Transport policy (ILUT) package.

Table 3-4 ILUT objectives and compliance

ID	ILUT objectives	Compliance
1	Improving access to housing, jobs and services by walking, cycling and public transport	A pedestrian and cycleway network will be provided to facilitate the movement of pedestrians and cyclist through the development area. Within the development proposal, the street network and central riparian corridor will be designed to provide safe walking routes and bicycle routes that link the site with the existing services and facilities in Black Hill. Through the NSW Government's Bike Plan, the Government will work in partnership with local councils communities and business to encourage bike riding growth and safer cycling in New South Wales. Newcastle City Council's Cycleway policy is to designate local streets for cycling and pedestrian use. This policy should ensure that road extensions that link to Black Hill will also contain provision for cyclists.
2	Increasing the choice of available transport and reducing dependence on cars;	The concept plan for Black Hill proposal will create an environment that is friendly to pedestrians, cyclists and public transport users. A pedestrian network will be installed to provide for movements of pedestrians throughout the development area. The centrally located Support Facilities area is incorporated to provide convenience facilities designed to reduce the need to leave the area during the day and hence dependency on cars. The local roads within the development will be designed to provide safe walking and bicycle routes that link with other existing services and facilities in Black Hill.
3	Reducing travel demand including the number of trips generated by development and the distances travelled, especially by car	Pedestrian and cycle routes within the development will connect with ▪ Existing facilities provided along John Renshaw Drive including existing public transport services. ▪ The central Support Facilities planned for the estate
4	Supporting the efficient and viable operation of public transport services	Currently no public transport operates in the immediate vicinity of the site. Bus route 160 (Newcastle-Kurri Kurri-Cessnock) runs just north of the proposed site, on John Renshaw Drive, but has no scheduled stop at that location. Five services run each way on that route during

ID	ILUT objectives	Compliance
		weekdays. The nearest train station to the proposed development site is located at Beresfield, on the Newcastle to Maitland/Scone/Dungog line, about five kilometres to the North East. The Lower Hunter Integrated Transport Plan has set as a target mode shift to secure 20% of peak hour work related trips to be other than by private car. Reaching this target will reduce peak vehicle trips and contribute to a reduction in congestion on the arterial road network. The key to meeting this target will be to provide Black Hill with regular bus services, particularly at peak hours, and to provide safe and convenient bicycle and pedestrian links to nearby residential areas. Possible bus routes could connect Black Hill with Beresfield railway station, and nearby residential areas. Considering the public transport strategy Hyder identified for the Coal & Allied's Minmi residential development site, a new bus route ` recommended between Cardiff Station/Glendale Interchange and Thornton Station. This new route would link the employment site directly to the rail line between Newcastle and Maitland and therefore give a public transport alternative to access the site from the major employment catchments of Newcastle and Maitland. Alternatively, consideration should also be given to implementing a shuttle bus service from Black Hill to the nearest rail station at Beresfield during peak hour services.
5	Providing for the efficient movement of freight	The proposed access on the John Renshaw Drive (via signalised T-Junction) and F3 Freeway (left in & left out) would provide efficient freight movements to and from site.

4 Summary of findings

The Lower Hunter Regional Strategy (LHRS) has identified the Coal & Allied Black Hill site as future employment lands. Hyder has been commissioned to carry out the traffic study to address the DGRs and assess the traffic and transport issues associated with the concept plan of the site. This traffic and transport report details the impact from the proposed employment development at the Black Hill site. The Black Hill development area consists of 183 hectares adjacent to the intersection of the F3 Freeway and John Renshaw Drive. The site is located within Newcastle Local Government Area (LGA). A Concept Plan for the subject site has been developed containing approximately 800,000 square metres of gross leasable floor area (GLFA) with the potential to create approximately 3,000 full time jobs. It is anticipated that the site will be developed over 17 years depending on market demand for employment land in the Lower Hunter. The site is expected to be operational from year 2016. Key findings from the traffic investigations are as follows:

- Most trips in the Black Hill area are undertaken by car. Journey to work data shows that the car accounts for more than 90 percent of journey to work trips. The local bus service provider, Blue Ribbon Bus Company provides only a school bus service in the Black Hill area and does not operate public bus services.
- John Renshaw Drive carries about 8,800 vehicles per day during a weekday, with weekend traffic around a 32% lower than an average weekday. The F3 Freeway carries over 31,500 vehicles per day on a weekday. Weekend volumes are significantly lower (20%) than the average weekday. This implies that both roads at this location carry a high proportion of commuter traffic to and from Newcastle. On the John Renshaw Drive about 1,000 heavy vehicles were recorded in a weekday. The heavy vehicle proportion was about 11% of total daily traffic. On the F3 Freeway about 5,750 heavy vehicles were recorded. The proportion of heavy vehicles on F3 Freeway was about 18.2 % of total daily traffic.
- Between 2004 and 2010, John Renshaw Drive traffic was grown by about 1.6% per annum. The recent growth on John Renshaw Drive is consistent with the general growth trend observed on other state roads in the Lower Hunter region which is between 1% and 2% per annum.
- Currently the F3 Freeway /John Renshaw Drive roundabout operates with a LoS between B and C. The peak hour degree of saturation (DoS) value was predicted between 0.74 and 0.87. The high DoS value (>0.85) indicating higher delays and overflow queues currently being experienced at this roundabout.
- The RTA provided trip generation rates for the Black Hill site. The traffic generation rate for the Black Hill site is proposed to be 0.58 (AM Peak) and 0.70 (PM peak) trips per 100 square metres GLFA respectively. The RTA's proposed trip rate for Black Hill site is about 23% to 25% higher than the trip generation rate estimated from existing business parks in the Lower Hunter.
- During the Concept Plan study the following six access Options for the Black Hill site were assessed.
    - Option 1: Left In Left Out at both John Renshaw Drive and F3. Access on F3 (at current Boral access) is proposed as per RTA publication of F3 to Raymond Terrace Link.
    - Option 2: Left In Left Out access on John Renshaw Drive and Left In Left Out access on F3 (Approximately 1.2 km south of F3/JRD roundabout).

- Option 3: Left In Left Out on John Renshaw Drive. Access on F3 is proposed via existing interchange at Black Hill Road.
- Option 4: No access onto the F3. A full access on John Renshaw Drive is proposed via a signalised T junction.
- Option 5: Left in Left out on the F3 (location is as per Option 1). A full access on John Renshaw Drive is proposed via a signalised T junction;
- Option 6: Left in only on the F3 (location is as per Option 1). A full access on John Renshaw Drive is proposed via a signalised T junction.

- Of those Options, access Option 5 (allows for all movements via a signalised T-Junction on the John Renshaw Drive, a left in /left out on the F3 Freeway) provides the highest benefit to Coal & Allied traffic.
- Future traffic conditions on the F3 Freeway and John Renshaw Drive corridor will be influenced by a combination of background growth, redistribution traffic effect from the Hunter Expressway and the proposed F3 to Raymond Terrace Link. With background traffic alone, the model forecasts corridor growth in the order of 1.6% per annum until 2031. The full Black Hill development is forecast to increase the corridor growth up to 3.3% per annum, primarily driven by the higher trip generation rate used for Black Hill estate as required by RTA.
- The development capacity of the Black Hill area is directly related to the traffic capacity at the critical intersection of the F3 Freeway/John Renshaw Drive roundabout. The Hunter Expressway is forecast to redistribute traffic across the regional network accessing the Black Hill site. The model predicts traffic reduction of up to 20% on the F3 Freeway near the Black Hill site. The Hunter Expressway and proposed F3 to Raymond Terrace Link is expected to reduce traffic flows through the roundabout, but that reduction is likely to be discounted by background traffic increases from other planned infill and greenfield developments in the Lower Hunter. The predicted background traffic growth until 2026 is expected to take up some additional capacity available at the roundabout. The traffic modelling predicts a lower LoS during peak periods for background growth alone.
- Using the RTA's trip generation rate for Black Hill site, the analysis suggests that a maximum of 500,000 square metres GLFA can be developed with one ingress on the F3 Freeway and one signalised ingress/egress on the John Renshaw Drive (access option 6). The LoS during the PM peak is forecast to reduce due to one egress from the Black Hill estate. Hyder recommends RTA consider an additional egress on the F3 Freeway (left out). The current Boral site access on the F3 Freeway should be considered for such egress arrangement until RTA finalises the concept design of the F3 to Raymond Terrace Link.
- The development of the Black Hill will require regular reviews of traffic generation and its impact as it relates to actual operating conditions on the road network. Any reduction in the trip generation rate measured against the RTA rate to be credited to the Coal & Allied estate to allow additional development over and above the 500,000 square metres development. Hyder recommends that actual Black Hill traffic generation be reviewed when agreed milestones are reached, for example after 100,000 sq meters of developable land is completed and occupied.

Director General's requirements

Table 4-1 Director General's Requirements

DG Requirement	Relevant Report Chapter(s)
1)Detail and justify the site access arrangements for the site, including how the proposed development will proceed and alternatives to the proposed access onto the F3 Freeway	Chap. 3.2, 3.4, 3.7
2)Include a traffic study prepared in accordance with the RTA Guide to Traffic Generating Developments, which addresses;	
(a) All relevant vehicular traffic routes and intersections for access to/from the subject area;	Chap. 2.1, 2.2,
(b) Current traffic counts for all of the above traffic routes and intersections;	Chap.2.10
(c) Anticipated additional vehicular traffic generated from the proposed development and associated trip distribution on the road network;	Chap 3.3, 3.5
(d) Consideration of the traffic impacts on existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicle traffic generated by the proposed development. The traffic impact shall also include the cumulative traffic impact of other proposed developments in the area;	Chap 3.1, 3.6,
(e) Details of the necessary road network infrastructure upgrades that are required to maintain existing levels of service on both the local and classified road network;	Chap 3.7, Appendix C
(f) Intersection analysis as well as a micro simulation model shall be submitted to determine the need for intersection and mid-block capacity upgrades, as well as ensure traffic signal co-ordination,	Chap 3.1, Appendix A
(g) Consideration of impacts on existing property access.	Chap 3.4
(h) Impact of Hunter Expressway and the proposed F3 to Raymond Terrace link.	Chap 3.6, 3.7

(i) Impacts on regional road networks during construction and operation. Assessment should be based on expected level of employment generation.	Chap 3.7
(j) Traffic management and proposed access from the wider road network as well the opportunities and constraints of alternative vehicular access points.	Chap 3.4, Chap 3.7, Appendix B
(k) Measures to introduce and promote public transport usage and mode share including pedestrian and cycle access within and to the site that connects to all relevant transport services and key off-site locations, having regard to the NSW Planning Guidelines for Walking and Cycling (2004) and the NSW Bike Plan (2010).	Chap 3.8
(l) Road design to cater for heavy vehicles associated with freight movement.	Chap 3.7
(3) Assess the proposal against the objectives of the Integrating Land Use and Transport Policy packages.	Chap 3.8

Appendix A

Local area model calibration

A1. Local area model calibration

Local area model calibration for Coal & Allied sites involved both TransCAD and the Paramics model. The following sections provide an overview of model calibration at both network and intersection levels.

A2. TransCAD model calibration

Model calibration is the process of matching the modelled flows with the observed traffic flows after adjusting the model parameter and inputs in a logical manner. The calibration of the model confirms the consistency of the future year model and assessment of the impact of increased traffic and network changes in the future. Table A-1 shows the comparison of existing base model forecasts with observed traffic flows counted in year 2007 at key roads in the study area. The result showed that TransCAD model was calibrated with observed counts within the 10% target.

Table A-1 Comparison of surveyed flows (in vehicles) with modelled flows (AM peak 1 hour, 2 way)

Road	Location	Traffic Count'07	Existing Base Model	Difference %
Newcastle Link Rd	East of Minmi Road	2114	1947	-9%
Minmi Road	South of Newcastle Link Rd	1304	1284	-2%
John Renshaw Dr.	West of Weakleys Drive	782	780	0%

Note: 2010 counts on Newcastle Link Road = 2139 vph, Minmi Road =1470 vph, John Renshaw Drive = 758 vph.

Between 2007 and 2010, AM peak hour traffic change on key roads in the Coal & Allied study area was low (within 5% in 3 years) and is unlikely to affect the above calibration target achieved for Coal & Allied study area.

A3. Paramics model calibration

The Paramics model covers the area bounded by the F3 Freeway, Newcastle Link Road and John Renshaw Drive. Key collector and local roads that feed traffic to above arterial and freeway are also included. Woodford Street, Minmi Road, Cameron Park Drive, Northlakes Drive and Lenaghans Drive provide key connections to Coal & Allied lands and are therefore included in the existing Paramics model. Figure A-1 shows coverage of the Paramics model.

In developing the Paramics model, relevant guidelines were adopted as per “Paramics Micro-Simulation Modelling – RTA Manual Version 1.0, May 2009. The Paramics demand matrix was estimated from the TransCAD model using a sub area technique. Both cars and heavy vehicles were modelled separately. All-or-nothing assignment approach was used. The route choice between origin and destination was based on the minimum generalised cost between the origin and destination.

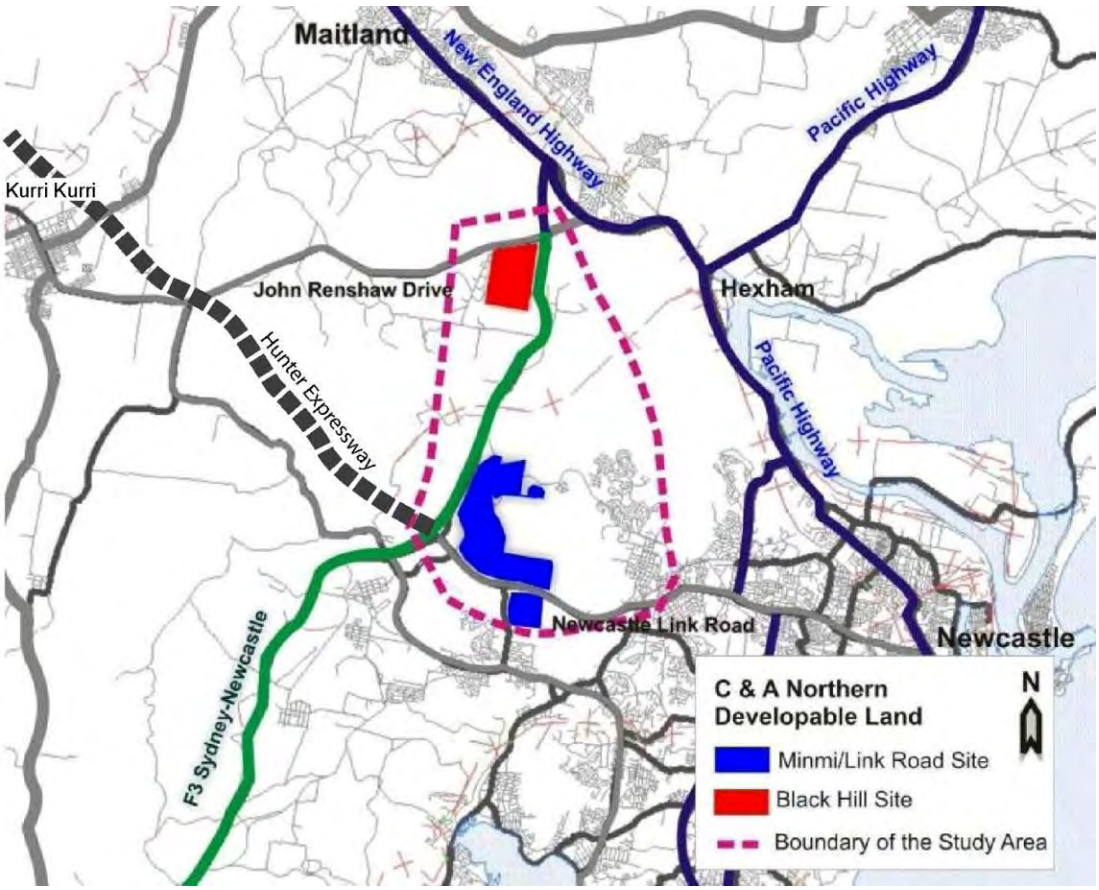

Figure A-1 Extent of Study Area, Paramics

The base Paramics model covers the two hour AM peak period (7:00 am to 9:00 am) demand consistent with the TransCAD model. The model period was extended by a 15 minutes warm up period to allow vehicles to load into the network.

In the Paramics model stability criteria were sourced from the RTA. Calibration criteria, which was based on the UK guidelines described in the Design Manual for Roads and Bridges (DMRB). The DMRB uses GEH statistics to test the model stability against observed flow.

The GEH statistics is calculated as:

$$GEH = \sqrt{2(M-C)^2 / (M+C)}$$

Where M is the model volume and C is the observed traffic count.

A GEH parameter of 5 or less indicates an acceptable fit between model and counts. Table A-2 and Table A-3 summarised calibration indicators used for Paramics model.

Table A-2 Mid-Block Calibration Results for AM Peak period

GEH	Percentage of Link Flow	Target	Overall
<5	96%	85%	Pass
<10	100%	100%	Pass

Table A-3 GEH Statistics for Inbound and Outbound Traffic

GEH statistics	GEH<5	Target	Overall
Percentage of Inbound counts (destinations)	100	85	Pass
Percentage of outbound counts (origin)	100	85	Pass

To check the Paramics model stability, hourly modelled flows were used for model runs using five different seed values. The seed values were selected as per the RTA standard. RTA guidelines state that total variation for different seed value runs should be within 5% (vehicle per hour). Table A-4 shows the seed values and the modelled traffic flows on midblock sections. The percentage variation was about 2% therefore confirming that the model achieved RTA's stability criteria.

Table A-4 Traffic Flows in selected locations for different selected seed value runs

Road	Location	Direction	560	28	7771	86524	2849	% Diff
Newcastle Link Road	West of Woodford Street	NB/WB	1076	1103	1081	1109	1095	3%
		SB/EB	1041	1086	1086	1066	1071	4%
Newcastle Link Road	East of Minmi Road	NB/WB	854	878	834	883	851	6%
		SB/EB	1196	1240	1242	1236	1236	4%
John Renshaw Drive	West of Weakleys Drive	NB/WB	307	314	305	297	314	6%
		SB/EB	518	494	495	491	514	5%
Total Modelled Flows			4992	5114	5044	5083	5083	2%

Figure A-2 shows the number of released vehicles in the current network at every minute for five runs using different seed (560, 28, 7771, 86524 and 2849). The Figure A-2 shows a consistent traffic patterns for all five seeds. This indicates the base model is stable between model period of 7:00 am and 9:00 am and can be used for future years.

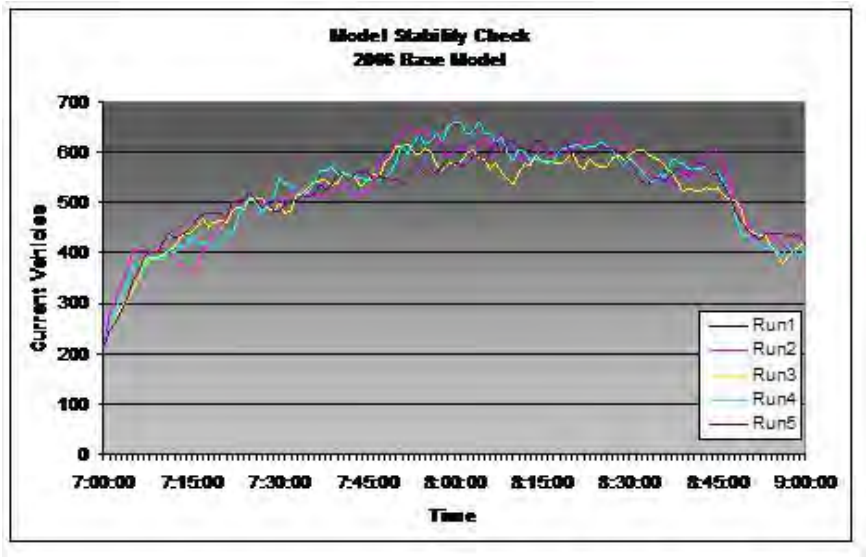

Figure A-2 Model Stability Check

Similar to TransCAD, the results from Paramics model were also measured at intersection level. Table A-5 summarises LoS and delays obtained from Paramics and aaSIDRA. Both model results showed a close match confirming that appropriate parameters are used in model calibration.

Table A-5 Intersections LoS comparison between surveyed and modelled for AM Peak hour

		Paramics Result		Traffic Counts,07	
Intersection	Control	Avg Delay	LoS	Avg Delay	LoS
Woodford Street / Newcastle Link Road	Roundabout	4	A	5	A
Newcastle Link Rd / Minmi Rd	Roundabout	4	A	7	A
Woodford Street / Minmi Rd	Signalised	7	A	15	B
John Renshaw Dr / Weakleys Dr	Roundabout	16	B	11	A

Note: Delay for roundabout is shown for average for all movements.

Table A-6 shows the maximum queue length observed at key intersections during the simulation period (AM peak period, 7-9). Due to the close proximity of Black Hill and Minmi/Link Road sites, model results were compared on key roads including Newcastle Link Road and John Renshaw Drive. The model indicated no significant queue at Woodford St and Minmi Road roundabouts with the Newcastle Link Road. However, occasional queues were observed at Cameron Park Drive and Minmi Road southern approach, due to the priority movements provided on the Newcastle Link Road traffic. At F3/John Renshaw Drive intersection, a queue was observed on F3 (south

approach). Figures A-3 to A-5 show the screen captured from the Paramics model at key intersections on Newcastle Link Road and John Renshaw Drive.

Table A-6 Max Queue Length (meters) observed in Paramics

ID	Intersection	Control	North	East	South	West
I-01	Newcastle Link Road and Woodford Street	Roundabout	25	14	41	14
I-02	Newcastle Link Road and Minmi Road	Roundabout	--	18	57	27
I-03	Woodford Street and Minmi Road	Signalised	19	52	22	--
I-04	John Renshaw Dr and Weakleys Dr.	Roundabout	129	54	114	162

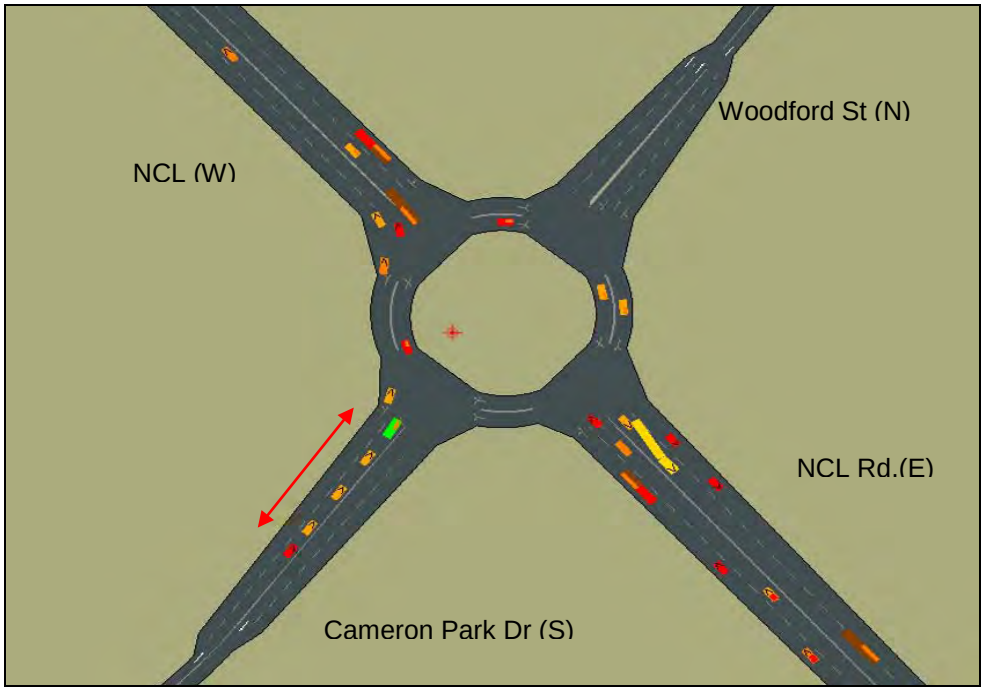

Figure A-3 Queue length observed in Newcastle Link Rd / Woodford Street roundabout(I- 01) –Time 7:52 AM

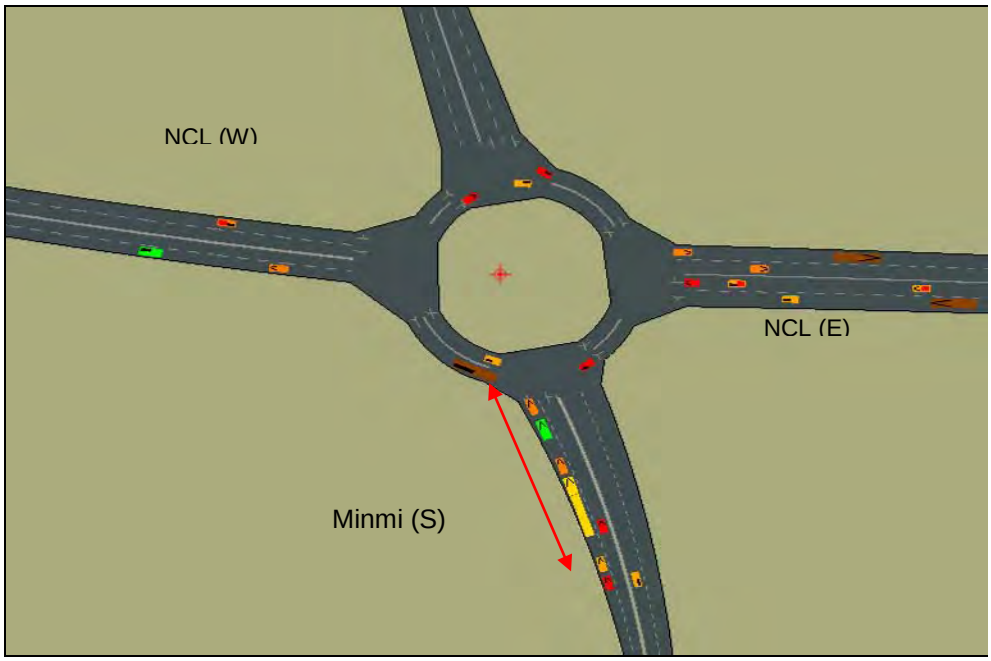

Figure A-4 Queue length observed in Newcastle Link Rd / Minmi Road roundabout (Time 8:13 AM)

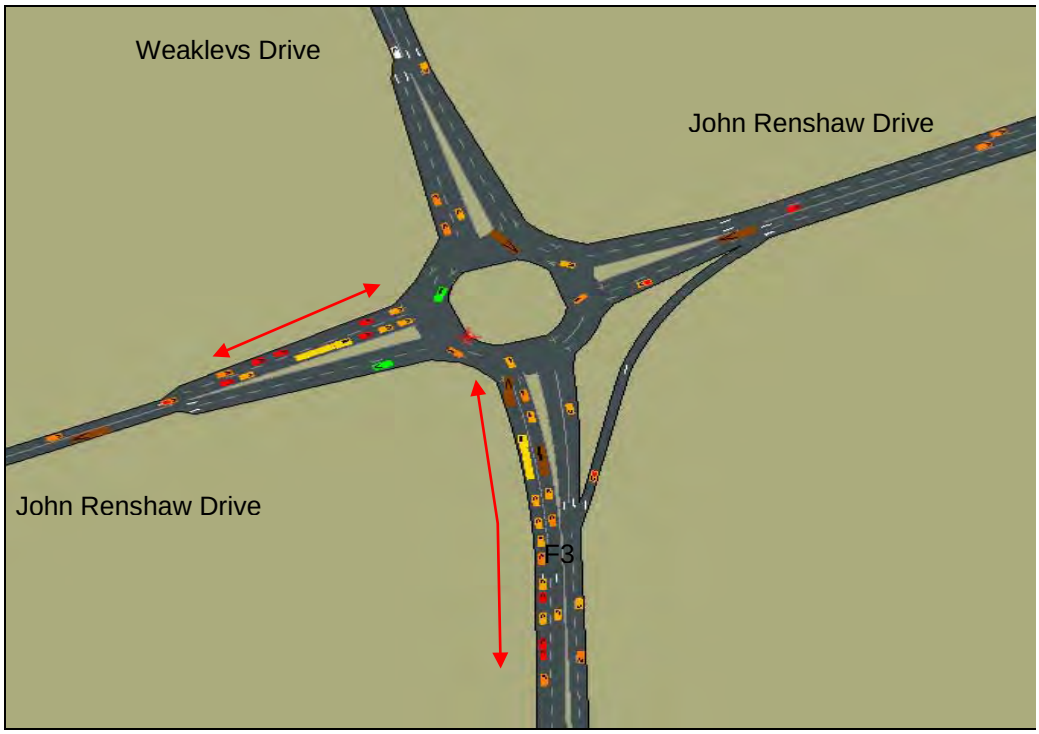

Figure A-5 Queue length observed in John Renshaw Drive / Weakleys Drive Roundabout (Time 8:25 AM)

Appendix B

Opportunities and constraints for access options

B.1 Site access options

During the Concept Plan study, possible access options were investigated for Black Hill site considering the pros and cons on the surrounding road network. The investigation included the planned F32R Link which will impact Coal & Allied access on the F3. Figures B-1 to B-4 summarise potential opportunities and constraints for access options.

Access Option 1

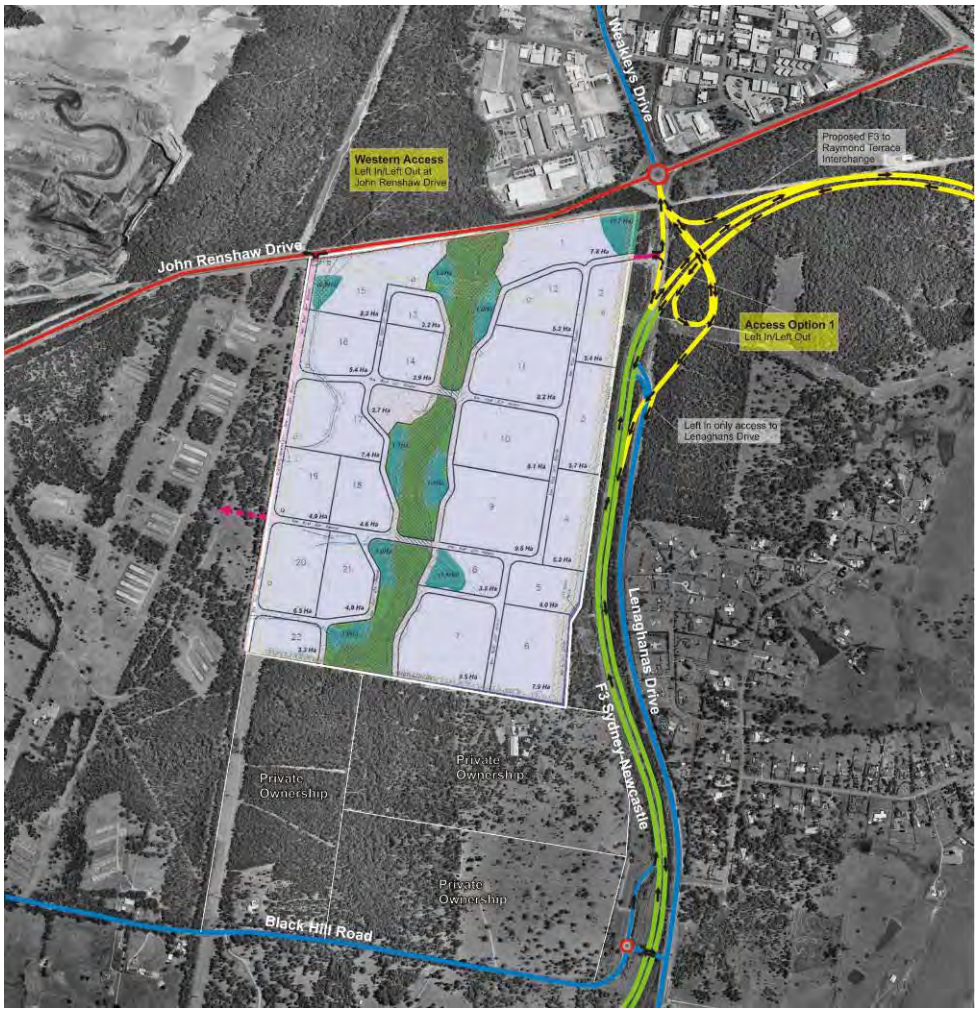

Figure B-1 Access Option 1

Access	Description	Advantages	Disadvantages
Option 1	Left In Left Out at both John Renshaw Drive and F3. Access on F3 (at current Boral access) is proposed as per RTA publication of F3 to Raymond Terrace Link	-No major conflict with F3 and JRD through movement; -Simple solution for a high speed road environment.	-Requires vehicles to travel extra distance to access site; - A left in/left out on the F3 immediately south of F3/JRD roundabout may have potential safety issues. With planned Black Hill interchange (as part of F32R Link) this access will be on the F3 offload ramp. -Currently some movements at the F3/JRD roundabout show capacity problems during peak. Future growth on F3 and JRD is expected to take up some of the spare capacity available at JRD/F3 roundabout;

Access Option 2

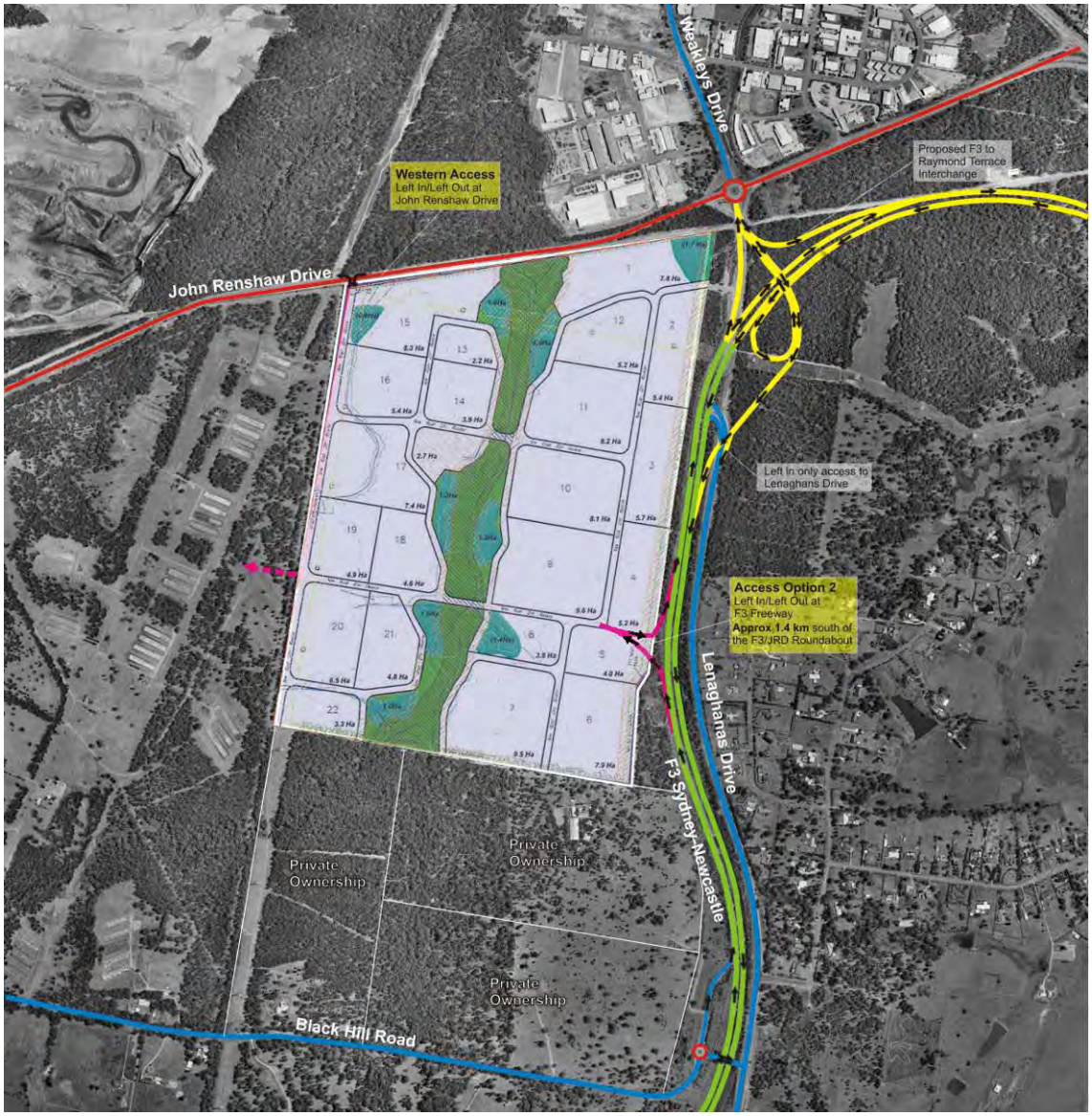

Figure B-2 Access Option 2

Access	Description	Advantages	Disadvantages
Option 2	Left In Left Out access on John Renshaw Drive. Left In Left Out access on F3 (Approximately 1.2 km south of F3/JRD roundabout)	-No major conflict with F3 and JRD through movement; -Simple solution for a high speed road environment. - Austroads guideline recommends a minimum spacing between interchanges of 5-8km, and between on and off ramps of between 0.9 and 1.5km.	-Merging and Diverging problems on the F3 due to close proximity with proposed Black Hill interchange -Can be expensive to build two additional ramps on the F3 -Requires vehicles to travel extra distance to access site; -Currently some movements at the F3/JRD roundabout show capacity problems during peak. The future growth on F3 and JRD is expected to take up some of spare capacity available at JRD/F3 roundabout;

Access Option 3

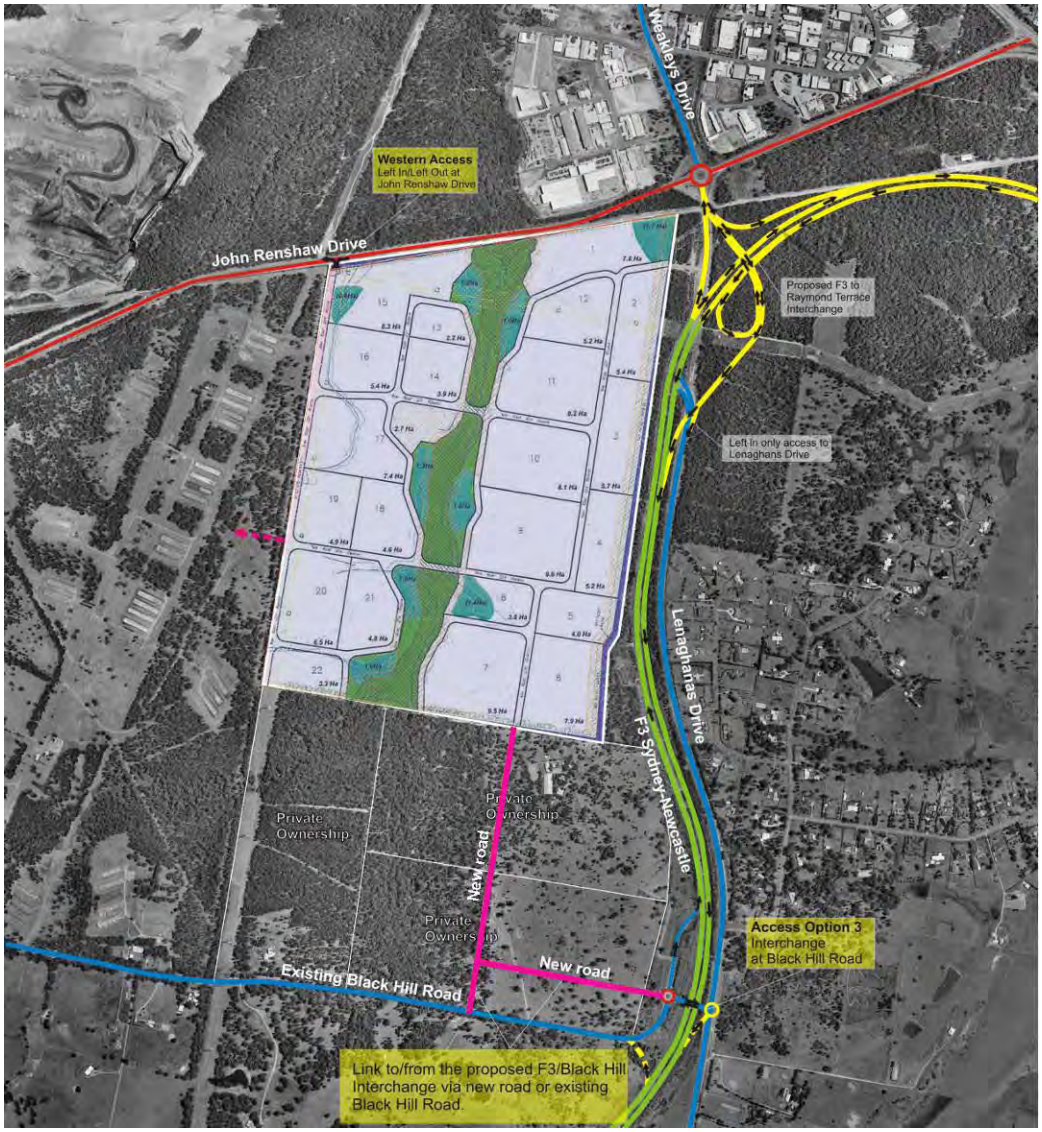

Figure B-3 Access Option 3

Access	Description	Advantages	Disadvantages
Option 3	Left In Left Out at John Renshaw Drive Access on F3 is proposed via existing interchange at Black Hill Road	-No major conflict with F3 and JRD through movements; -Provide high level of accessibility to the site. -Compared to Options 1 and 2, this Option reduces the volume of Coal & Allied traffic that must use the JRD/F3 roundabout. -Provides direct link for southbound traffic to/from F32RT; -Compared to Options 1 and 2, this option reduces travel distance for some vehicles, but increases it for others. -There is a bridge across the F3 (Black Hill Rd Interchange) that can be used as the basis for additional two ramps; -Offers opportunities to provide access to other development sites (Catholic Church Land, etc.)	-High cost solution; Black Hill Rd Interchange will generate major traffic flows and may require duplication of the existing bridge on F3; - New road on other land ownership -Requires additional on and off ramps at F3/Black Hill interchange -Change in road hierarchy of Black Hill Rd -Existing Black Hill Road will need to be upgraded to a sub-arterial from current local road standard. This does not comply with RTA's road hierarchy guideline; Option 3 Coal & Allied access is unlikely to reduce impact significantly on F3/JRD roundabout.

Appendix C

Potential upgrade scenarios for F3 and John Renshaw Drive roundabout

C.1 Upgrading scenraios

Hyder identified four scenarios on how this roundabout could be upgraded.

- Scenario 1 involves reconfiguring F32R Black Hill base interchange- F3 Off ramp to join F3/JRD roundabout as a separate leg and form a five leg roundabout;
- Scenario 2 involves reconfiguring F32R Black Hill base interchange - Northbound On Ramp and Southbound Off ramp to join with existing intersection on John Renshaw Dr east of Weakleys Dr;
- Scenario 3 involves grade separation of North-South movements at JRD/F3 Roundabout; and
- Scenario 4 is the variation of scenario 2. New signals to replace F3/JRD roundabout. The new intersection on JRD east of Weakleys Dr is likely to be signals. Two signals can be co coordinated.

Of the four scenarios we identified a single or a combination of scenarios could provide adequate network capacity at F3 and John Renshaw Drive corridor. Detailed modelling will be required to confirm the preferred scenario that meets the RTA requirements.

Figures C-1 to C-4 show schematic network configuration for each scenarios. Potential pros and cons from each scenario are also included.

Upgrade Scenario 1

Figure C-1 Upgrade Scenario 1

Upgrade	Description	Advantages	Disadvantages
Scenario 1	Reconfigure F32R Black Hill base interchange- F3 Off ramp to join F3/JRD roundabout as a separate leg and form a five leg roundabout	-Reduce traffic conflicts; -Can be staged to provide additional capacity at roundabout;	-Would increase the complexity of the roundabout; -Connection as a separate leg may be difficult to achieve within the available land area;

Upgrade Scenario 2

Figure C-2 Upgrade Scenario 2

Upgrade	Description	Advantages	Disadvantages
Scenario 2	Reconfigure F32R Black Hill base interchange - Northbound On Ramp and Southbound Off ramp to join with existing intersection on John Renshaw Dr east of Weakleys Dr	-Simplify roundabout geometry and reduce some of traffic "pressure" from roundabout; -Upgrade (improvement) of F3/JRD roundabout can be staged in the future	-Forms a new intersection on John Renshaw Drive east of Weakleys Drive -New intersection may require major upgrading depending on and off road traffic from F32R -Two intersections closely spaced on JRD

Upgrade Scenario 3

Figure C-3 Upgrade Scenario 3

Upgrade	Description	Advantages	Disadvantages
Scenario 3	Grade separation of North-South movements at JRD/F3 Roundabout.	-Separating major north-south movement likely to increase capacity to the roundabout	-There could be merging /diverging issue with Black Hill interchange (base configuration)

Upgrade Scenario 4

Figure C-4 Upgrade Scenario 4

Upgrade	Description	Advantages	Disadvantages
Scenario 4	Variation of Scenario 2. New signals to replace F3/JRD roundabout. New intersection on JRD east of Weakleys Dr may also signals	-Simplify F3/JRD intersection geometry; -Signal control may increase capacity of intersections; -Coordination may require to increase capacity with the proposed new signals at Coal & Allied access on the JRD;	-Two signals at relatively short distance -May increase side street traffic delays