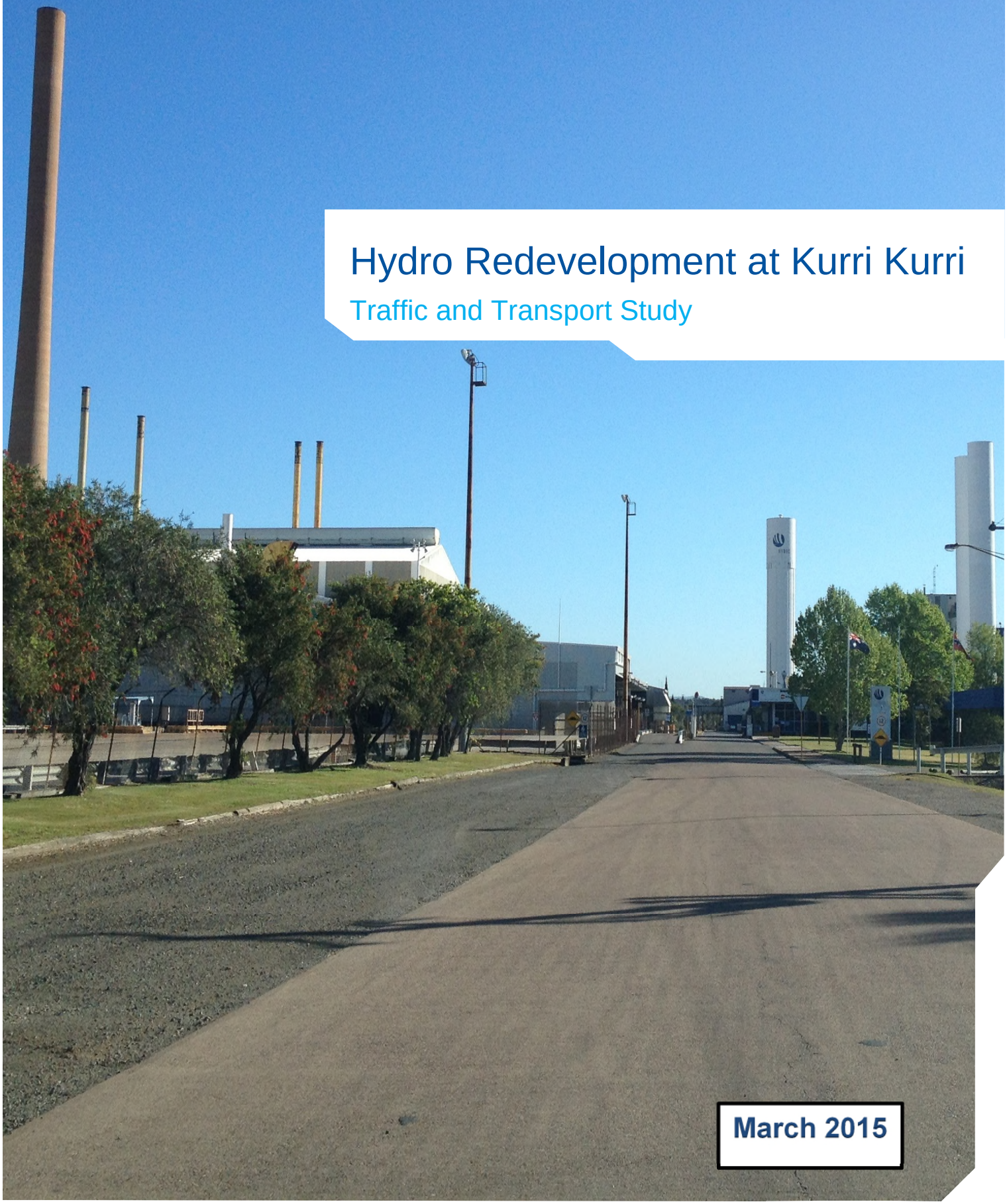
Final Report

Hyder

Hydro Redevelopment at Kurri Kurri

Traffic and Transport Study



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HYDRO ALUMINIUM KURRI KURRI PTY LTD TRAFFIC AND TRANSPORT STUDY

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REVISIONS

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	April 14	DRAFT	MR, SM	MR
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CONTENTS

1 Introduction

1.1 Study Purpose

The following document provides a Traffic and Transport Study (hereafter referred to as "the Study") of a proposal to redevelop the Hydro Kurri Kurri site. The Study has been commissioned by the Hydro Aluminium Kurri Kurri Pty Ltd (Hydro), the owner of the smelter.

The Study has been delivered into two separate Stages including:

- ***Stage 1***: Preliminary Traffic Impact Assessment & Loxford Interchange Design. The Stage 1 investigation was undertaken between October 2013 and April 2014. The scope of Hyder's Study was to carry out traffic support services to assist Hydro in the planning of the smelter site and determine any development constraints based on traffic. The traffic assessment was undertaken for two key access points proposed at Hart Road interchange with Hunter Expressway and Cessnock Road. Both access points to/from site were modelled using SIDRA software. In Stage 1 Preliminary Master Planning undertaken by Hydro identified development potentials up to 300 ha for employment purpose and about 1290 residential dwellings. The Stage 1 traffic assessment presented in this report was at high level and determined traffic capacity at key access points for 300 ha employment land and 1290 residential dwellings. The assessment determined potential infrastructure upgrades required to support both employment and residential development. An indicative development thresholds was determined that could be supported by the existing infrastructure and then identified the need for further upgrades. A meeting was held on 17 December 13 (during the early stage of the project) with Roads and Maritime Services (RMS) staff on Stage 1 investigation.

- ***Stage 2***: Revised Traffic Impact Assessment for Planning Proposal. The Stage 2 investigation was undertaken between December 2014 and February 2015. The site constraints analysis undertaken by Hydro identified the need to revise the development potentials. The updated Master Plan (referred to as the Planning Proposal) proposed the reduced employment development up to 200 ha. The Planning Proposal also proposed increased residential yields to 2088 dwellings. The Stage 2 traffic assessment was updated based on the revised development yields and also considered new traffic survey undertaken on 3rd Feb 2015 at Hart Road interchange with Hunter Expressway and Cessnock Road.

In the course of preparing this report, relevant documents of the proposal have been reviewed and potential traffic impacts on the road network have been assessed. The Study provides recommendations on potential upgrading works that will be required at two key access points to minimise impacts from redevelopment proposal.

The overall outcome of the Study is a Traffic and Transport assessment which determines the impact at key access points arising from the proposed redevelopment at Hydro Kurri Kurri site.

1.2 Background

The future of the smelter is currently under review including consideration of closure and decommissioning of the smelter. The Hunter Expressway which opened to traffic (on 22 March14) would facilitate redevelopment opportunities of the smelter site and the surrounding Hydro owned buffer land. Hydro has commenced initial investigations into land capability and future land uses for the smelter plant and the surrounding Hydro owned buffer land. Hydro has engaged consultants to assist in the investigation and analysis of its landholdings to progress its master plan for the site. The initial review has earmarked key landholdings adjacent to existing employment lands (to the south) and proposed urban areas (to the east) currently identified in the Lower Hunter Regional Strategy (LHRS) as potential key developments areas to support its master plan. It is proposed to rezone these two key areas from RU2 - Rural Landscape to employment and residential land. The preliminary assessment is focussed on these two areas as potential employment and residential land respectively.

As part of the "Gateway" process of Planning Proposal, a Traffic and Transport Study of the smelter site is required to address the principles of integrated transport planning, explore alternative methods of transport and determine capacity of the road network and identify required upgrades. This report forms the Traffic and Transport element of the Hydro Kurri Kurri Planning Proposal.

1.3 Study Aims and Objectives

The main purpose of Hyder's Study is to assess traffic and transport impact of the proposed redevelopment providing mitigation measures where required. Traffic modelling results were used to determine impact at key access points. The Study has assumed 2031 as the future horizon year for its assessment. The horizon year of 2031 is consistent with the planning time frame identified in the Lower Hunter Regional Strategy.

Key objectives of Hyder's Study include:

- Identify key access points and assess the impact caused by the increased development.
- Estimate additional traffic generated by the proposed development, based on the RMS's Guide to Traffic Generating Developments.
- Identify potential for converting half interchange to a full interchange at Loxford with Hunter Expressway; and
- Identify and examine the road and intersection upgrades required to support future development thresholds.

1.4 Study Area for Traffic Assessment

The traffic impact to key roads and intersections with the Core Study Area will be driven primarily by future Hydro residential and employment developments. For the purpose of traffic assessment, a Core Study Area was identified. In general, the study area includes key road network including the Hunter Expressway, Cessnock Road, Hart Road and McLeod Road. In general Core Study Area follows the proposed development footprints showed in Figure 1-1.

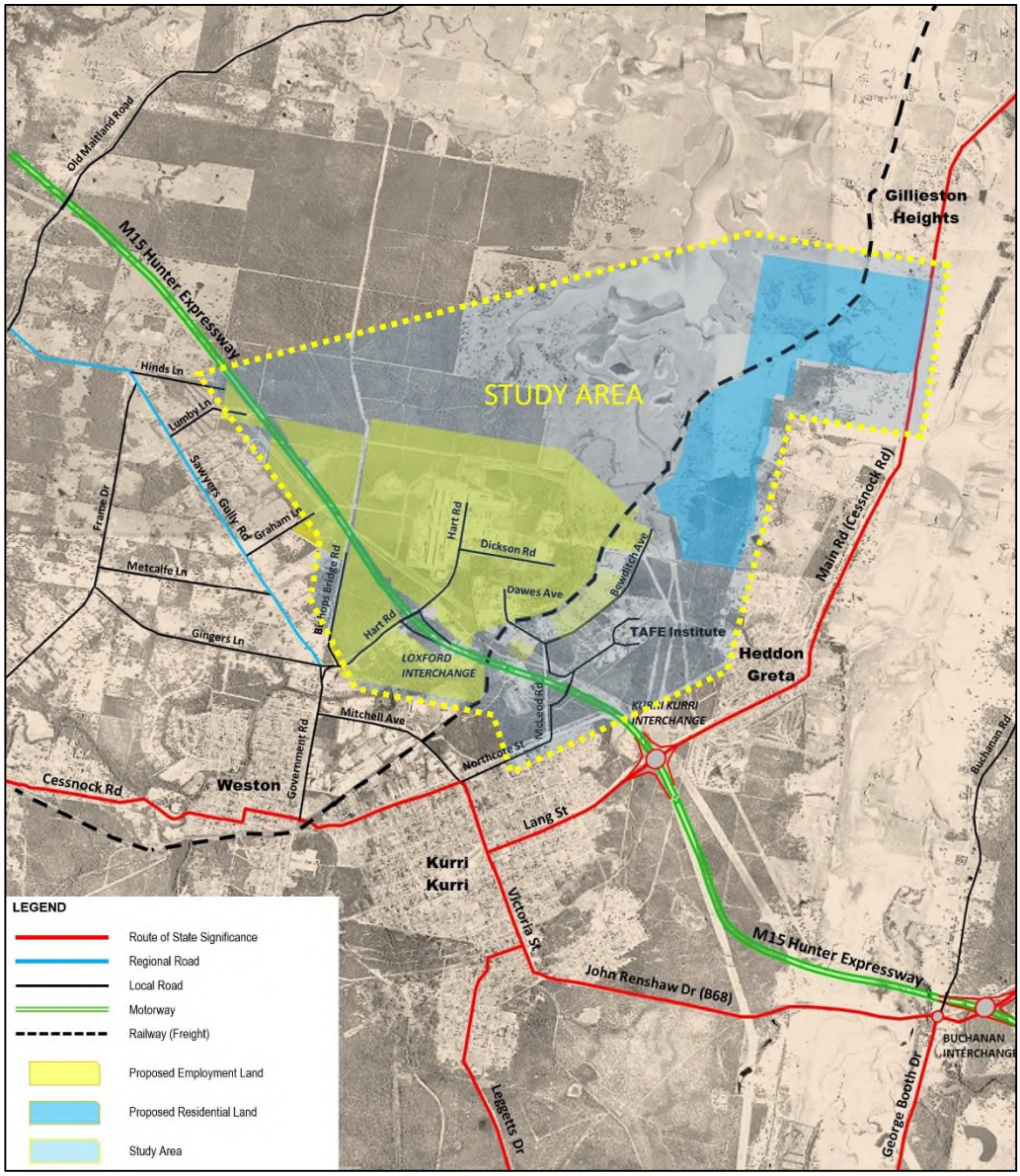


Figure 1-1 Core Study Area Boundary

1.5 Reference Traffic Data and Model

For the purpose of this Study, traffic and modelling data have been sourced from RMS's Lower Hunter Traffic Model (LHTM). Hyder was provided LHTM licensing deed agreement by the RMS for this study. Hyder used appropriate traffic data from LHTM relevant to the Core Study Area in particularly the background traffic growth. Two key access points at Cessnock Road and Hart Road were assessed taking into account background traffic volumes to 2031. Given the strategic high level assessment required for both Stage 1 and Stage 2, the existing available traffic data from various sources (inclusive of LHTM) was used. A new traffic survey was undertaken on 3rd February 2015 as part of the Hydro Aluminium Kurri Kurri Demolition and Remediation Project. The new traffic survey data was used for this study where relevant.

To assess intersection performance, Hyder used SIDRA modelling software. For the LHTM Hyder used TransCAD software.

1.6 Report Structure

Hyder's Study outcome has been reported in six chapters as follows:

- Chapter 1 outlines study purpose, background, study objectives and reference traffic data and model used in the assessment.
- ***Part A*** documents preliminary traffic impact assessment at key access points and identifies potential for converting half interchange to a full interchange at Loxford with Hunter Expressway. Stage 1 traffic assessment has been documented in three Chapters as follows:
- Chapter 2: Existing Transport Network – overview of the existing conditions regarding the road network, land use, demographics, public transport and Journey to Work data.
- Chapter 3: Access Strategy-identifies potential opportunities and constraints of access options. A preferred option is identified from traffic perspective.
- Chapter 4: Preliminary Traffic Assessment – identifies traffic impact to key access points and provides mitigation measures depending development thresholds. The design consideration for converting half interchange to a full interchange at Loxford with Hunter Expressway is included in this section.
- ***Part B***: Chapter 5 documents updated traffic and transport assessment from the Planning Proposal. The updated impact assessment has been documented in Chapter 5. This section also discusses proposed strategy for non-car modes.
- Chapter 6: Conclusion and Recommendations – the summary of findings from Stage 1 and Stage 2 traffic investigation.

Part A

Preliminary Traffic Impact Assessment & Loxford Interchange Design

Part A documents finding from Stage 1 investigations.

Structure

- Chapter 2: Existing Transport Network
- Chapter 3: Access Strategy
- Chapter 4: Preliminary Traffic Impact Assessment

2 Existing Transport Network

This section of the report provides a description of existing transport network in the vicinity of proposed development site. Analysis of transport network has been undertaken based on a desktop analysis with main focus on:

- Road hierarchy;
- Journey to work trends;
- Public transport;
- Alternative modes; and
- Crash data.

2.1 Road Hierarchy and Key Roads

RMS adopted the following road classification system and describes the roads as follows:

- Motorway (M);
- Route of National Significance (A); and
- Route of State Significance (B).

The management of the road network in NSW is shared between the State Government (through the RMS) and Local Government (through Local Councils).

Road management provides for three categories of road as follows:

- State Roads: Motorways (M), Routes of National (A) and State Significance (B);
- Regional Roads; and
- Local Roads.

State Roads are the major arterial links. The RMS takes responsibility for managing the primary traffic function of all State Roads including funding and determining priorities, and regulates the activities of third parties on the road and access to adjoining land to promote road safety, traffic efficiency and protect the road asset.

Regional Roads are performing a sub-arterial function in urban areas. Regional Roads have secondary importance between State Roads and Local Roads which together with the State Roads provide the main connections to and between smaller towns and districts. Regional Roads are the responsibility of Councils to fund, determine priorities and carry out works.

Local Roads comprise the remaining Council controlled roads which provide for local circulation and access. Local Roads are the responsibility of Councils to fund, determine priorities and carry out works.

The road hierarchy of key roads in the study area is summarised in the Table 2-1. Previous Figure 1-1 shows road hierarchy graphically.

Table 2-1 Road hierarchy and road characteristics

ID*	Road	Hierarchy	Responsibility	Main characteristics
1	M15 Hunter Expressway	Motorway	RMS	• M15 Hunter Expressway was opened to traffic on 22 March 2014. • It is a dual carriageway Motorway with two lanes in each direction running in southeast-northwest direction from M1 Motorway at the Newcastle Link Road (A15) interchange to the New England Highway (A43) north of Branxton. • Within the study area, M15 Hunter Expressway connects road network via two interchanges as follows: o *Loxford Interchange*. Loxford interchange is a half interchange with east-facing ramps at Hart Road. Traffic traveling towards Branxton can exit the expressway at this interchange to access Hart Road. Traffic on Hart Road can use the on-ramp to travel southeast towards Newcastle. o *Kurri Kurri Interchange*. Kurri Kurri interchange is a full interchange with north and south facing on/off ramps at Main Road-Cessnock Road.
2	Main Rd-Cessnock Road	Route of State Significance	RMS	• Main Road-Cessnock Road is arterial route providing connection between Maitland and Cessnock via Gillieston Heights, Cliftleigh, Heddon Greta, Kurri Kurri, Weston and Abermain. • Main Road connects the M15 Hunter Expressway via *Kurri Kurri Interchange.* • Main Road-Cessnock Road is an undivided road with two travel lanes (one lane in each direction). • It has various sign post speed limits between 60-80 km/h along the entire route.
3	Sawyers Gully Road	Regional	Council	• Sawyers Gully Road is a part of regional route which connects Kurri Kurri and Greta. • Sawyers Gully Road is an undivided road with two travel lanes (one lane in each direction). • It has various sign post speed limits between 60-80 km/h along the entire route.
4	Hart Road	Local	Council	• Currently Hart Road is a local road with the main purpose to provide access to/from the Hydro Aluminium facility, Kurri Kurri. • Hart Road is an undivided road with two travel lanes (one lane in each direction). • It has post speed limit of 70 km/h. • Hart Road connects the M15 Hunter Expressway *via Loxford Interchange*. An overbridge (one lane in each direction) provides access to Hart Road, with traffic on Hart Road travelling over M15 Hunter Expressway.

ID*	Road	Hierarchy	Responsibility	Main characteristics
5	Government Road	Local	Council	• Government Road is a local road which provides connection between Sawyers Gully Road to the north and Main Road-Cessnock Road to the south. • Government Road is an undivided road with two travel lanes (one lane in each direction). • In the section between Mitchell Avenue and Main Road-Cessnock Road, Government Road has urban street characteristics with wider lanes and on-street parking permitted. • It has posted speed limit of 70 km/h.
6	Mitchell Avenue	Local	Council	• Mitchell Avenue section between Northcote Street and Government Road is a local road which provides access to existing industrial estates north-west of Kurri Kurri town centre. • It is an undivided road with two travel lanes (one lane in each direction). This section has posted speed limit of 60 km/h. • Mitchell Avenue crosses the railway line via at grade railway crossing.
7	Bishops Bridge Road	Local	Council	• Currently Bishop Bridge Road is a narrow, rural type local road with no road pavement. • It provides access to/from some remote dwellings located along its route with the Hart Road to the south. • Bishop Bridge Road is permanently closed for traffic south of the expressway. No connection is provided along Bishop Bridge Road over or under the expressway.
8	Graham Lane	Local	Council	• Currently Graham Lane is a narrow rural type local road with no pavement. • It provides connection between Bishop Bridge Road and Sawyers Gully Road. • It provides only access to some remote dwellings located along its route. • Graham Lane is permanently closed for traffic southwest of the expressway. No connection is provided along Graham Lane over or under expressway.
9	Lumby Lane /Hinds Lane	Local	Council	• Currently Lumby Lane and Hinds Lane are narrow rural type of local roads with no pavement. • They provide access to some remotely located dwellings with Sawyers Gully Road.

ID*	Road	Hierarchy	Responsibility	Main characteristics
10	McLeod Road	Local	Council	• McLeod Road is local road which provides connection between street network in the Kurri Kurri town centre and some remote dwellings in Loxford. It also provides main access route to the TAFE Hunter Institute, Kurri Kurri Campus. • McLeod Road in the section between Northcote Street (Kurri Kurri) and TAFE Hunter Institute access to the north is undivided road with two travel lanes (one lane in each direction). This section has posted speed limit of 60 km/h. • McLeod Road in the section between TAFE Hunter Institute access and railway crossing at Dawes Avenue is a narrow, rural type local road with no road pavement. About 350 m long McLeod Road section south of TAFE Hunter Institute access is diverted to cross the expressway via a new over-bridge.
11	Dawes Avenue	Local	Council	• Dawes Avenue is rural type local road which provides access to some remotely located dwellings in Loxford. • It is connected with Kurri Kurri town via McLeod Road over at grade railway crossing.
12	Bowditch Avenue	Local	Council	• Bowditch Avenue is rural type local road which provides access to some remotely located dwellings in Loxford. • It is connected with Kurri Kurri town via McLeod Road. • Currently majority of road section is narrow with no pavement.

2.2 Journey to Work Analysis

An analysis of the 2011 Census Journey to Work (JTW) data shows that around 91% of work trips for those working and living in Kurri Kurri are undertaken by private car transport. Thus, there is a high dependence on private cars for work related trips. The study area is defined by nine travel zones, 6733, 6734, 6735, 6736, 6737, 6738, 6739, 6740, and 6741, as shown in Figure 2-1.

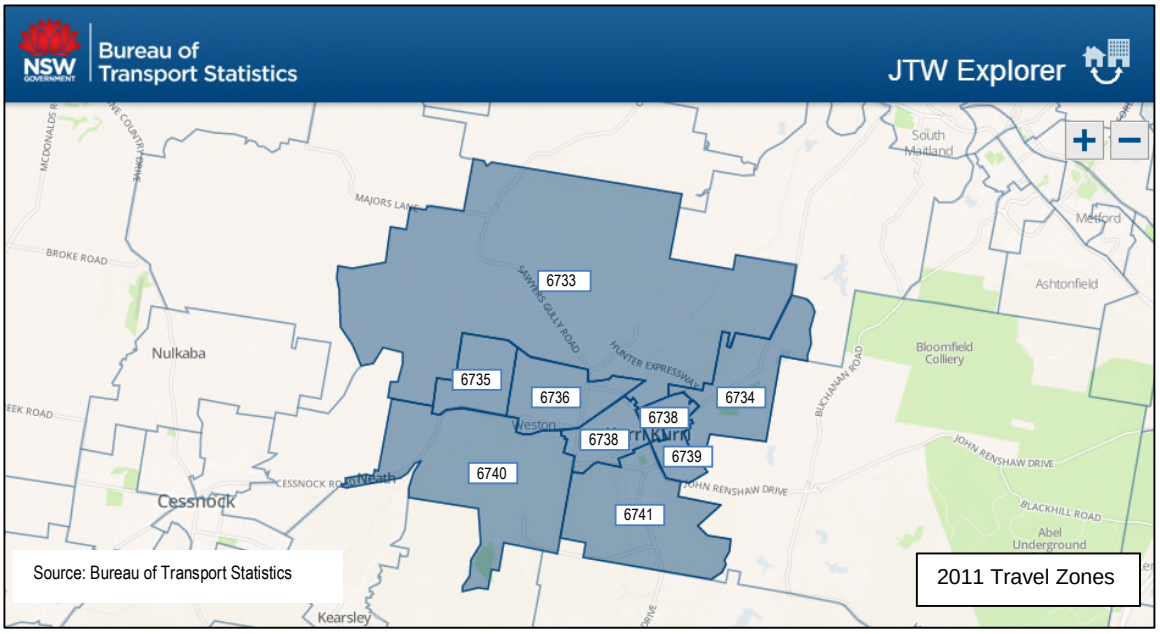


Figure 2-1 2011 Travel Zones

The 2011 JTW data indicates that only 1% of trips were undertaken by public transport (bus) within the study area. About 91% of trips were taken by private cars (both as drivers or passengers). Table 2-2 shows modes used for work trips within study area.

Table 2-2 Modes of Travel for Work Trips

Modes	Work Trips	%
Car	5940	91%
Public Transport	65	1%
Other	522	8%
Total	6527	100%

2.3 Existing Public Transport

2.3.1 Bus Service

Three bus routes operating in the vicinity the proposed development site are as follows:

- Bus Route 160: Connecting Newcastle Interchange and Cessnock via Kurri Kurri;
- Bus Route 163: Connecting Morisset and Cessnock via Kurri Kurri; and
- Bus Route 164: Connecting Maitland and Cessnock via Kurri Kurri.

All three bus routes are operated by Rover Coaches. Currently, access to available bus routes from the proposed development site is very limited. The nearest bus stop is located on Main Road-Cessnock Road where Bus Route 164 passing in the front of proposed residential land. Currently, there is no bus stop located within walking distance of the proposed employment land. Figure 2-2 shows existing bus routes in the context of proposed residential and employment land in the study area.

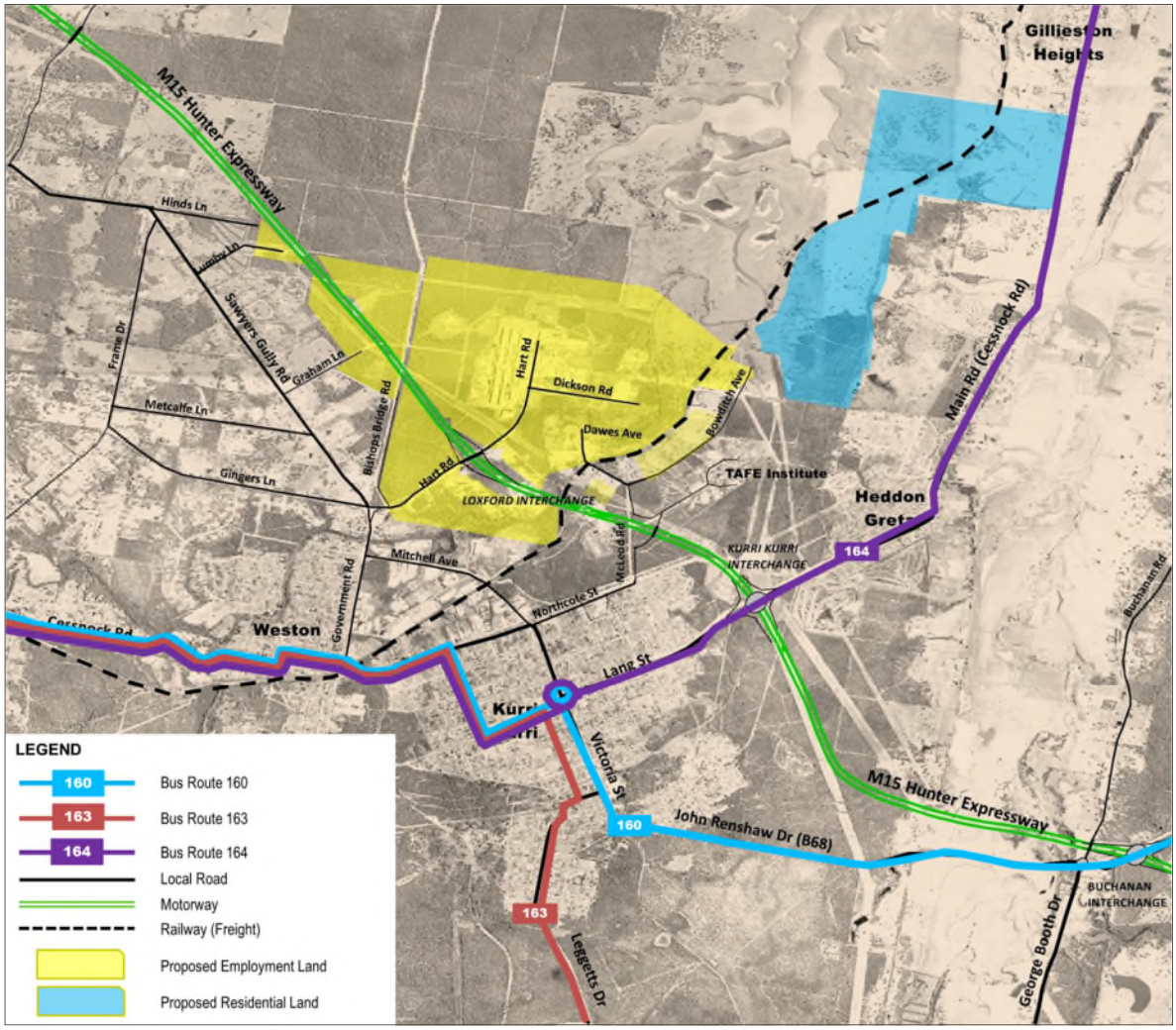


Figure 2-2 Existing bus service in the study area

2.3.2 Rail Service

The Southern Maitland Railway traverses the site from its northern border near Gillieston Heights to its southern border near Kurri Kurri. However, current rail services consist mainly of freight movements.

Passenger

Currently, there is no available rail commuter service in the study area.

Freight

The South Maitland Railway is a private railway that connects to the state rail network at Maitland. It comprises a single track that limits the number of trains that can use the line per day. In the vicinity of Station Street there are old spur lines that are not used, but are to be retained for heritage reasons. The rail line was developed to haul coal from collieries, including those around Weston and Cessnock. It now services one colliery, which is understood to have a residual working life of up to 25 years.

The railway currently carries one round trip per day comprising one down trip unladen, and one up trip carrying coal. The track and bridges have load limitations, and each train is restricted to a maximum of 33 wagons.

There may be a potential to increase carrying capacity of the rail line by running additional trains. However this will require substantial upgrades including new sidings for passing, to allow trains to wait clear of the main track. Even with additional sidings, the maximum number of round trips can be increased to three, equivalent to six one way trips in either direction per day.

2.4 Pedestrian and Cyclist Network

Currently, there is no formal cycle network or specific cycle facilities in the vicinity of the site. However, Cessnock Road has previously been designated in the Maitland Bike Plan 2005 as an on-road cycle route.

2.5 Crash Data Analysis

The crash analysis is based on crash data supplied by the RMS for five year period from July 2008 to June 2013 at the time of undertaking the analysis. In 5 years about 294 crashes were recorded (see Table 2-3).

Table 2-3 Crash Data Summary

Total Number of Crashes	Fatal Crashes	Injury Crashes	Non-Injury Crashes	Casualties		
				Killed	Injured	Total
294	5	137	152	6	191	197

Source: RMS

Five fatal crashes killed 6 people and occurred on John Renshaw Drive and Cessnock Road (see Figure 2-3). Crash data shows that, in general, crashes occurred along the full length of Cessnock Road and John Renshaw Road.

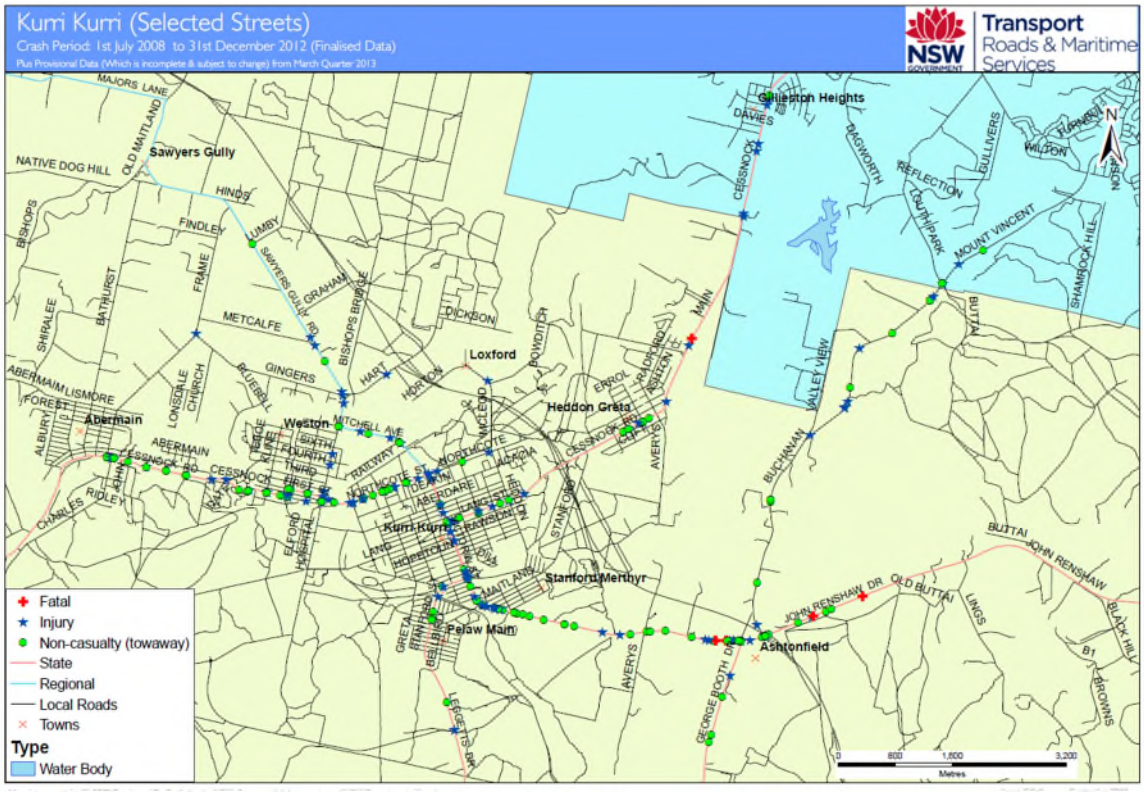


Figure 2-3 Spatial Distribution of Crashes

3 Access Strategy

3.1 Proposed Site Accesses

A number of potential access options were investigated to determine the most viable option that provides maximum benefit to Hydro redevelopment. Each access option was assessed to determine opportunities and constraints with a view to selecting a preferred access option. In general a range of broad control principles were followed in regards to traffic and transport management for development of Hydro site.

The following principles were considered to ensure effective transport management at site is achieved:

- Provision of appropriate access points on the road network. This provides an alternative option for emergency events such as bushfire, and to improve the viability of any bus services through the site.
- Investigate possible access arrangements via Cessnock Road and Loxford interchange at Hart Road.
- Providing a primary loop road within the site with access points to the existing road network.
- Establishing potential links to existing and future residential developments adjacent.
- Recognise external network opportunity and constraint when considering access to and from the Hunter Expressway at Loxford interchange.
- Support public transport and cycleway linkages between sub-regional residential areas and employment lands at Kurri Kurri.
- Provision of road network linkages between the proposed employment and residential developments.

About nine access options/points are assessed taking into account existing network connectivity, road geometry constraints and future impact. The assessed options are:

- Option A. Access is proposed on Hart Road north of Hunter Expressway. This access is proposed to service majority of employment land north of Hunter Expressway.
- Option B. Access is proposed on Hart Road south of Hunter Expressway. This access is proposed to service a parcel of employment land south of Hunter Expressway.
- Option C. Access is proposed on Main Road/Cessnock Road north of Cliftleigh near Gillieston Heights.
- Option D proposes a network connection between employment and residential lands within the site.

Five additional access Options from E to I are identified for employment land considering immediate existing local road connections:

- Option E considers potential access on Bishop Bridge Road.
- Option F considers potential access on Graham Lane.
- Option G considers potential access on Hinds Lane/Lumby Lane.
- Option H considers potential access on Dawes Avenue/\McLeod Road.
- Option I considers potential access on Bowditch Avenue.

Figure 3-1 below shows location of access options assessed.

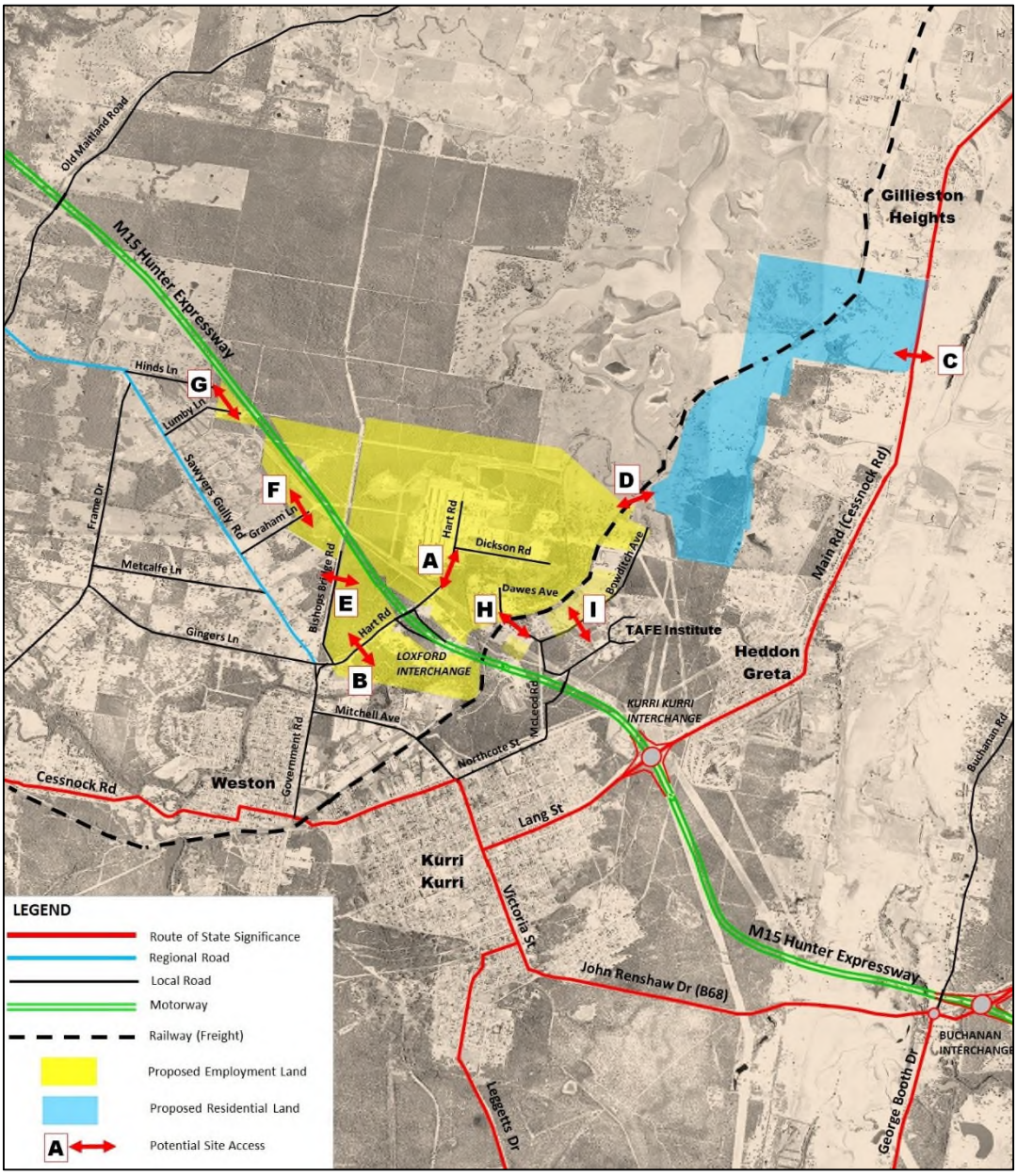


Figure 3-1 Site Access Options

The potential opportunities and constraints for all nine access options are summarised in Table to Table 3-8.

Table 3-1 Option A and Option B Potential Site Access Opportunities and Constraints

Option A and B - Access on Hart Road

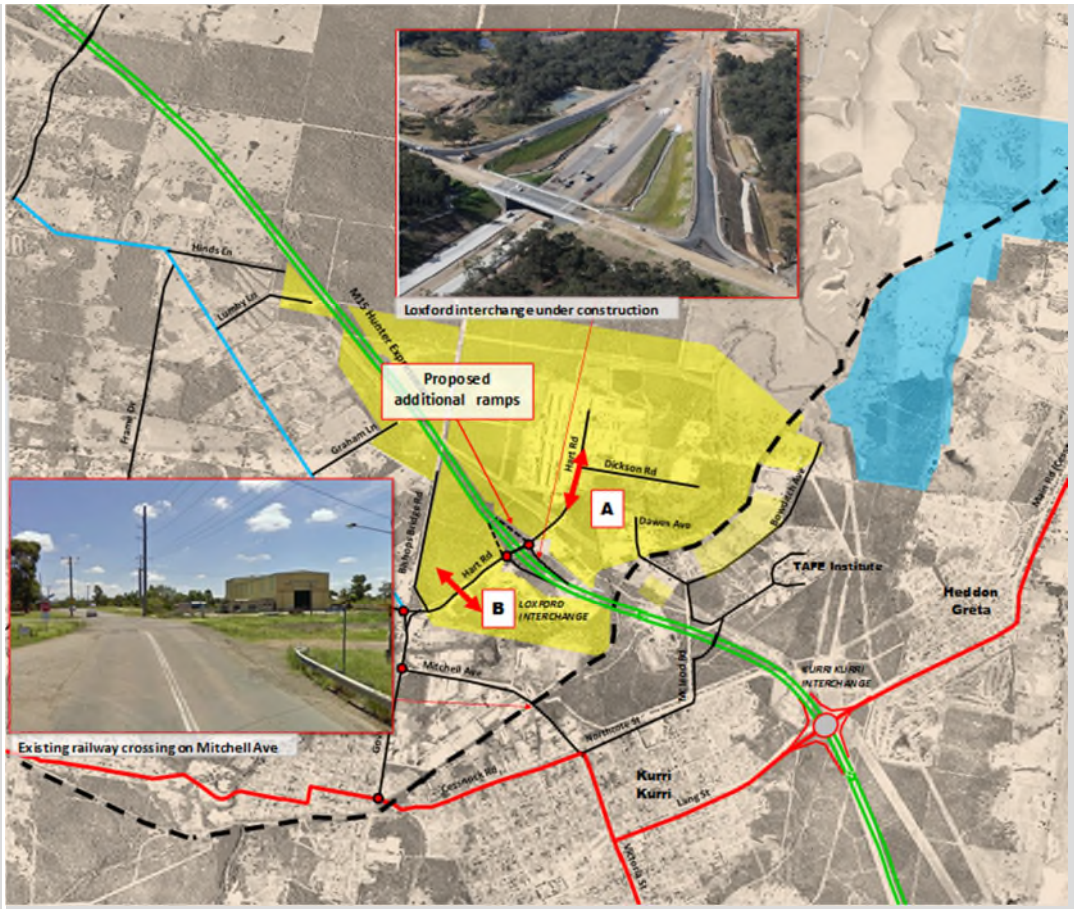
Opportunities	*Constraints*	*Location*
• Hart Road is passing through the middle of the proposed employment land and would provide main access to/from employment land; • Access from proposed employment land to Hart Road will provide connection to/from Newcastle and M1 Pacific Motorway via *Loxford Interchange and* M15 Hunter Expressway; • Proposed Hart Road overbridge above expressway will provide connection of proposed employment land with Kurri Kurri, Cessnock, Weston and Sawyers Gully; • Hart Road will provide connection to Maitland via *Loxford Interchange*, M15 Hunter Expressway, *Kurri Kurri Interchange* and Main Rd/Cessnock Rd.	• *Loxford Interchange* is proposed to be constructed as a half interchange with no available access to/from Hart Road to Branxton via M15 Hunter Expressway • *Loxford Interchange* has to be upgraded to full interchange to include eastbound off-ramp and westbound on-ramp; • Northern end of Hart Road is "NO THROUGH ROAD"; • Currently Hart Road is the only available route which would provide access to/from the majority of employment land located north of Hunter Expressway and west of the existing railway line; • Connection between Hart Road and Kurri Kurri and Cessnock town centres is limited via two local roads of Government Road and Mitchell Avenue; • Condition of the existing at grade railway crossing on Mitchell Avenue between Government Road and Northcote Road (Kurri Kurri town centre) appears to be not adequate to carry additional traffic demand and it would require upgrade.	

Table 3-2 Option C Potential Site Access Opportunities and Constraints

Option C – Main Road Cessnock

Opportunities	*Constraints*	*Location*
• Main Road-Cessnock Road (Route of State Significance) is passing in the front of the proposed residential development land; • It would provide main access to/from proposed residential land; • About 800 m long frontline of the proposed residential land south of Gillieston Heights is facing Main Rd-Cessnock Rd western kerb line; • Access from proposed residential land to Main Road-Cessnock Road would provide connection to Maitland to the north, Kurri Kurri and Cessnock to the southwest and Newcastle/M1 Pacific Motorway to the east via *Kurri Kurri Interchange* and M15 Hunter Expressway;	• New access to Main Road-Cessnock Road requires RMS agreement about access location as well as intersection control type; • In the vicinity of the proposed residential development land Main Rd-Cessnock Rd has undulating vertical alignment due to terrain topography which may limit number of adequate access locations northern part of residential land is divided by existing railway line. There is only one existing, narrow rural type railway crossing (overbridge) with no modern road pavement constructed; • Currently there is no available connection between proposed residential land and existing street network of nearby residential suburbs of Heddon Greta and Cliftleigh.	

Table 3-3 Option D Potential Site Access Opportunities and Constraints

Option D – Link Road

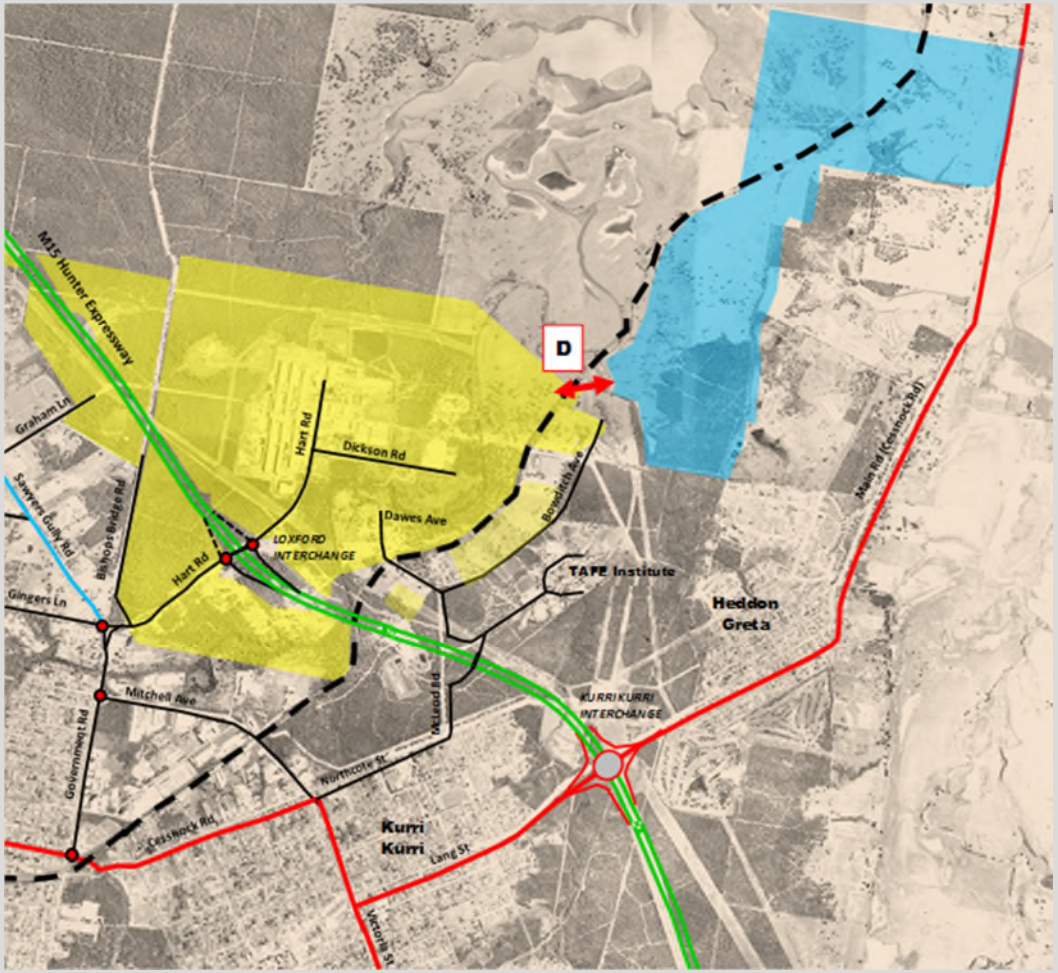
Opportunities	*Constraints*	*Location*
• Potential direct access route between proposed employment and residential lands should be considered to improve connectivity of the entire development site; • Potential connection between residential and employment lands would provide additional (alternative and emergency) access points for both residential and employment lands; • It will provide the shortest path and direct route for daily commuters (people who will live and work within development site); • Potential direct connection between employment and residential land will increase number of self-containment trips and reduce traffic impact on external road network.	• Proposed employment and residential development lands are separated with no shared boundaries; • Currently there is no available road corridor for this connection; • Existing railway line is passing between employment and residential lands; • It would require potential land purchase and new railway crossing to be constructed.	

Table 3-4 Option E Potential Site Access Opportunities and Constraints

Option E - Bishop Bridge Road		
Opportunities	***Constraints***	***Location***
• Part of the employment land south of M15 Hunter Expressway is facing eastern kerb line of Bishop Bridge Road; • Bishop Bridge Road could provide alternative access to/from employment land south of M15 Hunter Expressway.	• Currently Bishop Bridge Road is a narrow, rural type local road with no modern road pavement constructed; • Bishop Bridge Road would require substantial upgrade in order to provide adequate access to/from employment land; • South of M15 Hunter Expressway, Bishop Bridge Road is permanently closed for traffic ("NO THROUGH ROAD") and it would not provide connection to the employment land north of the expressway.	

Table 3-5 Option F Potential Site Access Opportunities and Constraints

Option F - Graham Lane		
Opportunities	***Constraints***	***Location***
• Small part of the employment land southwest of M15 Hunter Expressway has access to Graham Lane; • Graham Lane could provide potential access to/from this part of employment land to the Sawyers Gully Road (Regional Road).	• Currently Graham Lane is a narrow, rural type local road with no modern road pavement constructed; • Graham Lane would require substantial upgrade in order to provide adequate access to/from employment land; • South of M15 Hunter Expressway, Graham Lane is permanently closed for traffic ("NO THROUGH ROAD") and it would not provide connection to the employment land north of the expressway.	

Table 3-6 Option G Potential Site Access Opportunities and Constraints

Option G - Hinds Lane / Lumby Lane

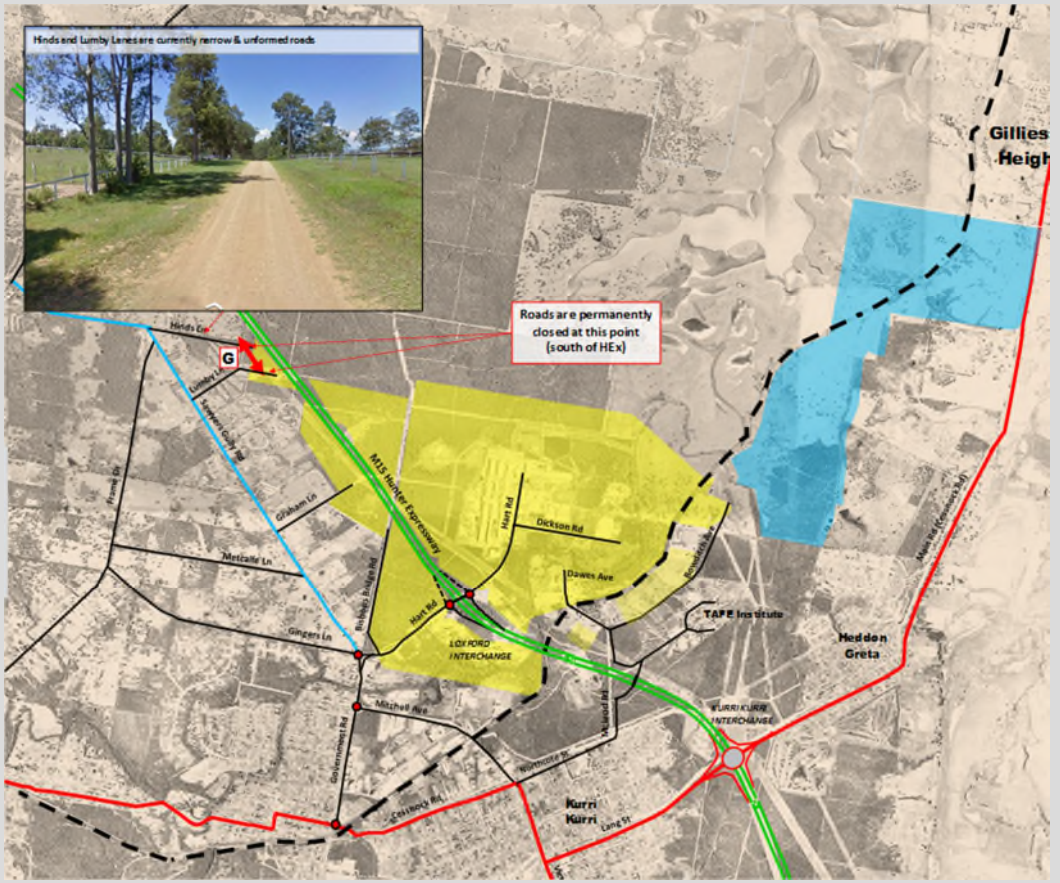
Opportunities	*Constraints*	*Location*
• Small part of the employment land southwest of M15 Hunter Expressway has access to Lumbi and Hinds Lanes; • Lumbi and Hinds Lanes could provide potential access to/from this part of employment land to the Sawyers Gully Road (Regional Road).	• Currently both Lumbi and Hinds Lanes are narrow, rural type local road with no modern road pavement constructed; • Lumbi and Hinds Lanes would require substantial upgrade in order to provide adequate access to/from employment land; • West of the expressway Lumbi and Hinds Lanes would be “NO THROUGH ROADS” and they would not provide connection to the employment land northeast of the expressway.	

Table 3-7 Option H Potential Site Access Opportunities and Constraints

Option H - Dawes Avenue/ McLeod Road

Opportunities	*Constraints*	*Location*
• Employment land west of railway line has access to Dawes Avenue and McLeod Road; • McLeod Road could provide an alternative and emergency access to employment land west of the existing railway line, providing connection to Kurri Kurri town centre and Main Road-Cessnock Road (State Road).	• Condition of the existing at grade railway crossing on McLeod Road appears to be not adequate to carry additional traffic demand and it would require substantial upgrade; • Current condition of McLeod Road section between Bowditch Avenue and TAFE Hunter Institute requires upgrade in order to carry additional traffic demand.	

Table 3-8 Option I Potential Site Access Opportunities and Constraints

Option I - Bowditch Avenue

Opportunities	*Constraints*	*Location*
• Part of proposed employment land southeast of the existing railway line has access to Bowditch Avenue; • Bowditch Avenue could provide potential access to/from this part of employment land to Kurri Kurri town centre and Main Road- Cessnock Road via McLeod Road.	• Currently Bowditch Avenue is narrow rural type local road with majority of road section with no modern pavement constructed ; • Bowditch Avenue would require substantial upgrade in order to provide adequate access to/from employment land; • Current condition of McLeod Road section between Bowditch Avenue and TAFE Hunter Institute requires upgrade in order to carry additional traffic demand.	

3.2 Shortlisted Site Accesses

Following a desktop investigation of the potential access locations, a workshop was held on 19 September 2013 among consultants as part of the master planning process. Hyder presented all nine access options to that workshop.

The following three access options are shortlisted and proposed for the site from traffic perspective:

- The main access to the residential development is proposed to be at the northeast boundary via a new intersection with Cessnock Road (Option C).
- The main access locations to the employment development be located along Hart Road via the Loxford interchange with Hunter Expressway (Option A and B).

Figure 3-2 shows the key access points with Hart Road and Cessnock Road respectively.

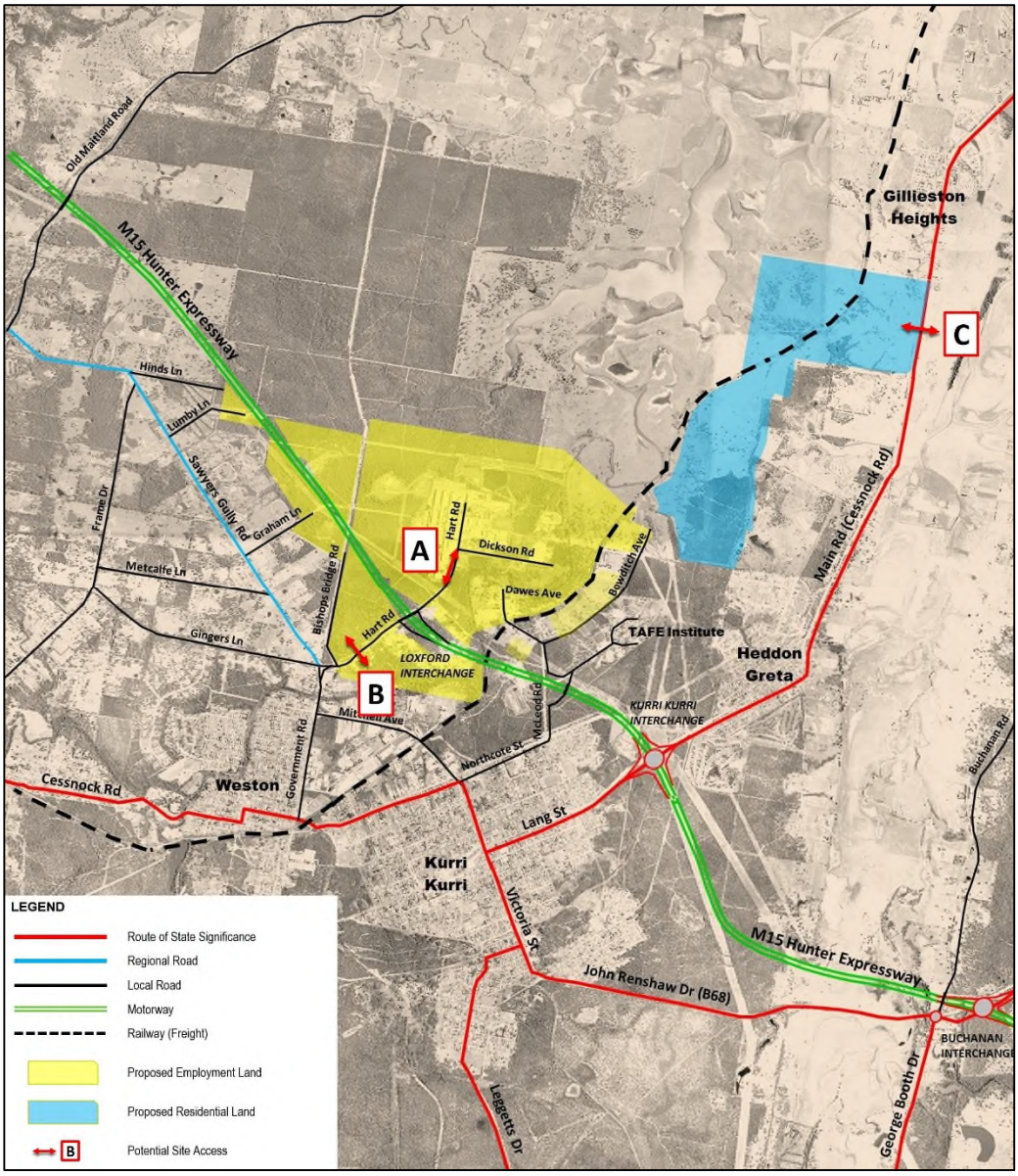
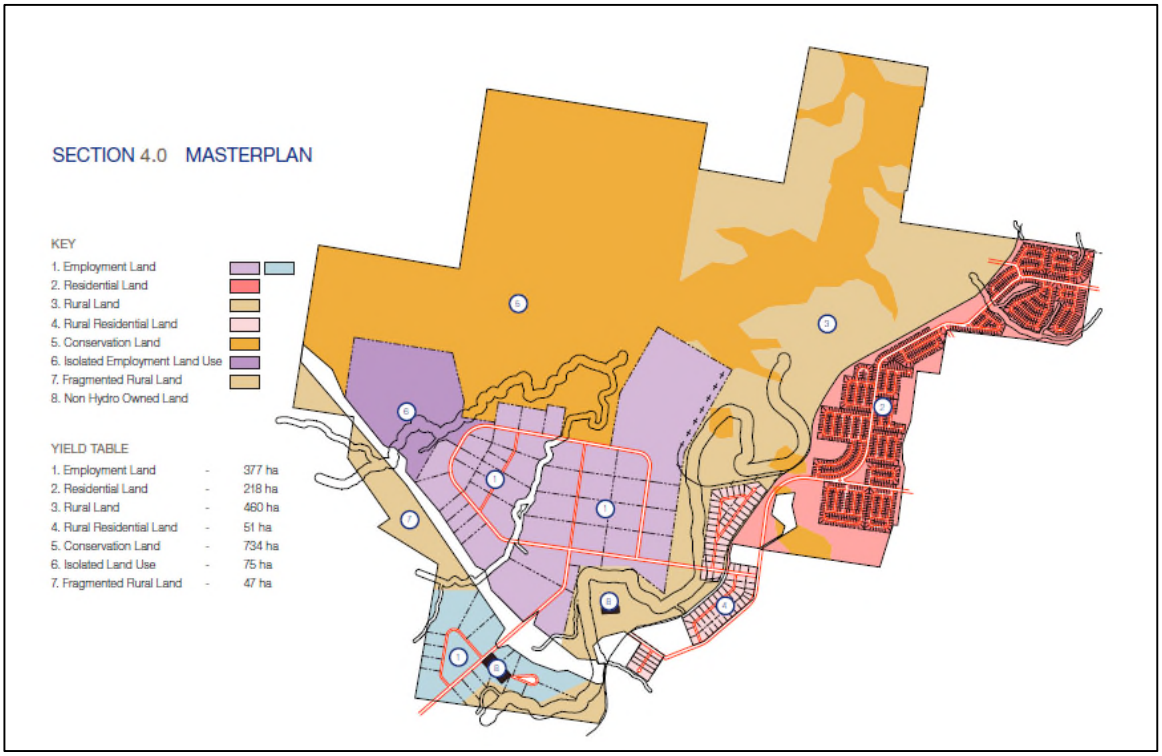


Figure 3-2 Shortlisted Site Accesses

4 Preliminary Traffic Impact Assessment

4.1 Development Potential

The initial traffic assessment work was based on the Preliminary Master Plan for the site identifying approximately 300 hectares to be rezoned for employment development purposes and approximately 1290 residential lots are proposed to be rezoned. Figure below shows the Preliminary Master Plan for Hydro development site.



Source: Hydro Kurri Kurri

Figure 4-1 Preliminary Master Plan

The proposed employment purpose land is estimated to provide approximately 105 hectares of Gross Floor Area (GFA) on the site. For trip generation purpose, the proposed GFA is assumed to be about 35% of the developable area. The GFA assumption (35%) is considered to be in line with similar developments and other recent studies endorsed by the RMS in the Hunter Region.

The rezoned site is intended to be developed in to a number of precincts depending on the market demand for residential and employment lands.

4.2 Potential Traffic Generation

Recent studies undertaken in the Hunter Region, NSW suggest that employment/commercial land peak hour trip rates varied between 0.47 and 0.56 per 100 m^2 GFA of employment land. These generation trip rates are considered to be in line with similar developments and other recent studies endorsed by RMS in the Hunter Region.

A trip generation rate of 0.85 peak hour vehicle trips per dwelling for residential land is assumed based on recommended rates for dwelling houses sourced from *Guide to Traffic Development, Version 2.2, RMS October 2002.*

RMS Guideline also states that about 25% of trips are usually internal to the subdivision, involving local shopping, schools and local social visits. In line with RMS guideline, the analysis assumed a maximum of 25% vehicle trips generated from proposed residential land would be internal. It is expected that 25% internal trips will occur when development of both residential and employment areas have substantially commenced. No trip generation discount rate is applied for employment land.

Table 4-1 summarises trip generation rate assumptions for employment and residential development lands respectively.

Table 4-1 Trip Generation Rates

Land Use	Trip Generation Rates and assumptions
Employment Land Use (2)	▪ AM Peak:0.47 trips per 100 m2 of GFA ▪ PM Peak: 0.56 trips per 100 m2 of GFA
Residential dwelling houses (1)	▪ 0.85 peak hour vehicle trips per dwelling; ▪ Maximum 25% of residential trips will be assumed to be self-contained (internal) trips.

Source: (1) *Guide to Traffic Generating Development, Version 2.2, RMS October 2002. (2) Based on trip generation survey in Hunter, NSW;*

4.2.1 Total Generated Trips from Full Development

Taking into account development yields and RMS' recommended trip generation rates for employment and residential land use, Table 4-2 summarises peak hour trip generation from proposed development.

Table 4-2 Trip Generation Estimate

Description	Development yield	AM Peak [two-way trips per hour]	PM Peak [two-way trips per hour]
Residential Development	1,290 dwellings	1,100	1,100
Employment Development	105 ha GFA	4,900	5,900
Gross Total (Residential and Employment)		6,000	7,000
Self-containment (internal) trips for residential development	25% of total residential development trips	270	270
Total (excluding self-containment trips)		5,700	6,600

Note: The trip generation figure in Table 4-2 is rounded.

The following points are noted from trip generation estimate presented in Table 4-2:

- The gross trip generation from the entire site when fully developed would be in order of 6,000 to 6,900 vehicle trips in one peak hour;

- As per RMS recommendation self-containment trip rates of 25% was applied to the residential component of the development only.
- Applying RMS' self-contained trip rates, the net trip generation from entire site when fully developed would be 5,700 and 6,600 vehicle trips for AM and PM Peak periods respectively;
- Residential development is forecast to generate about 1,100 peak hour trips to external road network; and
- Employment development is forecast to generate about 4,900 to 5,800 peak hour trips to external road network.

When fully developed the Hydro site is predicted to generate in the order of 5,700 and 6,600 vehicle trips in the morning (AM) and afternoon peak (PM) respectively. The residential trips constituted about 19% of total generated trips. The remaining 81% trips are predicted to be generated from employment land.

The afternoon (PM) peak trip is about 16% higher than morning (AM) peak trip and provides a worst case traffic assessment.

4.3 Potential Trip Distribution

The distribution of the additional trips generated by the proposed Hydro development was a key factor in determining its impact on Hart Road (at Loxford interchange) and Cessnock Road with future site access. The future distribution of residential and employment trips are estimated using Lower Hunter Traffic Model. The trip distribution has not assumed any internal connection between residential and employment lands being a worst case trip distribution for access assessment purpose. The peak hour future traffic distribution for residential and employment developments are shown in Figure 4-2 and Figure 4-3 respectively.

The potential trip distribution to and from proposal site considered redistribution traffic impact from Hunter Expressway. The Hunter Expressway will potentially attract trips to the proposal site from a wide range of areas including Newcastle, Lake Macquarie, Maitland, Branxton and the Upper Hunter.

The residential development suggests the following trip distribution patterns and assumes one access on Cessnock Road (see Figure 4-2):

- About 50% trips towards north to Maitland via Cessnock Road,
- About 20% trips towards east to Newcastle, Lake Macquarie, M1 Pacific Motorway via Cessnock Road and Hunter Expressway (Kurri Kurri interchange);
- About 15% trips towards south to Kurri Kurri and Cessnock via Cessnock Road; and
- About 15% trips towards west to Branxton and Upper Hunter via Cessnock Road and Hunter Expressway (Kurri Kurri interchange).

The employment land development suggests the following trip distribution patterns and assumes one access on Hart Road (see Figure 4-3):

- About 15% trips towards north to Maitland via Hunter Expressway (Loxford and Kurri Kurri interchanges) and Cessnock Road,
- About 40% trips towards east to Newcastle, Lake Macquarie, M1 Pacific Motorway via Hunter Expressway (Loxford interchange);
- About 15% trips towards south to Kurri Kurri via Hart Road; and
- About 30% trips towards west to Branxton and Upper Hunter via Hart Road and Hunter Expressway (Loxford and Kurri Kurri interchanges). The future additional west facing ramps at Loxford interchange will remove the potential U-turns at Kurri Kurri interchange for westbound trips.

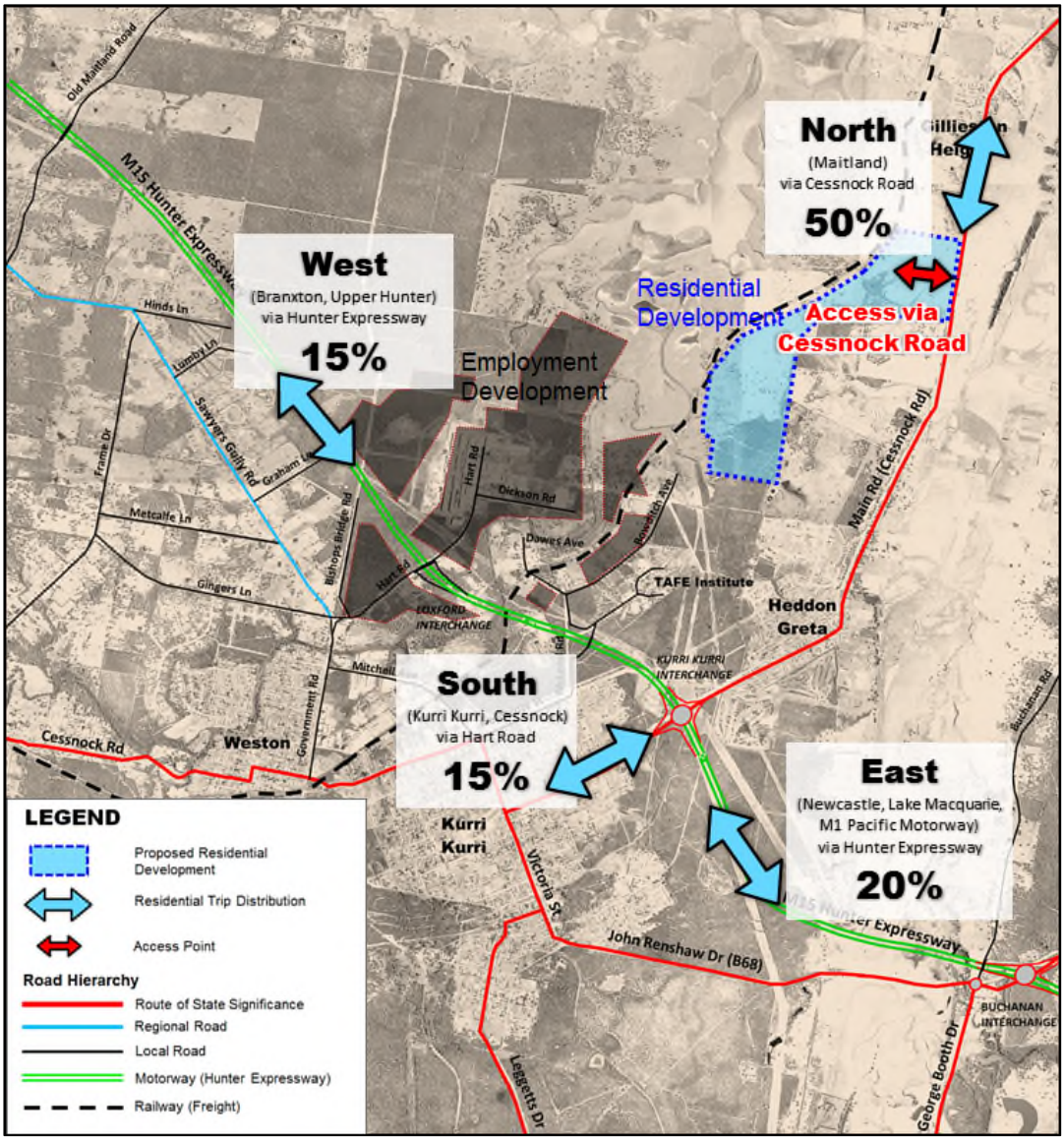


Figure 4-2 Trip Distribution for the Residential Trips

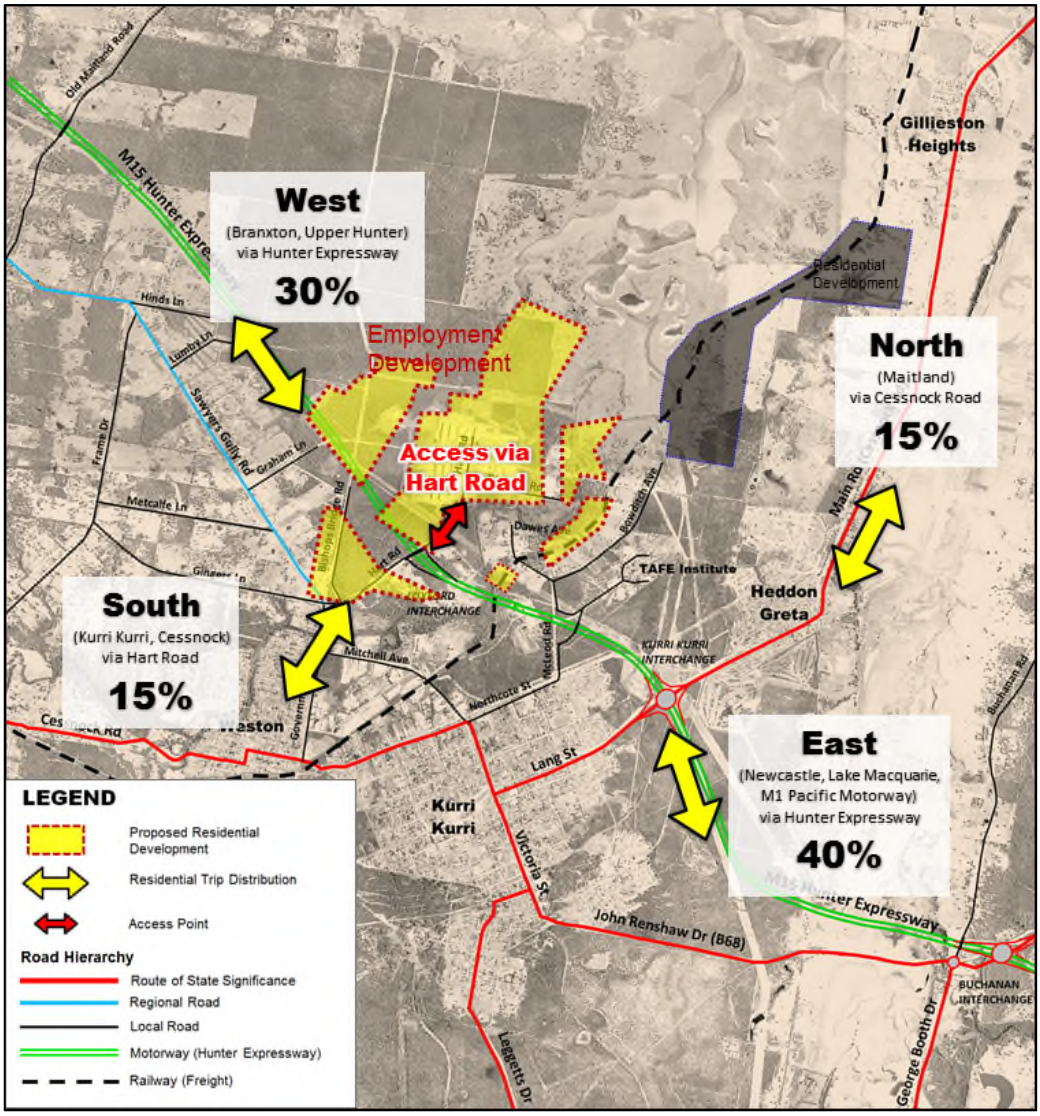


Figure 4-3 Trip Distribution for the Employment Trips

4.4 Modelling Results

The proposed development at Hydro site will impact traffic capacity of residential access intersection with Cessnock Road and employment access on Hart Road at Loxford interchange with Hunter Expressway. The Loxford interchange was built primarily to provide access to and from Hydro smelter. Two development applications are currently being prepared by Hydro for demolition and remediation of the smelter. The modelling assessment tested traffic capacity of the Cessnock Road/Hydro residential access road intersection and Loxford interchange against employment land development capacity thresholds. Background traffic growth was included where relevant.

The access intersections were assessed using SIDRA software. The modelling was undertaken using SIDRA software for assessing intersection capacity. Table 4-3 below shows standard level of service (LoS) criteria for intersection assessment.

Table 4-3 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: RMS Guide to Traffic Generating Developments

The following Section documents traffic impact at Cessnock Road/Hydro residential access road intersection and Loxford interchange separately.

4.4.1 Impact on Cessnock Road/Hydro Residential Access Intersection

A full access is considered on Cessnock Road with Hydro residential access road. A new signalised T junction is proposed. For residential development the analysis assumed full development capacity at 1290 lots. An indicative intersection footprint on Cessnock Road is identified taking into account trip generation impact from ultimate 1290 lots. The forecast traffic volumes at Cessnock Road/Hydro residential access road intersection is shown in Figure 4-4.

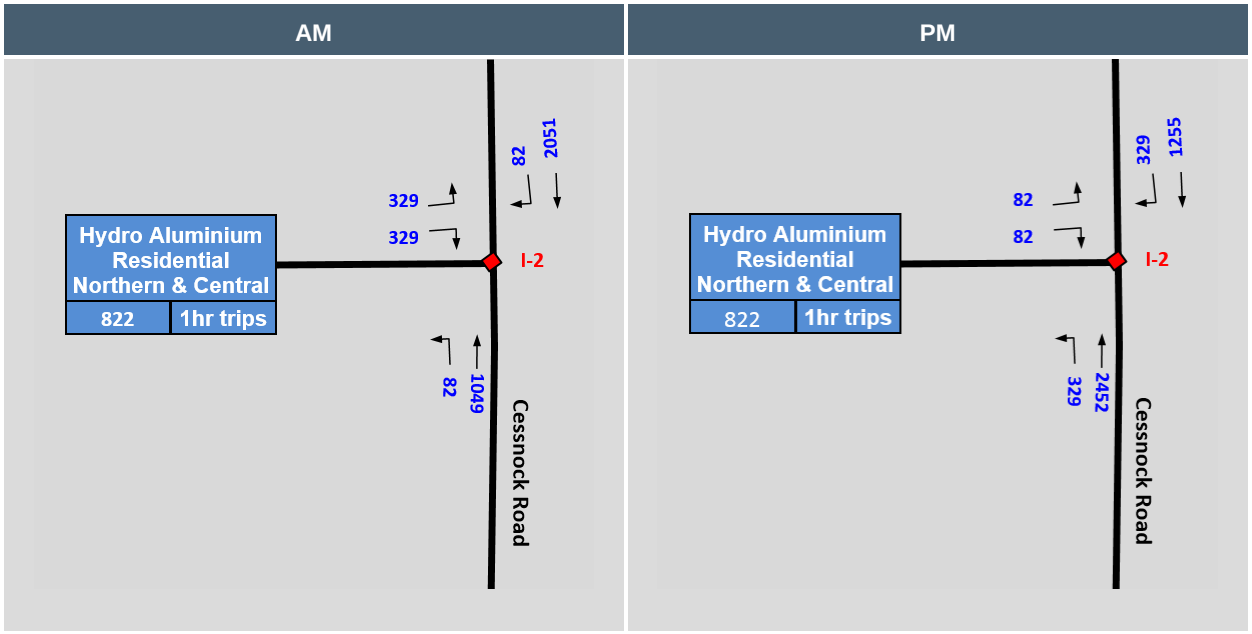


Figure 4-4 Future Traffic Volumes (2031) at Cessnock Road/ Hydro Access Intersection

Figure 4-5 shows an indicative ultimate intersection footprint required on Cessnock Road/Hydro residential access road traffic signals.

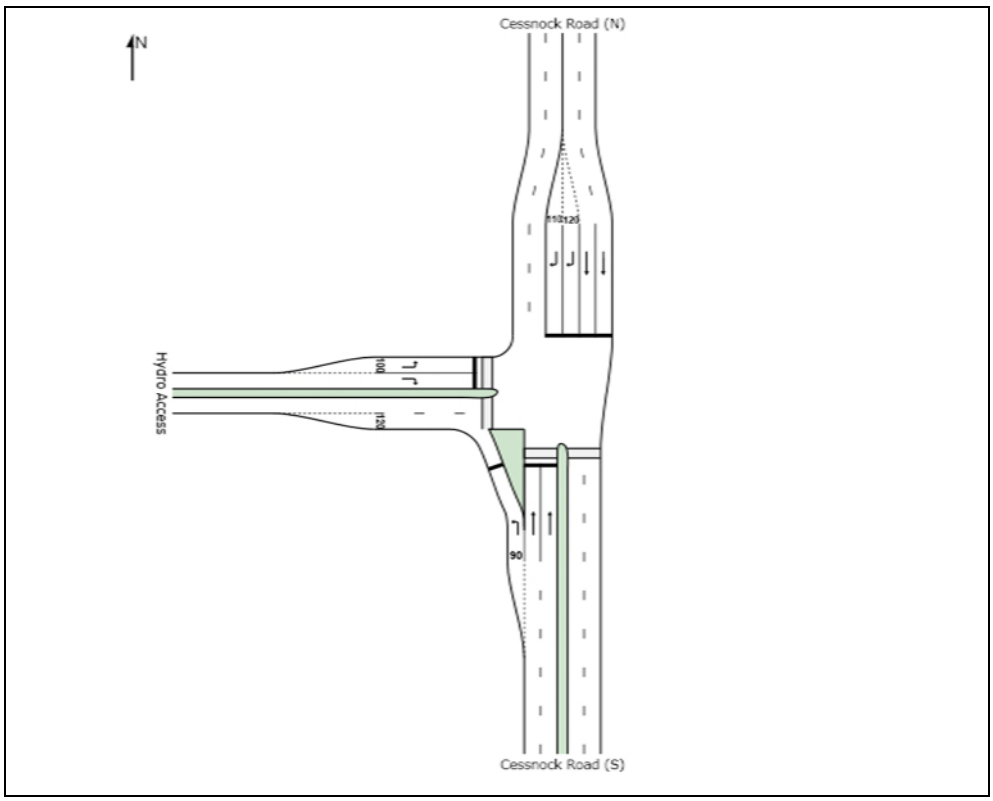


Figure 4-5 Indicative Intersection Footprint at Cessnock Road/ Hydro Access Intersection (2031)

Table 4-4 shows level of service results at Cessnock Road/Hydro access road predicted by SIDRA.

Table 4-4 Level of Service of Cessnock Road/Hydro Access Intersection

AM Peak			PM Peak		
LOS	Avg Delay (sec)	DoS	LOS	Avg Delay (sec)	DoS
B	21	0.83	B	22	0.90

Source: SIDRA

The result in Table 4-4 indicates that a new traffic signal on Cessnock Road will provide acceptable level of service. The Cessnock Road/Hydro access road intersection is predicted with level of service B.

The analysis suggests that a new traffic signal on Cessnock Road will accommodate ultimate residential development yields at about 1290 lots.

4.4.2 Impact on Loxford Interchange with Hunter Expressway

The modelling was undertaken for three development threshold scenarios. The analysis has varied employment land thresholds at 75 ha, 120 ha and 300ha. The assessment considered half and full interchanges configurations at Loxford as follows:

- The Loxford interchange at Hart Road assumes no change from current condition (i.e. half interchange with east facing ramps).
- A full interchange at Hart Road is tested. Two additional west facing ramps at Hart Road are assumed.

The 75 ha employment land is predicted to generate between 1200 and 1500 vehicles in one peak hour. The existing half interchange at Loxford with Hart Road is predicted to accommodate additional trip generation from 75 ha employment land. The LoS is predicted to be between A and B for Hart Road on/ off intersections. Figure 4-6 below shows an indicative intersection layout modelled for on and off ramps at Hart Road.

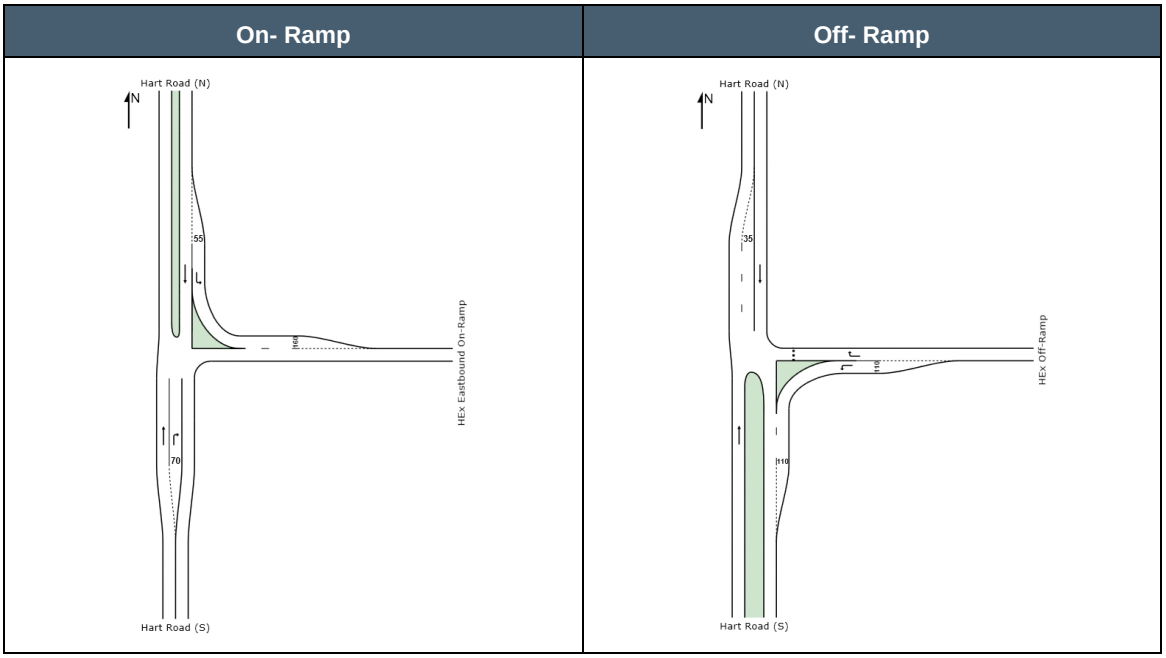


Figure 4-6 Indicative Intersection Layout on Hart Road (up to 75 ha employment land)

Further modelling assessment is undertaken for 120 ha employment land threshold. The 120 ha employment land is predicted to generate between 2000 and 2350 vehicles in one peak hour. A full interchange (with additional two west facing ramps) at Loxford is tested. The on and off ramps are modelled assuming roundabout control intersections on Hart Road. The LoS is predicted to be B for both northern and southern roundabout at Hart Road. Figure 4-7 below shows an indicative intersection layout modelled for on and off ramps at Hart Road. The full interchange at Loxford with Hart Road (roundabout control) is likely to accommodate up to 120 ha employment land. The Hart Road overbridge is likely to be impacted.

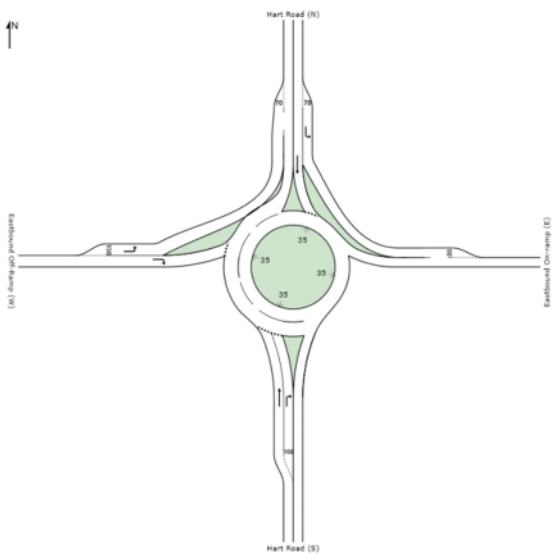
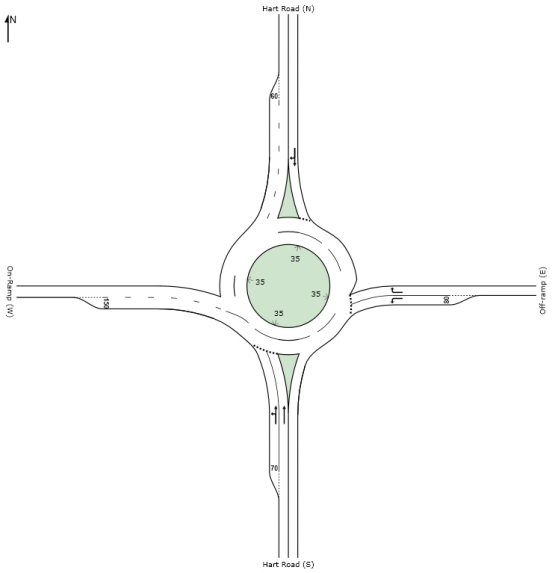
North Roundabout	South Roundabout
	

Figure 4-7 Indicative Intersection Layout on Hart Road (up to 120 ha employment land)

A maximum development footprint of 300 ha employment land is predicted to generate substantial traffic volumes between 4900 and 5900 vehicles in one peak hour. The full development at 300 ha will impact the full interchange (with additional two west facing ramps). The Hart Road overbridge is likely to be substantially impacted.

Figure 4-8 and Figure 4-9 shows forecast traffic volumes at Loxford for half interchange and full interchange configurations respectively.

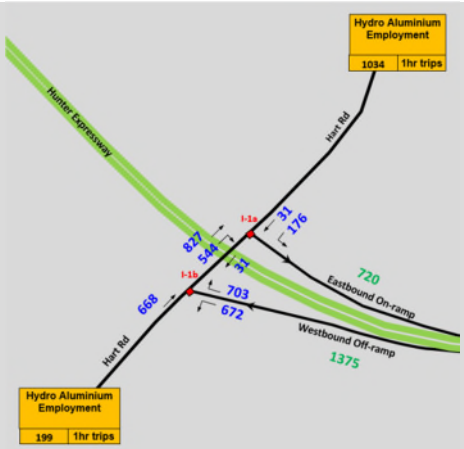
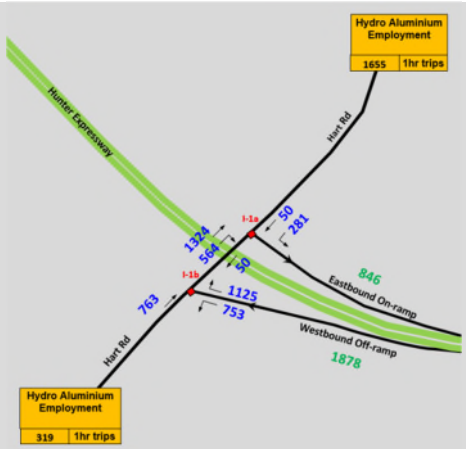
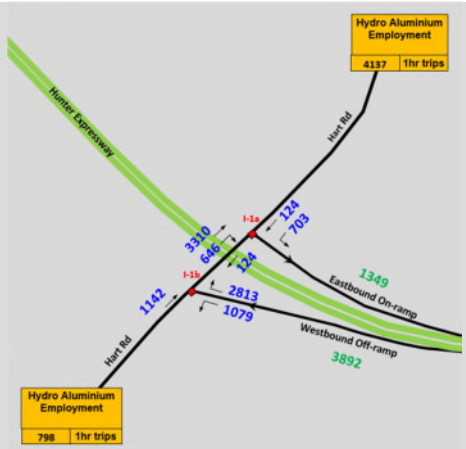
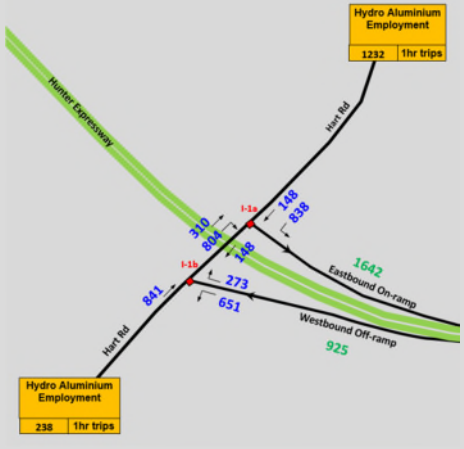
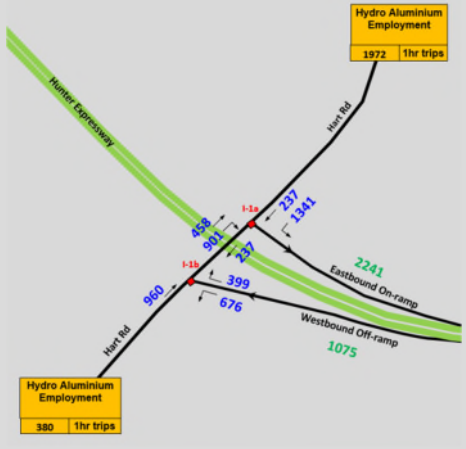
	75 ha	120 ha	300 ha
AM			
	AM Peak, Intersection Volume = 2250 veh/h	AM Peak, Intersection Volume = 2972 veh/h	AM Peak, Intersection Volume = 5862 veh/h
PM			
	PM Peak, Intersection Volume = 2751 veh/h	PM Peak, Intersection Volume = 3613 veh/h	PM Peak, Intersection Volume = 7055 veh/h

Figure 4-8 Future traffic volumes for Loxford Half Interchange

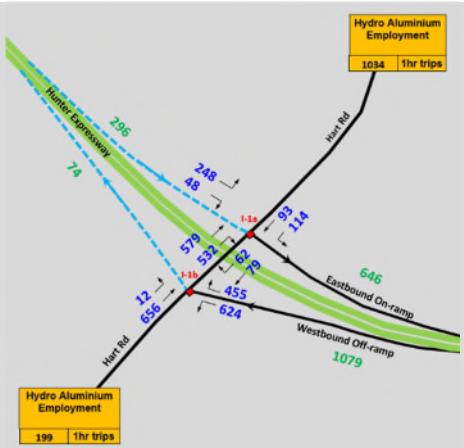
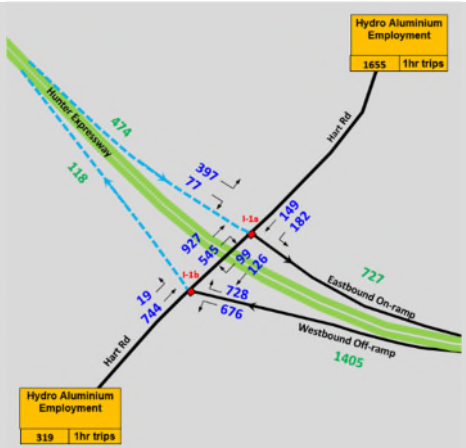
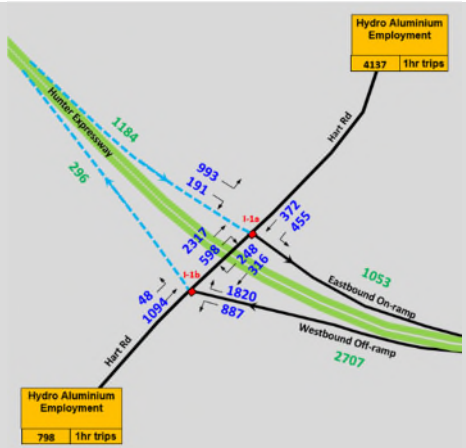
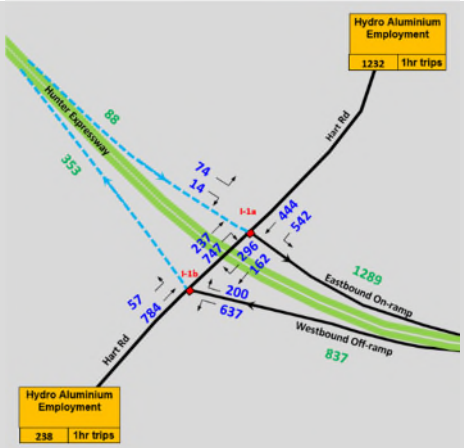
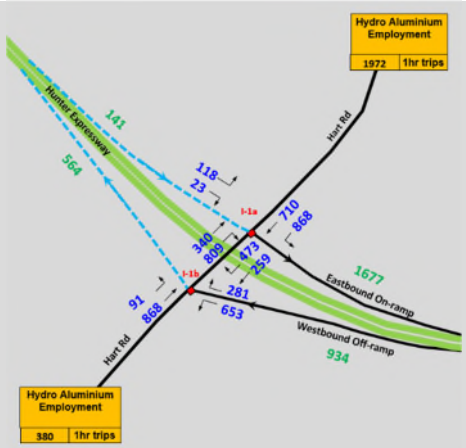
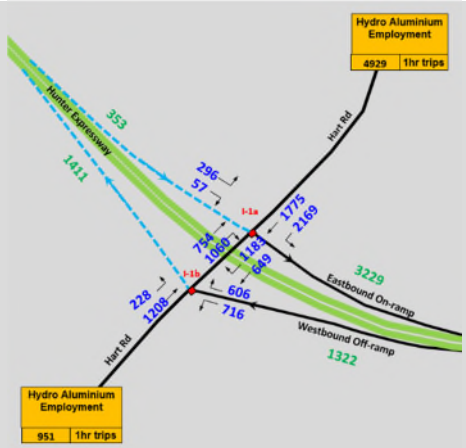
	75 ha	120 ha	300 ha
AM			
	AM Peak, Intersection Volume = 2250 veh/h	AM Peak, Intersection Volume = 2972 veh/h	AM Peak, Intersection Volume = 5862 veh/h
PM			
	PM Peak, Intersection Volume = 2751 veh/h	PM Peak, Intersection Volume = 3613 veh/h	PM Peak, Intersection Volume = 7055 veh/h

Figure 4-9 Future traffic volumes for Loxford Full Interchange

Table 4-5 below shows development thresholds, trip generation and upgrading works for Loxford interchange.

Table 4-5 Development Thresholds and Upgrades at Loxford Interchange

Thresholds	AM Peak Trips	PM Peak Trips	Upgrades at Loxford Interchange
75 ha	1200	1500	▪ Existing half interchange with two east facing ramps. ▪ The on and off ramps traffic are controlled by sign control intersections on the bridge.
120 ha	2000	2350	▪ Full interchange with two additional west facing ramps. ▪ The on and off ramps traffic are controlled by roundabout intersections on the bridge. ▪ The 3 lane existing bridge (one through lane in each direction and an acceleration lane which then becomes a right turn lane for eastbound traffic) is likely to be impacted.
300 ha	4900	5900	▪ Full interchange with two additional west facing ramps. ▪ The on and off ramps traffic are controlled by traffic signals on the bridge (diamond interchange). ▪ The 3 lane bridge may require substantial upgrade including turning lanes.

4.5 Preliminary Engineering Assessment of Loxford Interchange

The Loxford interchange with the Hunter Expressway was built by the RMS as a half interchange with two east facing ramps. A high level strategic design review was undertaken to investigate the viability to convert the half interchange to a full interchange. The full interchange includes two additional westbound ramps to and from Hart Road. The design includes two roundabouts at both ends of ramps. The relevant design files of Loxford interchange was sourced from RMS.

Figure 4-10 shows strategic concept design of full Loxford interchange with two additional west facing ramps. The preliminary engineering review indicates that the half interchange can be converted to full interchange (roundabout controls to both end of bridge) with additional land take, increased pavement extents and surrounding earthworks. The full interchange roundabout option would allow all movements at the interchange and would not require traffic to merge with free-flowing traffic. Hence, this would be considered the safer design solution. The existing bridge allows for a through lane in each direction and an acceleration lane which then becomes a right turn lane for eastbound traffic. The roundabout option could utilising the current design eastbound acceleration lane as a right turn lane onto the expressway. However, the need for an acceleration lane is negated with a roundabout design therefore potential safety issue is removed.

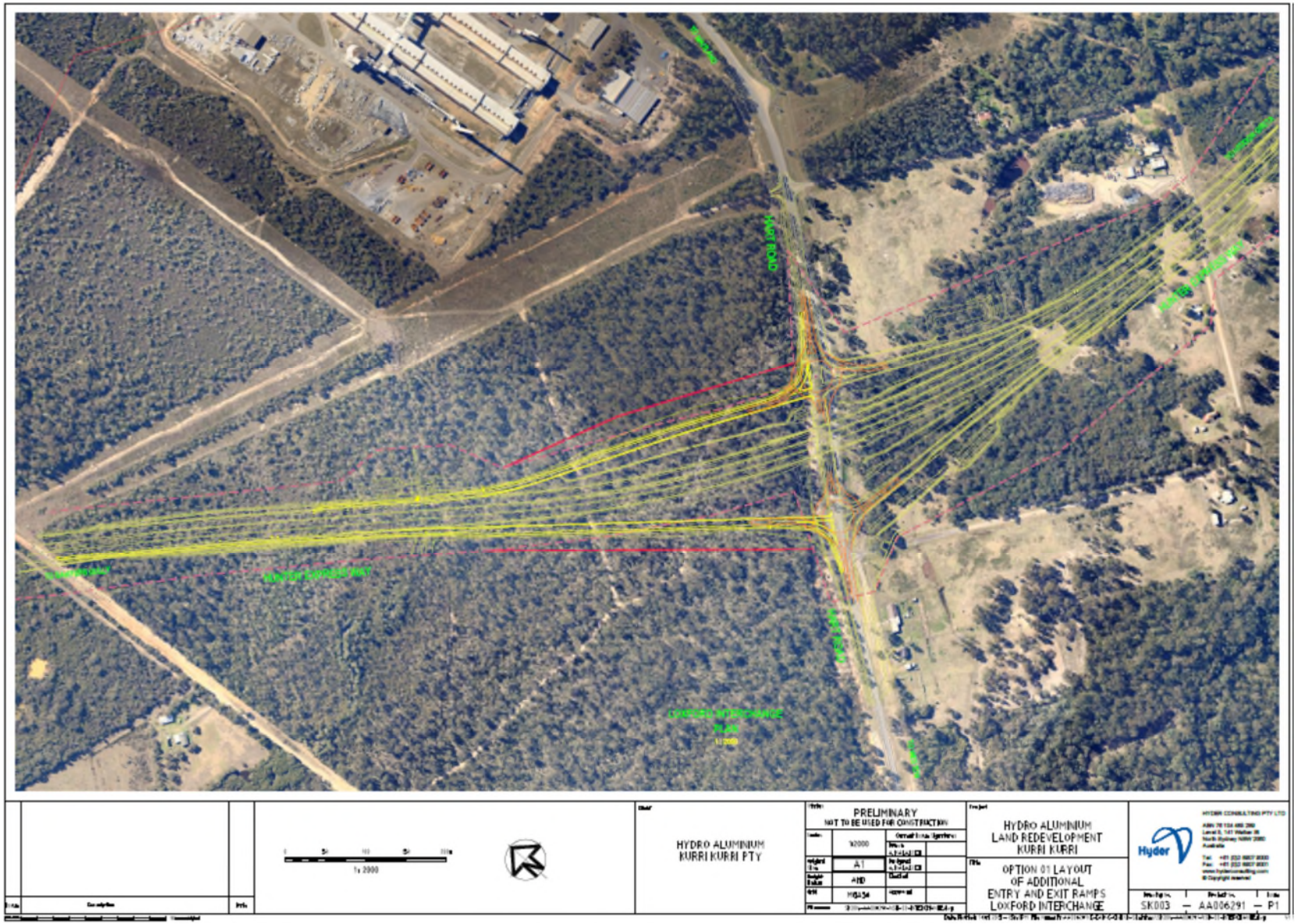


Figure 4-10 Full Interchange with Roundabout Control for On / Off ramps

Part B

Planning Proposal

Part B documents finding from Stage 2 investigations.

Structure

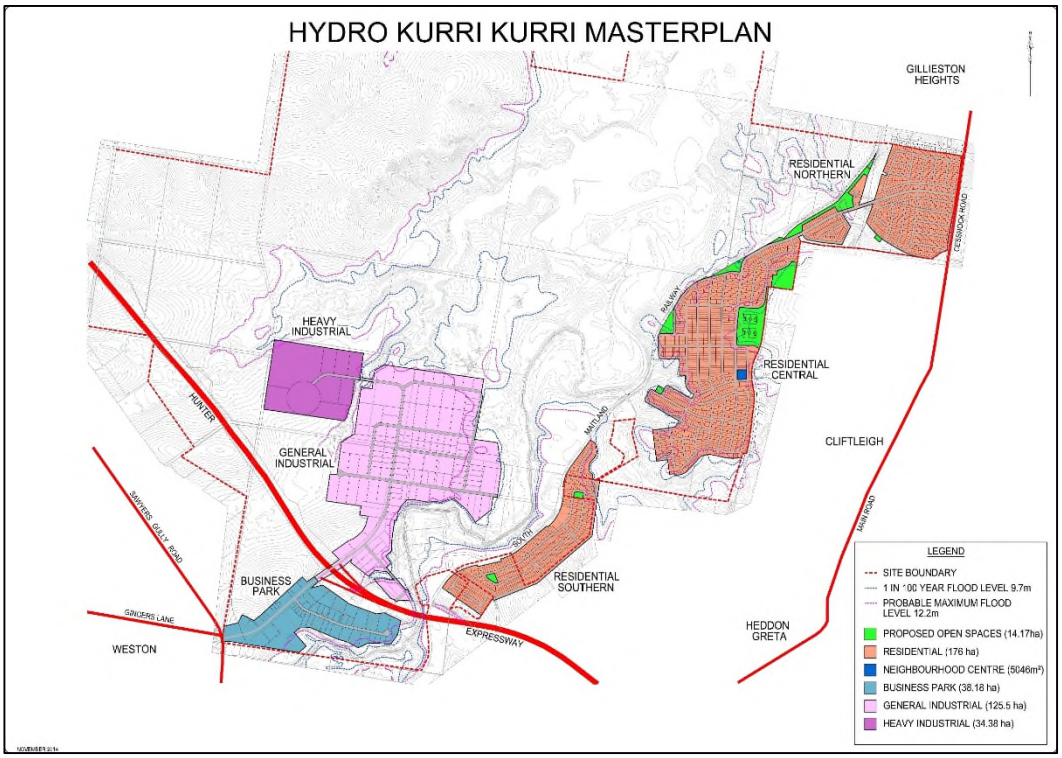
- Chapter 5: Planning Proposal
- Chapter 6: Conclusion and Recommendations

5 Planning Proposal

5.1 Hydro Kurri Kurri Master Plan

The revised Planning Proposal for the site proposes about 200 hectares (reduced from 300 hectares in the preliminary Master Plan) to be rezoned for employment development purposes. About 2088 residential dwellings (increased from 1290 residential dwellings) are proposed to be rezoned. The revised Master Plan has proposed 603 dwellings at the Northern precinct, about 1182 dwellings at the Central precinct and about 303 dwellings at the Southern precinct. Traffic from both Northern and Central residential precincts are likely to use new access proposed on the Cessnock Road. The residential development at southern precinct is likely to use McLeod Road. The revised master plan has proposed no internal connection between Central and Southern residential precincts.

Figure below shows the Hydro Kurri Kurri Master Plan for Hydro development site.



Source: Hydro Kurri Kurri

Figure 5-1 Hydro Kurri Kurri Master Plan

The proposed employment land is estimated to provide approximately 70 hectares of Gross Floor Area (GFA) on the site. For trip generation, the proposed GFA is assumed to be about 35% of the developable area. The GFA assumption (35%) is considered to be in line with similar developments and other recent studies endorsed by the RMS in the Hunter Region.

The rezoned site is intended to be developed in to a number of precincts depending on the market demand for residential and employment lands.

5.2 Potential Traffic Generation

Most recent studies undertaken in the Hunter Region, NSW suggest that employment/ commercial land peak hour trip rates varied between 0.56 and 0.58 per 100 m^2 GFA of employment land for morning (AM) and afternoon (PM) peak respectively.

Trip generation rate of 0.85 and 0.90 trips per dwelling for residential land are assumed for morning (AM) and afternoon (PM) peak respectively based on recommended rates for dwelling houses sourced from *Guide to Traffic Generating Developments, TDT 2013/04a, RMS August 2013.*

RMS Guideline also states that about 25% of trips are usually internal to the subdivision, involving local shopping, schools and local social visits. In line with RMS guideline, the analysis assumed a maximum of 25% vehicle trips generated from proposed residential land would be internal. It is expected that 25% internal trips will occur when development of both residential and employment areas have substantially commenced. No trip generation discount rate is applied for employment land.

Table and Table 5-2 summarise trip generation rate assumptions for residential and employment development lands respectively.

Table 5-1 Trip Generation for Residential Development

Land Use Type	Peak Hour trip rates assumed (per dwelling)
Residential dwellings (1)	▪ AM Peak: 0.85 ▪ PM Peak: 0.90
Assumption	▪ Maximum trip rates has been assumed, therefore this study represent the conservative scenario ▪ Maximum 25% of residential trips assumed to be self-contained (internal) trips.

Source: (1) *Guide to Traffic Generating Developments, TDT 2013/04a, RMS August 2013.*

Table 5-2 Trip Generation for Employment Development

Land Use Type	Peak Hour rates assumed (per 100 m^2 of GFA)
Business parks and industrial estate (1)	▪ AM Peak: 0.56 ▪ PM Peak: 0.58
Assumption	▪ 0.56 and 0.58 trips per 100 m^2 of GFA have been assumed for AM and PM peak respectively ▪ These values are adopted from the survey done in Anambah Business Park, Rutherford and Freeway Business Park, Beresfield in 2012. These two business parks are located approximately 20km from Loxford Hydro's site. ▪ These surveys outcome are sourced from Guide to Traffic Developments, TDT 2013/04a, RMS August 2013.

Source: (1) *Guide to Traffic Generating Developments, TDT 2013/04a, RMS August 2013.*

The updated trip generation rate for employment land was found to be about 19% higher (AM) and 4% higher (PM) than previously used in the preliminary traffic impact assessment. The

updated trip generation rate for residential land is similar for morning peak, but increased by 6% for afternoon peak.

5.2.1 Updated Generated Trips from Full Development

Taking into account development yields and RMS' recommended trip generation rates for employment and residential land use, Table 5-3 summarises peak hour trip generation from proposed development.

Table 5-3 Trip Generation Estimate

Description	Development yield	AM Peak [two-way trips per hour]	PM Peak [two-way trips per hour]
Residential Development	2088 dwellings	1,800	1,900
Employment Development	70 ha GFA	3,900	4,030
Gross Total (Residential and Employment)		5,700	5,930
Self-containment (internal) trips for residential development	25% of total residential development trips	450	480
Total (excluding self-containment trips)		5,250	5,450

Note: The trip generation figure in Table 5-3 is rounded.

The following points are noted from trip generation estimate presented in Table 5-3:

- Residential development is forecast to generate about 1,800 trips in the morning peak and 1,900 trips in the evening peak to the entire road network;
- Employment development is forecast to generate about 3,900 to 4,030 peak hour trips to external road network;
- The gross trip generation from the entire site when fully developed would be in order of 5,700 to 5,930 vehicle trips in one peak hour;
- As per RMS recommendation self-containment trip rates of 25% was applied to the residential component of the development only; and
- Applying RMS' self-contained trip rates, the net trip generation from entire site when fully developed would be 5,250 and 5,450 vehicle trips for AM and PM Peak periods respectively.

When fully developed Hydro site is predicted to generate in the order of 5,250 and 5,450 vehicle trips in the morning (AM) and afternoon peak (PM) respectively. The residential trips constituted about 32% of total generated trips. The remaining 68% trips are predicted to be generated from employment land.

The afternoon (PM) peak trip is about 4% higher than morning (AM) peak trip and provides a worst case traffic assessment.

The residential and employment developments proposed in the Planning Proposal will generate about 8% less trips (in AM peak) and 17% less trips (in PM peak) compared to the preliminary master plan.

The previous Chapter 4.3 documented future distribution of residential and employment trips. The trip distribution assumptions for the Planning Proposal will be similar to future traffic distribution showed in the previous Chapter 4-3, Figure 4-2 and Figure 4-3 respectively.

5.3 Background Traffic Growth

The February 2015 new survey data was sourced from the Hydro Aluminium Kurri Kurri Remediation and Demolition project. The 2015 traffic survey data have been used as the basis for the Planning Proposal assessment. The 2015 counts are used for the following locations being relevant to this project:

- Intersection count for Eastbound On-ramp at Loxford Interchange;
- Intersection count for Westbound Off-ramp at Loxford Interchange;
- Intersection count for McLeod Road/Northcote Street roundabout; and
- Mid-block count at Cessnock Road.

The revised modelling assumed 2031 as the horizon year consistent with the previous preliminary assessment. The revised assessment used background traffic growth of about 2% per annum on Cessnock Road at proposed residential access point and Hart Road (west of Hunter Expressway). For McLeod Road/Northcote Street roundabout, background traffic is assumed to be 1% per annum.

5.4 Updated Modelling Results

The updated modelling assessment tested traffic capacity of the Cessnock Road/Hydro residential access road intersection, Loxford interchange and McLeod Road/Northcote Road roundabout against employment and residential land development capacity thresholds. SIDRA software was used consistent with the previous assessment. The new traffic survey data used in the Planning Proposal provided additional confidence in the SIDRA modelling results presented in this section.

The following Section documents updated traffic impact at Cessnock Road/Hydro residential access road intersection, Loxford interchange and McLeod Road/Northcote Road roundabout separately.

5.4.1 Impact on Cessnock Road/Hydro Residential Access Intersection

Hydro residential access intersection with Cessnock Road has been reassessed with updated forecast traffic volumes. The revised analysis assumed a full signalised T-junction on Cessnock Road with Hydro residential access road consistent with previously assessed. Figure 5-2 shows an indicative ultimate intersection footprint required on Cessnock Road/Hydro residential access road traffic signals.

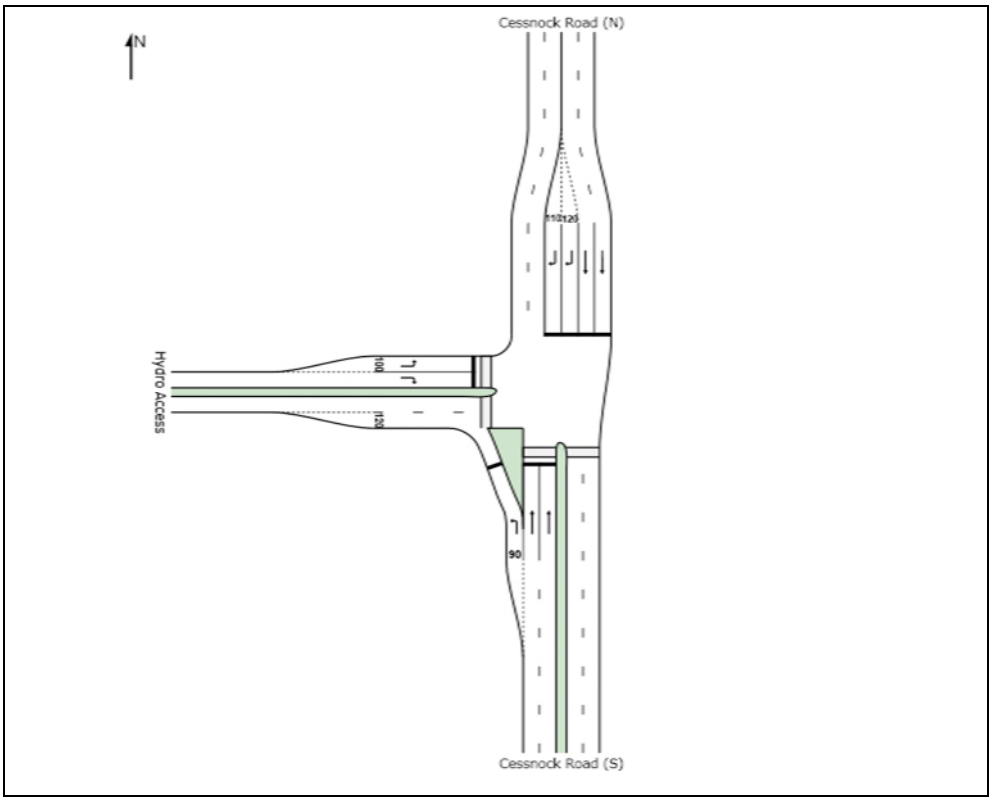
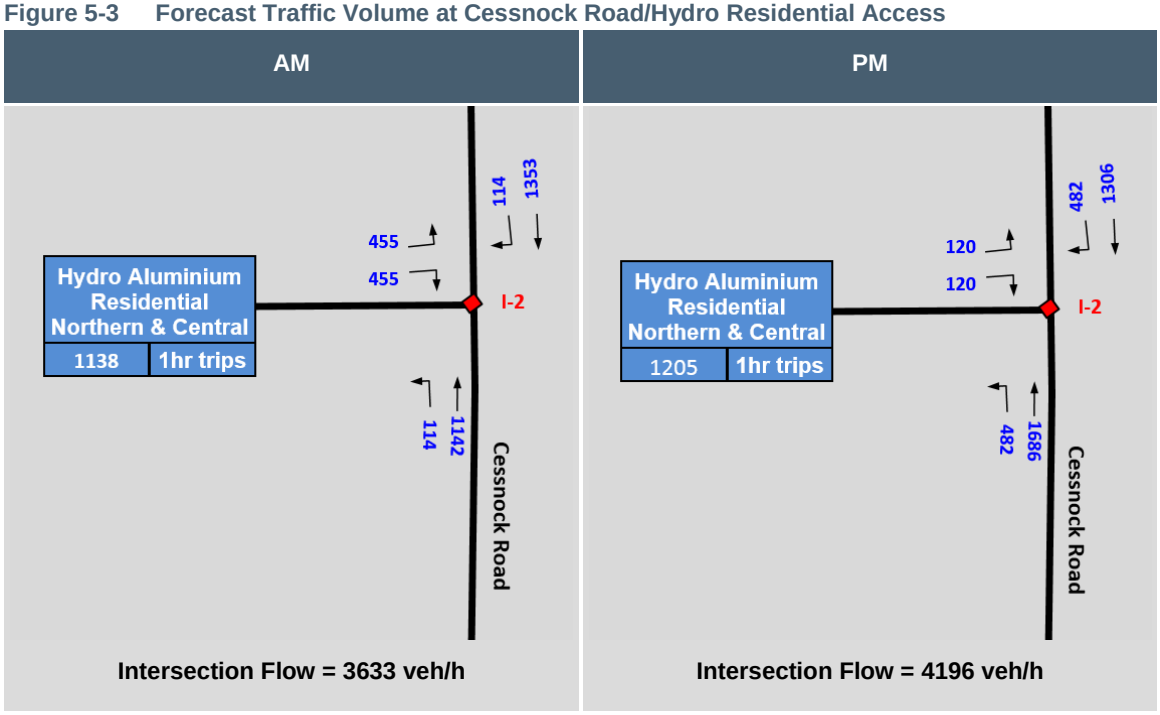


Figure 5-2 Indicative Intersection Footprint at Cessnock Road/ Hydro Access Intersection

Figure 5-3 below shows the revised forecast traffic volumes at new signalised intersection based on 1785 dwellings proposed at the Northern and the Central residential precincts.

Figure 5-3 Forecast Traffic Volume at Cessnock Road/Hydro Residential Access



There can be opportunity for Hydro to connect their internal road network via Cliftleigh development. The internal road network for Hydro site will be refined as development progress. The forecast traffic volume in this analysis represents the worst case scenario, as all residential traffic is assumed to be accessed via Cessnock Road new signalised intersection.

Table 5-4 below shows predicted level of service results at Cessnock Road/Hydro access signalised intersection.

Table 5-4 Level of Service of Cessnock Road/Hydro Residential Access

AM Peak			PM Peak		
Average Delay (sec)	LoS	Degree of Saturation	Average Delay (sec)	LoS	Degree of Saturation
24	B	0.83	21	B	0.82

The result in Table 5-4 indicates that a new traffic signal on the Cessnock Road will provide acceptable level of service B.

The analysis suggests that a new traffic signal on the Cessnock Road will accommodate ultimate residential development (1785 dwellings) proposed at the Northern and Central residential precincts.

5.4.2 Impact on Loxford Interchange with Hunter Expressway

Loxford interchange capacity has been re-assessed with updated forecast traffic volumes. The revised assessment considered half and full interchanges configurations at Loxford as follows (consistent with the previous assessment, see Figure 5-4):

- The Loxford interchange at Hart Road assumes no change from current condition (i.e. half interchange with east facing ramps)
- A full interchange at Hart Road is tested. Two additional west facing ramps at Hart Road are assumed.

Table 5-5 below shows development thresholds and generated trips for employment land.

Table 5-5 Development Thresholds and Generated Trips from Employment Land

	Development Traffic	
Thresholds	**AM Peak Trips**	**PM Peak Trips**
75 ha	1450	1500
120 ha	2330	2400
200 ha	3900	4030

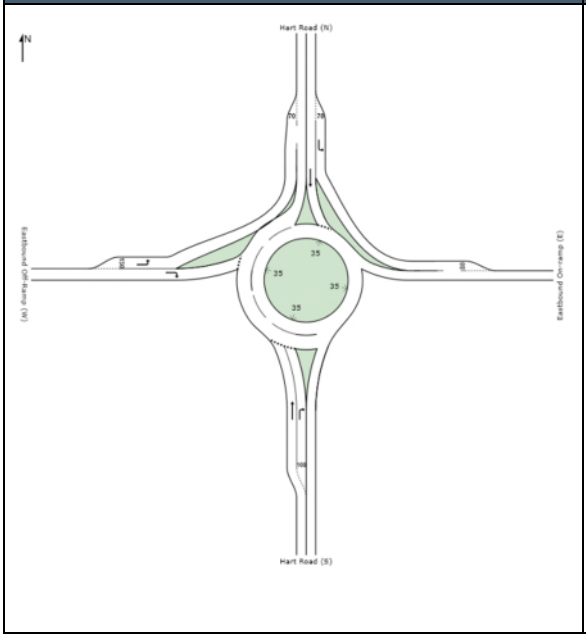
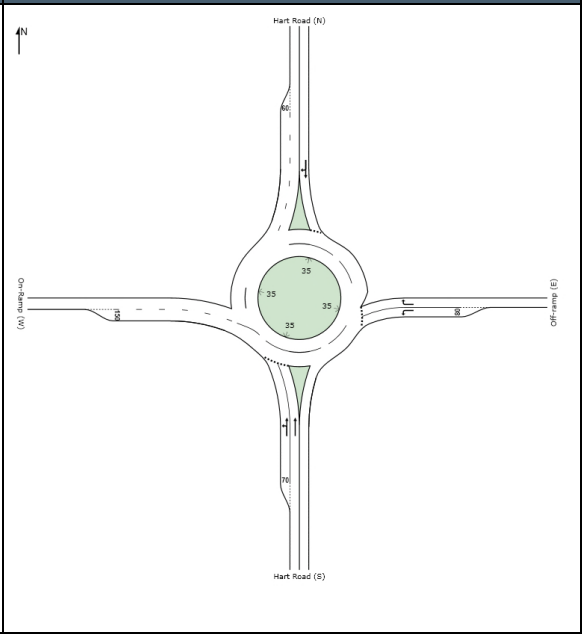
North Roundabout	South Roundabout
	

Figure 5-4 Indicative Intersection Layout on Hart Road (up to 120 ha employment land)

Based on the revised trip generation rate, 75 ha employment land is predicted to generate approximately 1500 vehicles in one peak hour. The existing half interchange at Loxford with Hart Road will accommodate additional trip generation from 75 ha employment land. The existing sign controlled on and off ramp intersections with Hart Road are predicted to operate with LoS A. The analysis has suggested that existing Loxford interchange will have capacity to accommodate up to 75 ha of employment development.

Figure 5-5 and Figure 5-6 below shows the revised forecast traffic volumes based on 75 ha, 120 ha and 200 ha employment land yields.

Figure 5-5 Forecast Traffic Volume at Loxford Half Interchange

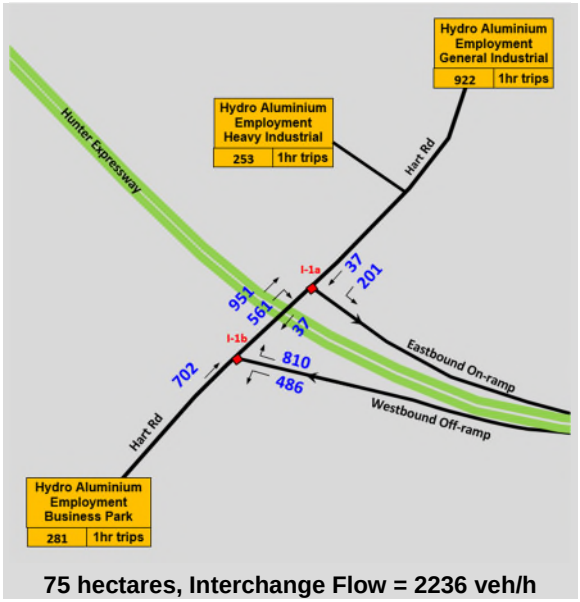
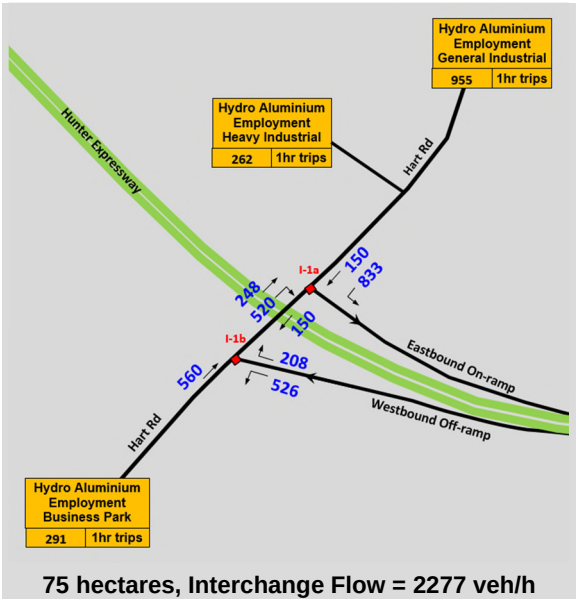
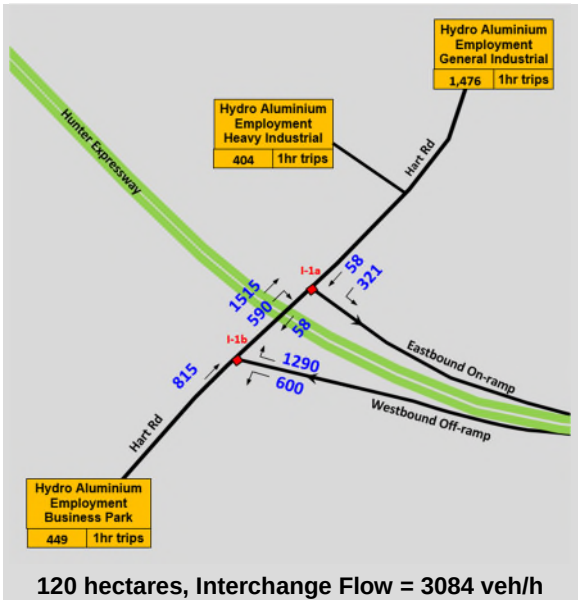
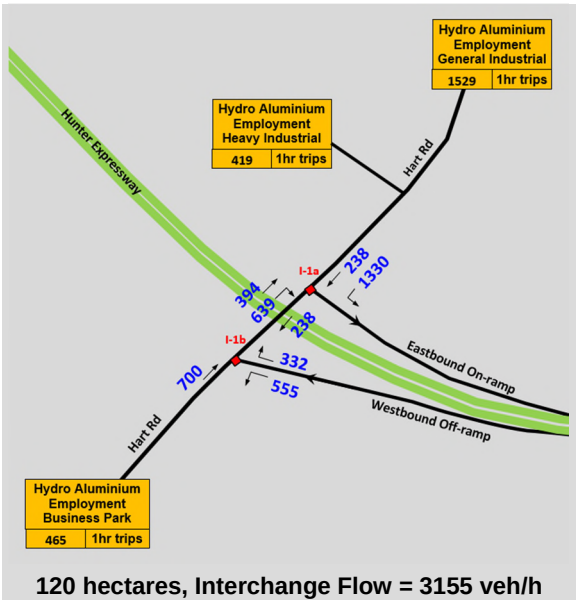
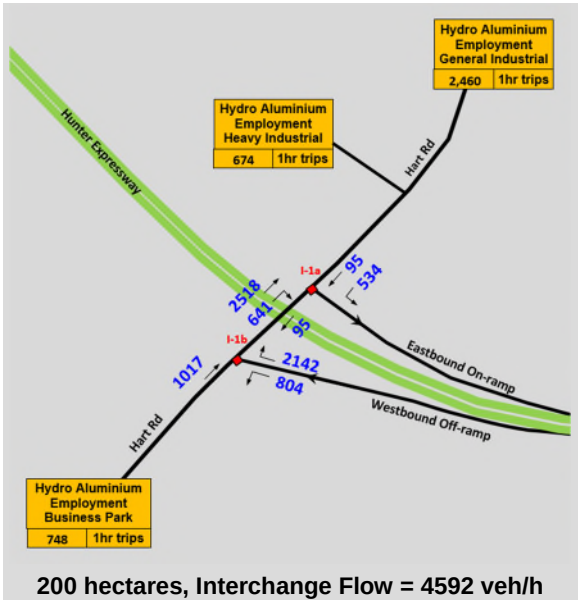
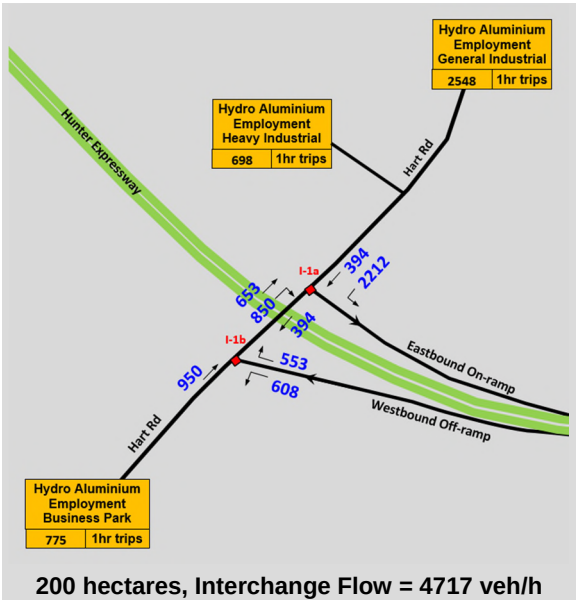
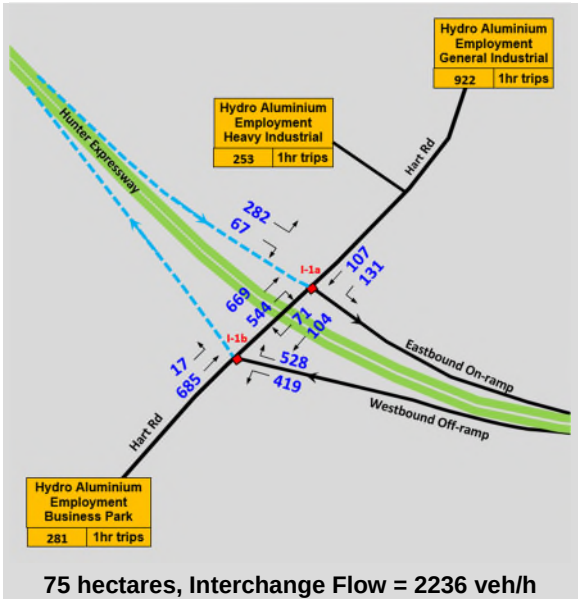
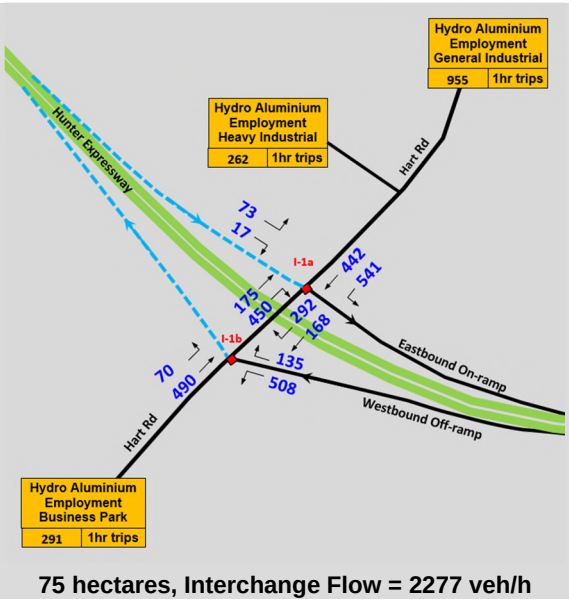
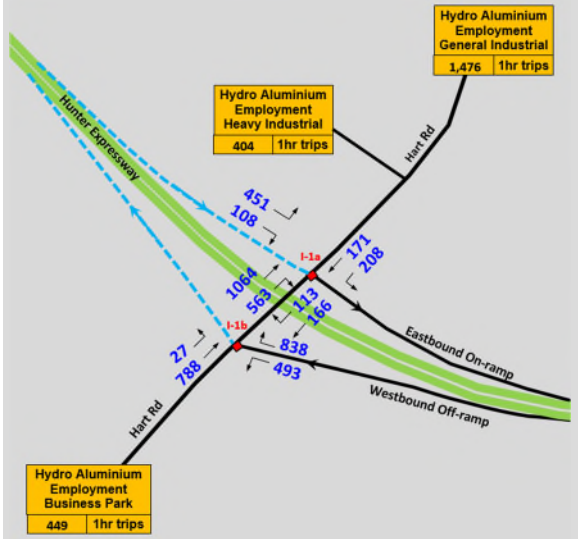
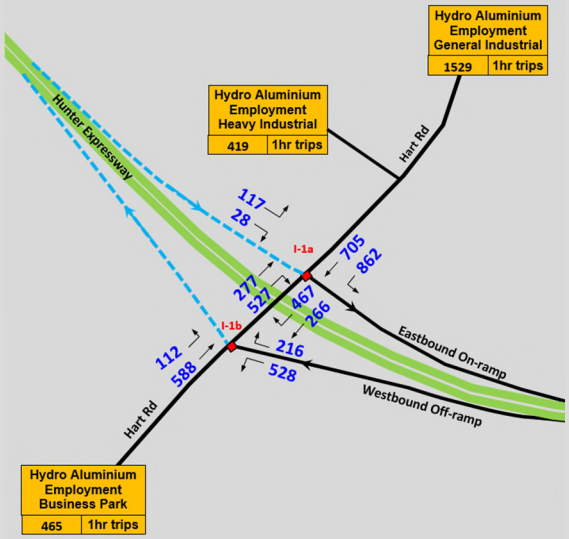
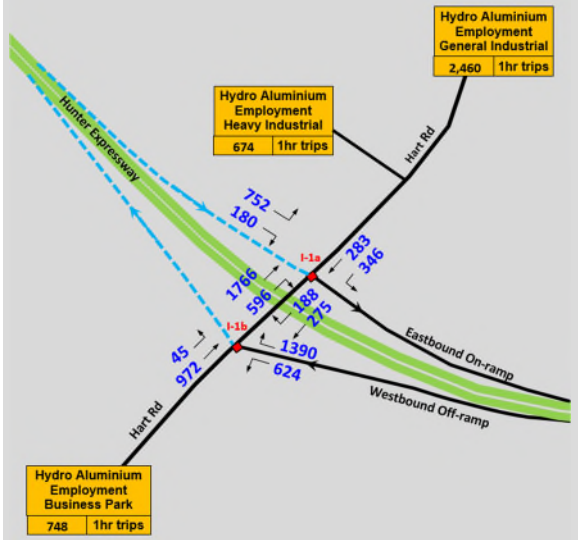
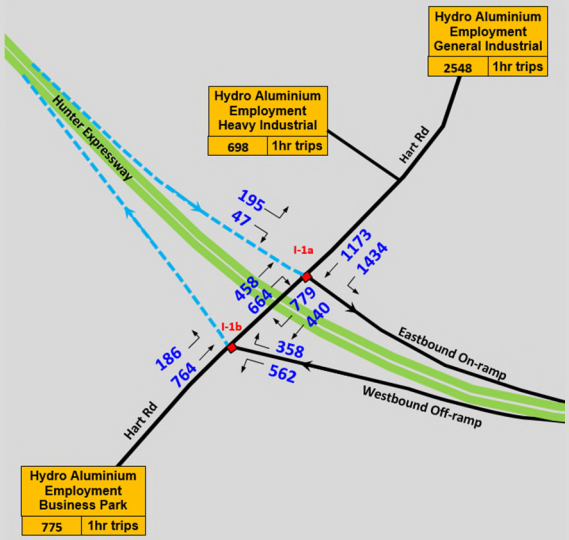
AM	PM
	
75 hectares, Interchange Flow = 2236 veh/h	**75 hectares, Interchange Flow = 2277 veh/h**
	
120 hectares, Interchange Flow = 3084 veh/h	**120 hectares, Interchange Flow = 3155 veh/h**
	
200 hectares, Interchange Flow = 4592 veh/h	**200 hectares, Interchange Flow = 4717 veh/h**

Figure 5-6 Forecast Traffic Volume at Loxford Full Interchange

AM	PM
	
75 hectares, Interchange Flow = 2236 veh/h	**75 hectares, Interchange Flow = 2277 veh/h**
	
120 hectares, Interchange Flow = 3084 veh/h	**120 hectares, Interchange Flow = 3155 veh/h**
	
200 hectares, Interchange Flow = 4592 veh/h	**200 hectares, Interchange Flow = 4717 veh/h**

The 120 ha employment land is predicted to generate about 2400 vehicles in one peak hour. The capacity of the full interchange at Loxford was re-assessed. A full interchange (with additional two west facing ramps) at Loxford is tested. The on and off ramps are modelled assuming roundabout control intersections on Hart Road. The modelling analysis has suggested that two roundabouts at the interchange would accommodate up to 120 ha employment land. The LoS is predicted to be B for both northern and southern roundabout at Hart Road.

The 200 ha employment land is predicted to generate substantial traffic volumes about 4000 vehicles in one peak hour. The full development at 200 ha will impact the full interchange (with additional two west facing ramps). The Hart Road overbridge is likely to be substantially impacted.

Table 5-6 below shows development thresholds, trip generation and likely upgrading works for Loxford interchange.

Table 5-6 Development Thresholds and Upgrades at Loxford Interchange

Thresholds	AM Peak Trips	PM Peak Trips	Upgrades at Loxford Interchange
75 ha	1450	1500	▪ Existing half interchange with two east facing ramps. ▪ The on and off ramps traffic are controlled by existing sign control intersections on the bridge.
120 ha	2330	2400	▪ Full interchange with two additional west facing ramps. ▪ The on and off ramps traffic are controlled by roundabout intersections on the bridge. ▪ The 3 lane existing bridge (one through lane in each direction and an acceleration lane which then becomes a right turn lane for eastbound traffic) is likely to be impacted.
200 ha	3900	4030	▪ Full interchange with two additional west facing ramps. ▪ The on and off ramps traffic are controlled by traffic signals on the bridge (diamond interchange). ▪ The 3 lane bridge may require substantial upgrade including turning lanes.

5.4.3 Impact on McLeod Road/Northcote Street Roundabout

Hydro proposes to develop about 303 lots of residential development at the Southern precinct. The development trips from Southern precinct are likely to have minimal impact on McLeod Road roundabout with Northcote Street.

Figure 5-7 below shows the forecast development trips at Southern residential access via McLeod Road/Northcote Street roundabout.

Figure 5-7 Forecast Development Traffic Volume at McLeod Road/Northcote Street roundabout

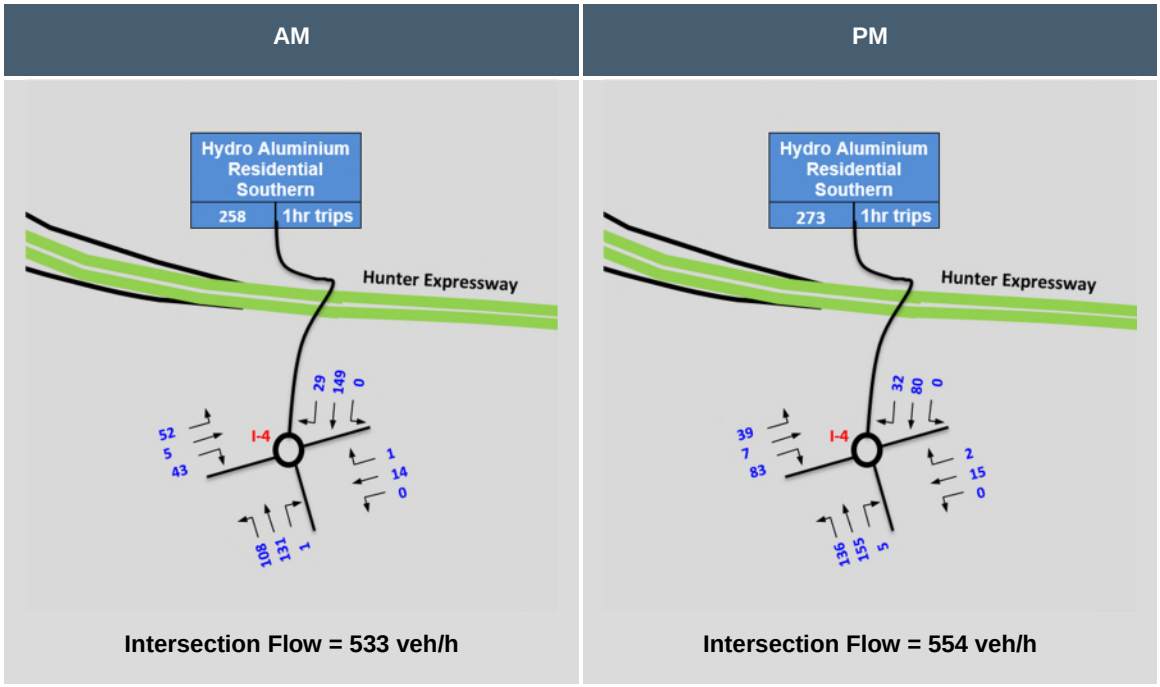


Table 5-7 Level of Service of McLeod Road/Northcote Street roundabout

AM Peak			PM Peak		
Worst Movement Delay (sec)	LoS	Degree of Saturation	Worst Movement Delay (sec)	LoS	Degree of Saturation
11	A	0.18	11	A	0.21

The analysis suggests that existing roundabout at McLeod Road/Northcote Street will accommodate additional trips from 303 lots proposed at the Southern residential precinct.

5.5 Non-Car Modes Strategy

5.5.1 Guidelines for Integrated Land Use and Transport

The guidelines for Integrating Land Use and Transport (ILUT) provided in the draft SEPP advises local councils, the development industry, state agencies, other transport providers and the community how they can:

- locate land uses and design development to encourage the use of more sustainable transport such as public transport, walking and cycling;
- help provide transport choice and manage travel demand to improve the environment, accessibility and liveability.

Table 5-8 summarises broader assessment of the proposal site against the objectives of the Integrating Land Use and Transport Policy (ILUT) package.

Table 5-8 Integrated Land Use Objectives and Compliance

Items	ILUT objectives	Compliance
1	Improving access to housing, jobs and services by walking, cycling and public transport	Following the Planning Proposal approval, a Master Plan will be prepared for the site showing subdivision lot layout and internal road network. 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 will be designed to provide safe walking routes and bicycle routes that can link the site with the existing services and facilities in Hydro development site. Through the NSW Government's Bike Plan, the Government will work in partnership with local Councils, communities and businesses to encourage bike riding growth and safer cycling in New South Wales. The Hydro site will also contain provision for pedestrians and cyclists in accordance to the NSW Guidelines for Walking and Cycling.
2	Increasing the choice of available transport and reducing dependence on cars	The Master Plan for Hydro site 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 local roads within the development will be designed to provide safe walking and bicycle routes that link with other existing services and facilities in the vicinity of the Hydro site.
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 existing facilities along Cessnock Road including existing public transport services.

Items	ILUT objectives	Compliance
4	Supporting the efficient and viable operation of public transport services	Currently there is only 3 bus routes (route 160, 163 and 164) operated by Rover Coaches that traverses along Cessnock Road. Provision of more frequent bus routes connecting the development site to nearby residential areas will increase dependence on public transport reducing dependence on cars. There is a potential to provide regular bus services, particularly at peak hours, and to provide safe and convenient bicycle and pedestrian links to nearby residential areas.
5	Providing for the efficient movement of freight	The proposed access on Hart Road via Loxford interchange with Hunter Expressway will enable the provision of efficient freight movements to and from the site. The future provision of two west facing ramps at Loxford interchange will provide a direct connection to the west including Upper Hunter and beyond.

5.5.2 Public Transport Initiatives

Public transport in the vicinity of the site is currently limited, mainly due to low existing residential and commercial development within the vicinity of the site. The integration of public transport in the development planning of the site provides an opportunity to provide a good means of access for future residents and employees within the site. With the provision of good public transport, the demands on the road infrastructure and associated costs could be reduced. There will be high commuter demands to and from the employment site from residential precincts in Maitland, Newcastle, Branxton and Upper Hunter. The key focus for public transport will be increased bus routes to service the development with external centres. A bus servicing strategy will be essential to guide future requirements of the development. Discussions will be required with local bus operators and the State government to facilitate future provision of additional and expanded bus services.

6 Conclusions

This Traffic and Transport Report has been prepared by Hyder consulting Pty Ltd (Hyder) to support a proposal to redevelop the Hydro Kurri Kurri site. The Traffic and Transport Study has been commissioned by the Hydro Aluminium Kurri Kurri Pty Ltd (Hydro), the owner of the smelter. As part of the "Gateway" Planning Proposal, a Traffic and Transport Study of the smelter site is required to address the principles of integrated transport planning, explore alternative methods of transport and determine capacity of the road network and identify required upgrades.

This report forms the Traffic and Transport element of the Hydro Kurri Kurri Planning Proposal.

This report summarises the outcomes relating to Stage 1 and Stage 2 of the Study. Hyder's Study outcome has been reported in two parts as follows:

- Part A documents preliminary traffic impact assessment at key access points and identifies potential for converting half interchange to a full interchange at Loxford with Hunter Expressway.
- Part B documents revised traffic impact assessment for the Planning Proposal.

About nine access options /points are assessed taking into account existing network connectivity, road geometry constraints and future impact. A workshop was held on 19 September 2013 among consultants as part of the Master Planning process. Hyder presented all eight access options in that workshop. The following three access options are shortlisted and proposed for the site from traffic perspectives:

- The main access to the residential development be located at the northeast boundary via a new intersection with Cessnock Road (Option C).
- The main access locations to the employment development be located along Hart Road via the Loxford interchange with Hunter Expressway (Option A and B).

The Planning Proposal for the site has identified approximately 200 hectares to be rezoned for employment development purpose and approximately 2088 residential lots are proposed to be rezoned. In the event projected development growth is realised as identified within the Planning Proposal, the traffic analysis has predicted peak hour trip generation between 5,200 and 5,450 vehicle trips in one typical peak hour. The residential trips constituted about 32% of total generated trips. The remaining 68% trips are predicted to be generated from employment land.

The modelling was undertaken for three development threshold scenarios. The analysis has varied employment land thresholds at 75 ha, 120 ha and 200 ha. The assessment considered half and full interchanges configurations at Loxford as follows:

- The Loxford interchange at Hart Road assumes no change from current condition (i.e. half interchange with east facing ramps).
- A full interchange at Hart Road is tested. Two additional west facing ramps at Hart Road are assumed.

The traffic assessment found that:

- A new traffic signal on Cessnock Road would accommodate the ultimate Northern and Central residential development yields at about 1785 lots.
- The existing half interchange at Loxford with Hunter Expressway is predicted to accommodate additional trip generation from 75 ha employment land.
- The preliminary engineering review indicates that the half interchange at Loxford can be converted to full interchange (roundabout controls to both end of bridge) with additional land take, increased pavement extents and surrounding earthworks.
- The full interchange at Loxford with Hart Road (roundabout control) is likely to accommodate up to 120 ha employment land. However, the Hart Road overbridge is likely to be impacted.
- The 200 ha employment land is predicted to generate substantial traffic volumes 4,000 vehicles in one peak hour. The full development at 200 ha will impact the full interchange (with additional two west facing ramps). The Hart Road overbridge is likely to be substantially impacted.

It is intended that further discussion will be held with RMS following the rezoning approval. At that time in consultation with RMS the proponent will develop a concept design for the proposed access intersections. The concept design is proposed to be undertaken at DA application stage.

The development of the Hydro site will require regular reviews of traffic generation and its impact on the road network. Hyder recommends that RMS traffic generation be reviewed when agreed milestones are reached, for example after 75 ha of developable land is completed and occupied.