WOOLGOOLGA TO BALLINA UPGRADE

MOONIMBA BORROW SITE TRAFFIC IMPACT ASSESSMENT

W2B-PC0-0

REV	DATE	DESCRIPTION	ORIGINATOR	REVIEWER	APPROVER
01		DRAFT	G. AOUAD	R. MILLER	
02		DRAFT	G. AOUAD	A. ZAMBOLT	
A	02/06/2017	FINAL	G. AOUAD	R. MILLER	
B	22/08/2017	FINAL	G. AOUAD	A. ZAMBOLT	

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ABBREVIATIONS

AADT	Average Annual Daily Traffic
EIS	Environmental Impact Statement
GAA	Greg Aldersons & Associates
PC	Pacific Complete
RMS	Roads and Maritime Services
RSA	Road Safety Audit
TTIA	Transport & Traffic Impact Assessment
VPD	Vehicles Per Day
VPH	Vehicles Per Hour
W2B	Woolgoolga to Ballina

EXECUTIVE SUMMARY

Pacific Complete on behalf of Roads and Maritime Services (RMS) is preparing a Modification Report for the Woolgoolga to Ballina Pacific Highway Upgrade for the use of the Moonimba Quarry, known to the project as Moonimba Borrow Site, situated in Bungawalbin, NSW. This Traffic Impact Assessment (TIA) will form part of this Modification Report.

The site is currently operating under a council development application (DA 2015/97) with an approved extraction limit of 30,000m^3 per annum. Consent to extract 90,000m^3 of material and import 30,000 m^3 fill was approved in 2015 by Richmond Valley Council (DA 2015/069).

Pacific Complete is proposing to intensify the extraction rate at the site to one million tonnes (1,000,000 tonnes), which is equivalent to 400,000m^3 of material per annum to provide sufficient materials to complete the W2B project. Approval for this increased extraction rate is being sought through the Department of Planning and Environment via a modification to the W2B project approval.

A Transport and Traffic Impact Assessment (TTIA) report was produced by ***Greg Alderson & Associates*** in 2014 as part of an Environmental Impact Statement (Moonimba EIS) that was submitted with the DA2015/069. The TTIA report was used to support the objectives of this TTIA.

Assumptions have been introduced in **Section 2.4.1,** based on available information to ensure a sufficient analysis of the existing and future conditions of the proposed haulage routes.

Following the analysis of the combined traffic volumes within the Woodburn region, i.e. haulage, private, school and land use; it was ascertained that the local network (i.e. Boggy Creek Road, Reardons Lane and Woodburn-Coraki Road) will be adequate in servicing future traffic activities, under the provision that the road upgrades stipulated within DA 2015/069 are completed, prior to the activation of increased extractive operations.

Despite the adequate operational capacity of the local network, the cumulative impacts generated by the surrounding quarries in conjunction with the Moonimba Borrow site, will warrant temporary traffic management at the Woodburn-Coraki Road - Pacific Highway intersection, for the duration of the W2B construction works. Mitigation measures such as; Traffic Management Plans (TMPs), intersection reconfiguration and delineation amendments have been recommended as temporary solutions.

1. INTRODUCTION

Pacific Complete on behalf of Roads and Maritime Services (RMS) is preparing a modification report for the Woolgoolga to Ballina Pacific Highway Upgrade for the use of the Moonimba Quarry, known to the project as Moonimba Borrow Site, situated in Bungawalbin, NSW. This Traffic Impact Assessment (TIA) will form part of this modification report.

The Moonimba Borrow Site is currently operating under a council development application (DA 2015/97) with an approved extraction limit of 30,000m^3 per annum. Consent to extract 90,000m^3 of material and import 30,000m^3 fill was approved in 2015 by Richmond Valley Council (DA 2015/069). The DA 2015/069 has not currently been activated. Pacific Complete is proposing to intensify the extraction rate at the site to one million tonnes (1,000,000 tonnes) per annum, which is equivalent to 400,000m^3 of aggregate per annum to provide sufficient material to complete the W2B project. The purpose of this traffic impact assessment, is to explore the implications of increasing haulage and heavy vehicle activity; specifically relating to road performance, general traffic operation, school bus routes and land usages both current and future.

The Moonimba Borrow Site is situated approximately 16km south-west of Woodburn, NSW. It resides to the west of Portion C's W2B construction zone and is bounded by Devil's Pulpit and Broadwater Township. Split between two pits, the site will operate with a confirmed total excavation area of 21 hectares. This is consistent with the excavation area given consent under a DA 2015/069 for an expansion of the existing quarry.

The Environmental Impact Statement issued in 2012 for W2B (Roads and Maritime Service + Aurecon + SKM, 2012) projected 1.23 million tonnes of road base, 0.79 million tonnes of sand and approximately 1.4 million tonnes of aggregate for the construction of drainage structures, pavements, spray sealing works, production of concrete and asphalt. Sections 7, 8 and 9 which encapsulate Portion C, were forecasted to require the following material quantities:

Table 1.1 W2B EIS Indicative Construction Material Quantities *(Source: W2B EIS)*

Project section	Earthworks (general fill) (m^3)	Earthworks (select fill) (m^3)	Aggregate (t)	Road base (m^3)	Sand (t)	Asphalt (t)	Cement (t)	Fly ash (t)	Precast concrete (t)	Steel (t)
7	481,000	128,000	159,000	20,000	93,000	10,000	30,000	15,000	800	30
8	811,000	117,000	68,000	70,000	25,000	60,000	6000	3000	2000	850
9	792,000	87,000	72,000	40,000	36,000	25,000	11,000	5000	800	100

Moonimba Borrow Site was initially identified as Robinsons Quarry within the W2B EIS (Roads and Maritime Service + Aurecon + SKM, 2012) as a supply location to contribute to these volumes. Several other quarries situated within Portion C (i.e. Coraki, Swan Bay, Broadwater and Evans Head) were considered as potential supply sites, for W2B.

Figure 1-1 Portion C Construction Boundaries

1.1 Project Overview

Under this modification to the proposal, the Borrow Site is anticipated to operate within the following parameters:

- A new proposed haulage capacity until the completion of the W2B Project, marking the anticipated completion of the Woolgoolga to Ballina Pacific Highway Upgrade.
- The haulage vehicle demands of the Borrow Site will be dependent upon road construction requirements of Portion C (Devils Pulpit to Broadwater). The number of haulage vehicles will fluctuate with the construction requirements and demands of the Portion C road works. There will be circumstances during the project's progression, where additional haulage vehicles will be required to meet construction expectations.
- Haulage operation of surrounding sites will be assessed in conjunction with the additional vehicles generated for the Moonimba borrow site. This is to ensure a conservative and holistic analysis of the study area.

1.2 Study Area

1.2.1 Site Access

Split between two pits, identified as East and West pits, the Moonimba Borrow Site presently operates at 30,000m^3 per annum. Additional approval was granted in 2015 to increase the extraction rate at the site to 90,000m^3 per annum. This DA has not been activated, at the time this assessment was prepared. **Figures 1-2** and **1-6** depict the proximity and size of the two pits within the Moonimba Borrow Site.

Site access is provided by Boggy Creek Road which joins with Reardons Lane, 3 km east of the site and adjacent to a residential property (Lot 2 DP 805371). The previous TTIA (Greg Alderson & Associates, 2014) report confirmed that the first 300 metres of the access road has been sealed, to minimise dust and noise disruption to the residents.

The majority of land used within the Bungawalbin region is for agriculture, grazing and cropping purposes. The TTIA (Greg Alderson & Associates, 2014) report forecasted an additional 84 residential lots to be developed/released by 2024. These future developments affect peak hour traffic generation and operational capacity of the road network.

The existing haulage route (refer to **Figure 1-7**) passes through eight intersections, on the approach to the Pacific Highway in Woodburn. The major intersections that will be explored within this study are:

- Pacific Highway (River Street) and Woodburn-Coraki Road
- Reardons Lane and Woodburn-Coraki Road
- Site Access Road and Boggy Creek Road

Once on the Pacific Highway, haulage vehicles are anticipated to access the construction corridor via a number of local roads including: Watsons Lane and Alfred Street (that lead into Wagner Street and then onto Woodburn-Evans Head Road). These roads were identified in Section 6.6.1 of the W2B EIS (Roads and Maritime Service + Aurecon + SKM, 2012) as local roads that could potentially be used for construction access or haulage routes. The impacts to these local roads have not been considered within this assessment, as they have already been addressed under the W2B EIS, for the delivery of material.

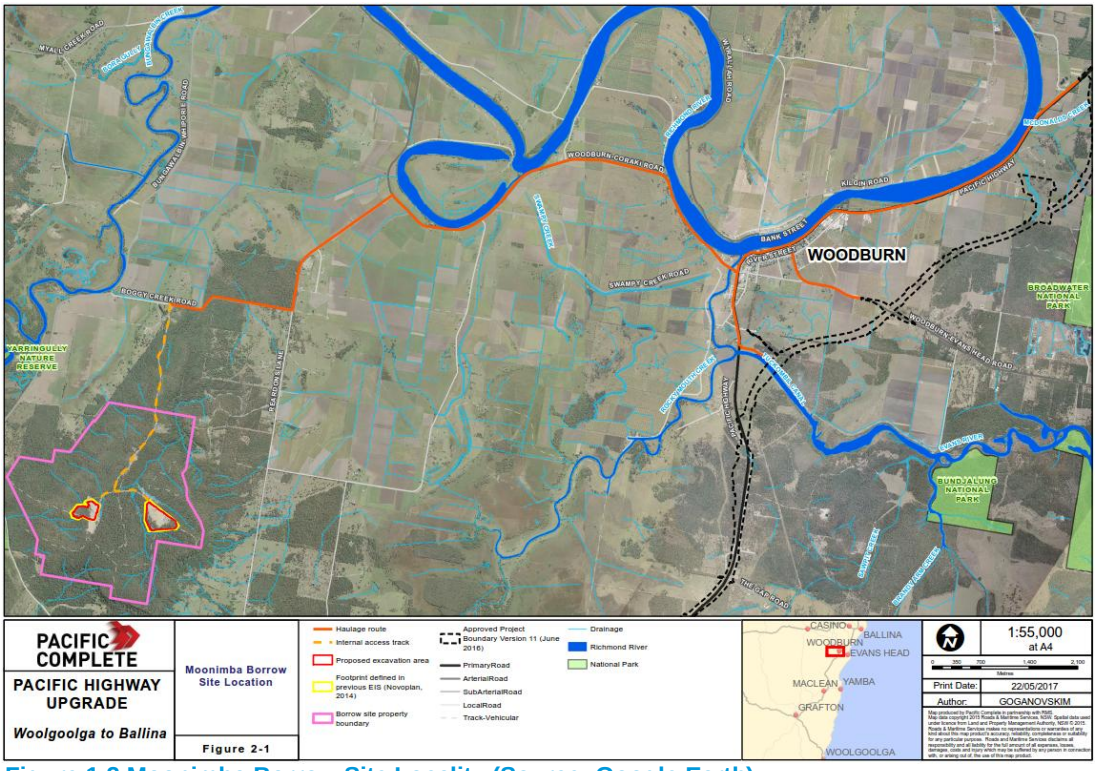


Figure 1-2 Moonimba Borrow Site Locality (Source: Google Earth)

1.2.2 Surrounding Quarries

In conjunction with the Moonimba site operation, Coraki quarry and Champions quarry are in operation within the study area.

Presently Coraki quarry operates between 7:00AM to 6:00PM, with a dispatch rate of 21 vehicles per hour. Furthermore, there is an additional 'private' quarry within the Coraki complex, generating traffic. Due to the overlapping segments between the Moonimba borrow site haulage corridor and Coraki quarry (i.e. Woodburn-Coraki Road), volumes contributed by this site have been considered as a cumulative impact for this study.

Champions quarry, which is situated in Tuckarimba, north-west of Woodburn, contributes 11 to 30 trucks per day, with restrictions to operate between 7:00AM to 5:30PM. The identified haulage route for this site, is via the Bruxner Highway, with the preferred access to the Pacific Highway via Wyrallah Road. The indicative traffic impacts of haulage operations from Champions quarry, are wholly restricted to Wyrallah Road and the Pacific Highway. Therefore, the Moonimba borrow site haulage route does not incur any cumulative impacts from Champions quarry.

1.2.3 Schools

The list below summarises the schools situated within the Woodburn - Coraki - Broadwater study area:

- St Joseph's Woodburn Primary School
- St Joseph's Coraki Primary School
- Woodburn Public School
- Evans River K-12 School
- Coraki Public School
- Broadwater Public School.

School bus routes and frequencies will be explored within this report, to ascertain any conflicts with haulage and backfilling operations.

NOTE - Bus routes are susceptible to change from year to year, depending on student enrolments and the proximity of to the school to residents.

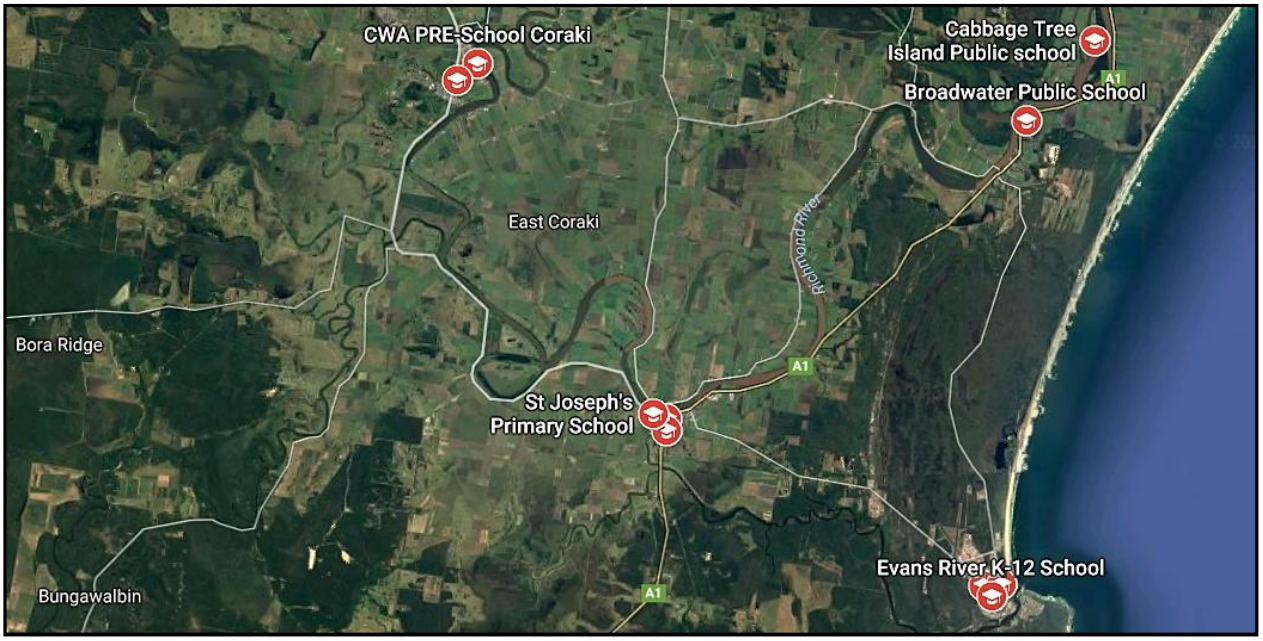


Figure 1-3 Schools within Portion C Jurisdiction *(Source: Google Maps)*

1.2.4 Residences

The current haulage route overlaps with most of Woodburn's residential access along the Pacific Highway. The Woodburn-Coraki Road and Pacific Highway intersection is the focal point within the study area, servicing schools, businesses and residents.

There are three major unloading points across Portion C: Woodburn-Evans Head Road, Southern Woodburn and Southern Broadwater. Due to their locations and access, many of the conflicts with residential vehicles will be along the Pacific Highway.

Figure 1-4 Surrounding Schools and Residential Catchments near Critical Intersections

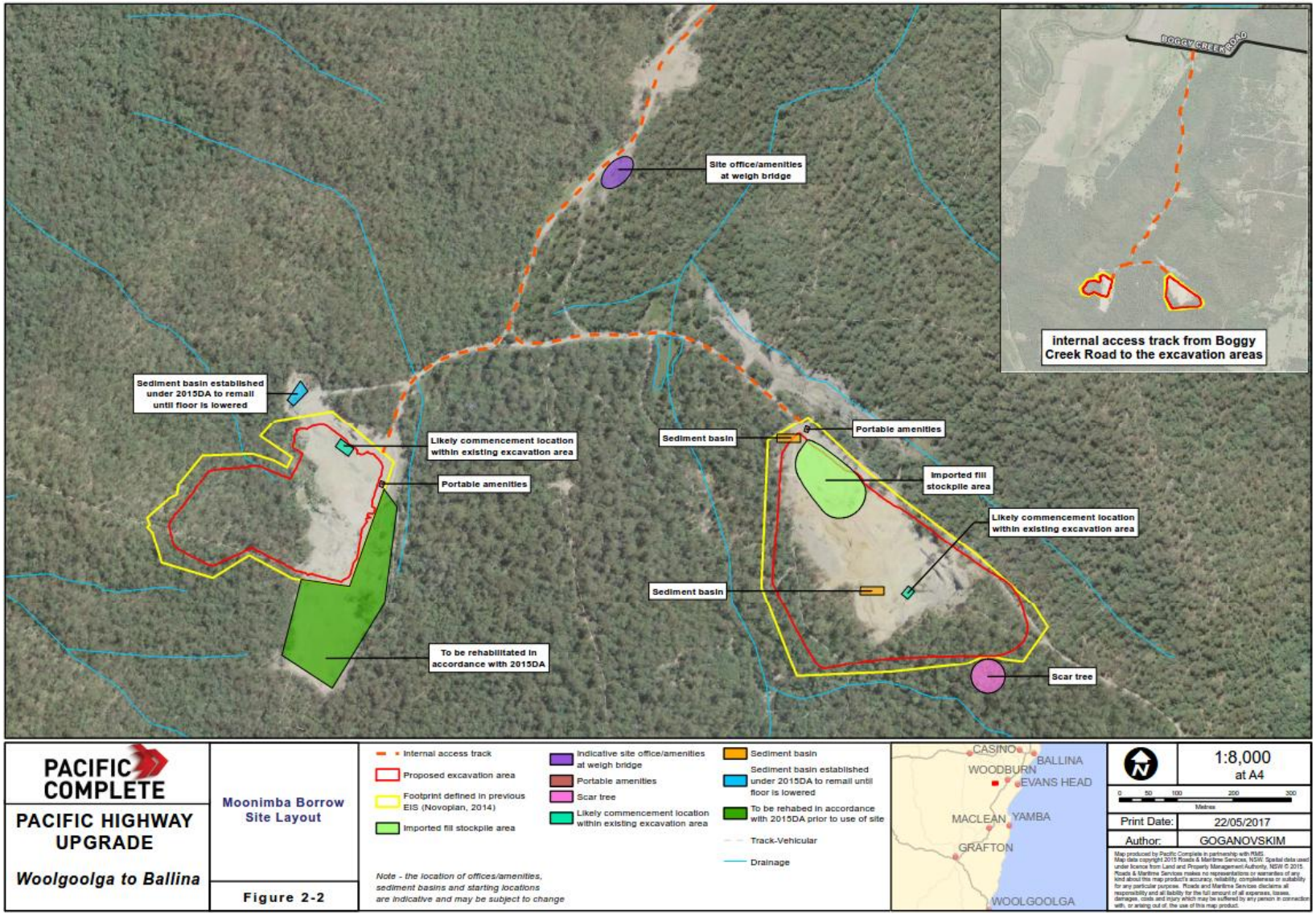


Figure 1-5 Moonimba Borrow Site (Source: Pacific Complete)

1.3 Traffic and Transport Impact Assessment – Greg Alderson & Associates (GAA 2014)

The TTIA (Greg Aldersons & Associates, 2014) formed part of the EIS, which accompanied the DA 2015/069 to expand the quarry. A lot of their major findings are still applicable to this analysis, with the exception of changes to released land, traffic volumes, school routes and construction activities.

The study was conducted in accordance with the Guide to Traffic Generating Development Version 2.2 of 2002 as well as AUSTROADS standards where appropriate. The safety of all road users was assessed including passenger cars, school buses and passengers, pedestrians and cyclists and children. The key objective of the TTIA was to evaluate the potential for impacts of the proposed extension of the existing quarry and the importation of fill, and identify mitigation measures where appropriate.

The methodology of the TTIA included:

- Assessment of traffic generation by the proposed development.
- Assessment of the capacity and efficiency of the road network, having regard to other likely development in the vicinity.
- Evaluation of road conditions, drainage and maintenance issues along the haul route.
- Completion of a Road Safety Audit on the haul route including intersection sight distances curves in Boggy Creek Road and other safety issues.
- Assessment of traffic impacts or the importation of fill.
- Identification of mitigation measures where appropriate.

The assessment of traffic generation by the sandstone extraction operation in the TTIA was based on the maximum proposed annual output of 193,000 tonnes averaged over the working days in a year. This was calculated as 40 truck movements per day. Based on traffic surveys at the quarry and rules of thumb, the report confirmed that 6 truck movements per hour is reasonable in the long term.

The TTIA also proposed an annual fill importation limit of 30,000 m^3. This was calculated to generate an average of 14 truck movements per day when fill importation is taking place. It was concluded that the resulting additional traffic will not cause the traffic loads to exceed the traffic volume limits for the roads in the haul route. The community consultation for the proposed development highlighted concerns about safety issues including truck speed, driver behaviour, pedestrian safety and school bus safety.

In response, the TTIA recommended a speed limit of 60 km/hour be placed on Boggy Creek Road between Reardons Lane and the quarry access road , and that a double continuity centreline to be marked along the proposed sealed section of Boggy Creek Road and the haulage component of Reardons Lane to discourage road users crossing over into the opposing traffic lane.

The report concluded that the average peak truck volume, including importation of fill, is estimated to be 54 truck movements per day. It concludes that: ***"The existing road network is generally adequate for the proposed quarry operations" and "approval of the development from a traffic engineering point of view"*** is recommended.

The DA 2015/069 approval of the TTIA stipulates that Boggy Creek Road is to be sealed between the quarry access road and Reardons Lane to achieve seal of 6 metres width with 1 metre wide gravel shoulders, if the extractive rate of 90,000m^3 p.a. is activated.

In respect of the Coraki-Woodburn Road intersection with Reardons Lane, the TTIA states***: "Council has requested that the potential be investigated for creating a left turn deceleration lane on Coraki Woodburn Road at this intersection***." The investigation is required to establish if this lane can be constructed without requiring significant earthworks or drainage upgrade works.

1.4 Objectives

The proposed increase to haulage operations is anticipated to affect local network performance within Woodburn and Bungawalbin. The objectives of this report are to address the following criteria:

- 2016 and 2020 traffic volume impacts.
- Released Land/Land use changes.
- Proposed haulage frequency.
- Bus routes.
- Comparison against the W2B EIS Traffic and Transport Working Paper.

Currently the haulage route operates via Boggy Creek Road, Reardons Lane, Woodburn-Coraki Road and The Pacific Highway. This path is depicted in orange in **Figure 1-6** below.

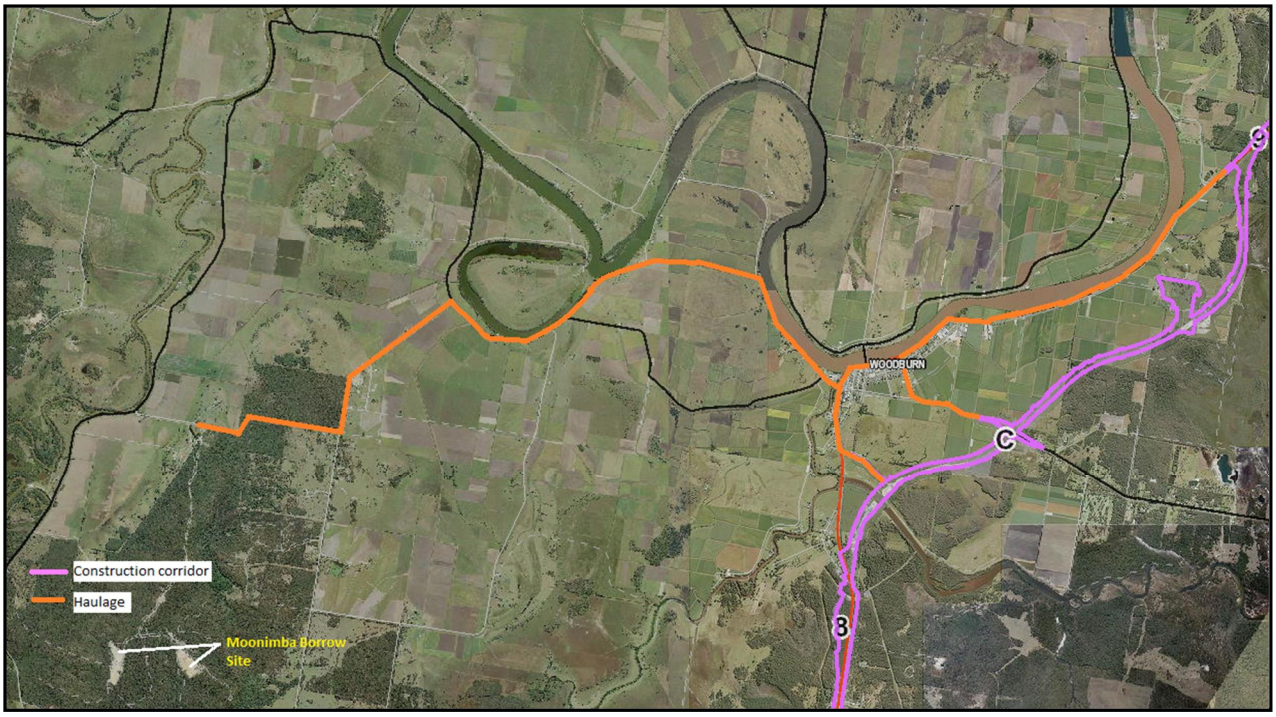


Figure 1-6 Proposed Haulage Routes (Source: Google Earth)

2. EXISTING CONDITIONS

2.1 Road Network

From the TTIA (Greg Aldersons & Associates, 2014), the following table indicates the present road capacities for the haulage route:

Table 2.1 Road Quality – Proposed Haulage Route

Road Name	Boggy Creek Road	Reardons Lane	Coraki-Woodburn Road
Pavement Types and Widths	7 metre width – Gravel	6 metre width – bitumen seal +1 metre gravel shoulders	7.5 metre seal + 0.5 metre sealed shoulders
Operational Vehicle Capacity	150 vpd	500 vpd	>1000 vpd

Source: Greg Alderson and Associates

Clause 30 of DA 2015/069 stipulates the ongoing upgrades to Boggy Creek Road and the ongoing maintenance of the haulage route. Prior to Pacific Complete occupation of the borrow sites, the following roadworks are to be completed by the land owner in accordance with Richmond Valley Council's criteria:

Table 2.2 Road Quality – Pending Upgrades and Maintenance

Location	Boggy Creek Road	Borrow Site Access Road	Reardons Lane Boggy Creek Road	Woodburn-Coraki Road Reardons Lane
Upgrade Description	6 metre width – bitumen seal +1 metre gravel shoulders	Widened entrance	→ Left turn widening out of Boggy Creek Road. → BAR[1] and BAL[2] turning treatments.	→ Subject to approval by Richmond Valley Council, a westbound deceleration lane shall be constructed on Woodburn-Coraki Road for heavy vehicles turning into Reardons Lane.
Operational Vehicle Capacity	500 vpd			

Source: Richmond Valley Council – DA 2015/069

[1] The basic right-turn treatment (BAR) is the minimum treatment for right-turn movements from a through road to side roads and local access points. This treatment provides sufficient trafficable width for the design through vehicle to pass on the left of a stationary turning vehicle.

[2] Rural Basic Left-turn Treatment (BAL) shows a minimum treatment for use in a rural situation (i.e. high-speed environment) which provides tapers leading into and out of the left-turn treatment to cater for the swept path of a large design vehicle.

Prior to any further changes to the extractive procedures, it has been clearly identified within DA 2015/069 that increased quarrying can only take place, provided the above upgrades have been completed and the ongoing maintenance of the corridor can be assured.

Council have acknowledged that infrastructural damages implicated by adverse weather are their responsibility to rectify. However, the development and improvements to the haulage corridor is to be undertaken by the land owner, to ensure continued haulage operations.

2.2 Traffic Counts

A preliminary traffic count was performed for the TTIA (Greg Aldersons & Associates, 2014) for the study area. These traffic volumes were used for the traffic impact assessment developed for the haulage route in **Figure 1-6.**

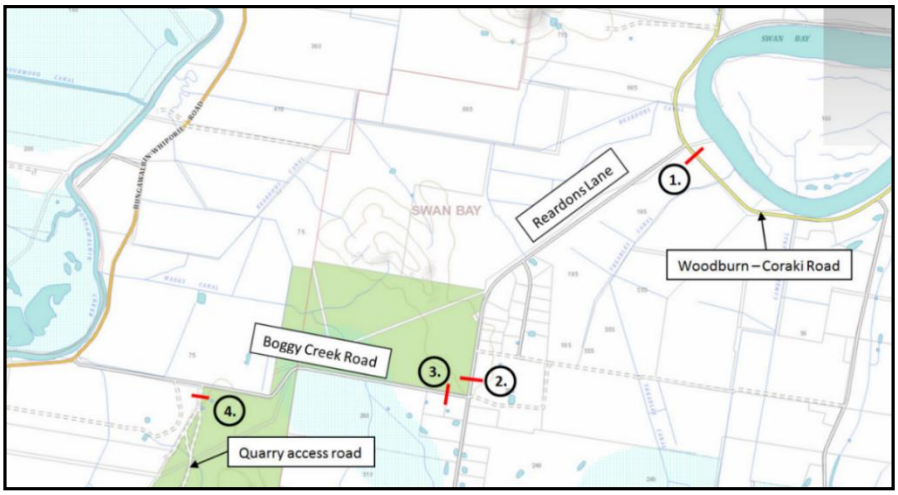


Figure 2-1 Traffic Counter Locations (Source: Greg Alderson & Associates, 2014)

Table 2.3 depicts the averaged AM, PM and daily traffic volumes from the TTIA (Greg Aldersons & Associates, 2014) assessment:

Table 2.3 2014 Averaged Traffic Volumes

Location	Daily Traffic (Vehicles per day - vpd)	Peak Hourly Volumes (Vehicles per hour - vph)
Reardons Lane	220	25
Woodburn-Coraki Road	1,397	133
Boggy Creek Road	132	<10
Site Access Road	30	

Source: Greg Alderson & Associates

A secondary traffic count was performed in 2016 for the Pacific Highway corridor, focusing on major local roads, exit/entry ramps and the mainline itself. These counts were used in the development of the traffic model. Furthermore, future traffic volumes had been forecasted, to account for new demand, road upgrades and background growth. These volumes will be used for this TTIA, to ensure consistency in the applied assumptions and methodology.

Table 2.4 2016 Traffic Volumes

2016 Counts	Northbound annual average daily traffic (AADT)	%HV	Southbound annual average daily traffic (AADT)	%HV
Pacific Highway - Woodburn	4,548	26%	4,754	29%
Wyrallah Road	1,121	16%	1,023	16%

Source: Pacific Complete Traffic Model

2.3 Haulage Operations and Site Access

The existing entrance for the Borrow Site (Lot 193 DP755603, Bungawalbin) is located on Boggy Creek Road approximately 2km west of the intersection with Reardons Lane. This access road heads south toward the excavation pits. The first 300 metres of the access road, measured from Boggy Creek Road, has been sealed to minimise dust and noise impacts on the nearby residents on Lot DP 805371.

The TTIA (Greg Aldersons & Associates, 2014) report indicated that the site access road incurs 30 truckloads per day. Following the DA 2015/069 for 90,000m^3, it was forecasted that 40 truck movements per day, plus an additional 14 back-fill trucks per day would meet the yearly demand, thus resulting in 54 movements per day.

In conjunction with the Moonimba site operation, the Coraki Quarry, depicted in **Figure 2-2** currently has approval to dispatch 21 trucks per hour, between: 7:00AM to 6:00PM.

Note - Coraki quarry recently applied for approval to dispatch 31 truckloads per hour. Furthermore, there is an additional 'private' quarry within the Coraki complex, generating traffic movements. For this assessment, these volumes have been considered as a cumulative impact with the Moonimba borrow site.

The overlapping segments along this corridor and total volumes will be examined at the relevant intersections within the study area.

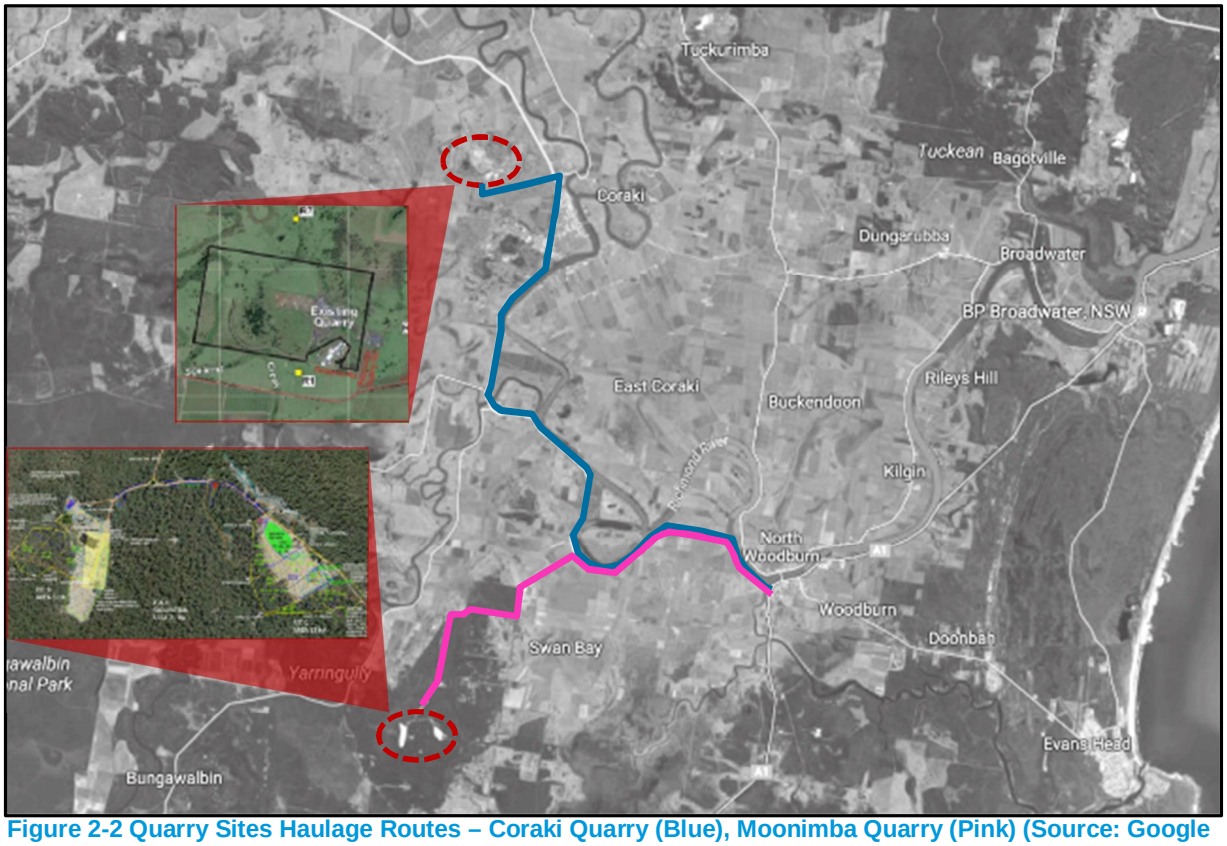


Figure 2-2 Quarry Sites Haulage Routes – Coraki Quarry (Blue), Moonimba Quarry (Pink) (Source: Google Maps)

2.4 School Bus Operation Hours

Year to year, bus routes are susceptible to change, depending on student enrolments and the proximity of to the school to residents. Due to these changes, there are no definitive bus routes or graphical representations of the bus corridors. However, accessed streets and stoppage times are publicly available. **Table 2.5** summarises the number of buses operating along the haulage corridor, during the morning and afternoon school peaks. The morning peak operates between 7:00AM and 9:00AM and the afternoon peak takes place between 2:55PM and 5:00PM.

Table 2.5 Overlapping Haulage and Bus Routes

Bus Routes	Suburb	Street	Number of Buses (AM)	Number of Buses (PM)
Locality	Bungawalbin	Boggy Creek Road	8	7
		Reardons Lane	10	7
	Woodburn	Woodburn-Coraki Road	7	7
		Pacific Highway	20	20

A high-level assessment of the bus routes and the roads accessed, provides the following bus routes within the area:

- Local Roads: Boggy Creek Road, Reardons Lane and Woodburn-Coraki Road incur approximately ***4-5 buses per hour*** during the AM and PM school peaks
- The Pacific Highway services buses delivering students to schools north and south of the study area. The approximated bus frequency is ***10 buses per hour***, during the AM and PM school peaks.

Despite the clause stipulated within development application (DA 2015/069) to limit the movement of heavy vehicles during school hours, the elected peak between 11:00AM and 1:00PM holds precedence in this study, as the impacted study area incurs the greatest traffic volumes during this time.

2.4.1 Assumptions

This report will explore impacts generated by increased traffic volumes within the study area. Without future road maintenance data, road geometry and backfill requirements, the following assumptions will be considered and applied for this study:

1. Traffic volumes calculated within the TTIA (Greg Aldersons & Associates, 2014) will be utilised and conservatively grown at 2% p.a., to account for future volumes within Woodburn. Despite the anticipated drop in vehicles using the Pacific Highway following the completion of W2B, this growth will ensure a worst-case scenario analysis.
2. The Pacific Highway is capable of servicing increases in heavy vehicle proportionality.
3. As stipulated within Richmond Valley Council's DA 2015/069, upgrades and maintenance of the haulage route are to be carried out by the owner prior to Pacific Complete occupation of the borrow site.
4. Without a follow-up traffic survey of the study area, increased traffic volumes will be split throughout the network; based on land usage, points of interest and dominant directions of traffic flow.
5. The results and future impacts from the TTIA (Greg Aldersons & Associates, 2014) will be used as the precedent for further mitigation measures and strategies.
6. A Road Safety Audit will not be performed for the study area. The results from the RSA undertaken for the TTIA (Greg Aldersons & Associates, 2014) will remain applicable to the haulage route.
7. Potential upgrades to the haulage route have been considered by Richmond Valley Council. It has been acknowledged that the severe storm events within the region warrant adequate maintenance and upgrade of the haulage route, particularly Woodburn-Coraki Road.
8. As a high-level assessment, this report will focus on the impacts generated by traffic alone. Studies into road design, traffic management plans and safety will need to be pursued by Pacific Complete and/or the contractor. This report will provide potential mitigation measures to the affected roads and intersections.

3. PROPOSED MODIFICATION

3.1 Present Haulage Rate

The following procedure depicts the haulage rates based on the approved extraction rate, calculated by ***Greg Alderson & Associates:***

$$\frac{193,000\ tonnes}{300\ days} = 645\ tonnes\ per\ day \ldots (1)$$

Assuming that a typical truck and dog can transport 32 tonnes per load:

$$\therefore Average\ loaded\ trucks = 20\ truckloads\ per\ day \ldots (2)$$

Or

$$Movements\ per\ day = 40\ truck\ movements\ per\ day \ldots (3)$$

Or

$$Movements\ per\ week = 220\ truck\ movements\ per\ week \ldots (4)$$

3.2 Proposed Haulage Rate

It has been proposed to increase the maximum annual extraction rate of the Moonimba Borrow Site to 1,000,000 tonnes per annum. The Borrow Site is proposed to run six (6) days a week (7am-6pm Weekdays and 8am-5pm Saturdays) during greater demand periods for the Pacific Highway upgrade. By maintaining the same haulage calculations and methodology performed by ***Greg Alderson & Associates***, the following outputs are indicative of the new haulage operations:

$$\frac{1,000,000\ tonnes}{300\ days} = 3,333\ tonnes\ per\ day \ldots (9)$$

$$\therefore Average\ Loaded\ Trucks: \frac{3,333}{32} = 104\ truckloads\ per\ day \ldots (10)$$

Or

$$Movements\ per\ day: = 208\ truck\ movements\ per\ day \ldots (11)$$

Or

$$Movements\ per\ week: = 1,144\ truck\ movements\ per\ week \ldots (12)$$

The average hourly traffic generation can be calculated as:

$$208\ movements\ per\ day\ /\ 11\ hours\ per\ day = 19\ movements\ per\ hour$$

$$208\ movements\ per\ day\ /\ 9\ effective\ hours\ per\ day = 23\ movements\ per\ hour.$$

The effective hourly rate will be applied and examined across the impacted intersections and utilised haulage routes. Despite the proposed operational hours of 7:00am to 6:00pm (11 hours), effective haulage time of 9 hours has been applied to account for school buses accessing the corridor.

Number of vehicles to satisfy 30,000m^3 backfill is ~14 truck movements per day. (Greg Aldersons & Associates, 2014).

Haulage + Backfilling = Total Number of Vehicles

$$\mathbf{12}\ \boldsymbol{truckloads\ per\ hour}\ +\ \mathbf{1}\ \boldsymbol{truckloads\ per\ hour}\ =\ \mathbf{13}\ \boldsymbol{truckloads\ per\ hour}$$ **(One way)**

$$\mathbf{23}\ \boldsymbol{movements\ per\ hour}\ +\ \mathbf{3}\ \boldsymbol{movements\ per\ hour}\ =\ \mathbf{26}\ \boldsymbol{movements\ per\ hour}$$ **(Two way)**

Approximately; ***234 movements per day.***

Note – With an average of **234 movements per day**, an operational threshold of **300 truck movements a day or 33 movements per hour (two-way) or 16 vehicles per hour (one way)**, has been considered to account for influxes in construction demands. This extractive industry will be used as the upper limit for assessing traffic impacts.

4. FUTURE CONDITIONS

4.1 Traffic Generation

Table 4.1 depicts the average hourly vehicle volumes, forecasted for the Pacific Highway in 2020. These volumes have been estimated from existing (2016) hourly proportions, reflecting the greatest traffic peak (11AM – 1PM). The 2016 volumes were extracted from the online ***Roads and Maritime Traffic Volume Viewer.***

Table 4.1 2020 Pacific Highway Volumes (Without Additional Haulage Vehicles)

	2020 Volumes	Northbound AADT	AVG vph	%HV	Southbound AADT	AVG vph	%HV
Road Location	Pacific Highway Woodburn	4,051	243	31%	4,205	294	32%

Source: Pacific Complete Traffic Model

Table 4-2 presents future traffic volumes, following the completion of W2B. A 2% traffic volume annual growth rate has been applied, to ensure a conservative assessment of the network's performance.

Table 4.2 2020 Project Completion Volumes (Without Additional Haulage Vehicles)

Location	Daily Traffic	Peak Hourly Volume
Reardons Lane	250 vpd	24 vph
Woodburn-Coraki Road	1,600 vpd	140 vph
Boggy Creek Road	150 vpd	12 vph

Following the preliminary calculations of Land Rezoning and Future Land Releases, by ***Greg Alderson & Associates,*** the following Land Released Generated Traffic was calculated for the Bungawalbin and Swan Bay area:

Table 4.3 Land Released Generated Traffic

Number of Lots	Daily Traffic Generation	Peak Hour Traffic Generation
84	907 vpd	109 vph

For the duration of the W2B road works, it is assumed that the anticipated 84 lots will not be completed *and or* occupied, to generate the daily traffic stipulated within **Table 4.3**.

40% of the hourly traffic generated by future land use (34 developed lots before the end of 2018) has been applied within this impact assessment.

5. IMPACTS

5.1 Summary of Preliminary Impacts

The TTIA (Greg Aldersons & Associates, 2014) only accounted for roads that Richmond Valley Council preside over. With ongoing construction and developments of W2B, additional traffic has been introduced within the Woodburn Township. This has inherently affected the access and operation of Woodburn-Coraki Road, with vehicles entering it via the Pacific Highway. Therefore, the future performance and management of Woodburn-Coraki Road and the Pacific Highway intersection has been examined within this report. The table below summarises the impacts observed within the TTIA (Greg Aldersons & Associates, 2014) and this assessment.

Table 5.1 Impact Summary

Transport and Traffic Impact Assessment (Greg Aldersons & Associates, 2014)

Location	Impact Description	Outcomes
Moonimba Borrow Site	→ Average peak daily traffic generated by the proposed quarry was 54 truck movements per day.	→ It was ascertained that the road condition and network can service these volumes.
Boggy Creek Road	→ If the proposed annual extraction rate exceeds the current approval of 30,000m^3 per annum (as assessed by Council), Boggy Creek is to be sealed/hotmixed and a BAR intersection treatment is to be implemented before this exceedance occurs.	→ Boggy Creek Road sealed between the quarry access road and Reardons Lane to achieve seal of 6 metres width with 1 metre wide gravel shoulders. → Double continuity lines be marked on centrelines of proposed sealed section of Boggy Creek Road and haulage section of Reardons Lane.

Moonimba Borrow Site Traffic Impact Assessment (Pacific Complete, 2017)

Woodburn - Coraki Road / Pacific Highway	→ It is anticipated that the number of vehicles accessing Woodburn-Coraki Road and the Pacific Highway intersection will increase. Particularly left turning vehicles from Woodburn-Coraki Road and right turning vehicles from the North approach of the Pacific Highway → The anticipated proportion of hauling vehicles splitting at this intersection is depicted in **Table 5-2**.	
Moonimba Borrow Site	→ Increase in haulage operations from the quarry obligates the land owner to satisfy Clause 30 of DA 2015/069 and the widen site access.	
Boggy Creek Road, Reardons Lane	→ Design capacity of Boggy Creek Road and Reardons Lane will be adequate in servicing the proposed haulage rate of 400,000m^3, under the provision that their upgrades referenced in the DA 2015/069 have already been completed.	→ Left turn widening out of Boggy Creek Road. → BAR and BAL turning treatments.

5.2 Turning Volumes and Traffic Impacts

The following table and figure present the haulage vehicle split at the Woodburn-Coraki Road and Pacific Highway intersection, as identified by the Portion C contractor:

Table 5.2 Proportional Split of Material Delivery Locations

Material Delivery Locations	Proportional Split of Heavy Vehicles
South to Tabbimoble	20%
North to Woodburn – Evans Head	10%
North Along Pacific Highway	70%

Figure 5-1 Haulage Split at Woodburn-Coraki Road and Pacific Highway Intersection

Intersections within the study area were assessed against ***AUSTROADS Guide to Road Design Part A: Unsignalised and Signalised Intersections*** criteria, for potential channelisation.

Channelisation is the provision of traffic islands to separate through movement and turning vehicles. These treatments are installed to improve safety and turning manoeuvres, for vehicles crossing the opposing carriageway. Warrant for channelisation will be measured by combining the forecasted heavy vehicle volumes and traffic count data and plotting these volumes against ***Figure 4.9 within the AUSTROADS Guide to Road Design Part 4A.***

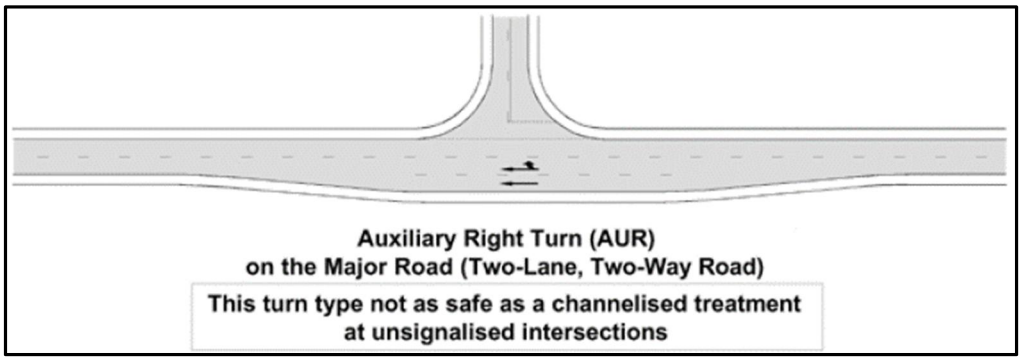
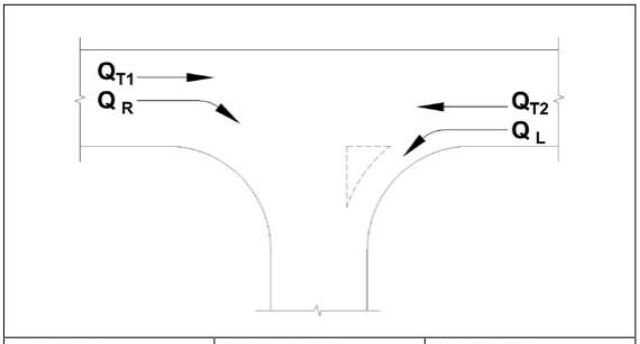


Figure 5-2 Existing Woodburn-Coraki Road and Pacific Highway Treatment (Source: AUSTROADS)

Without dedicated traffic surveys or turning counts, the following treatment assessments assume volumes 20% greater than the calculated daily average. This accounts for peak directional behaviours and land uses (i.e. residential, schools and businesses).

Figure 5-3 presents the template for measuring two-way through movements, left and right turning vehicles, to measure turning treatment eligibility.



Turn type	Splitter island	Q_M (veh/h)
Right	No	$= Q_{T1} + Q_{T2} + Q_L$
Right	Yes	$= Q_{T1} + Q_{T2}$
Left	No/Yes	$= Q_{T2}$

Figure 5-3 Calculation of the major road traffic volume parameter Q_m (Source: AUSTROADS)

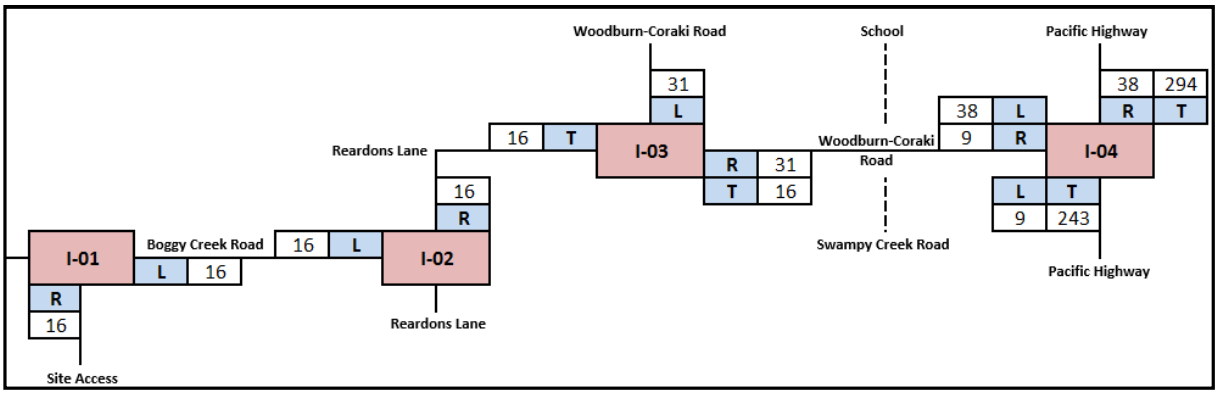


Figure 5-4 Stick Diagram (Exclusively Upper Limit Heavy Vehicle Movements)

Figure 5-4 presents the upper limit of heavy vehicle movements. This has been provided to compare the extent of impact, when buses and private vehicles volumes are introduced. **Table 4-2** presents the forecasted two way, daily and hourly traffic volumes. Woodburn-Coraki Road incurs 140 vehicles per hour. This implicates a further 70 vehicles turning from Woodburn-Coraki Road onto the Pacific Highway. Applying a 50-50 split (turning left and right), the following volumes have been calculated:

Table 5.3 Future Intersection Volumes - Proposed Haulage Operation

INTERSECTION	ID	Q_{T1} (vph)	Q_{T2} (vph)	Q_L (vph)	Q_R (vph)	Q_M (vph)
Woodburn Coraki Road - Pacific Highway (AVG HV Only)	**A**	294	243	7	27	544
Woodburn Coraki Road - Pacific Highway (Max HV Only)	**B**	294	243	9	38	546
Woodburn Coraki Road - Pacific Highway (LV + HV)	**C**	294	243	>60	>80	581

Utilising **Figure 5-5**, major road traffic is plotted against turning volumes. For this study and the impacted intersections, chart (b) will be used, as it presents the treatment warrants for design speeds below 100km/h.

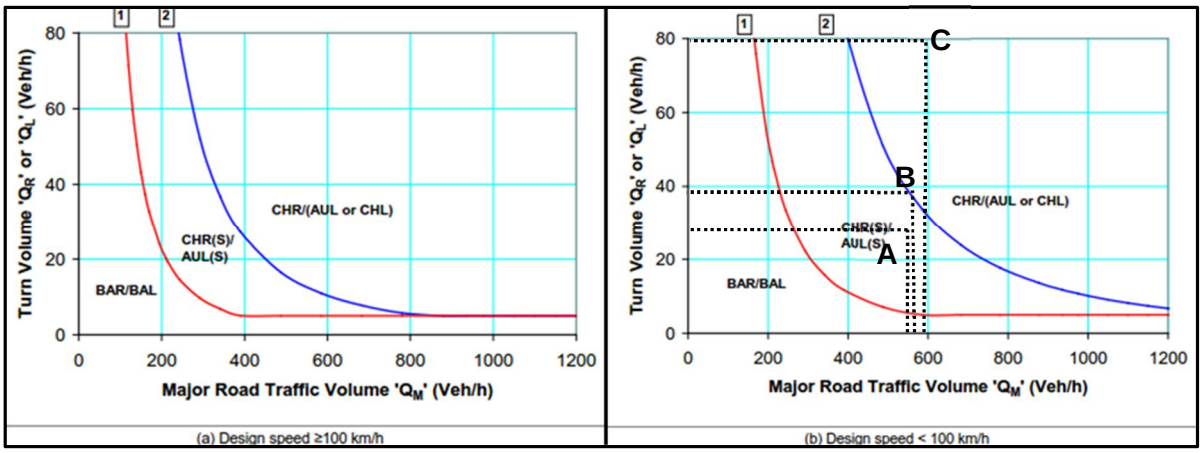


Figure 5-5 ***AUSTROADS Figure 4.9 - Warrants for Turn Treatments***

5.3 Discussion

From the forecasted through volumes (Q_m) along the Pacific Highway and the number of right turning vehicles (Q_R) intending to access Woodburn-Coraki Road, **Figure 5-5** depicts the warrant for channelisation of this intersection. The volumes generated by the increased extractive operations implicate right-turn treatment on the Pacific Highway, for vehicles to safely and efficiently access Woodburn-Coraki Road. The appropriate treatment is a channelised right-turn bay (CHR) on the Pacific Highway, southbound.

Due to the locality of St Joseph's Primary School, the AM and PM peaks incur greater bus and light vehicle volumes accessing Woodburn-Coraki Road. The introduction of a channelised lane would improve the safety and manoeuvrability of construction and local vehicles.

Depicted in **Figure 5-2,** it is stipulated than an Auxiliary Right Turn (AUR) is not as safe as a CHR, at unsignalised intersections. The TTIA developed by ***Greg Aldersons & Associates*** did not account for the Woodburn-Coraki Road and Pacific Highway intersection. Observing the 2014 traffic volumes, this intersection would have been flagged within that report. However, it has continued operation despite the changes to the quarry's extractive rates.

6. MANAGEMENT METHODS

The Woolgoolga to Ballina Pacific Highway upgrade is anticipated to be completed by 2020, therefore it is a priority to consider temporary mitigation measures, to accommodate for the interim construction activities.

Under the provision that the road upgrades prefaced within the DA 2015/069 have been completed by the land owner; Boggy Creek Road, Reardons Lane and the quarry site access road will provide adequate capacity, to service the 400,000m^3 haulage activities.

With the present information and immediate impacts, the following recommendations have been ascertained for the Woodburn-Coraki Road – Pacific Highway intersection.

Upon forecasting the magnitude of turning vehicles accessing Woodburn-Coraki Road and Pacific Highway, it warrants a dedicated right turn bay. This outcome will require reconfiguration of the intersection's layout. The following measures have been suggested, to address this impact:

6.1 Delineation and Line Marking Variation

Observing the present configuration of the Woodburn-Coraki Road and Pacific Highway intersection, the shared through-right turning lane will create the greatest safety concerns. Particularly for adequate ingress and egress of construction and private vehicles.

A proposed mitigation measure is to convert the intersection into a channelised right turn, through the reconfiguration and re-alignment of the existing line marking. There is little benefit in converting the layout into a signalised intersection, particularly for temporary haulage operations such as this.

The AUSTROADS guidelines stipulate that the following layout is the most common form of channelisation for rural roads:

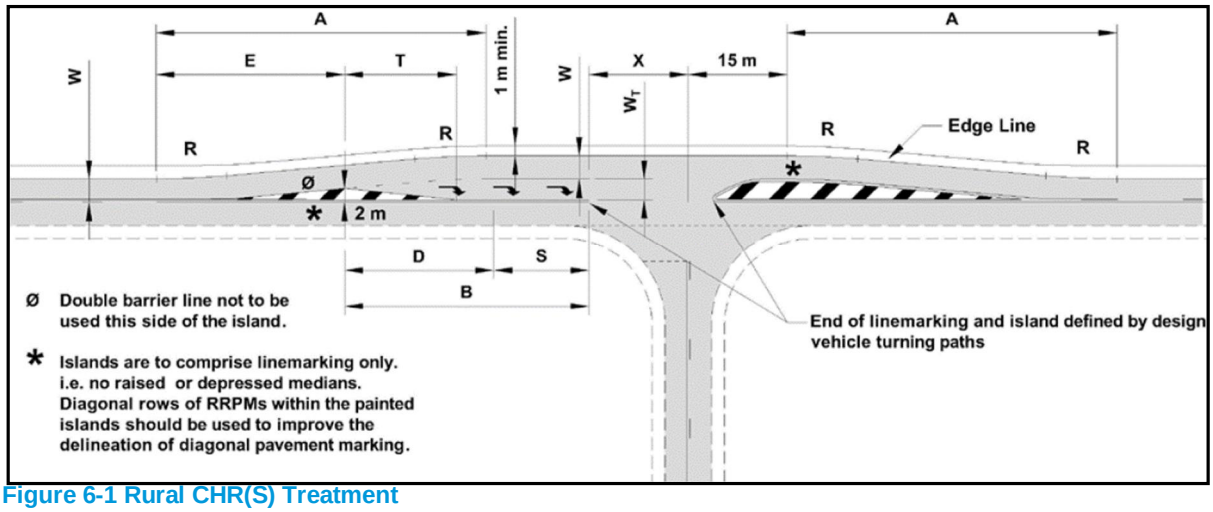


Figure 6-1 Rural CHR(S) Treatment

By re-aligning the line marking to facilitate for a continuous left lane and a right turn storage bay, a turning lane of 100 metres can be introduced (See **Figure 6-2)**. Vehicles intending to continue southbound, will remain in the left lane as vehicles intending to access Woodburn-Coraki Road, will be accommodated by the storage bay. This will minimise the delay and the number of overtaking manoeuvres performed by vehicles caught behind right-turners. This treatment can be implemented temporarily, however permanent conversion would provide safer long-term operation, following the completion of W2B.

NOTE - Further study will need to be pursued by the Portion Team, to assess safety, radius and sight distance criteria, for the satisfactory implementation of this treatment.

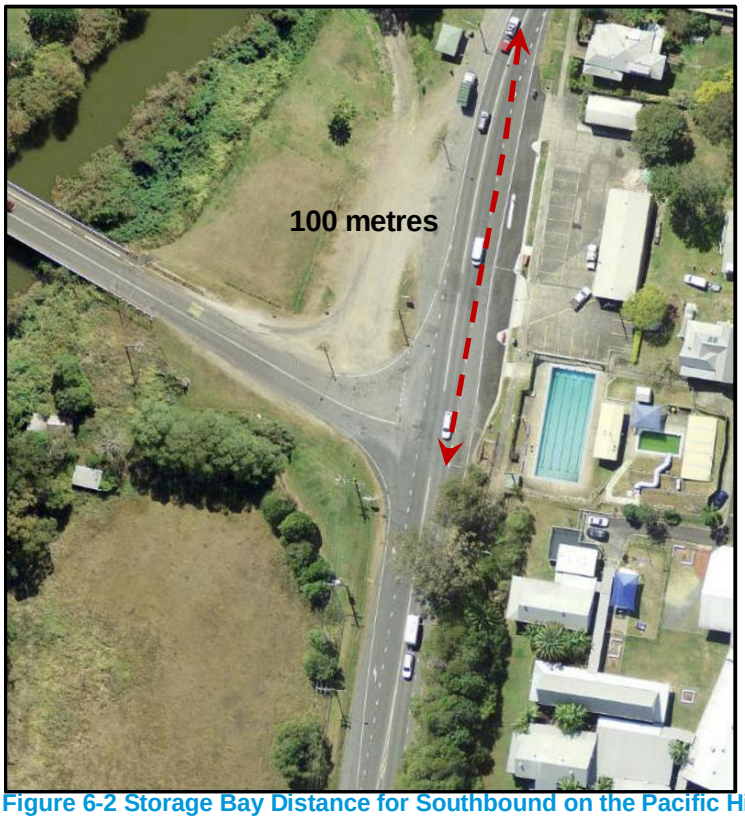


Figure 6-2 Storage Bay Distance for Southbound on the Pacific Highway

6.2 Temporary Traffic Management Plan and Signage

Due to fluctuations in project demands; there will be circumstances where the frequency of haulage operations will increase or decrease. An alternative to delineation amendments, would be the introduction of a traffic management plan (TMP). Positioning traffic controllers, variable message signs and adequate tapering, this intersection could be managed during peaks in construction activities. Already operating at 50km/h and within a school zone, the slowing down of traffic typically takes place at this location. Therefore, to accommodate for the number of turning vehicles accessing entering/exiting Woodburn-Coraki Road, a TMP could be applied.

Pacific Complete construction staff and/or their contractor would need to liaise with the Pacific Complete logistics team, to ascertain other construction activities, such as concrete and precast unit deliveries, to ensure future proposed TMPs account for situation specific traffic movements. These TMPs will be prepared in accordance with the approved Woolgoolga to Ballina Pacific Highway Upgrade Construction Traffic and Access Management Plan (CTAMP), Appendix B1 of the Construction Environmental Management Plan.

6.3 Additional Safety Measures and Practices

The implementation of GPS tracking of haulage vehicles should be investigated to observe the location of haulage trucks during school peak hours and ensure minimal impact on bus operations.

Prefaced within Section 3.2, it has been assumed 9 hours of effective hauling time, due to the clash with school peaks. The application of GPS tracking will facilitate for more predictable traffic management, particularly between 7:00-9:00AM and 3:00PM- 5:00PM, to ensure more effective road utilisation for buses and trucks.

7. CONCLUSION

Moonimba Borrow Site is presently operating under a Richmond Valley Council DA 2015/97 approved for the extraction of 30,000m^3 of material per annum. An additional consent was granted in 2015 for the extraction of 90,000 m^3 of material and importation of 30,000 m^3 of fill material. This consent has not currently been activated. Pacific Complete is proposing to extract one million tonnes (1,000,000 tonnes), which is equivalent to 400,000m^3 of aggregate per annum. By utilising the previous Transport and Traffic Impact Assessment developed by ***Greg Alderson & Associates*** and the previously issued ***W2B EIS***, existing traffic and road data; this high-level traffic impact assessment produced the following observations:

Table 7.1 Summary of Observations

Observations	Comments
Study Area traffic volumes	• With the ongoing completion of segments of the W2B alignment, traffic switches and traffic behaviours are anticipated to change. Prior to the anticipated completion of the W2B project in 2020, total through volumes on the Pacific Highway are expected to be lower than existing AADT. • Without specific traffic count data, it was assumed that general traffic volumes would increase over the course of the project, to provide a conservative assessment of the network's performance. In reality this could be different, implicating a lower impact than initially measured. • Therefore, temporary changes and improvements to the study area are considered more feasible for the operational purposes of the Project Team and general public.
Coraki Borrow Site	• North-West of the Moonimba Borrow Site, a quarry in Coraki is in operation. The quarry has approved to dispatch 21 vehicles per hour, with consideration to increase this to 31 vehicles per hour. • These volumes contribute to the total volumes travelling via Woodburn-Coraki Road and turning onto the Pacific Highway.
Woodburn-Coraki Road and Pacific Highway Intersection	• Forecasted traffic volumes implicate right-turn channelisation of this intersection. The extractive rates calculated in Section 3.2, present averaged and maximum truck movements, to account for influxes in project demands. • This traffic impact assessment applied local traffic volumes 20% greater than forecasted, to anticipate changes in land use and Pacific Highway utilisation. • Heavy vehicle impacts were compared against combined vehicle operation at this intersection. This assessment confirmed that the cumulative impacts from Coraki and Moonimba quarries warrants further management of the Woodburn-Coraki Road and Pacific Highway junction.

Considering these observations, it is clear the region depends on the efficient operation of Woodburn-Coraki Road. In the event of adverse weather and the potential temporary closure of this path, construction and haulage proceedings can be significantly set back, if not appropriately managed.

Changes to delineation on the Pacific Highway, in conjunction with adequate wayfinding and signage protocols, ingress and egress manoeuvres can be improved. Woodburn-Coraki Road and the Pacific Highway intersection are in proximity to schools and residences. The increased number of heavy vehicles introduces further risks and hazards to locals. Therefore, management of this access point are paramount.

Further studies into road condition, geometry, safety and construction scheduling will need to be pursued further by Pacific Complete and/or their contractor, to adequately address the feasibility of introducing a TMP or reconfiguring the Woodburn-Coraki Road - Pacific Highway intersection. The findings of this report are the indicative impacts created by future local and development traffic.

REFERENCES

Greg Alderson & Associates. (2014). *Transport and Traffic Impact Assessment - Extension of Moonimba Quarry Bungawalbin.* Nashua: Greg Alderson & Associates.

Roads and Maritime Service + Aurecon + SKM. (2012). *Pacific Highway Upgrade - Environmental Impact Statement.* North Sydney: Roads and Maritime Services.