Annex O – Traffic Impact Assessment

Bobs Farm Sand Quarry

Ammos Resource Management Pty Ltd

Traffic Impact Assessment

July 2016

SECAsolution

Bobs Farm Sand Extraction development

Traffic Impact Assessment

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1 Introduction

1.1 Background

Seca Solution was commissioned by Tattersall Lander Pty Ltd on behalf of Ammos Resource Management Pty Ltd to prepare a Traffic Impact Assessment for the proposed sand extraction quarry located off Nelson Bay Road, Bobs Farm. This report will form part of the supporting documentation being prepared to support a Development Application (DA) to Port Stephens Council.

As this is a mining project, the development proposal will be reviewed by the Department of Planning and Infrastructure and DGRs have been issued for the project.

The project is located adjacent to Nelson Bay Road which forms part of the regional road network. Whilst Council are the road authority the project will also be reviewed by the Roads and Maritime Services (RMS) and they will need to provide concurrence for the project to have access off Nelson Bay Road.

Initial discussion has been held with Council and the access proposals discussed to allow for entry off Nelson Bay Road and exit movements onto Marsh Road.

This traffic impact assessment has been prepared in accordance with Austroads Guidelines and the "RTA Guide to Traffic Generating Developments" published by the Roads and Maritime Services (RMS).

1.2 Scope of Report

The scope of this report is to review the traffic and access impacts associated with the proposed development and to assess the access arrangements for the development. The report provides advice on road network capacity, access issues and safety review.

1.3 Issues and Objectives of the study

The issues relative to the proposal are:

- Determine the future traffic generation for the development;
- Assess impact on the local road network due to the additional flows;
- Review the access arrangements for the development;
- Assess any other transport impacts associated with the development including a safety review.

The objective of the report is to document the impacts of the proposed development and provide advice on any infrastructure work required on the external road network as part of the development.

1.4 Planning Context

In preparing this document, the following guides and publications were used:

- RTA Guide to Traffic Generating Developments, Version 2.2 Dated October 2002;
- RMS TDT 2013/04 "Update Traffic surveys August 2013"
- Department of Planning EIS Guidelines, Roads and Related Facilities

1.5 Authority Requirements

The following issues were included in the DGRs issued for the development (including comments raised by the RMS) and are addressed in the following sections of this traffic impact assessment.

Table 1-1 DGRs Response

Comment	Report Inclusion
Accurate predictions of project-related traffic and a detailed assessment of the potential impacts of project-related traffic on the capacity, safety and efficiency of the road network	4.1, 4.1.2, 4.3.1, 4.3.2
A detailed description of the measures that would be implemented to upgrade and / or maintain the capacity, efficiency and safety of effected roads and intersections over the life of project	4.3.2
Identify all relevant vehicular traffic routes and intersections for access to / from the subject site	4.2, 4.2.1
Current traffic counts for all of the above traffic routes and intersections	2.3.1-7
The distribution on the road network of the trips generated by the proposed development. It is requested that the predicted traffic flows are shown diagrammatically to a level of detail sufficient for easy interpretation	4.2.1
Consideration of the traffic impacts on existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated by the proposed development during the construction and operational stages. The study should also give consideration to the cumulative traffic impacts of other proposed and approved developments in the area	4.3
Traffic analysis of any major / relevant intersection, using SIDRA or similar traffic model	4.3.2
Any other impacts on the regional and state road network including consideration of pedestrians, cyclists and public transport facilities and provision of service vehicles	3.2.3, 3.5, 4.1.5

2 Existing Situation

2.1 Site Description and Proposed Activity

2.1.1 Site Location and Access

The site is located within the general locality of Bobs Farm with road frontage to both Nelson Bay Road and Marsh Road (Figure 2-1 below). Access for heavy vehicles will be provided off Nelson Bay Road with exiting heavy vehicle movements via Marsh Road. Access for light vehicles will be allowed via both of these access points.

The site is currently vacant.

The location of the site is shown below in Figure 2-1.

Source: Google maps

■ *Figure 2-1 - Site Location*

Existing land use adjacent to the site is a mixture of rural residential and a local primary school.

2.2 Existing Traffic Conditions

2.2.1 Road Hierarchy

The major road through the locality is **Nelson Bay Road** which provides an important road link between the Nelson Bay area to the east of the site and Newcastle / Newcastle airport and the Pacific Highway to the west of the site. In the locality of the subject site, it provides two lanes of travel in both directions with a sealed shoulder. There are verges to both sides and there is a central median to restrict right turn movements to intersections with a number of U turn bays provided along its length to cater for local traffic demands.

The speed limit varies along its length and in the vicinity of the subject site is 80 km/h.

Access to the site is also available via Marsh Road, a local road providing access to a number of local rural suburbs and rural residential holdings. It provides a single lane of travel in both directions and operates under the posted speed limit of 60 km/h. There is a school zone located close to the intersection with Nelson Bay Road with the normal restriction of 40 km/h during the morning and afternoon school activity periods.

2.2.2 Roadworks

There are currently no road works occurring within the immediate vicinity of the of the subject site. Further to the east of the site, the Roads and Maritime Services (RMS) are currently upgrading Nelson Bay Road, from the current

single lane of travel to provide two lanes of travel in both directions. There will be a central median to restrict right turn movements with a number of U turn facilities provided at side roads to allow for the right turn demand movements.

2.2.3 Traffic Management Works

No further traffic management works are proposed along Nelson Bay Road in this locality.

2.2.4 Pedestrian and Cycling Facilities

There are minimal pedestrian and cycling facilities in the general locality of the site, reflective of the very low demands in this area. Pedestrians and cyclists are able to utilise the sealed shoulder provided in both directions along Nelson Bay Road. During the site work a number of cyclists were observed on Nelson Bay Road but no pedestrians. This is reflective of the relatively remote location of the area from the major centres.

2.3 Traffic Flows

2.3.1 Peak Hour Flows

As part of the study work, Seca Solution completed traffic surveys at the 3-way give way controlled intersection of Marsh Road and Nelson Bay Road. These surveys were completed during both the morning and afternoon peak periods on Thursday 21st August 2014 during term time. The two-way traffic flows adjacent to the site on Nelson Bay Road (south of Marsh Road) were:

- 1,273, split 769 westbound towards Newcastle (60%) in the morning peak between 7.45 and 8.45 AM and
- 1,321, split 826 eastbound towards Nelson Bay (62%) in the afternoon peak between 3.30 and 4.30 PM

During the same periods, the two-way traffic movements on Marsh Road were much lower, at 42 in the AM peak and 110 in the PM period.

The surveyed morning and afternoon traffic flows are shown below:

Figure 2-2 - AM peak surveyed numbers

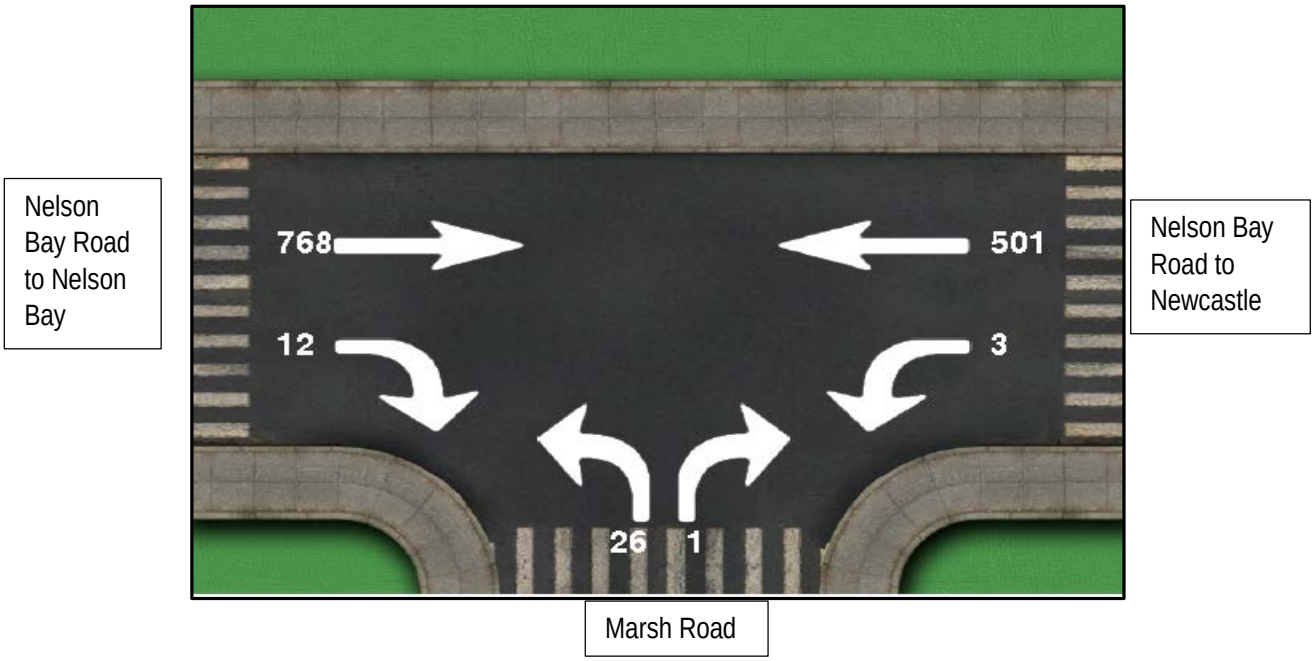


Figure 2-3 – PM peak surveyed numbers

2.3.2 Daily Traffic Flows

As part of the project, Seca Solution commissioned automatic tube counts to obtain current traffic volumes along both Nelson Bay Road and Marsh Road. A summary of the tube count data is provided below:

- The Marsh Road Annual Average Daily Traffic flow (AADT) was 713 vehicles per day. This was split between 412 eastbound and 301 westbound. This value is considerably lower than the value identified above (based on peak hour flows) and indicates that peak hour flows are influenced by the activities associated with student drop off and pick at the nearby school.
- The eastbound AADT on Nelson Bay Road was recorded at 7,612 vehicles per day.
- The westbound AADT on Nelson Bay Road was recorded at 7,699 vehicles per day.
- The combined two-way AADT for this section of Nelson Bay Road was 15,311 vehicles per day.

These tube counts were competed between 12th and 18th September 2014 outside of school holidays.

2.3.3 Daily Traffic Flow Distribution

The daily traffic volumes are reasonably balanced in both directions, with the above data indicating a bias in traffic movements eastbound in the morning and westbound in the afternoon. This would be reflective of the commuter demands, with commuters travelling from the Nelson Bay area towards greater Newcastle, Maitland and the Lower Hunter Valley and the reverse occurring in the afternoon period.

2.3.4 Vehicle Speeds

No speed surveys were completed as part of the study work. It is considered that drivers on Nelson Bay Road could travel at speeds over the posted speed limit, due to the speed limit being 100 km/h to the west of this location and there being no noticeable change in the road environment. For eastbound traffic, the road upgrades that have occurred in this area encourage drivers to speed up and as such could travel over the posted speed limit of 80 km/h. The posted speed limit increases to 100 km/h to the west of the site and it is considered that drivers speed up in anticipation of this change in speed.

The automatic tube counts provide the following data:

- 85th percentile speed on Nelson Bay Road eastbound was 91 km/h
- 85th percentile speed on Nelson Bay Road westbound was 90 km/h.

Vehicle speeds are low on Marsh Road, reflective of the road width and alignment as well as the presence of the school zone in this area. The tube count was located close to the intersection with Nelson Bay Road but west of the U-turn facility and indicates the following speeds:

- 85th percentile on Marsh Road eastbound was 65 km/h
- 85th percentile on Marsh Road westbound was 59 km/h.

2.3.5 Existing Site Flows

The site currently generates minimal traffic flows.

2.3.6 Heavy Vehicle Flows

Heavy vehicle movements in the vicinity of the subject site are relatively low, reflective of the limited through traffic movements along Nelson Bay Road. As a road that serves the Nelson Bay peninsular, there are no through traffic movements, with the only heavy vehicle movements being those associated with deliveries to the various urban centres. Heavy vehicle movements are restricted to delivery vehicles to the major shopping centres as well as some light industrial users.

During the traffic surveys, the vast majority of the traffic were light vehicles with the heavy vehicle content representing some 5% of the overall traffic movements.

2.3.7 Current Road Network Operation

Observations on site during the peak periods showed that the road network currently operates very well with minimal delays and congestion. The traffic movements along Nelson Bay Road flows well with no delays or congestion, and the two lanes of travel allow faster moving traffic to pass slow vehicles as appropriate. For traffic movements in and out of Marsh Road, the delays were minimal and drivers were able to determine suitable gaps for the right turn movements with very minimal delays.

Further to the west, it can be seen that the single lane of travel causes some delays, due to the volume of traffic. However, the road upgrade will allow for 2 lanes of travel and eliminate these delays.

Traffic flows along Nelson Bay Road are also influenced by seasonal demands, with summer demands increasing due to the tourists facilities in the Nelson Bay area. Similarly, the weekend traffic demands can be relatively high, reflective of weekend and day trips to the Nelson Bay area.

2.4 Traffic Safety and Accident History

Accident data provided by the RMS for the locality shows that there have been a low number of recorded accidents in the vicinity of the intersection of Nelson Bay Road and Marsh Road, reflective of the low side road traffic flows and the good alignment of this intersection, providing good visibility in both directions for drivers entering and exiting the side road. The accidents that have occurred have been located away from the intersection and do not relate to the layout of the intersection nor its controls.

2.5 Parking Supply and Demand

2.5.1 On-street Parking Provision

Parking is permitted along both sides of the roads in the locality, on the verges as required with normal restricts in the immediate vicinity of the intersection and driveways.

2.5.2 Off-Street Parking Provision

There is parking provided within the various lots in the immediate vicinity of the subject site.

2.5.3 Parking Demand and Utilisation

During the site work, there were no vehicles parked on Nelson Bay Road. It is considered that any vehicles parking on this road would be associated with emergency or breakdowns only, as there is no demand to park on the road side in this location.

Vehicles associated with drop off and pick up at the local school on Marsh Road park adjacent to the school but outside of the school hours there is very little demand for parking in this location, with the local houses all allowing for off-street parking.

2.5.4 Set down or pick up areas

There is an indented bus drop off / pick up zone outside the entrance to the local school on Marsh Road.

2.6 Public Transport

2.6.1 Rail Station Locations

The subject site is not served by trains. The nearest train station is in Hexham, approximately 25kms from the subject site.

2.6.2 Bus Stops and Associated Facilities

There is a bus drop off zone located outside the local school on Marsh Road together with a bus stop on the opposite side of the road. There is a single shelter on Marsh Road to service these bus stops. There are bus stops located on both sides of Nelson Bay Road to both sides of the intersection with Marsh Road, to service patron demands for buses that operate along Nelson Bay Road. The stops on Nelson Bay Road provide a sign only with no seats or shelter.

2.7 Other Proposed Developments

There are no other major developments occurring in the immediate vicinity of the subject site.

3 Proposed Development

3.1 The Development

The development proposal allows for a sand mining operation, with access off Nelson Bay Road and Marsh Road. The initial stage of the proposal allows for establishing the site, clearing the site of vegetation and providing the two access points. The following stages are nominated:

a. Operational Stage 1 – Clearing and stockpiling of topsoil and production of initial sand material that is likely to be processed into landscaping soil base and sports field top-dress material.

b. Operational Stage 2- Processing of blonde sand material for all products range.

c. Operational Stage 3 – Setting up of dredging operations and winning of sand material for the processing of all products range.

Within the operational stages the main activities will be the bulk handling of sand material, utilising front end loaders and trucks and the general truck and dogs for transport of the material to the required markets.

The peak use on the site would allow for 200 trucks to enter and exit the site per day.

3.1.1 Phasing and Timing

The development will be established in the first phase then proceed to operations. No staging of the project has been allowed for in this assessment.

3.1.2 Access and Circulation Requirements

A vehicle access point is proposed to allow for direct access off Nelson Bay Road. This access will be used by both light and heavy vehicles and allow for entry movements only, with no exit movements. This access will be designed and constructed in accordance with Council and RMS design requirements. All vehicles will exit the site via the access road upgrade to Marsh Road. For heavy vehicles requiring access from the east of the site, access would be via the entry point off Nelson Bay Road. Trucks will travel along Nelson Bay Road and then complete a U-turn to then turn left into the site. There is an existing U-turn facility provided to the west of the site access, with a deceleration lane for the traffic turning off the westbound traffic lane. At this location, the opposing traffic streams are separated by some 45 metres, which allows for a safe U-turn to occur for trucks.

The access driveway on Marsh Road is located to the east of the local school and all trucks will exit and turn right out of this driveway to turn towards Nelson Bay Road. There is an existing access at this location which will be upgraded to allow for the increased use and this access will be designed and constructed in accordance with Council design requirements.

Circulation within the site will be determined by the operational requirements of the development. All vehicles will be able to enter the site and manoeuvre as required within the site and exit in a forward direction.

3.2 Access

The new access of Nelson Bay Road and the upgraded driveway will be designed and constructed in accordance with Council and / or RMS requirements and allows for left in traffic movements only off Nelson Bay Road due to the central median. The upgraded access on Marsh Road will allow for all traffic movements, however trucks will only exit through this access and undertake a right turn. No heavy vehicles will enter the site through the Marsh Road access.

3.2.1 Driveway Location

The driveway access on Nelson Bay Road is located on the inside of a low angle left hand bend. In this location Nelson Bay Road provides two lanes of travel in both directions and the trucks will turn off the through lane and enter a left turn deceleration (to be constructed) before entering the site. This entry point is located 30 metres west of an existing U-turn lane on Nelson Bay Road and will only allow for left turn in traffic movements.

The driveway on Marsh Road will be an upgrade of the existing access point in this location. Marsh Road in this location offers a reasonably straight alignment to provide safe entry and exit movements. Due to the low speed limit (60 km/h) and the low traffic speeds, this access will be a simple driveway access with no left turn deceleration lane provided. All trucks exiting the site will turn right out of this driveway. All vehicles entering the site at this location will be light vehicles only associated with staffing requirements.

Photo 1 – View west along Marsh Road showing road alignment. Access to site is on left hand side of the photograph

3.2.2 Service Vehicle Access.

All service vehicle access will be via Marsh Road, with servicing levels expected to be low. There will be a requirement for a fuel truck to access the site as well as occasional maintenance vehicles for the quarry vehicles which will be located permanently on site. For the material handling trucks, servicing requirements will be completed off site.

3.2.3 Access to Public Transport

The site has limited access to public transport, with limited bus services provided along Nelson Bay Road and Marsh Road. While future workers could use these bus services, it is considered that the proposed development will generate no demand for public transport use.

3.3 Circulation

3.3.1 Pattern of circulation

All vehicles will be able to enter and exit the site in a forward direction from the local road network. All trucks will enter the site off Nelson Bay Road via the left turn slip. These trucks will then proceed through the site in a forward direction and then exit the site onto Marsh Road. All trucks will turn right when exiting the site onto Marsh Road. Light vehicles will access the site via Marsh Road, move within the site and then exit the site onto Marsh Road in a forward direction.

3.3.2 Road width

The access points on Nelson Bay Road and Marsh Road will be designed and constructed in accordance with Council and RMS requirements and will allow for the movement of trucks. The internal roads will take into account the swept path requirement of a truck and trailer combination. There will not be any formal roads within the site, due to the nature of the development.

3.3.3 Internal Bus Movements

No internal bus movement required for this development.

3.3.4 Service Area Layout

No dedicated service area is provide. Trucks will be serviced off site and there will be no requirement for a dedicated service bay on the site.

3.4 Parking

The parking for the development will be provided for the staff located on site with access via the driveway off Marsh Road. This will be in an informal area close to the offices on the site.

There will be no requirement for the trucks to park on the site overnight. Equipment associated with the quarry operations will stand on site.

3.5 Pedestrian and Bicycle Facilities

The site is relatively remote and as such it is considered that there will be no demand for pedestrian or cyclists' access. The access off Marsh Road will allow for pedestrian and cyclist access should it be required. There will be no demand or provision for internal movement of pedestrians or cyclists within the site.

4 Transportation Analysis

4.1 Traffic Generation

Traffic associated with the development will vary based upon the market demands. Advice from the study team indicates that a peak daily demand could be 200 trucks entering and exiting the site. This is an absolute peak and at other times, there would be much lower flows and during particularly quiet periods, there would be no demand for trucks to enter and exit the site.

As a worst case scenario, this assessment has worked on the assumption that the peak daily demand could be 200 trucks entering and exiting the site per day. The site is proposed to operate between 6.00 AM and 6.00 PM Monday to Saturday.

Based on a typical working day of 10 hours for the delivery of material off site, the development will generate some 20 inbound and 20 outbound trucks per hour on average when the site is working at maximum capacity.

4.1.1 Daily and Seasonal Factors

The nature of the development will lead to significant variation is daily traffic flows, dependent upon market demands. During quiet periods, it is expected that there would be no demand for trucks to enter or exit the site. Flows could be much lower on a Saturday and the site will not operate on Sundays or public holidays.

4.1.2 Sight Distances

The site access point on Nelson Bay Road is located within an 80 km/h speed zone. This access is an entry only and as such there is no requirement for drivers to observe vehicle movements on Nelson Bay Road to exit the site at this location. For drivers entering the site, the alignment of Nelson Bay Road ensures that the required forward visibility distance is available along the road, to allow a driver to observe the left turn slip road into the site. For the 80 km/h, the stopping sight distance requirements is 100 metres and this distance is available based upon the on-site assessment. This distance will allow a driver approaching the site access to observe the start of the left turn deceleration lane and allow for safe manoeuvring into this lane for the trucks. This will also allow drivers following the trucks to adjust their vehicle speeds or move into the right hand lane on Nelson Bay Road and ensure that the trucks can safely enter the left turn slip lane.

For the existing U-turn facility on Nelson Bay Road, for the westbound trucks turning off Nelson Bay Road, there is a deceleration lane for the U-turn bay, allowing the truck to enter this U-turn facility in a safe manner. There is good visibility available on this approach, which is greater than 100 metres. Trucks will then have to turn right out of this U-turn facility to then head east along Nelson Bay Road to then access the left turn slip into the site. At this point, the sight visibility distance exceeds 300 metres, safely exceeding the sight line distance of 160 metres for the sight distance requirements at this location.

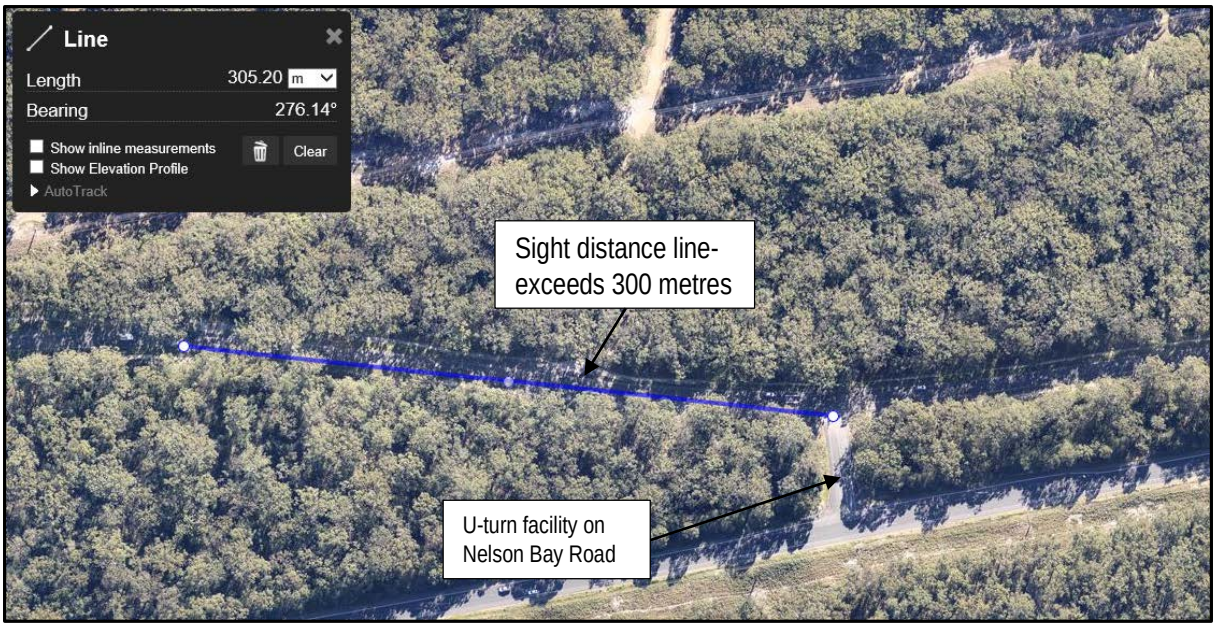


Photo 2 Aerial of U-turn facility on Nelson Bay Road west of Marsh Road

The access point on Marsh Road is located within a 60 km/h speed zone, and the required sight distance for a driveway in this speed zone is 83 metres. Under Austroad requirements for an intersection in this speed zone, the safe intersection sight distance is 105 metres. For drivers exiting the site, the sight distance available to the left is 140 metres or more, as shown below.

Photo 3 Aerial photo showing available sight distance left of the site access on Marsh Road

Visibility to the right is less than this distance, due to the road alignment to the east of the site (as shown in Photo 3 below). However, vehicle speeds at this point are below 60 km/h, as drivers have turned off Nelson Bay Road into Marsh Road. The distance available is 78 metres, which is some 5 metres less than the required distance of 83 metres for the posted speed zone of 60 km/h. However, it is noted that the minimum sight distance requirement for a driveway in this speed zone is 65 metres, which is less than the distance available. Further, it is noted that for a 50 km/h zone the sight distance requirement for a driveway is 69 metres desirable (45 metres minimum) and it is considered reasonable that vehicle speeds at this point could be 50 km/h, as this distance is only 70 metres away from Nelson Bay Road.

Photo 4 Aerial photo showing sight line to the right of the site access

Photo 5 – View to left for driver exiting the site on Marsh Road

Photo 6 – View to right for driver exiting site on Marsh Road

Overall, it is considered that the sight distances available for vehicles entering and exiting the site via Marsh Road are acceptable, given the road alignment and the vehicle speeds.

4.1.3 Queuing at entrance to site

There are no vehicle queues expected at site entry / exit points. Given the low overall traffic demands associated with the future development and the left in traffic arrangement on Nelson Bay Road all vehicles will be able to enter the site without delay. Any queues associated with exit movements from the site are expected to be minimal and will be contained within the site.

Light vehicle movements associated with staff are expected to be low with no delays as these vehicles turn left off Marsh Road to enter the site.

4.1.4 Comparison with existing site access

The site is currently used as a home business and has an access onto Marsh Road. The current use on site involves the occasional use of truck and dog combinations and these trucks operate in a safe manner with no reported issues or concerns.

4.1.5 Pedestrian Movements

The development is not expected to be a generator of pedestrian movements either to the site or within the site.

4.2 Traffic Distribution and Assignments

Given the location of Bobs Farm on the Nelson Bay peninsula, through traffic is limited. The markets for the quarry products are expected to be primarily to the north via Raymond Terrace or south through the greater Hunter area.

95% of all traffic is expected to have an origin/destination west of the site with all traffic using Nelson Bay Road.

4.2.1 Origin / destinations assignment

90% of traffic is expected to have an origin/destination west of the site along Nelson Bay Road. The location of the access and the raised central median on Nelson Bay Road restricts heavy vehicle access to the site to be from the west only, including any traffic initially from the east. This will be reinforced by WHS Guidelines for the site operations.

All heavy vehicles exiting the site will access Marsh Road and connect with Nelson Bay Road with the vast majority expected to want to head west from Marsh Road onto Nelson Bay Road.

The destination for deliveries will depend on market forces. Haulage routes are expected to be dispersed along existing local roads with:

- north bound deliveries travelling along Richardson Road to the Pacific Highway and Raymond Terrace
- west bound deliveries travelling along Cabbage Tree Road to Tomago and west along the New England Highway
- southbound deliveries travelling to Tomago to then travel south along the M1 Motorway
- Newcastle based deliveries travelling along Nelson Bay Road to Kooragang and connecting with the local road network as appropriate

Both Nelson Bay Road and Cabbage Tree Road are restricted access vehicle routes suitable for B-doubles and similar heavy haulage.

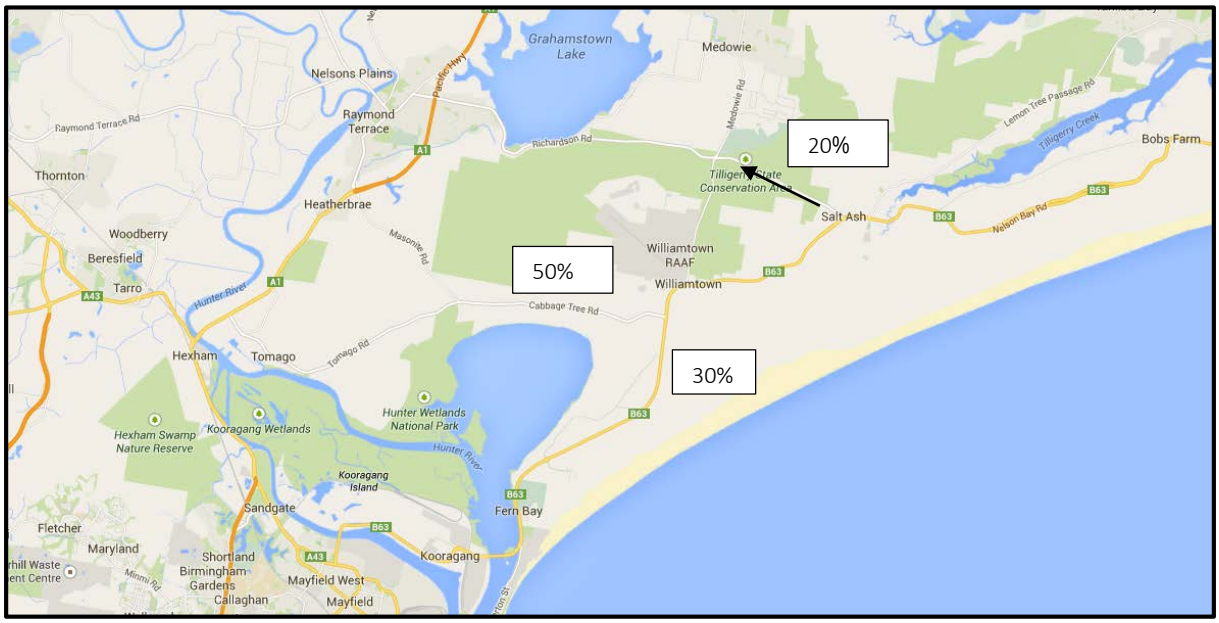


Figure 4-1 Traffic movements associated with outbound material movements

4.3 Impact of Generated Traffic

4.3.1 Impact on daily Traffic Flows

It can be seen that the development will have a low impact upon the overall daily traffic movements in the general locality of the subject site. At peak operations, there will be 200 truck movements in and out of the site with 90% of these movements heading west along Nelson Bay Road. This will potentially increase flows in Nelson Bay Road to the west of the site by 360 vehicles. The current AADT for this length of Nelson Bay Road is 15,311 and this could increase to 15,671 vehicles per day, an increase of 2.3% over the existing flows.

As a major state road, under the Network Planning guidelines provided by the RTA (now RMS) the road would be classified as a Class 5R, typically providing 2 or more lanes with frequent overtaking opportunities. This guide indicates that the average daily traffic flows would be 12,000 vehicles per day. The next classification of road, 6R, with annual traffic flows greater than 12,000 vehicles per day would typically provide 4 or more traffic lanes.

Overall it is concluded that the additional traffic movements associated with the proposed development will have an acceptable impact upon daily traffic flows along Nelson Bay Road.

4.3.2 Peak Hour Impacts on Intersections

The peak hour traffic volumes associated with the development have been determined based upon first principals. The development, at peak operations, will generate 200 inbound and 200 outbound truck movements per day, and based on the truck movements occurring over a 10 hour day the average hourly traffic movement would be 20 inbound and 20 outbound movements per hour, which could include peak hour periods.

The key intersection that could be impacted upon by the proposed development would be the give way controlled intersection of Nelson Bay Road and Marsh Road. The operation of this intersection has been assessed with the computer program Sidra based upon the existing traffic data collected for the project. This traffic data was collected 21st April 2014 outside of school holidays.

The automatic traffic data collected for the project shows the daily traffic flow variance along Nelson Bay Road and demonstrates the distinctive peak in traffic movements. It is noted, and confirmed with the Sidra modelling, that some delays could occur for trucks when exiting Marsh Road during the peak periods. Outside of these peak periods the delays are much lower and the intersection operates well.

The results for the intersection analysis for the morning peak period (7.45 to 8.45) and afternoon peak period (15.30 to 16.30) are shown below.

Table 4-1 – Sidra results, 2014 existing situation Marsh Road and Nelson Bay Road

Approach	Level of Service	Delay (seconds)	Queue (metres)
Nelson Bay Road (Nelson Bay)	A / A	0.2 / 1.0	0.5 / 2.4
Marsh Road – left turn out	A / A	9.3 / 10.6	0.7 / 2.3
Marsh Road – right turn out	E / F	58.3 / 70.6	0.3 / 1.4
Nelson Bay Road (Newcastle)	A / A	0.0 / 0.0	0.0 / 0.0
Overall	A / A	0.3 / 0.9	0.6 / 2.4

Note- results for the AM / PM peak periods

The above analysis shows that the intersection operates well with minimal delays, although it is noted that that the right turn out operates at a level of service of E in both the AM and F in the PM peak periods with delays of 58.3 and 70.6 seconds respectively. Observations on site show however that typically the delay for traffic turning right out of Marsh Road are low, as drivers have good visibility and can use the central turn lane to undertake the right turn out of the side road in two stages.

Photo 7 – View to right for drivers exiting Marsh Road onto Nelson Bay Road

It can be seen that with the additional traffic associated with the quarry trucks added to the right turn movement out of Marsh Road, the delays will increase for drivers and could lead to frustration and safety concerns. It is further noted that the trucks exiting the site and using this intersection will be laden and as such, will not be able to accelerate at a significant rate.

To ensure road safety is maintained and not impact upon other traffic movements out of Marsh Road, all trucks exiting the proposed development will turn left out of Marsh Road, proceed along Nelson Bay Road to the roundabout at Nelson Bay Road / Port Stephens Drive and complete a U-turn at this location. This will be enforced through WH&S for the site as well as driver instructions for any contractors visiting the site. As part of the site induction all drivers will be advised of the restriction for the left turn only from Marsh Road onto Nelson Bay Road.

The traffic modelling above, together with on-site observations, confirm that the left turn out of Marsh Road operates well with minimal delays. The alignment of Nelson Bay Road in this location allows for good visibility to the right. Nelson Bay Road to the left (westbound) in this location is reasonably flat allowing laden trucks to accelerate to the posted speed limit appropriately with minimal delays to the through traffic movements on Nelson Bay Road.

The intersection of Marsh Road and Nelson Bay Road has been assessed allowing for all additional truck movements associated with the quarry turning left into and left out of Marsh Road. The results of the Sidra analysis are presented below.

Table 4-2 - Sidra results, 2014 existing situation Marsh Road and Nelson Bay Road plus development traffic

Approach	Level of Service	Delay (seconds)	Queue (metres)
Nelson Bay Road (Nelson Bay)	A / A	0.2 / 1.0	0.1 / 2.5
Marsh Road – left turn out	A / A	12.3 / 10.7	2.6 / 3.0
Marsh Road – right turn out	E / F	60.2 / 77.0	0.3 / 1.6
Nelson Bay Road (Newcastle)	A / A	0.3 / 0.2	0.0 / 0.0
Overall	A / A	0.7 / 1.3	2.6 / 3.0

Note- results for the AM / PM peak periods

The Sidra results above demonstrate that the additional truck movements will have a negligible impact upon the operation of this intersection, with the left turn in and left turn out of Marsh Road operating at similar levels to the existing operation.

Photo 8 – View along Marsh Road showing two lane approach to Nelson Bay Road with separate left turn lane

The intersection of Marsh Road and Nelson Bay Road was then assessed for the future design year of 2026, allowing for 12 years background growth. The results of this analysis are presented below. A typical annual growth value of 2% has been applied on Nelson Bay Road.

Table 4-3 - Sidra results, 2026 flows allowing for 2% annual growth along Nelson Bay Road plus development traffic

Approach	Level of Service	Delay (seconds)	Queue (metres)
Nelson Bay Road (Nelson Bay)	A / A	0.2 / 1.1	0.6 / 3.5
Marsh Road – left turn out	A / A	13.0 / 11.7	2.8 / 3.5
Marsh Road – right turn out	F / F	124.9 / 192.5	0.7 / 3.7
Nelson Bay Road (Newcastle)	A / A	0.3 / 0.2	0.0 / 0.0
Overall	A / A	0.7 / 1.5	2.8 / 3.7

Note- results for the AM / PM peak periods

The above results demonstrate that allowing for background growth on Nelson Bay Road, the intersection will continue to operate well with the additional left in and left out traffic movements associated with the development proposal.

Seca Solution has previously collected traffic data at the intersection of Nelson Bay Road and Port Stephens Drive during the critical afternoon peak period on 2nd April 2014 (outside of school holidays) and the results of the survey are shown in Figure 4-2 below.

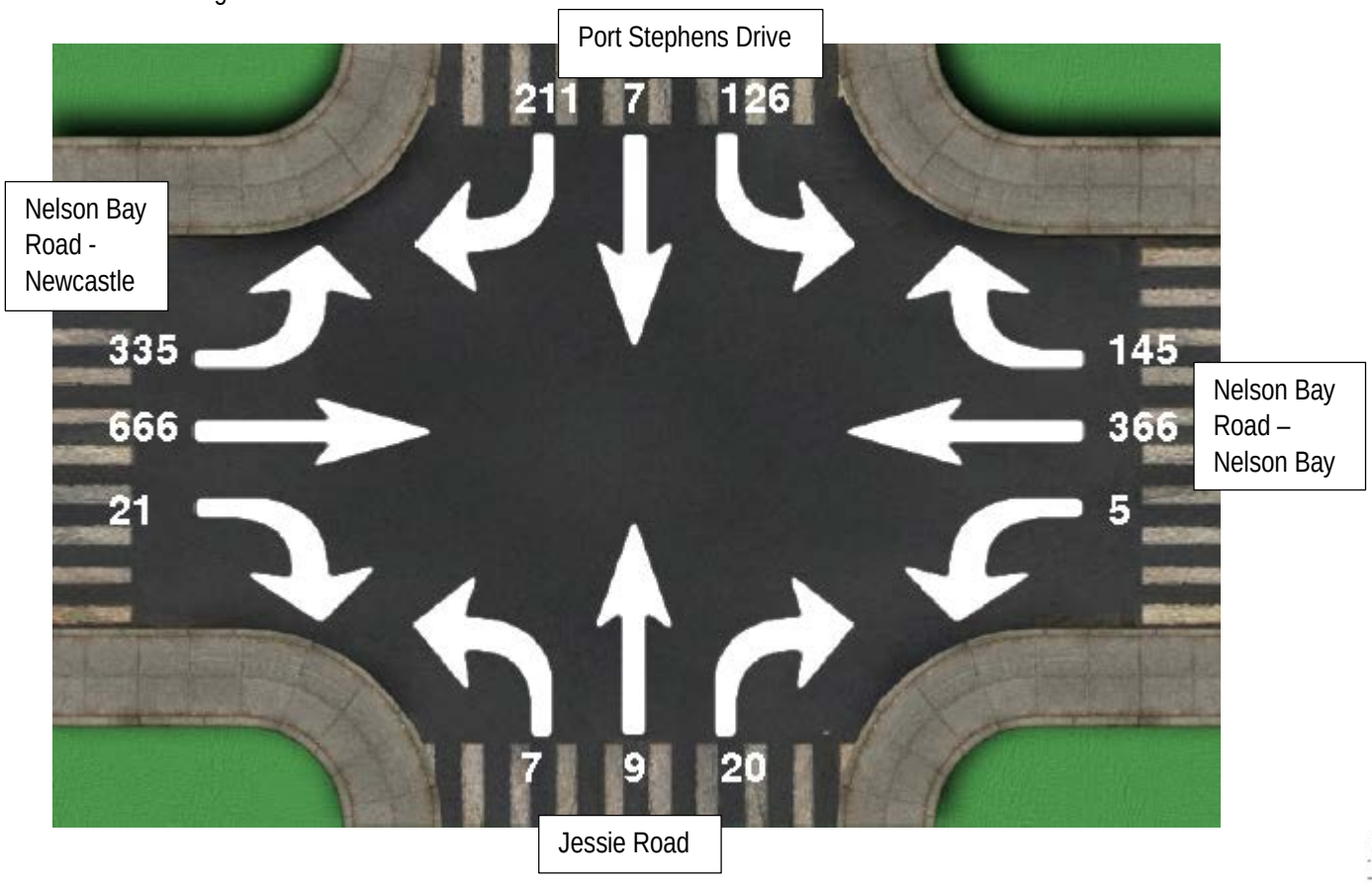


Figure 4-2 – Traffic survey results, roundabout at Nelson Bay Road and Port Stephens Drive (PM peak)

The operation of this roundabout has been assessed with Sidra and the results of the analysis are presented below in Table 4-4.

Table 4-4 - Sidra modelling, roundabout of Nelson Bay Road and Port Stephens Road

Approach	Level of service	Delay (seconds)	Queue (metres)
Jessie Road	A / A	9.2 / 9.9	1.4 / 1.9
Nelson Bay Road east	A / A	8.5 / 8.8	12.4 / 16.8
Port Stephens Road	A / A	11.6 / 12.1	7.4 / 10.5
Nelson Bay Road west	A / A	6.7 / 7.1	17.6 / 24.6

Note – results for 2014 PM existing flows / 2024 PM flows allowing for 20% growth on all movements.

The above analysis shows that the roundabout is operating well with minimal delays and congestion for all road users. This roundabout will be impacted upon by the trucks from the quarry that have turned left out of Marsh Road and then use this roundabout to complete a U-turn.

The current traffic flows through this roundabout are in the order of 1900 vehicles per hour in the PM peak, with a similar value in the AM peak. The additional traffic movements associated with the development could increase these values by some 20 vehicles per hour, representing an increase of 1% over the existing flows. It is considered that this will have a negligible impact upon the operation of the roundabout, based upon site observations and the Sidra analysis above for the peak period. Outside of the peaks, the traffic movements are much lower (20% or more) and the roundabout will operate with less delays, allowing for the movement of the trucks to occur.

The observations on site indicate that in the morning peak this roundabout operates well with similar or lower delays that during the morning peak period. Therefore there will be minimal impact created the additional truck movements associated with the proposal.

For the access route through to Newcastle / Raymond Terrace and Maitland, all of the major intersections are controlled by traffic signals or roundabouts and operate well with minimal delays and congestion. It is considered that the additional 40 trucks movements per hour maximum would have an acceptable impact upon these intersections.

4.3.3 Background traffic and other developments

In accordance with normal RMS requirements, the impact of the additional traffic has been reviewed allowing for 10 years background growth along Nelson Bay Road. A review of the historic traffic data along Nelson Bay Road shows that the rate of background growth is very low, at less than 1.5% per annum. Allowing for 15% background growth over a 10 year timeframe it is considered that the roundabout and the road network in the locality of the subject site will continue to operate to a high level.

As part of the planning for the upgrade of Nelson Bay Road, the RMS have assessed the background growth along the road which would allow for development such as the development site and has designed the road and the connections accordingly. Therefore it is concluded that the background growth together with the traffic associated with the development will have an acceptable impact.

The Sidra results above show that the roundabout at the intersection of Nelson Bay Road and Port Stephens Drive will continue to operate with minimal delays and congestion. With all traffic movements increase by 20% the roundabout continues to operate with low overall delays and minimal queues.

4.3.4 Impact of Construction Traffic

There will be minimal construction activity on site associated with the proposed development, as the site set up and establishment allows for clearing of vegetation only. The major impact during the establishment of the site will be during the construction of the left turn slip into the site off Nelson Bay Road. This will require work on the site as well as work adjacent to the existing road carriageway.

As part of the construction work for the left turn slip into the site, a Traffic Management Plan will need to be developed and implemented. This will be submitted to the RMS and Council for approval prior to any works commencing on site. A Works Authorisation Deed (WAD) will also be signed with the RMS to ensure the site access is designed and constructed in accordance with the road authority requirements.

4.4 Impact on Road Safety

The additional traffic flows associated with the development of the subject site will have a relatively low impact upon traffic safety. The site entry point for the trucks is located on nelson bay Road and a left turn deceleration lane will be provided in accordance with Austroads and RMS design requirements to ensure trucks can safely enter the site. All vehicles will exit the site on Marsh Road, via the existing vehicle access point. This access is located on a relatively straight section of road offering good visibility for drivers entering and exiting the site at this location. All light vehicles will enter and exit the site via this access point. The connection to the main road network is via the stop sign controlled intersection of Marsh Road and Nelson Bay Road and this intersection provides sheltered turn lanes and good visibility. The trucks associated with the development will turn left out of this intersection, with good visibility permitting these vehicles to safely enter the traffic stream on Nelson Bay Road. These trucks will then complete a U-turn at the roundabout of Nelson Bay Road and Port Stephens Drive, which ensures road safety is maintained for all users.

Overall it is considered that the proposed development will have a negligible impact upon road safety in the general locality of the subject site.

4.5 Parking Analysis

The parking for the proposed development can all be accommodated on site. There will be an area set aside beside the office which will accommodate the staff located on site. The site will only require 1 or 2 people to operate the facility. Note that the trucks will not be parked on site and as such do not need to be provided for nor parking for the truck drivers private vehicles.

4.6 Public Transport

4.6.1 Options for improving services

It can be seen that the site is not well serviced by public transport and the nature of the development does not support public transport use. No improvements to public transport are considered necessary for the project.

5 Improvement Analysis

5.1 Improvements to Accommodate Existing Traffic

The existing road network in the immediate vicinity of the subject site is well developed and there are no road network upgrades currently occurring within the immediate vicinity of the subject site. The RMS are currently upgrading Nelson Bay Road to the east of the site to provide two lanes of travel between the subject site and Port Stephens Drive. This will benefit the trucks movements associated with the development. No further road upgrades are required to accommodate the existing traffic movements.

5.2 Improvements to Accommodate Background Traffic

The upgrade of Nelson Bay Road by the RMS is being completed to improve road safety and ensure there is adequate capacity for future increases in traffic movements. It is considered that no further road upgrades are required other than those currently being completed by the RMS on Nelson Bay Road.

5.3 Additional Improvements to Accommodate Development Traffic

Based upon the Sidra analysis, it is considered that no road upgrade works are required to accommodate the traffic movement's associated with the subject development site. Trucks will turn left out of Marsh Road and travel along Nelson Bay Road to then complete a U-turn at the roundabout controlled intersection at Port Stephens Drive. This will ensure that there are no delays for traffic at the intersection of Marsh Road and Nelson Bay Road and ensures that there will be no impact upon road safety at this location.

5.4 Alternative Improvements

No alternative improvements are put forward for the project.

6 Summary and Recommendations

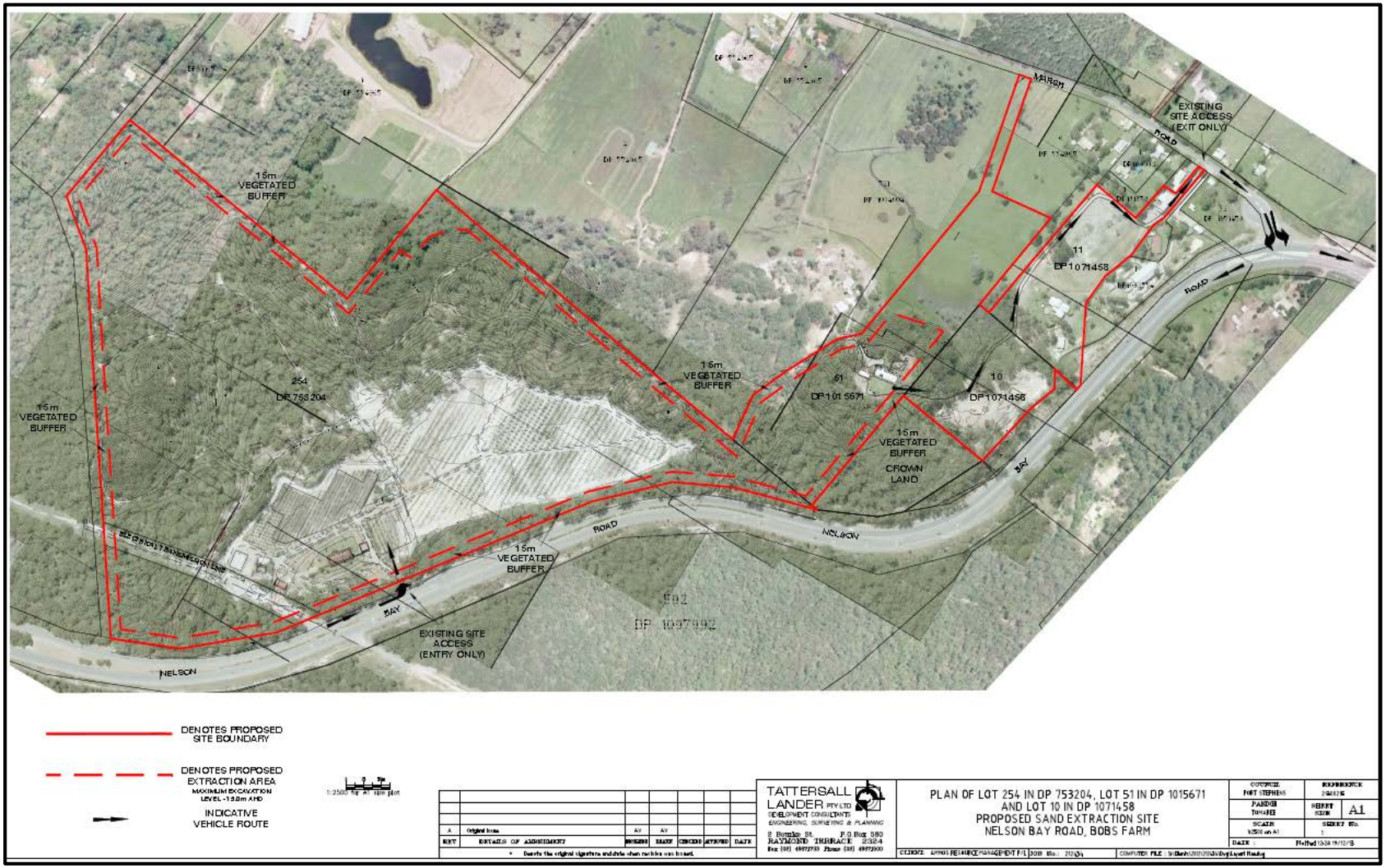
6.1 Summary

The following conclusions are drawn from the investigations into the proposed sand quarry at Bobs Farm off Nelson Bay Road:

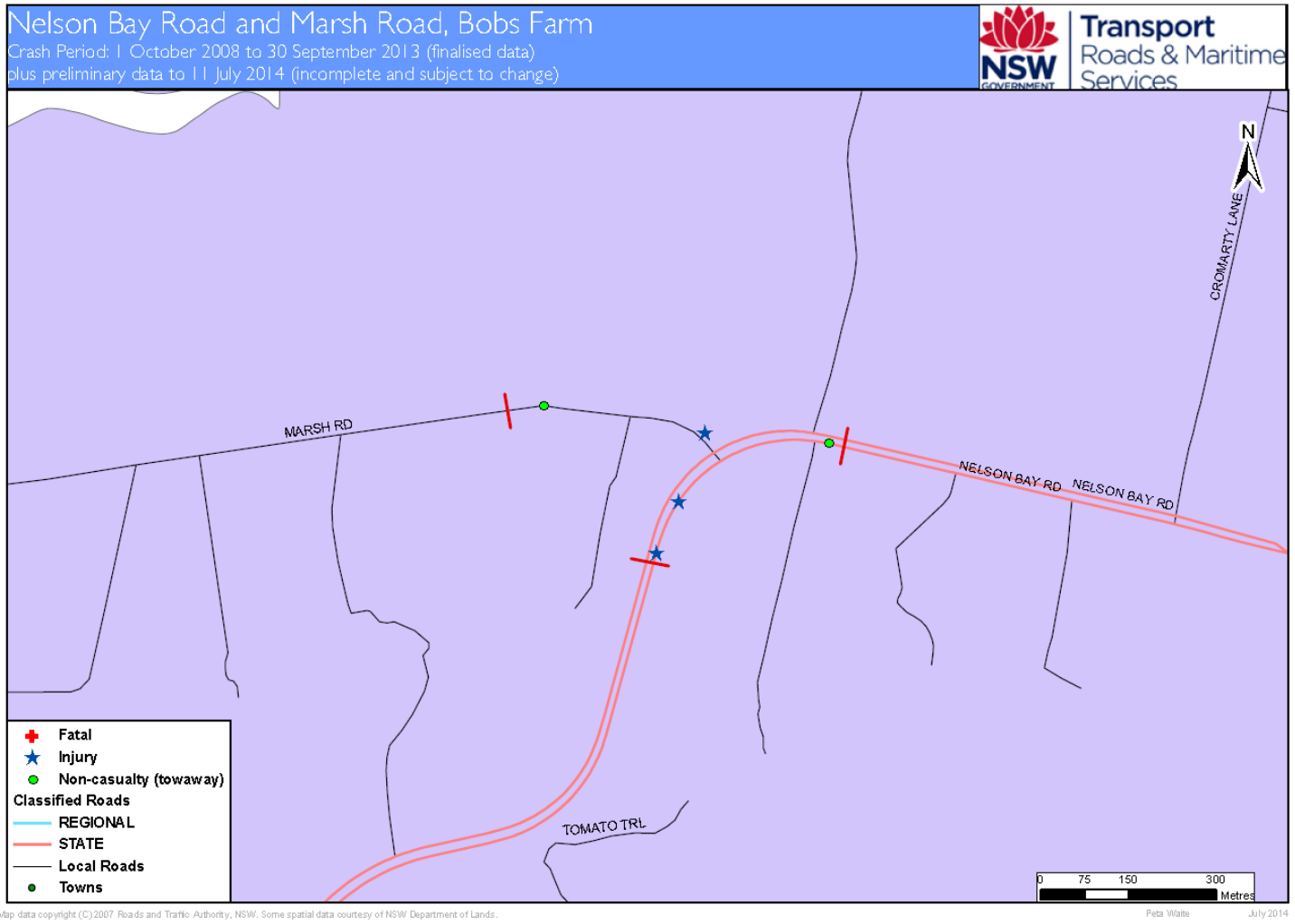
1. The proposal allows for a sand quarry with all heavy vehicle entry via a new access point off Nelson Bay Road. Light vehicle access will be via the upgraded access off Marsh Road and all vehicle exit movements will be via this access on Marsh Road.
2. The site is located within the locality of Bobs Farm with frontage to both Nelson Bay Road and Marsh Road. The major access route for outbound material will be to the west of the site along Nelson Bay Road to centres such as Newcastle, Raymond Terrace and the Lower Hunter Valley.
3. All trucks will enter the site directly off Nelson Bay Road via an upgraded access. This will require a left turn deceleration lane to be built on Nelson Bay Road and this will be designed and constructed in accordance with RMS and Council requirements. All trucks will then drive through the site and exit via the existing access point on Marsh Road. All trucks will turn right out of the exit on Marsh Road and then proceed to the intersection of Nelson Bay Road with Marsh Road.
4. Due to potential delays for the trucks turning right out of Marsh Road and associated safety concerns, all trucks will turn left out of Marsh Road and proceed in an eastbound direction along Nelson Bay Road. The trucks will then complete a U-turn at the roundabout controlled intersection of Nelson Bay Road and Port Stephens Drive to return in a westbound direction. The trucks will then continue along Nelson Bay Road and then use Richardson Road to head towards Raymond Terrace and the Pacific Highway, or Cabbage Tree Road to head towards the New England Highway and Maitland or continue along Nelson Bay Road towards Newcastle. Both Nelson Bay Road and Cabbage Tree Road are RAV approved routes suitable for heavy haulage.
5. All light vehicles will enter and exit the site via the access point on Marsh Road. This will reduce the conflict between light and heavy vehicle and allows direct access to the site office.
6. The site access points have been reviewed on site and allow for safe vehicle movements, with adequate sight lines available based upon vehicle speeds and the posted speed limits.
7. All parking can be accommodated on site. The trucks will not be parked on site over-night and there is minimal on-site staffing levels requiring minimal on-site parking.

The overall conclusion from the investigations is that traffic and access arrangements for the development proposal are satisfactory and that there is no traffic or access impediments to the development. The trucks access routes have been reviewed based upon impacts for other road users and road safety and the proposed access routes can operate in a safe and efficient manner with minimal delays for other road users. The access point on Nelson Bay Road will be designed and constructed in accordance with RMS and Council requirements to ensure the trucks can safely enter the site. The access on Marsh Road is an existing access point and allows for a safe entry and exit movements.

Appendix A Site Plan



Appendix B Accident Data



Summary Crash Report

Transport for NSW — Centre for Road Safety

# Crash Type		
Car Crash	5	100.0%
Light Truck Crash	0	0.0%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(0)	(0.0%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(0)	(0.0%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	20.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	0	0.0%
Non intersection	5	100.0%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	4	80.0%
Multi Vehicle	1	20.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	3	60.0%
Unclassified Road	2	40.0%

Contributing Factors		
Speeding	3	60.0%
Fatigue	1	20.0%

Weather		
Fine	5	100.0%
Rain	0	0.0%
Overcast	0	0.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	1	20.0%
Dry	4	80.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	1	20.0%
Daylight	2	40.0%
Dusk	0	0.0%
Darkness	2	40.0%

Crash Movement		
Intersection, adjacent approaches	0	0.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	1	20.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	1	20.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	3	60.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit				
~ 40km/h or less	0	0.0%		
40 km/h or less	0	0.0%	80 km/h zone	4	80.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	1	20.0%	100 km/h zone	0	0.0%
70 km/h zone	0	0.0%	110 km/h zone	0	0.0%

CRASHES	5	
Fatal crash	0	0.0%
Injury crash	3	60.0%
Non-casualty crash	2	40.0%

CASUALTIES	3	
Killed	0	0.0%
Injured	3	100.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Time Group		% of Day	
00:01 - 02:59	1	20.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	1	20.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	1	20.0%	4.2%
14:00 - 14:59	0	0.0%	4.2%
15:00 - 15:59	1	20.0%	4.2%
16:00 - 16:59	0	0.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	1	20.0%	8.3%

Street Lighting Off/Nil	% of Dark
1 of 2 in Dark	50.0%

Crashes		Casualties
1	2014	1
1	2010	0
3	2009	2

~ School Travel Time		
Involvement	0	0.0%

McLean Periods			% Week
A	1	20.0%	17.9%
B	0	0.0%	7.1%
C	1	20.0%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	0	0.0%	10.7%
G	0	0.0%	7.1%
H	1	20.0%	7.1%
I	1	20.0%	12.5%
J	1	20.0%	10.7%

Day of the Week						# Holiday Periods					
Monday	0	0.0%	Thursday	0	0.0%	Sunday	2	40.0%	New Year	0	0.0%	Queen's BD	0	0.0%	Easter SH	0	0.0%
Tuesday	0	0.0%	Friday	0	0.0%	WEEKDAY	2	40.0%	Aust. Day	0	0.0%	Labour Day	0	0.0%	June/July SH	0	0.0%
Wednesday	2	40.0%	Saturday	1	20.0%	WEEKEND	3	60.0%	Easter	0	0.0%	Christmas	0	0.0%	Sept./Oct. SH	0	0.0%
									Anzac Day	0	0.0%	January SH	1	20.0%	December SH	0	0.0%

Crashid dataset 01/10/08-30/09/13 plus preliminary data to 11/07/14 Nelson Bay Road and Marsh Road, Bobs Farm
Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

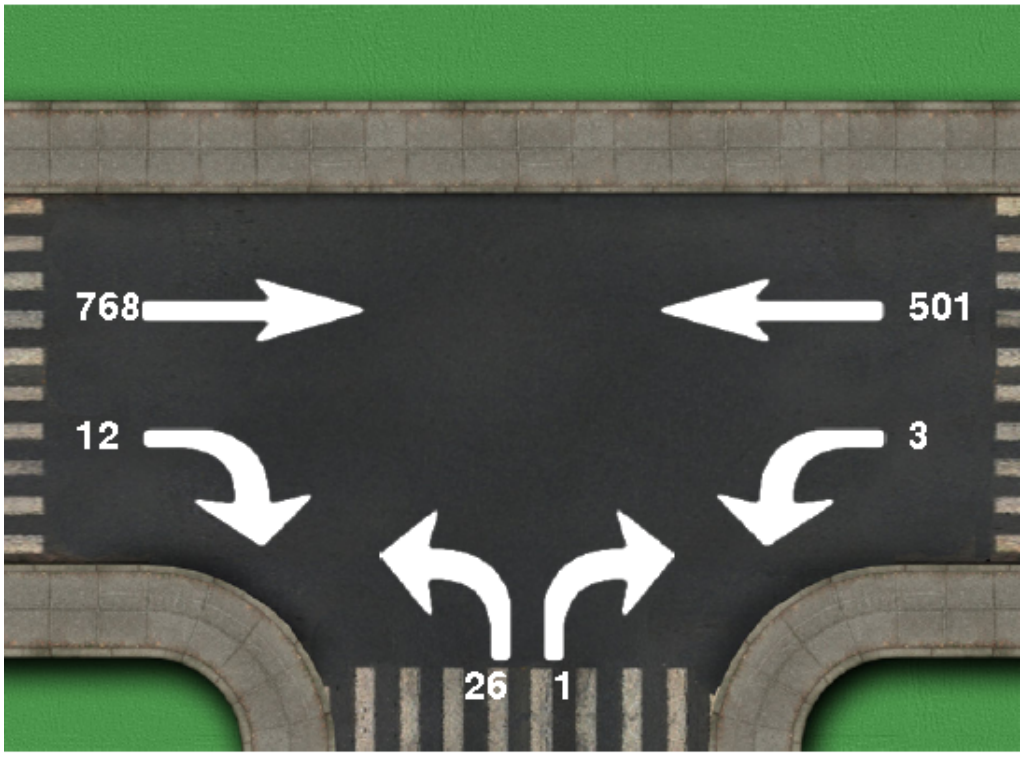
Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Rep ID: REG01 **Office:** Hunter **User ID:** waitep Page 1 of 1 Generated: 11/07/2014 08:20

Appendix C Traffic Surveys Nelson Bay Road / Marsh Road

Intersection Peak Hour

Location: Marsh Road at Nelson Bay Road,
GPS Coordinates: N = -32.766439, W= 152.013208
Date: 2014-08-21
Day of week: Thursday
Weather:
Analyst: sm



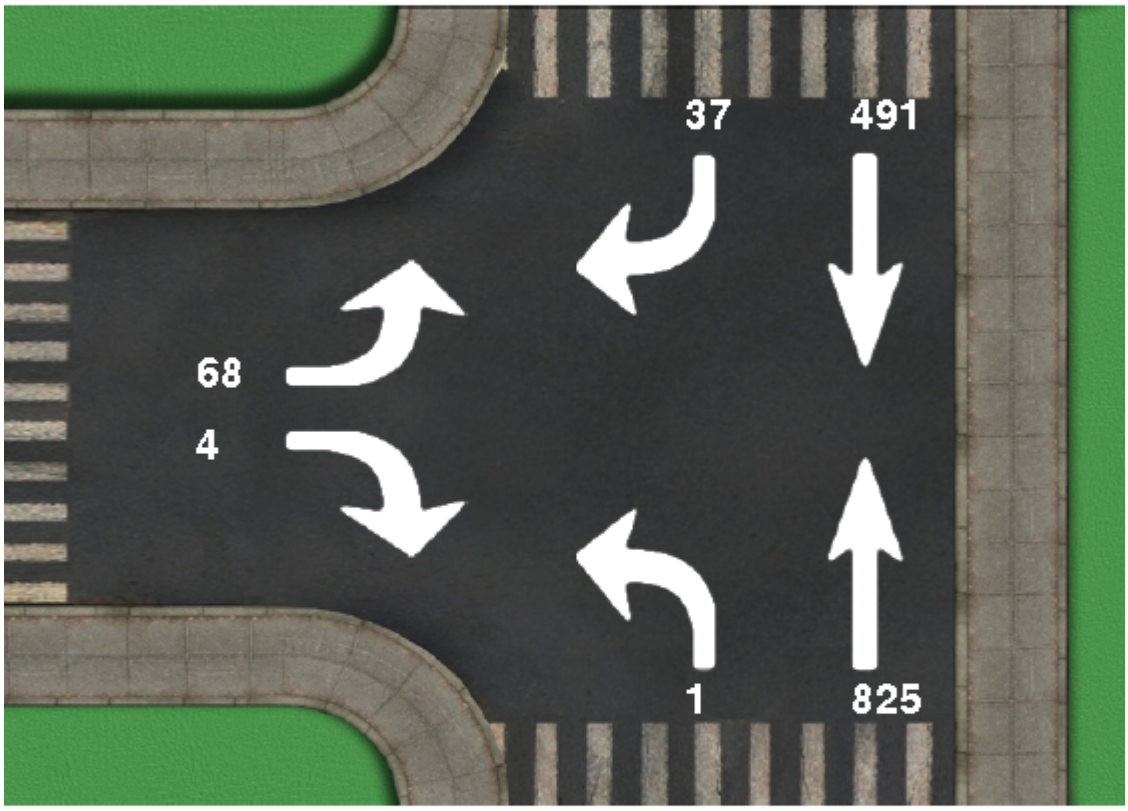
Intersection Peak Hour

07:45 - 08:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	3	501	0	26	0	1	0	768	12	1311
Factor	0.00	0.00	0.00	0.38	0.90	0.00	0.72	0.00	0.25	0.00	0.87	0.43	0.90
Approach factor	0.00			0.90			0.68			0.88			

Intersection Peak Hour

Location: Nelson Bay Rd at Marsh Rd, Bobs Farm
GPS Coordinates:
Date: 2014-08-21
Day of week: Thursday
Weather:
Analyst: BM



Intersection Peak Hour

15:30 - 16:30

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	491	37	0	0	0	1	825	0	68	0	4	1426
Factor	0.00	0.85	0.71	0.00	0.00	0.00	0.25	0.82	0.00	0.59	0.00	0.33	0.94
Approach factor	0.84			0.00			0.82			0.56			

Appendix D Sidra Results

Criteria for interpreting results of SIDRA

1-Level of Service (LoS)

LoS	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Good	Good
B	Good, with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but requires accident study
D	Operating near capacity	Near capacity and requires accident study
E	At capacity, excessive delay: roundabout requires other control method	At capacity, requires other control mode
F	Unsatisfactory, requires other control mode or additional capacity	Unsatisfactory, requires other control mode

2-Average Vehicle Delay (AVD)

The AVD is a measure of operational performance of an intersection relating to its LoS. The average delay should be taken as a guide only for an average intersection. Longer delays may be tolerated at some intersections where delays are expected by motorists (e.g. those in inner city areas or major arterial roads).

LoS	Average Delay / Vehicle (secs)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 15	Good operation	Good operation
B	15 to 28	Good with acceptable delays and	Acceptable delays and spare
C	28 to 42	Satisfactory	Satisfactory but accident study required
D	42 to 56	Operating near capacity	Near capacity, accident study required
E	56 to 70	At capacity, excessive delays: roundabout requires other control mode	At capacity; requires other control mode
F	Exceeding 70	Unsatisfactory, requires additional capacity	Unsatisfactory, requires other control mode

3-Degree of Saturation (D/S)

The D/S of an intersection is usually taken as the highest ratio of traffic volumes on an approach to an intersection compared with the theoretical capacity, and is a measure of the utilisation of available green time. For intersections controlled by traffic signals, both queues and delays increase rapidly as DS approaches 1.0. An intersection operates satisfactorily when its D/S is kept below 0.75. When D/S exceeds 0.9, queues are expected.

INTERSECTION SUMMARY

Site: 2014 AM Nelson Bay Road and Marsh Road

2014 AM base flows
Stop / Yield (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Travel Speed (Average)	59.6	km/h	59.6	km/h
Travel Distance (Total)	1328.4	veh-km/h	1594.1	pers-km/h
Travel Time (Total)	22.3	veh-h/h	26.7	pers-h/h
Demand Flows (Total)	1311	veh/h	1573	pers/h
Percent Heavy Vehicles (Demand)	4.8	%		
Degree of Saturation	0.203			
Practical Spare Capacity	382.0	%		
Effective Intersection Capacity	6448	veh/h		
Control Delay (Total)	0.13	veh-h/h	0.15	pers-h/h
Control Delay (Average)	0.3	sec	0.3	sec
Control Delay (Worst Lane)	58.3	sec		
Control Delay (Worst Movement)	58.3	sec	58.3	sec
Geometric Delay (Average)	0.2	sec		
Stop-Line Delay (Average)	0.1	sec		
Idling Time (Average)	0.1	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.1	veh		
95% Back of Queue - Distance (Worst Lane)	0.7	m		
Queue Storage Ratio (Worst Lane)	0.00			
Total Effective Stops	34	veh/h	40	pers/h
Effective Stop Rate	0.03	per veh	0.03	per pers
Proportion Queued	0.01		0.01	
Performance Index	22.5		22.5	
Cost (Total)	454.00	$/h	454.00	$/h
Fuel Consumption (Total)	91.1	L/h		
Carbon Dioxide (Total)	217.4	kg/h		
Hydrocarbons (Total)	0.016	kg/h		
Carbon Monoxide (Total)	0.257	kg/h		
NOx (Total)	0.340	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 2014 AM Nelson Bay Road and Marsh Road

2014 AM base flows
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	768	5.0	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	12	0.0	0.022	9.2	LOS A	0.1	0.5	0.49	0.69	50.9
Approach		780	4.9	0.203	0.2	NA	0.1	0.5	0.01	0.01	59.8
North: Marsh Road											
7	L2	26	0.0	0.029	9.3	LOS A	0.1	0.7	0.35	0.87	51.3
9	R2	1	0.0	0.016	58.3	LOS E	0.0	0.3	0.92	1.00	30.8
Approach		27	0.0	0.029	11.1	LOS A	0.1	0.7	0.37	0.87	50.1
West: Nelson Bay Road (Newcastle)											
10	L2	3	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	501	5.0	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		504	5.0	0.133	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1311	4.8	0.203	0.3	NA	0.1	0.7	0.01	0.03	59.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 6

Project: C:\Sidra folders\Bobs Farm.sip6
8002653, 6019222, SECA SOLUTION, NETWORK / 1PC

INTERSECTION SUMMARY

Site: 2014 PM Nelson Bay Road and Marsh Road

2014 PM base flows
Stop / Yield (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Travel Speed (Average)	58.8	km/h	58.8	km/h
Travel Distance (Total)	1445.1	veh-km/h	1734.1	pers-km/h
Travel Time (Total)	24.6	veh-h/h	29.5	pers-h/h
Demand Flows (Total)	1426	veh/h	1711	pers/h
Percent Heavy Vehicles (Demand)	4.6	%		
Degree of Saturation	0.218			
Practical Spare Capacity	348.7	%		
Effective Intersection Capacity	6529	veh/h		
Control Delay (Total)	0.43	veh-h/h	0.52	pers-h/h
Control Delay (Average)	1.1	sec	1.1	sec
Control Delay (Worst Lane)	70.6	sec		
Control Delay (Worst Movement)	70.6	sec	70.6	sec
Geometric Delay (Average)	0.6	sec		
Stop-Line Delay (Average)	0.5	sec		
Idling Time (Average)	0.4	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.3	veh		
95% Back of Queue - Distance (Worst Lane)	2.4	m		
Queue Storage Ratio (Worst Lane)	0.00			
Total Effective Stops	100	veh/h	120	pers/h
Effective Stop Rate	0.07	per veh	0.07	per pers
Proportion Queued	0.04		0.04	
Performance Index	25.3		25.3	
Cost (Total)	509.26	$/h	509.26	$/h
Fuel Consumption (Total)	100.3	L/h		
Carbon Dioxide (Total)	239.0	kg/h		
Hydrocarbons (Total)	0.017	kg/h		
Carbon Monoxide (Total)	0.282	kg/h		
NOx (Total)	0.357	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 2014 PM Nelson Bay Road and Marsh Road

2014 PM base flows
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	491	5.0	0.130	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	37	0.0	0.109	14.2	LOS A	0.3	2.4	0.70	0.87	47.5
Approach		528	4.6	0.130	1.0	NA	0.3	2.4	0.05	0.06	58.9
North: Marsh Road											
7	L2	68	0.0	0.093	10.6	LOS A	0.3	2.3	0.47	0.93	50.6
9	R2	4	0.0	0.076	70.6	LOS F	0.2	1.4	0.94	1.00	27.9
Approach		72	0.0	0.093	14.0	LOS A	0.3	2.3	0.50	0.93	48.4
West: Nelson Bay Road (Newcastle)											
10	L2	1	0.0	0.001	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	825	5.0	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		826	5.0	0.218	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		1426	4.6	0.218	1.1	NA	0.3	2.4	0.04	0.07	58.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 6

Project: C:\Sidra folders\Bobs Farm.sip6
8002653, 6019222, SECA SOLUTION, NETWORK / 1PC

INTERSECTION SUMMARY

Site: 2014 Mid day Nelson Bay Road and MarshRoad

2014 mid day mid week base flows
Stop (Two-Way)

Intersection Performance - Hourly Values				
Performance Measure	Vehicles		Persons	
Travel Speed (Average)	59.5	km/h	59.5	km/h
Travel Distance (Total)	989.0	veh-km/h	1186.8	pers-km/h
Travel Time (Total)	16.6	veh-h/h	19.9	pers-h/h
Demand Flows (Total)	976	veh/h	1171	pers/h
Percent Heavy Vehicles (Demand)	4.8	%		
Degree of Saturation	0.124			
Practical Spare Capacity	691.0	%		
Effective Intersection Capacity	7877	veh/h		
Control Delay (Total)	0.11	veh-h/h	0.13	pers-h/h
Control Delay (Average)	0.4	sec	0.4	sec
Control Delay (Worst Lane)	29.2	sec		
Control Delay (Worst Movement)	29.2	sec	29.2	sec
Geometric Delay (Average)	0.3	sec		
Stop-Line Delay (Average)	0.1	sec		
Idling Time (Average)	0.0	sec		
Intersection Level of Service (LOS)	NA			
95% Back of Queue - Vehicles (Worst Lane)	0.1	veh		
95% Back of Queue - Distance (Worst Lane)	0.7	m		
Queue Storage Ratio (Worst Lane)	0.00			
Total Effective Stops	33	veh/h	40	pers/h
Effective Stop Rate	0.03	per veh	0.03	per pers
Proportion Queued	0.02		0.02	
Performance Index	16.8		16.8	
Cost (Total)	339.61	$/h	339.61	$/h
Fuel Consumption (Total)	68.0	L/h		
Carbon Dioxide (Total)	162.2	kg/h		
Hydrocarbons (Total)	0.012	kg/h		
Carbon Monoxide (Total)	0.192	kg/h		
NOx (Total)	0.251	kg/h		

Level of Service (LOS) Method: Delay (RTA NSW).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 2014 Mid day Nelson Bay Road and Marsh Road

2014 mid day mid week base flows
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	466	5.0	0.123	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	12	0.0	0.021	8.9	LOS A	0.1	0.5	0.47	0.67	51.1
Approach		478	4.9	0.123	0.2	NA	0.1	0.5	0.01	0.02	59.7
North: Marsh Road											
7	L2	26	0.0	0.028	9.2	LOS A	0.1	0.7	0.33	0.87	51.4
9	R2	1	0.0	0.007	29.2	LOS C	0.0	0.1	0.82	0.94	40.6
Approach		27	0.0	0.028	9.9	LOS A	0.1	0.7	0.35	0.87	50.9
West: Nelson Bay Road (Newcastle)											
10	L2	3	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	468	5.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		471	5.0	0.124	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		976	4.8	0.124	0.4	NA	0.1	0.7	0.02	0.03	59.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 6

Project: C:\Sidra folders\Bobs Farm.sip6
8002653, 6019222, SECA SOLUTION, NETWORK / 1PC

INTERSECTION SUMMARY

Site: 1 [2014 AM Nelson Bay Road and Marsh Road+dev]

2014 AM base flows
plus development flows
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	59.1 km/h	59.1 km/h
Travel Distance (Total)	1372.1 veh-km/h	1646.5 pers-km/h
Travel Time (Total)	23.2 veh-h/h	27.8 pers-h/h
Demand Flows (Total)	1354 veh/h	1625 pers/h
Percent Heavy Vehicles (Demand)	8.0 %	
Degree of Saturation	0.203	
Practical Spare Capacity	382.0 %	
Effective Intersection Capacity	6659 veh/h	
Control Delay (Total)	0.26 veh-h/h	0.32 pers-h/h
Control Delay (Average)	0.7 sec	0.7 sec
Control Delay (Worst Lane)	60.2 sec	
Control Delay (Worst Movement)	60.2 sec	60.2 sec
Geometric Delay (Average)	0.5 sec	
Stop-Line Delay (Average)	0.2 sec	
Idling Time (Average)	0.1 sec	
Intersection Level of Service (LOS)	NA	
95% Back of Queue - Vehicles (Worst Lane)	0.3 veh	
95% Back of Queue - Distance (Worst Lane)	2.6 m	
Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	68 veh/h	82 pers/h
Effective Stop Rate	0.05 per veh	0.05 per pers
Proportion Queued	0.02	0.02
Performance Index	23.8	23.8
Cost (Total)	513.09 $/h	513.09 $/h
Fuel Consumption (Total)	113.5 L/h	
Carbon Dioxide (Total)	275.0 kg/h	
Hydrocarbons (Total)	0.019 kg/h	
Carbon Monoxide (Total)	0.297 kg/h	
NOx (Total)	0.769 kg/h	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 1 [2014 AM Nelson Bay Road and Marsh Road+dev]

2014 AM base flows
plus development flows
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	768	5.0	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	12	0.0	0.023	9.5	LOS A	0.1	0.5	0.50	0.70	50.7
Approach		780	4.9	0.203	0.2	NA	0.1	0.5	0.01	0.01	59.8
North: Marsh Road											
7	L2	49	50.0	0.072	12.3	LOS A	0.3	2.6	0.40	0.94	48.9
9	R2	1	0.0	0.016	60.2	LOS E	0.0	0.3	0.92	1.00	30.3
Approach		50	49.0	0.072	13.3	LOS A	0.3	2.6	0.41	0.94	48.3
West: Nelson Bay Road (Newcastle)											
10	L2	23	90.0	0.020	6.6	LOS A	0.0	0.0	0.00	0.56	50.0
11	T1	501	5.0	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		524	8.7	0.133	0.3	NA	0.0	0.0	0.00	0.02	59.5
All Vehicles		1354	8.0	0.203	0.7	NA	0.3	2.6	0.02	0.05	59.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: SECA SOLUTION | Processed: Thursday, 30 June 2016 11:24:05 AM

Project: C:\Sidra folders\Bobs Farm.sip7

INTERSECTION SUMMARY

Site: 1 [2014 PM Nelson Bay Road and Marsh Road+dev]

2014 PM base flows
plus development traffic
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	58.6 km/h	58.6 km/h
Travel Distance (Total)	1506.0 veh-km/h	1807.2 pers-km/h
Travel Time (Total)	25.7 veh-h/h	30.9 pers-h/h
Demand Flows (Total)	1486 veh/h	1783 pers/h
Percent Heavy Vehicles (Demand)	6.5 %	
Degree of Saturation	0.218	
Practical Spare Capacity	348.7 %	
Effective Intersection Capacity	6804 veh/h	
Control Delay (Total)	0.54 veh-h/h	0.65 pers-h/h
Control Delay (Average)	1.3 sec	1.3 sec
Control Delay (Worst Lane)	77.0 sec	
Control Delay (Worst Movement)	77.0 sec	77.0 sec
Geometric Delay (Average)	0.7 sec	
Stop-Line Delay (Average)	0.6 sec	
Idling Time (Average)	0.4 sec	
Intersection Level of Service (LOS)	NA	
95% Back of Queue - Vehicles (Worst Lane)	0.4 veh	
95% Back of Queue - Distance (Worst Lane)	3.0 m	
Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	131 veh/h	157 pers/h
Effective Stop Rate	0.09 per veh	0.09 per pers
Proportion Queued	0.05	0.05
Performance Index	26.8	26.8
Cost (Total)	555.41 $/h	555.41 $/h
Fuel Consumption (Total)	115.5 L/h	
Carbon Dioxide (Total)	278.1 kg/h	
Hydrocarbons (Total)	0.020 kg/h	
Carbon Monoxide (Total)	0.312 kg/h	
NOx (Total)	0.597 kg/h	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 1 [2014 PM Nelson Bay Road and Marsh Road+dev]

2014 PM base flows
plus development traffic
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	511	7.0	0.137	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	37	0.0	0.114	14.7	LOS B	0.4	2.5	0.71	0.88	47.2
Approach		548	6.5	0.137	1.0	NA	0.4	2.5	0.05	0.06	58.9
North: Marsh Road											
7	L2	88	0.0	0.120	10.7	LOS A	0.4	3.0	0.48	0.94	50.5
9	R2	4	0.0	0.084	77.0	LOS F	0.2	1.6	0.94	1.00	26.6
Approach		92	0.0	0.120	13.6	LOS A	0.4	3.0	0.50	0.94	48.6
West: Nelson Bay Road (Newcastle)											
10	L2	21	95.0	0.019	6.6	LOS A	0.0	0.0	0.00	0.56	49.8
11	T1	825	5.0	0.218	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		846	7.2	0.218	0.2	NA	0.0	0.0	0.00	0.01	59.7
All Vehicles		1486	6.5	0.218	1.3	NA	0.4	3.0	0.05	0.09	58.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: SECA SOLUTION | Processed: Thursday, 30 June 2016 11:31:07 AM

Project: C:\Sidra folders\Bobs Farm.sip7

INTERSECTION SUMMARY

Site: 1 [2026 AM Nelson Bay Road and Marsh Road+dev]

20264 AM base flows
plus development flows
allows 2% growth per annum
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	59.2 km/h	59.2 km/h
Travel Distance (Total)	1680.1 veh-km/h	2016.1 pers-km/h
Travel Time (Total)	28.4 veh-h/h	34.0 pers-h/h
Demand Flows (Total)	1658 veh/h	1990 pers/h
Percent Heavy Vehicles (Demand)	7.5 %	
Degree of Saturation	0.252	
Practical Spare Capacity	288.8 %	
Effective Intersection Capacity	6578 veh/h	
Control Delay (Total)	0.30 veh-h/h	0.36 pers-h/h
Control Delay (Average)	0.7 sec	0.7 sec
Control Delay (Worst Lane)	124.9 sec	
Control Delay (Worst Movement)	124.9 sec	124.9 sec
Geometric Delay (Average)	0.4 sec	
Stop-Line Delay (Average)	0.2 sec	
Idling Time (Average)	0.1 sec	
Intersection Level of Service (LOS)	NA	
95% Back of Queue - Vehicles (Worst Lane)	0.3 veh	
95% Back of Queue - Distance (Worst Lane)	2.8 m	
Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	70 veh/h	84 pers/h
Effective Stop Rate	0.04 per veh	0.04 per pers
Proportion Queued	0.02	0.02
Performance Index	29.0	29.0
Cost (Total)	617.63 $/h	617.63 $/h
Fuel Consumption (Total)	134.5 L/h	
Carbon Dioxide (Total)	325.2 kg/h	
Hydrocarbons (Total)	0.023 kg/h	
Carbon Monoxide (Total)	0.357 kg/h	
NOx (Total)	0.850 kg/h	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

MOVEMENT SUMMARY

Site: 1 [2026 AM Nelson Bay Road and Marsh Road+dev]

20264 AM base flows
plus development flows
allows 2% growth per annum
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Nelson Bay Road (Nelson Bay)											
5	T1	952	5.0	0.252	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	12	0.0	0.027	10.9	LOS A	0.1	0.6	0.57	0.76	49.7
Approach		964	4.9	0.252	0.2	NA	0.1	0.6	0.01	0.01	59.8
North: Marsh Road											
7	L2	49	50.0	0.080	13.0	LOS A	0.3	2.8	0.45	0.95	48.5
9	R2	1	0.0	0.037	124.9	LOS F	0.1	0.7	0.97	1.00	19.7
Approach		50	49.0	0.080	15.3	LOS B	0.3	2.8	0.46	0.96	47.1
West: Nelson Bay Road (Newcastle)											
10	L2	23	90.0	0.020	6.6	LOS A	0.0	0.0	0.00	0.56	50.0
11	T1	621	5.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		644	8.0	0.164	0.3	NA	0.0	0.0	0.00	0.02	59.5
All Vehicles		1658	7.5	0.252	0.7	NA	0.3	2.8	0.02	0.04	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: SECA SOLUTION | Processed: Thursday, 30 June 2016 1:03:31 PM
Project: C:\Sidra folders\Bobs Farm.sip7

INTERSECTION SUMMARY

Site: 1 [2026 PM Nelson Bay Road and Marsh Road+dev]

2026 PM base flows
plus development traffic
plus 2% growth per annum
Giveway / Yield (Two-Way)

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	58.4 km/h	58.4 km/h
Travel Distance (Total)	1831.2 veh-km/h	2197.5 pers-km/h
Travel Time (Total)	31.4 veh-h/h	37.6 pers-h/h
Demand Flows (Total)	1807 veh/h	2168 pers/h
Percent Heavy Vehicles (Demand)	6.4 %	
Degree of Saturation	0.271	
Practical Spare Capacity	261.8 %	
Effective Intersection Capacity	6672 veh/h	
Control Delay (Total)	0.76 veh-h/h	0.91 pers-h/h
Control Delay (Average)	1.5 sec	1.5 sec
Control Delay (Worst Lane)	192.5 sec	
Control Delay (Worst Movement)	192.5 sec	192.5 sec
Geometric Delay (Average)	0.6 sec	
Stop-Line Delay (Average)	0.9 sec	
Idling Time (Average)	0.8 sec	
Intersection Level of Service (LOS)	NA	
95% Back of Queue - Vehicles (Worst Lane)	0.5 veh	
95% Back of Queue - Distance (Worst Lane)	3.7 m	
Queue Storage Ratio (Worst Lane)	0.00	
Total Effective Stops	136 veh/h	163 pers/h
Effective Stop Rate	0.08 per veh	0.08 per pers
Proportion Queued	0.04	0.04
Performance Index	32.6	32.6
Cost (Total)	671.69 $/h	671.69 $/h
Fuel Consumption (Total)	138.5 L/h	
Carbon Dioxide (Total)	333.1 kg/h	
Hydrocarbons (Total)	0.024 kg/h	
Carbon Monoxide (Total)	0.376 kg/h	
NOx (Total)	0.694 kg/h	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA: Intersection LOS for Vehicles is Not Applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.