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25 May 2023

Our Ref: ARO0188

Chief Executive Officer
Douglas Shire Council
PO BOX 723
MOSSMAN QLD 4873

To: Jenny.Elphinstone@douglas.qld.gov.au (By Email)

Dear Jenny,

Response to Information Request Reconfiguring a Lot (One lot into nine lots and road) at 368-380 Port Douglas Road, Port Douglas (RP Lot 3RP729037) (ROL 2022_4962/1)

The following information is provided in response to Council's Information Request dated 27 October 2022.

This response to Council's Information Request provides **all of the information requested** by Council in accordance with Part 3 (Information Request) of the Development Assessment Rules.

In support of our response please find attached the following documents:

Attachment 1 - Amended Layout Plan ARO0188-SK05(1)
Attachment 2 – Traffic Impact Assessment dated 25 May 2023
Attachment 3 - Alternative Intersection Location ARO0188-SK06(1)
Attachment 4 – Stormwater Assessment Report dated 25 May 2023
Attachment 5- Tree Health and Condition Report 2023

Response to Council Matters

Design Layout, extent and plan of fill and recontouring

1. Page 4 of the report states, "The current access from Port Douglas Road will be closed and a new access created to access the lots approximately 40m further away from the Old Port Douglas Road intersection. This will improve safety and the functionality of the road network."

a. Please advise whether the State Assessment Referral Agency has given agreement for the proposed additional new access to Port Douglas Road.

Response: It is proposed to replace the existing access from Port Douglas Road with a new intersection. *The application has been referred to SARA and it is understood that the state will assess the proposed intersection's acceptability.*

b. The existing access also provides for the neighbouring land to the south. Please provide written advice from the neighbouring landowner that there is agreement that the existing access will be closed and what is the intended alternative access for this neighbouring lot.

Response: It is noted that the address for the neighbouring property (4RP729037) is 2-14 Old Port Road, Port Douglas and a lawful point of access is from this local road. Notwithstanding, a new sealed access will be provided from the new road to the neighbouring lot. Refer to amended Layout Plan ARO0188-SK05(1) provided as ***Attachment 1****.*

c. Please provide a report by a suitably qualified RPEQ Engineer that the proposed access and removal of the existing access will improve the safety and functionality of the road network, including the pedestrian and bicycle footpath The applicant nominates that the intersection of Road A and Port Douglas Road is a better traffic outcome, however, concern is raised with removal of access to lot 4. The applicant is to clarify how access to Lot 4 will be achieved and in the event that this requires a second intersection, how does this impact the applicant's representations regarding improved traffic outcomes;

Response: Refer attached Traffic Assessment. In summary the proposed location of the new road, moves the intersection away from the existing Port Douglas/Old Port Road intersection and provides greater sight distance along Port Douglas Road. The existing bike lane is unaffected and the new road provides better delineation at the pedestrian crossing provided as ***Attachment 2****.*

d. Please provide a report by a suitably qualified RPEQ traffic Engineer to confirm that the left-out movement is practical based on opportunities to turn elsewhere in the road system. Please provide commentary, for exiting motorists planning to go north to Port Douglas township. In regard to these two traffic queries, the applicant is to consider whether a service road off Port Douglas Road to the south or Barrier Street to the north would address this issue.

Response: Refer attached Traffic Assessment provided as ***Attachment 2****. In summary, vehicles exiting the development wishing to head north towards the town centre will be required to turn around at the Agincourt/Ulysses/Port Douglas Road Roundabout, which will increase the trip by approximately 1km. Similarly, vehicles entering the development from the South will be required to turn around at the Bale/Barrier/Port Douglas Road Roundabout, which will increase the trip by approximately 450m. the increase in travel time is approximately 1.5 minutes and 0.5 minutes, respectively.*

2. Council requires the applicant to consider the traffic demand based on development potential of the land under its zoning and confirm the classification of the road based on the maximum traffic potential. Council requests that the proposed new road be upgraded to an Access Street standard

as a minimum. The planning report refers to the new road as an access road. Please advise whether the new road is to be:

a. A private road, and if so, whether the road will be gated or not gated;
b. An access place, as per FNQROC Regional Development Manual Standard drawing S1005; or
c. An access street, as per FNQROC Regional Development Manual Standard drawing S1005.

Response: The potential higher use of land is acknowledged and the Access Road has been amended to be commensurate with an access street standard.

3. Proposed Lot 5 fronts the turning head and has no opportunity for on-street parking. Please provide advice and plans demonstrating where on-street parking can be accommodated within the road reserve.

Response: The amended Layout Plan shows the on-street parking. It is noted that the available on-street parking spaces are within 25m of the property frontages.

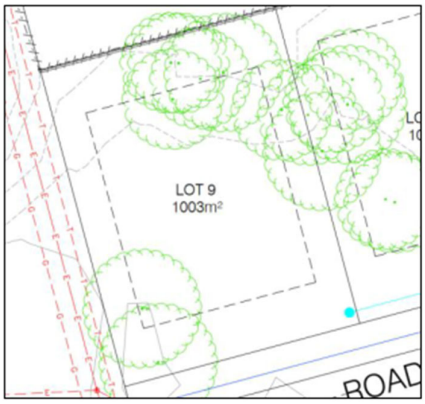
4. The proposed layout does not provide the minimum verge width on the eastern end of the tee head. Please provide a design that includes the minimum verge width, or justification for why any relaxation should be considered. The current 1-1.5m verge is not acceptable.

Response: The layout plan has been amended to provide the full verge width.

5. Concepts for Road A should be further developed and the full footprint of works through to Port Douglas Road shown to demonstrate that drainage, pedestrian connectivity and the streetscape generally are not adversely impacted by the proposed works. Please provide the existing services and street furniture detail on the sketches including the streetlight that appears to be located within the intersection footprint. Noting the level differences between Port Douglas Road and the site, additional information on likely road grading and levels is required. The interface to the existing pathway should be shown for assessment.

*Response: The amended intersection layout is provided on drawing ARO0188-SK06(1) provided as **Attachment 3**. The proposed alignment will not require the removal of the Oil Palms along Port Douglas Road.*

6. Please clarify the purpose of the rectangles drawn within each new lot.



Response: The rectangles show the minimum lot dimension as specified in the Douglas Shire Planning Scheme.

Drainage

7. The plans detail the existing ponds on the land that appear to remain on Lots 3 and 4 in the design plans. The planning report accompanying the application states on page 8, "The site will be designed and profiled to drain to the lawful point of discharge." Please provide a lot layout plan, that is dimensioned and to scale that details the intended finished contours for the new lots. The plan of the development is to include the intended connection to Council's water infrastructure and the extent of the plans should include the whole width of the adjacent Port Douglas Road.

Response: The existing ponds will be removed and the lots will be graded to direct stormwater to the internal access street. The layout plan has been amended to show the indicative stormwater infrastructure and overall drainage regime.

8. Please undertake a local drainage study of the site to determine the drainage impacts on upstream and downstream properties and the mitigation measures required to minimise such impacts. In particular, the study must address the following:
    a. The contributing catchment boundaries;
    b. The extent of the 100 year ARI flood event in relation to the site both pre and post development;
    c. Primary and secondary flow paths for the 5, 20, 50 and 100 year ARI flood events;
    d. Identify any requirement for drainage easements;
    e. Identify the need and tenure for flood detention areas to ensure a no worsening impact on downstream properties for the entire development;
    f. Information on the proposed works and any impacts proposed at the drainage
    g. outlet from the proposed development;

*Response: Refer attached drainage study provided as **Attachment 4.***

9. Concern is raised with the proposed stormwater discharge to and the construction of drainage infrastructure on the adjacent land. Council prefers stormwater drain to the road.
    a. Please provide a local drainage plan
    b. Please confirm whether the levels within the adjoining lot (Lot 10) are low enough to achieve the pipe outlet and maintain cover to the stormwater pipes in the road.
    c. The contour levels indicate low lying land near the northwest corner of the subject site. Please confirm whether this represents an overland flow path in this corner and whether filling the land would impact local drainage;
    d. There is existing drainage flow path along the Port Douglas Road frontage. Please provide additional advice is required to address the size, capacity or operation of this drainage path and how the proposed access will avoid impacting this drainage path.

Response: Due to level constrains with the subject land and the open drain at the lot frontage, not all stormwater is able to be conveyed to the drain. The stormwater from the site will be conveyed to the drain at the lot frontage and Lot 10 at the rear of the site. There is approximately 600mm height difference between the finished surface levels and the existing level at the boundary between the site and lot 10. Culverts will be installed at the road crossing of the open drain at the property frontage. The size of the culvert will be confirmed prior to submission of the Operational Works Application.

Sewer

10. Concern is held with the intention to construct sewer infrastructure on the adjoining freehold land. Please provide advice as to the ability to ensure the sewerage reticulation infrastructure is contained within the subject site, other than a simple connection, and not rely on the adjoining lot.

Response: The Layout Plan has been amended to contain the sewer within lot 6 with a short section of sewer line within lot 10 for the connection to the existing line.

11. Please confirm that the existing sewer loads and capacity within the sewerage system to accept additional loading for this site based on the maximum demand permitted under the Planning Scheme;

Response: It is noted that the proposed development will connect at the top of Council's sewer network. Modelling of Council's sewer network to determine the downstream capacity and loading is not considered appropriate for a development of this type and size. It is proposed, instead, that the load for the maximum developed scenario is provided to Council for input into the existing mode. Refer below.

Number of Lots: 10

Number of dwellings per lot: 3 (Triplex)

Equivalent Persons (EP) per Dwelling: 2.8 (1EDC)

Total EPs: 84 (30 EDCs)

Average Dry Weather Flow (ADWF) = 22,680L/d

Peak Wet Weather Flow (PWWF) = 168,403L/d

12. Please confirm existing sewer invert levels and proposed lot development levels will allow connection to all lots within the subject site;

Response: The invert level of Manhole B3/8 is approximately 0.807m. There is sufficient fall from the furthest lot (Lot 1) at a level of 4.2m, providing a minimum slope of 1:50.

Alternatively, the sewer can be connected to the pump station C, which has an invert level of -1.208m.

Fill

13. Please provide detail of the amount of fill and the amount of cut of earth intended for the development, including any work required for the construction of the new road. Note the extent of fill may trigger referral of the application due to the nearby wetlands. Where a further referral is necessary an amended Confirmation Notice will issue.

The amount of fill proposed on the site is expected to be in the order of 7000m^3.

Water

14. The applicant is to confirm the size and location of water mains within Port Douglas Road to facilitate connection of the development. In the event water mains require additional road crossings, these are to be identified.

Response: It is proposed to connect to the existing watermains 150mm AC water main along the Port Douglas Road frontage.

Electricity

15. The deign identifies indicates a single electricity connection to the site, but no further layout details. Please provide details of the intended layout of the servicing. Please provide details of the form of power to each lot – whether this is underground or overhead. Please also advise whether a padmount facility is required and whether any referral is necessary. Note the electricity supply should have regard to the final development capability of the land to reflect the land zoning.

Response: The form of electricity and telecommunication service will be determined by the relevant service providers. However, it is expected that the service will be underground. The provision of a substation will be determined through detailed design.

Existing trees and marine plants

16. Please provide a plan showing all the street trees and vegetation, from the centre line of the road pavement to the property boundary. Please note, Council does not support the removal of the oil palm. Relocation of the palm is not recommended due to its size there is a high risk of trauma/ loss of the palm.

Response: Refer amended layout plan. The proposed intersection will not result in the removal of any oil palms.

17. Please provide a detailed analysis of vegetation on the land including the location, species and height, and canopy spread of all trees of 7.5m or greater in height and of 300mm diameter trunk when measured at 1m height above ground level. The report should also provide details of the condition of the tree (i.e., health) and presence of any protected flora and fauna communities residing thereon.

*Response: Refer attached Arborist report provided as **Attachment 5.***

18. Please advise of the capacity of the development to include covenants over groups of trees on Lot 3.

Response: Covenants over trees are not proposed as most trees will be removed as per the recommendations of the Arborist report.

19. Please provide a report on the location and position of marine plants on Lot 3 and also over the extent by which the development will impact on Lot 10. Impacts are to include the velocity, amount and extent of impact of storm water discharge on Lot 10.
    Note, the impact of the development on marine plants may give rise to trigger a referral of the application due to damage to marine plants. A suitably qualified professional is to provide advice as to whether the trees and vegetation on Lot 3 and Lot 10 are marine plants.

    Where a further referral is necessary an amended Confirmation Notice will issue.

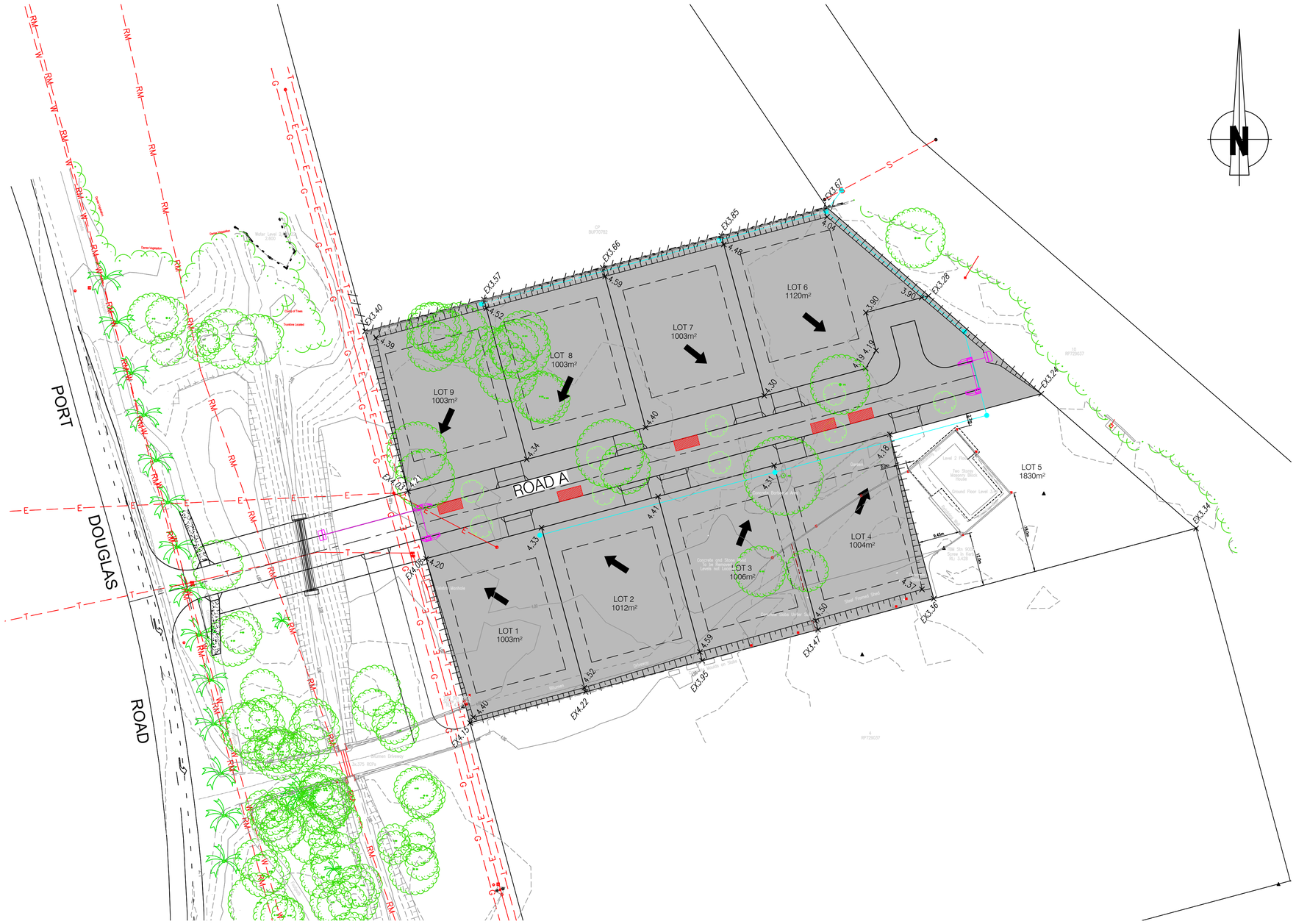
Response: There are no identified marine plants on lot 3 and the stormwater assessment report concludes that the velocity, amount and extent of the impact of storm water discharge into lot 10 is inconsequential and as such, no damage is proposed to marine plants as a result of the development.

Should you require any further information, please do not hesitate to contact Kelly Reaston on 0400 974 688 or at kelly@kellyreaston.com.au.

Kind regards

Kelly Reaston | Director

Attachment 1 - Amended Layout Plan ARO0188-SK05(1)



LEGEND

- DIRECTION OF FALL ON LOTS
- +4.68 FINISHED SURFACE LEVEL ON ALLOTMENT (REFER NOTE 1)
- +EX5.09 EXISTING SURFACE LEVEL
- 4.0 EXISTING SURFACE CONTOUR (0.5m INTERVAL)
- FILL AREAS
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RESIDENTIAL LAND DEVELOPMENT LOT 3 ON RP729037

LAYOUT PLAN

ARO0188-SK05

1:250
A1 Full Size

Acad No. ARO0188-SK05(1)

28th March 2023

Attachment 2 – Traffic Impact Assessment dated 25 May 2023

ARO INDUSTRIES

368-380 PORT DOUGLAS ROAD, PORT DOUGLAS TRAFFIC IMPACT ASSESSMENT

TABLE OF CONTENTS

1. INTRODUCTION

This engineering report has been prepared by ARO Industries to assess any potential traffic impacts of a proposed subdivision of Lot 3 on RP729037. This traffic assessment will investigate vehicular access to and from the site and the impact of the development traffic on the surrounding road network, including state and local roads. The proposed development is located at 368-380 Port Douglas Road, Port Douglas. A locality plan of the site is provided in Figure 1 below and the Site Layout Plan is provided in Appendix A.

Figure 1 – Locality Plan (Courtesy of Queensland Globe)

2. EXISTING CONDITION

2.1 Land Use

The site of the proposed change of use is currently a large (approximately 1.2ha) residential lot with a single dwelling that has direct access to Port Douglas Road, which is shared with the adjacent property at 2-14 Old Port Douglas Road.

2.2 Adjacent Road Network

The development site has frontage to the Port Douglas Road, between the Barrier Street Intersection (Roundabout) to the north and Old Port Road Intersection to the south. Port Douglas Road is a State Controlled Road consisting of a two-way single carriageway with sealed shoulder approximately 11m wide.

2.3 Traffic Volumes

Traffic volume data on Port Douglas Road has been sourced from Queensland Open Data Portal. The latest traffic data for Port Douglas Road was collected in September 2020. Although the traffic data shows there has been a decrease in traffic volumes from 2016, a conservative linear growth rate of 1% has been applied to the background traffic (year 2020) to the year 2023. This growth rate is commensurate with the growth experience between 2004 and 2016. This growth rate has also been applied from the current base year (2023) for a period of 10 years into the future (2033). Average hourly directional traffic volumes have been assessed to determine the peak periods and traffic volumes. The diurnal patterns shows that there is a single peak at 11:00AM, which can be attributed to the high tourist traffic volumes. It is assumed that the peak development traffic would generally follow traditional diurnal patterns with an AM peak of 8:00-9:00 and a PM peak of 16:00-17:00. The results are summarised in table 1, below.

Table 1 – Weekday Background traffic volumes on Port Douglas Road

Year	AADT	AM Peak (8:00 – 9:00)		PM Peak (16:00 – 17:00)		Network Peak (11:00 – 12:00)	
		Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
2020	8296	372	206	272	356	349	357
2023	**8545**	383	212	280	367	359	368
2033	**9400**	421	233	308	403	395	404

The composition of the traffic on Port Douglas Road consists of 3.6% heavy vehicles.

3. DEVELOPMENT SITE

3.1 Traffic generation

3.1.1 Existing use

The existing use of the site is a residential dwelling. Notwithstanding the trips generated by the approved use, the impact assessment of the proposed development assumes that there are no trips generated by the existing approved use. The property shares an access to Port Douglas Road via a sealed driveway shared with the adjacent vacant property to the south.

3.1.2 Proposed Development

Details of the proposed subdivision of the site have been prepare and are attached in Appendix A. The residential development consists of 10 large lots serviced by access street connection to Port Douglas Road.

According to the Douglas Shire Council Planning Scheme, Duplexes are an accepted development on these lots. The development traffic generation is assumed to be this higher intensity use. The RTA (RMS) Guide to Traffic Generating Developments provides traffic generation rates for low density residential developments. The traffic generated by the development is presented in Table 2, below.

Table 2 – Development trip generation

Development	Unit
Residential Lots	10
Dwellings per Lot	2
Total Dwelling	20
Daily Vehicle Trips Rate (RMS)	7.4 / dwelling
AM Peak Trips Rate (RMS)	0.71 / dwelling
PM Peak Trips Rate (RMS)	0.78 / dwelling
Total Daily Trips	**148**
Total AM Peak Trips	**14**
Total PM Peak Trips	**16**

3.2 Impact on Network Performance

The intersection of the new Access Street and Port Douglas Road will provide for Left-in and Left-out manoeuvres only. Accordingly, the proposed intersection will only directly affect the southbound lane on Port Douglas Road.

Although unlikely, it is conservatively assumed that the Pm peak development traffic will coincide with the Port Douglas Road Peak. The impact of the fully developed residential subdivision on Port Douglas Road is tabulated in Table 3, below.

Table 3 – Traffic Impact

Condition	Background Traffic Volume	Combined Traffic Volume	% Increase
2023 Daily Traffic (Southbound)	4343	4491	3.4%
2023 Peak Traffic (Southbound)	368	384	4.3%
2033 Daily Traffic (Southbound)	4777	4925	3.1%
2033 Peak Traffic (Southbound)	404	420	4.0%

The increase in traffic as a result of the development is considered to be a negligible impact on the capacity of the State Controlled Road, Port Douglas Road. A SIDRA analysis was conducted on the intersection and the results are provided in Appendix B. the analysis showed that the average delay for vehicles existing the development during the peak is 7 seconds, with a queue length of 0.4m.

3.2.1 Impact on Travel Time

It is acknowledged that the left-in and left-out only movement will increase travel time for drivers wanting to travel in the opposite direction. Image 2, below shows the route required for vehicles travel in the opposite direction i.e. entering the development from the South and existing the development to the North.

Figure 2 – Additional Travel Distance

The Purple line represents the additional travel of 1100m that a vehicle heading north will incur. The Orange line represents the additional travel of 440m that vehicle entering the site from the south will incur. Based on an average vehicle speed of 40km/hr, the additional travel time incurred associated with the left-in and left-out is 80 seconds and 40 seconds, respectively.

3.3 Sight distances

The intersection of the access street and Port Douglas Road is located approximately 150m from the exit of the Barrier Street Roundabout and 100m from the Old Port Road Intersection. There is unobstructed sight distance between the proposed access street and the adjacent intersections. The minimum sight distances as defined in the Austroads Guide to Road Design is summarised in Table 4. There is ample sight distance for development traffic to exit onto Port Douglas Road safely and efficiently.

Table 4 – Sight distance requirements

Criteria	Distance	Comments
Approach Sight Distance	N/A	Applies to traffic on Minor Road (Carpark)
Safe Intersection Sight Distance	123m	Access Street to Roundabout (North) – 60km/hr
Safe Intersection Sight Distance	97m	Old Port Road to Access Street (South) – 50km/hr
Minimum Gap Sight Distance	69m	5 secs in 60km/hr zone.

It is noted that the Approach Sight Distance (ASD) applies to the minor road approach to an intersection. In the context of the site, the ASD is not applicable because the 'intersection' with Port Douglas Road would reasonably be anticipated by vehicles exiting the site.

3.4 Safety

It is proposed to limit access and egress at the development to left-in and left-out only to ensure that the intersection functions safely. Restricting movements to the left turn only removes the risk of collision with oncoming traffic.

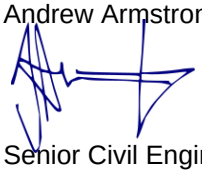
The access street will be moved approximately 50m further north of the Old Port Road intersection than the existing access to Lot 3 and 4. This will provide greater reaction time for the vehicles negotiating the Old Port Road Intersection.

In accordance with the warrants within the Austroads Guide to Road Design Port Douglas Road will be widened to provide a basic left turn treatment.

4. CONCLUSION

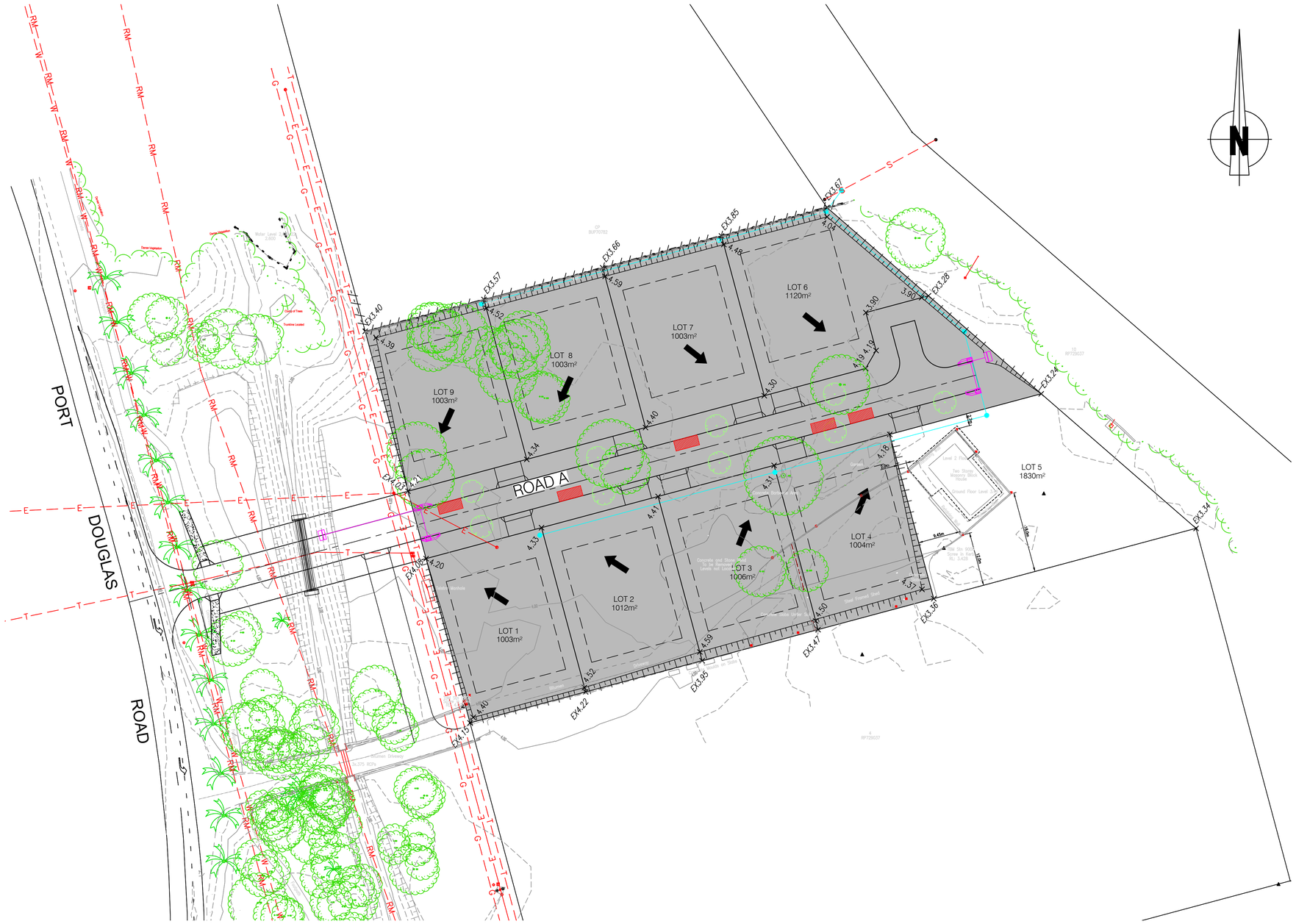
The proposed development of 368-380 Port Douglas Road, consisting of 10 Residential Lots has been assessed as having an insignificant impact on the surrounding transport network.

Andrew Armstrong



Senior Civil Engineer (RPEQ)

APPENDIX A
Site Layout Plan



LEGEND

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RESIDENTIAL LAND DEVELOPMENT LOT 3 ON RP729037

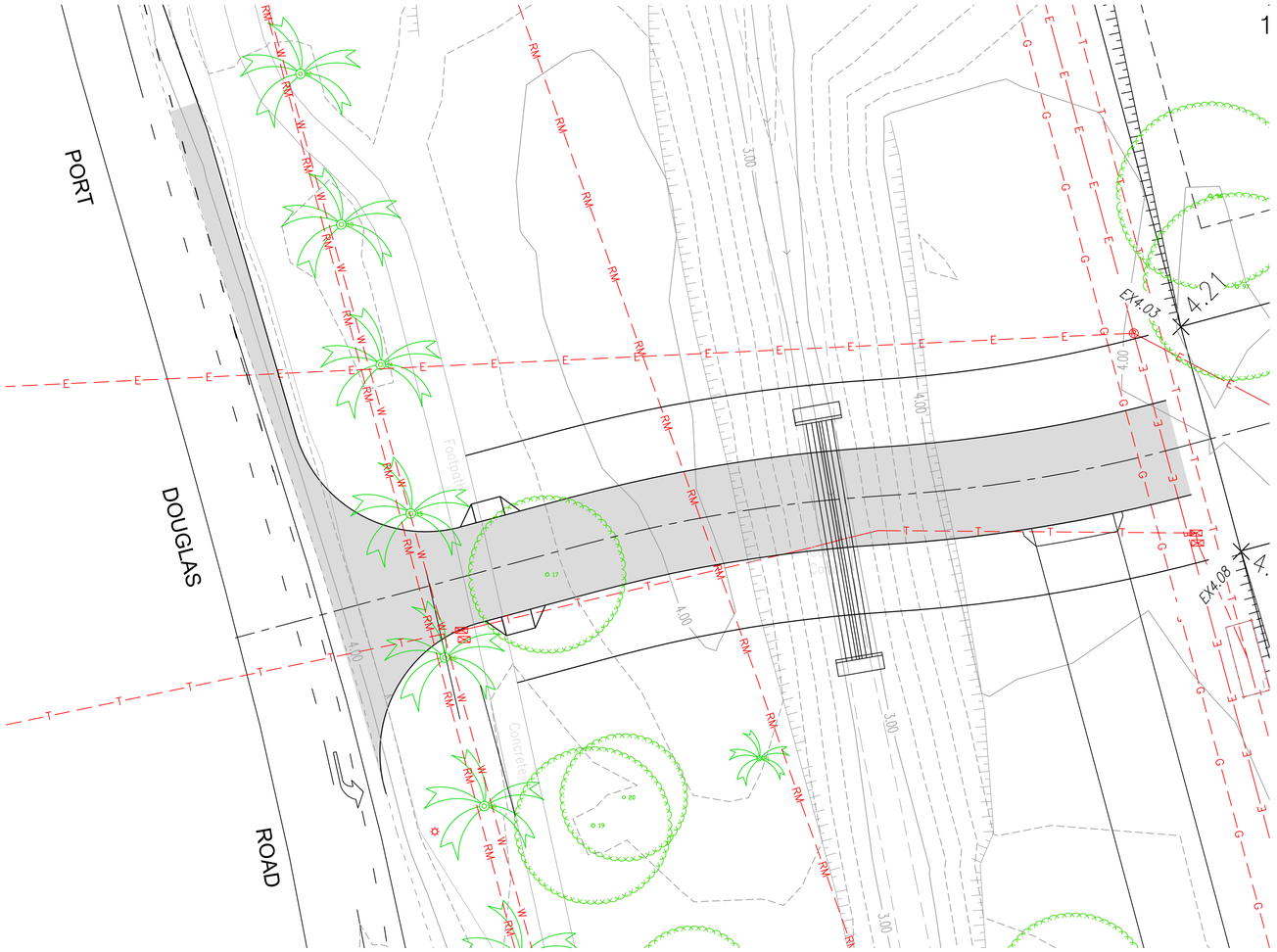
LAYOUT PLAN

ARO0188-SK05

1:250
A1 Full Size

Acad No. ARO0188-SK05(1)

28th March 2023



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RESIDENTIAL LAND DEVELOPMENT
LOT 3 ON RP729037

ALTERNATE INTERSECTION LOCATION

ARO0188-SK06

1:250
A1 Full Size

Acad No. ARO0188-SK06(1)

28th March 2023

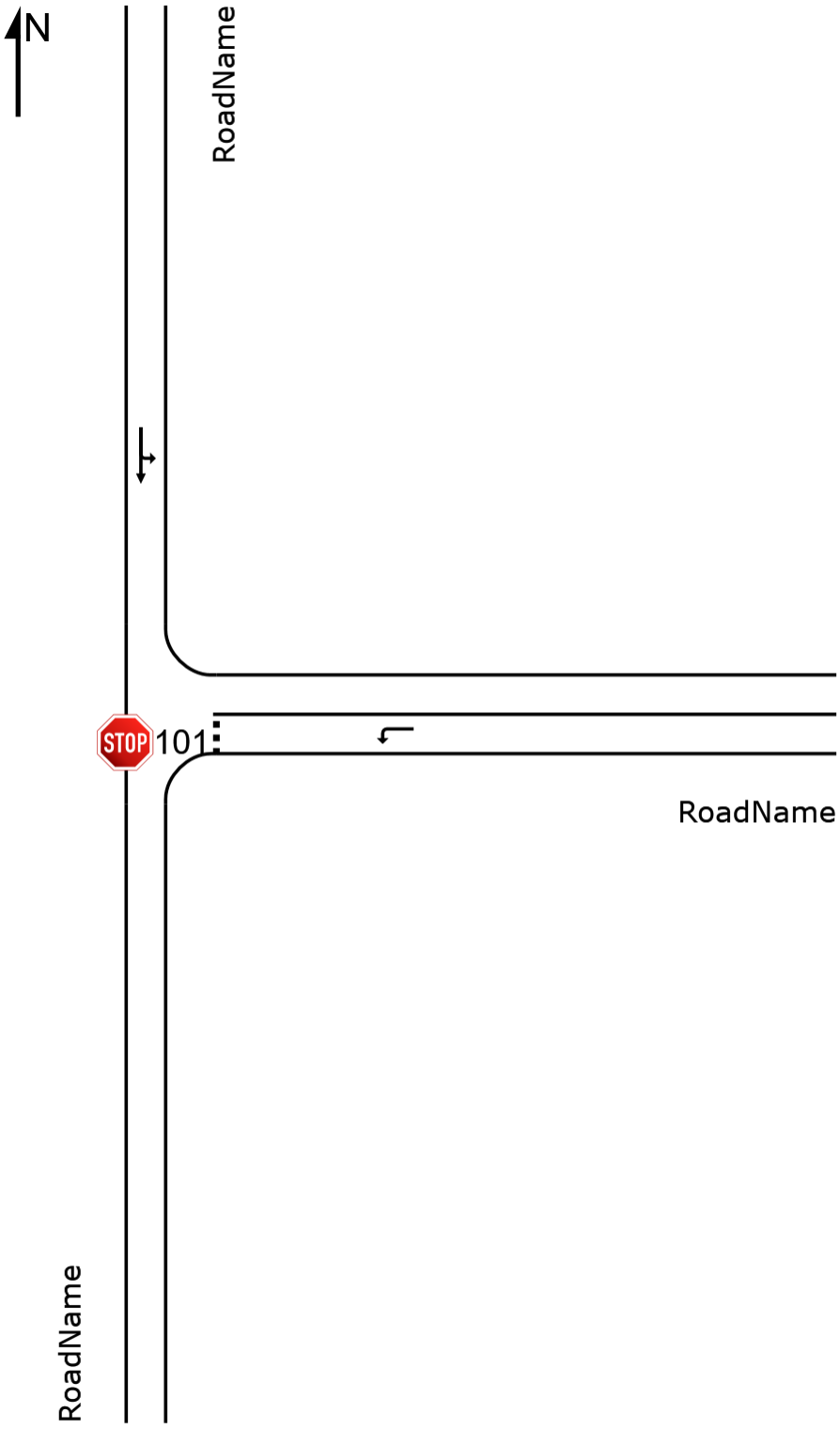
APPENDIX B
SIDRA Analysis

SITE LAYOUT

Site: 101 [Site1 (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Site1 (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

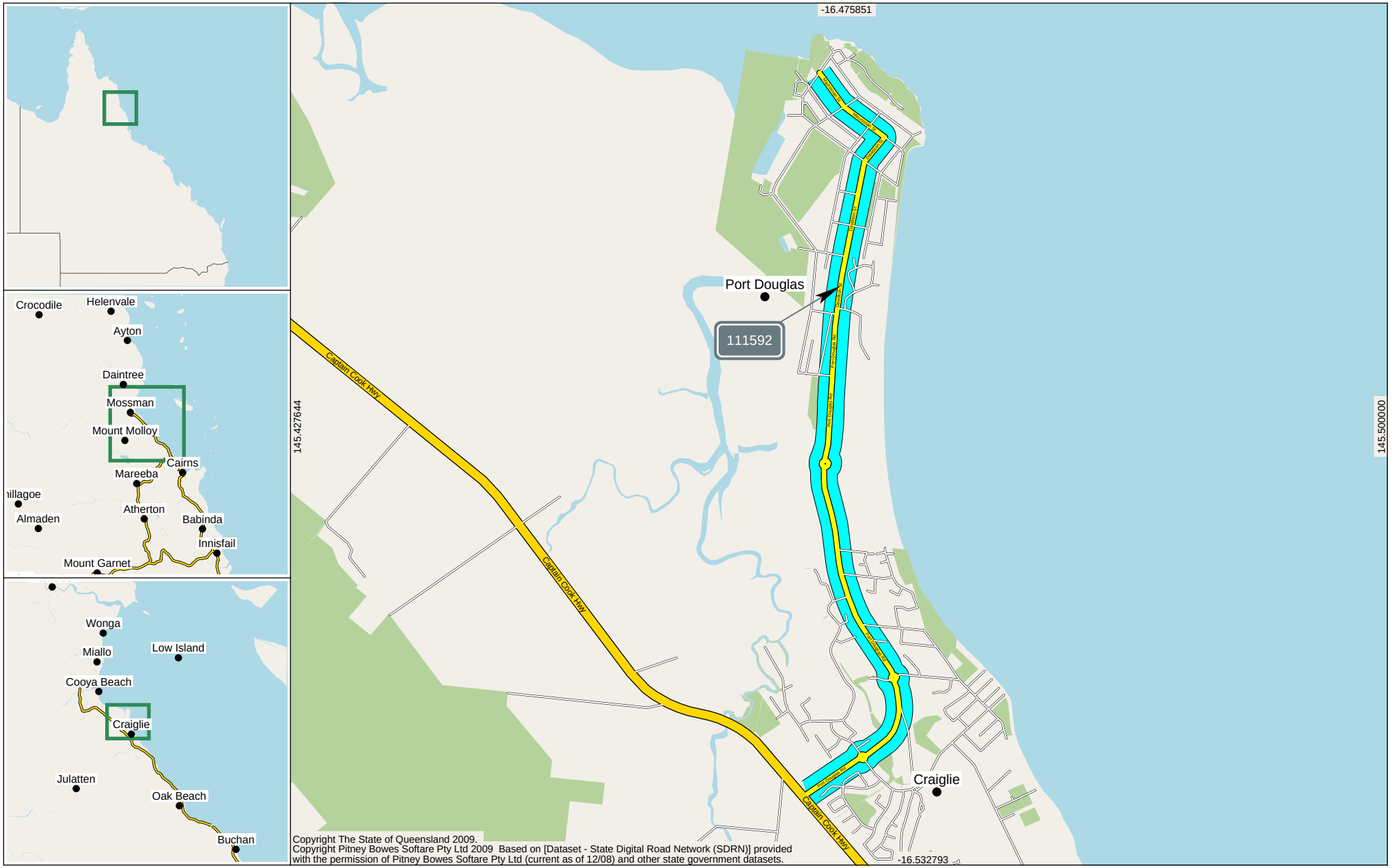
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: RoadName															
4	L2	All MCs	17	0.0	17	0.0	0.016	7.0	LOS A	0.1	0.4	0.43	0.61	0.43	35.2
Approach			17	0.0	17	0.0	0.016	7.0	LOS A	0.1	0.4	0.43	0.61	0.43	35.2
North: RoadName															
7	L2	All MCs	1	0.0	1	0.0	0.221	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	37.3
8	T1	All MCs	425	3.6	425	3.6	0.221	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach			426	3.6	426	3.6	0.221	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles			443	3.5	443	3.5	0.221	0.3	NA	0.1	0.4	0.02	0.02	0.02	58.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

AADT Segment Report

Area 403 - Far North District Road Section 6504 - PORT DOUGLAS ROAD

Road Segment from 0.000km to 5.960km Segment Site 111592 Traffic Year 2020 Data Collection Year 2020

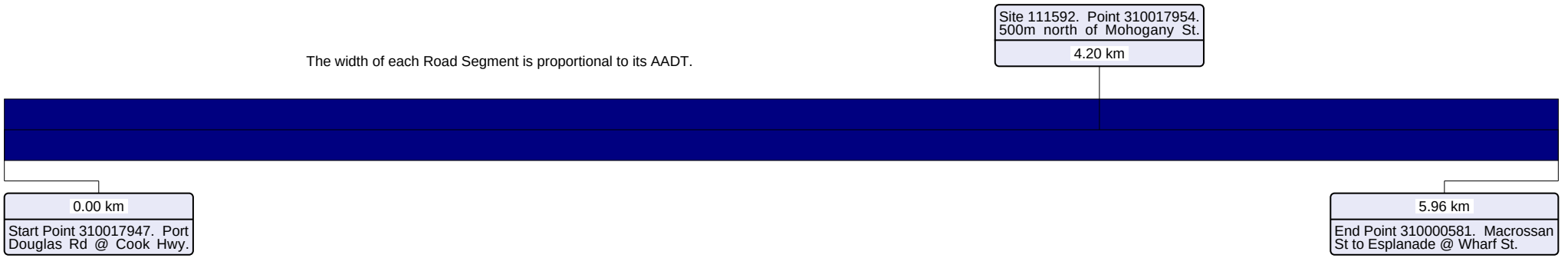


AADT Segment Report

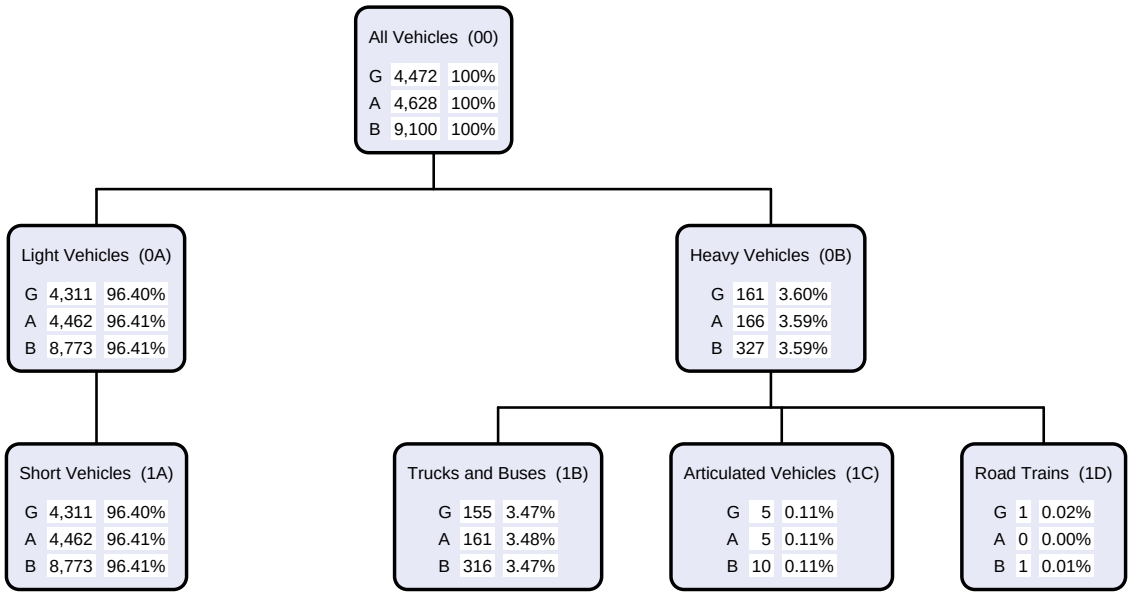
Area 403 - Far North District Road Section 6504 - PORT DOUGLAS ROAD

Road Segment from 0.000km to 5.960km Segment Site 111592 Traffic Year 2020 Data Collection Year 2020

The width of each Road Segment is proportional to its AADT.



This report shows Annual Average Daily Traffic values (AADTs). Because the AADT values are converted to whole numbers, there will be occasional inaccuracies due to rounding. These inaccuracies are statistically insignificant.



AADT Segment Annual Volume Report
Provides summary data for the selected AADT Segment of a Road Section. Summary data is presented as both directional information and a combined bi-directional figure. The data is then broken down by Traffic Class, when available. The report also includes maps displaying the location of both the AADT Segment and the traffic count site.

Annual Average Daily Traffic (AADT)
Annual Average Daily Traffic (AADT) is the number of vehicles passing a point on a road in a 24 hour period, averaged over a calendar year.

AADT Segments
The State declared road network is broken into Road Sections and then further broken down into AADT Segments. An AADT Segment is a sub-section of the declared road network where traffic volume is similar along the entire AADT Segment.

Area
For administration purposes the Department of Transport and Main Roads has divided Queensland into 12 Districts. The Area field in TSDM reports displays the District Name and Number.

District Name	District
Central West District	401
Darling Downs District	402
Far North District	403
Fitzroy District	404
Mackay/Whitsunday District	405
Metropolitian District	406
North Coast District	407
North West District	409
Northern District	408
South Coast District	410
South West District	411
Wide Bay/Burnett District	412

AADT Values
AADT values are displayed by direction of travel as:

- G Traffic flow in gazettal direction
- A Traffic flow against gazettal direction
- B Traffic flow in both directions

Data Collection Year
Is the most recent year that data was collected at the data collection site.

Please Note:
Due to location and/or departmental policy, some sites are not counted every year.

Gazettal Direction
Is the direction of the traffic flow. It can be easily recognised by referring to the name of the road eg. Road Section: 10A Brisbane - Gympie denotes that the gazettal direction is from Brisbane to Gympie.

Maps
Display the selected location from a range of viewing levels, the start and end position details for the AADT Segment and the location of the traffic count site.

Road Section
Is the Gazetted road from which the traffic data is collected. Each Road Section is given a code, allocated sequentially in Gazettal Direction. Larger roads are broken down into sections and identified by an ID code with a suffix for easier data collection and reporting (eg. 10A, 10B, 10C). Road Sections are then broken into AADT Segments which are determined by traffic volume.

Segment Site
Is the unique identifier for the traffic count site representing the traffic flow within the AADT Segment.

Site
The physical location of a traffic counting device. Sites are located at a specified Through Distance along a Road Section.

Site Description
The description of the physical location of the traffic counting device.

Start and End Point
The unique identifier for the Through Distance along a Road Section.

Vehicle Class
Traffic is categorised as per the Austroads Vehicle Classification scheme. Traffic classes are in the following hierarchical format:

Volume or All Vehicles
00 = 0A + 0B

Light Vehicles
0A = 1A
1A = 2A + 2B

Heavy Vehicles
0B = 1B + 1C + 1D
1B = 2C + 2D + 2E
1C = 2F + 2G + 2H + 2I
1D = 2J + 2K + 2L

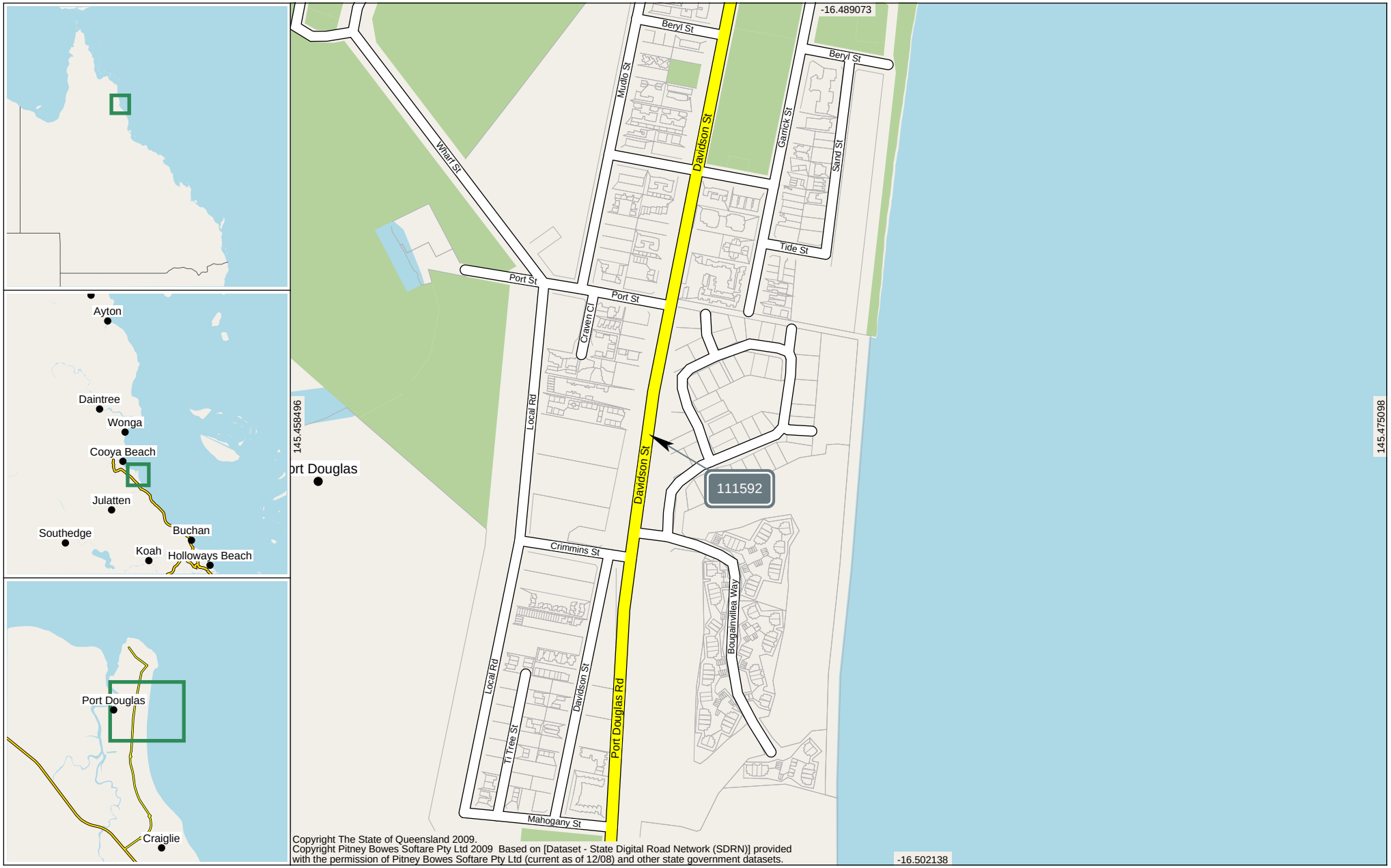
The following classes are the categories for which data can be captured:

Volume
00 All vehicles

2-Bin
0A Light vehicles
0B Heavy vehicles

4-Bin
1A Short vehicles
1B Truck or bus
1C Articulated vehicles
1D Road train

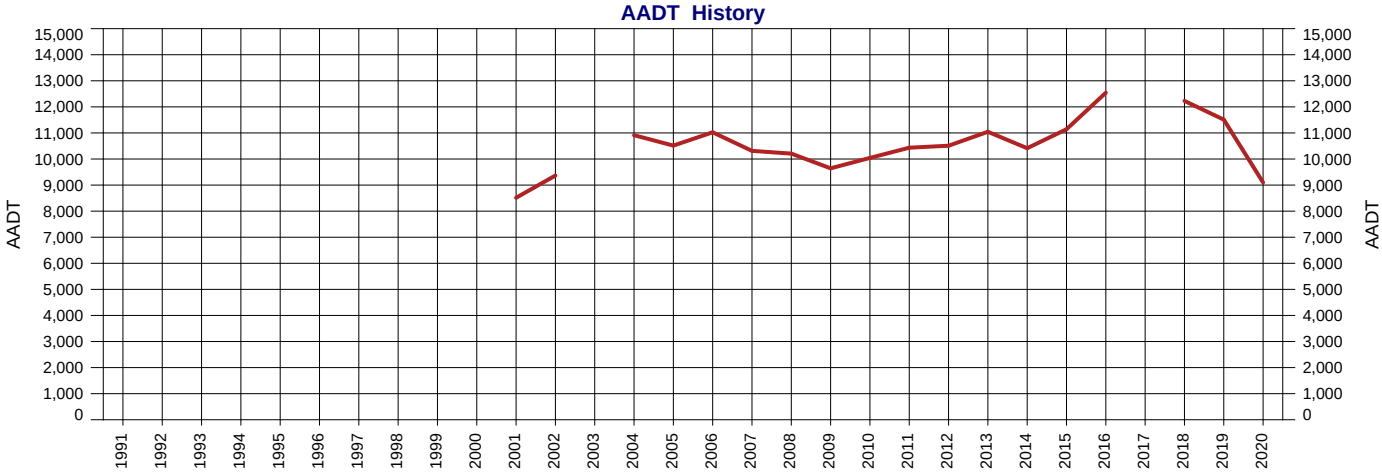
12-Bin
2A Short 2 axle vehicles
2B Short vehicles towing
2C 2 axle truck or bus
2D 3 axle truck or bus
2E 4 axle truck
2F 3 axle articulated vehicle
2G 4 axle articulated vehicle
2H 5 axle articulated vehicle
2I 6 axle articulated vehicle
2J B double
2K Double road train
2L Triple road train


Ayton
Daintree
Wonga
Cooya Beach
Julatten
Southedge
Buchan
Koah
Holloways Beach
Port Douglas
Craiglie
-16.489073
-16.502138
145.458496
145.475098
Beryl St
Beryl St
Mudio St
Davidson St
Garnick St
Sand St
Wharf St
Tide St
Port St
Port St
Craven Ct
Local Rd
Davidson St
111592
Crimmins St
Bougainvillea Way
Local Rd
Davidson St
Tri Tree St
Port Douglas Rd
Mahogany St
Copyright The State of Queensland 2009.
Copyright Pitney Bowes Softare Pty Ltd 2009 Based on [Dataset - State Digital Road Network (SDRN)] provided with the permission of Pitney Bowes Softare Pty Ltd (current as of 12/08) and other state government datasets.

Area	403 - Far North District
Road Section	6504 - PORT DOUGLAS ROAD
Site	111592 - 500m north of Mahogany St
Thru Dist	4.2
Type	C - Coverage
Stream	TB - Bi-directional traffic flow

Year	2020	Growth last Year	-20.95%
AADT	9,100	Growth last 5 Yrs	-6.56%
Avg Week Day	8,190	Growth last 10 Yrs	-2.28%
Avg Weekend Day	7,462		

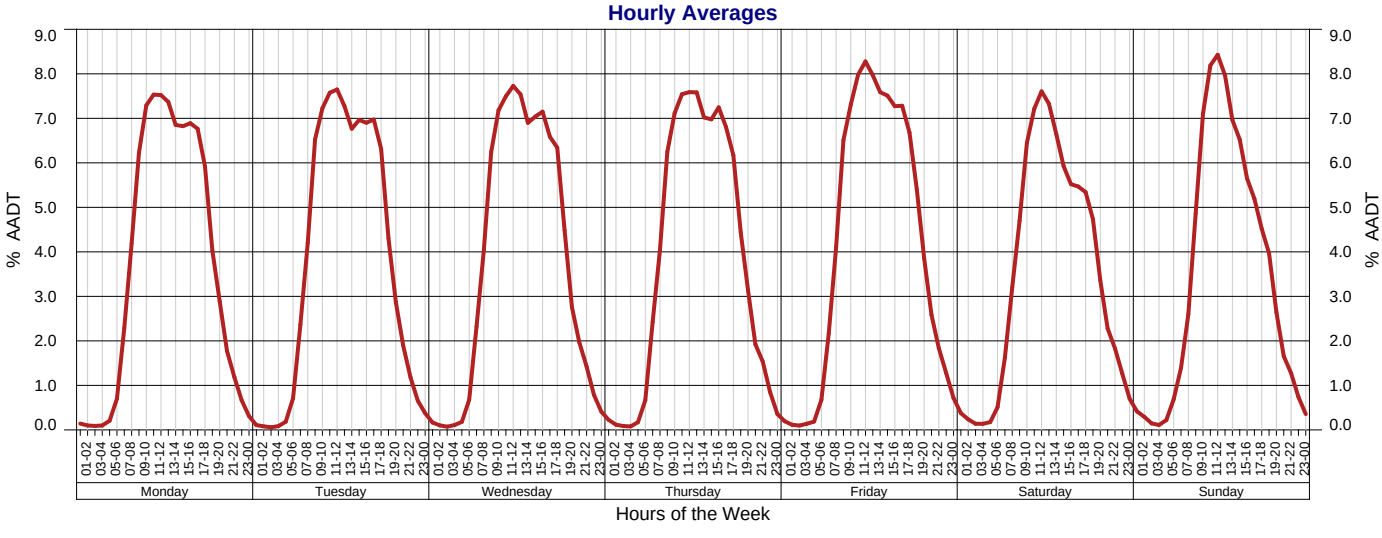
AADT History



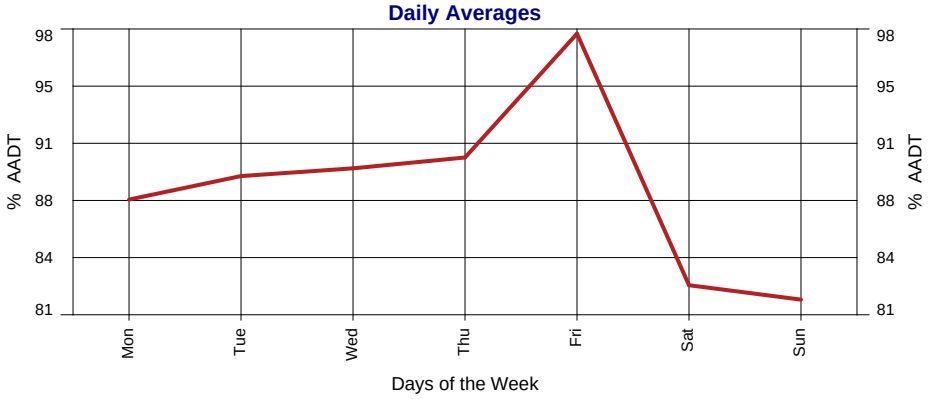
Year	AADT	1-Year Growth	5-Year Growth	10-Year Growth
2020	9,100	-20.95%	-6.56%	-2.28%
2019	11,511	-5.87%	0.62%	1.32%
2018	12,229		2.59%	2.35%
2017				
2016	12,542	12.58%	4.65%	2.73%
2015	11,141	6.97%	1.91%	0.99%
2014	10,415	-5.70%	0.82%	-0.10%
2013	11,044	5.08%	2.55%	
2012	10,510	0.73%	1.04%	0.37%
2011	10,434	3.90%	0.06%	0.84%
2010	10,042	4.14%	-1.22%	
2009	9,643	-5.53%	-2.79%	
2008	10,207	-1.03%		
2007	10,313	-6.45%	0.53%	
2006	11,024	4.84%	4.47%	

Year	AADT	1-Year Growth	5-Year Growth	10-Year Growth
2005	10,515	-3.65%		
2004	10,913			
2003				
2002	9,366	10.01%		
2001	8,514			
2000				
1999				
1998				
1997				
1996				
1995				
1994				
1993				
1992				
1991				

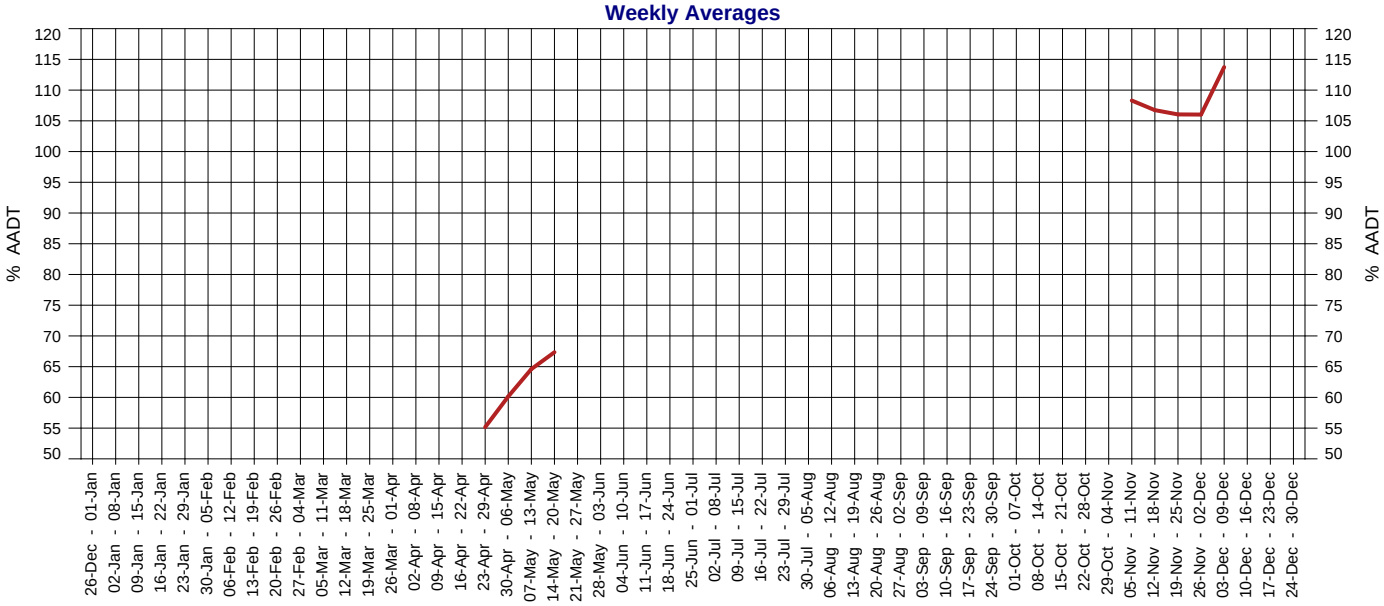
Hourly Averages



Daily Averages



Weekly Averages



2020 Calendar

January

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

March

M	T	W	T	F	S	S
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

April

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August

M	T	W	T	F	S	S
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

September

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

October

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November

M	T	W	T	F	S	S
30						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

December

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Days on which traffic data was collected.

Annual Volume Report
Displays AADT history with hourly, daily and weekly patterns by Stream in addition to annual data for AADT figures with 1 year, 5 year and 10 year growth rates.

Annual Average Daily Traffic (AADT)
Annual Average Daily Traffic (AADT) is the number of vehicles passing a point on a road in a 24 hour period, averaged over a calendar year.

AADT History
Displays the years when traffic data was collected at this count site.

Area
For administration purposes the Department of Transport and Main Roads has divided Queensland into 12 Districts. The Area field in TSDM reports displays the District Name and Number.

District Name	District
Central West District	401
Darling Downs District	402
Far North District	403
Fitzroy District	404
Mackay/Whitsunday District	405
Metropolitian District	406
North Coast District	407
North West District	409
Northern District	408
South Coast District	410
South West District	411
Wide Bay/Burnett District	412

Avg Week Day
Average daily traffic volume during the week days, Monday to Friday.

Avg Weekend Day
Average daily traffic volume during the weekend, Saturday and Sunday.

Calendar
Days on which traffic data was collected are highlighted in green.

Gazettal Direction
The Gazettal Direction is the direction of the traffic flow. It can be easily recognised by referring to the name of the road eg. Road Section: 10A Brisbane - Gympie denotes that the gazettal direction is from Brisbane to Gympie.

- G Traffic flowing in Gazettal Direction
- A Traffic flowing against Gazettal Direction
- B The combined traffic flow in both Directions

Growth Percentage
Represents the increase or decrease in AADT, using a exponential fit over the previous 1, 5 or 10 year period.

Hour, Day & Week Averages
The amount of traffic on the road network will vary depending on the time of day, the day of the week and the week of the year. The ebb and flow of traffic travelling through a site over a period of time forms a pattern. The Hour, Day and Week Averages are then used in the calculation of AADT.

Road Section
Is the Gazetted road from which the traffic data is collected. Each Road Section is given a code, allocated sequentially in Gazettal Direction. Larger roads are broken down into sections and identified by an ID code with a suffix for easier data collection and reporting (eg. 10A, 10B, 10C). Road Sections are then broken into AADT Segments which are determined by traffic volume.

Site
The unique identifier and description of the physical location of a traffic counting device. Sites are located at a Through Distance along a Road Section.

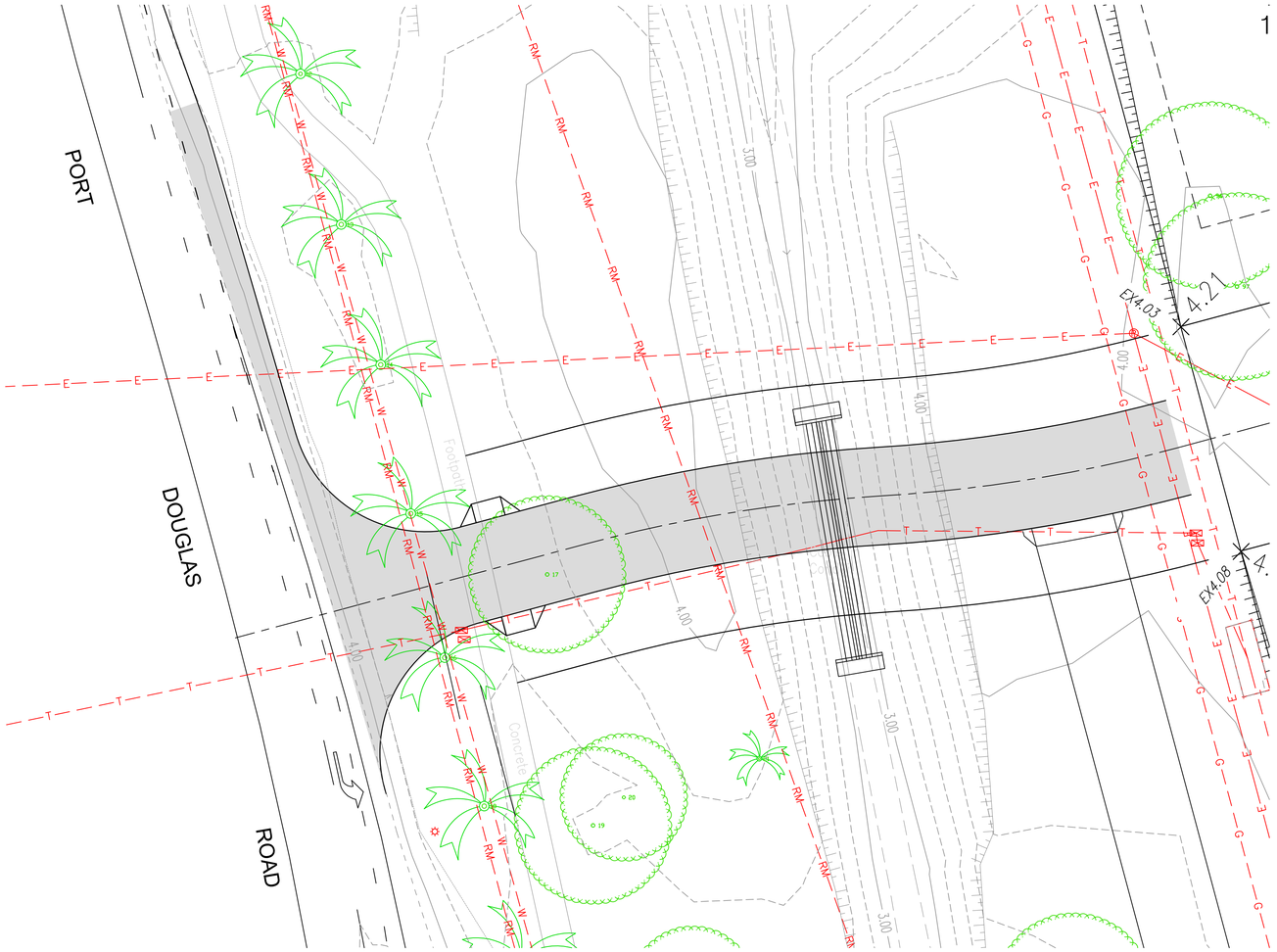
Stream
The lane in which the traffic is travelling in. This report provides data for the combined flow of traffic in both directions.

Thru Dist or TDist
The distance from the beginning of the Road Section, in kilometres.

Type
There are two types of traffic counting sites, Permanent and Coverage. Permanent means the traffic counting device is in place 24/7. Coverage means the traffic counting device is in place for a specified period of time.

Year
Is the current year for the report. Where an AADT Year record is missing a traffic count has not been conducted, for that year.

Attachment 3 - **Alternative Intersection Location ARO0188-SK06(1)**



LEGEND

- FINISHED SURFACE LEVEL ON ALLOTMENT (REFER NOTE 1) — +4.68
- EXISTING SURFACE LEVEL — +EX5.09
- EXISTING SURFACE CONTOUR (0.5m INTERVAL) — 4.0
- KERB RAMP
- TOP OF BATTER
- ACCESS CROSSOVER
- EDGE OF EXISTING SEALED ROAD
- EXISTING STORMWATER — SW
- EXISTING WATER — W
- EXISTING TELECOMMUNICATIONS — T
- EXISTING SEWER RISING MAIN — RM
- EXISTING OVERHEAD ELECTRICITY — E
- EDGE OF EXISTING VEGETATION

ARO

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W www.aroindustries.com.au
ABN: 49 641 461 298

RESIDENTIAL LAND DEVELOPMENT
LOT 3 ON RP729037

ALTERNATE INTERSECTION LOCATION

ARO0188-SK06

1:250
A1 Full Size

Acad No. ARO0188-SK06(1)

28th March 2023

Attachment 4 – Stormwater Assessment Report dated 25 May 2023

25 May 2023

LOT 3RP729037, 368-380 PORT DOUGLAS ROAD, PORT DOUGLAS

LOCAL DRAINAGE STUDY

Introduction

This file note focuses on the residential development proposed to be created from the subdivision of Lot 3 on RP729037 (368-280 Port Douglas Road).

The existing topography of the proposed lot is relatively flat with slight fall (~0.3-1.0%) to the rear of the allotment discharging into the natural gully balance lot. The runoff makes its way through Council owned freehold land (Lot 10 on RP729037). It is understood that this allotment is zoned Recreation and Open Space and that Douglas Shire Council has provided landowner consent for the discharge of stormwater into this allotment, hence this is considered a lawful point of discharge.

A formed unlined drain is also located in the road reserve along the frontage of Lot 3 on RP729037. This drain conveys water to Council owned freehold land (Lot 10 on RP729037) Through lot 125 on SR730. It is understood that this allotment is Reserve and is identified on The DSC LGIP as “Land for Drainage Purposes”. As such it is considered that the road frontage is also a lawful point of discharge for the proposed development.

It is proposed that the drainage regime of the proposed subdivision meet the requirements of FNQROC and QDUM.

The aim of this local drainage study is to address the following items;

a) All contributing catchment areas;
b) The impact of the proposed development on the proposed stormwater discharge drains.
c) Pre and post development flow characteristics of the discharge drains;
d) Identify the sites lawful points of discharge.

Catchment Boundaries

The predevelopment catchments are identified in Figure 1.

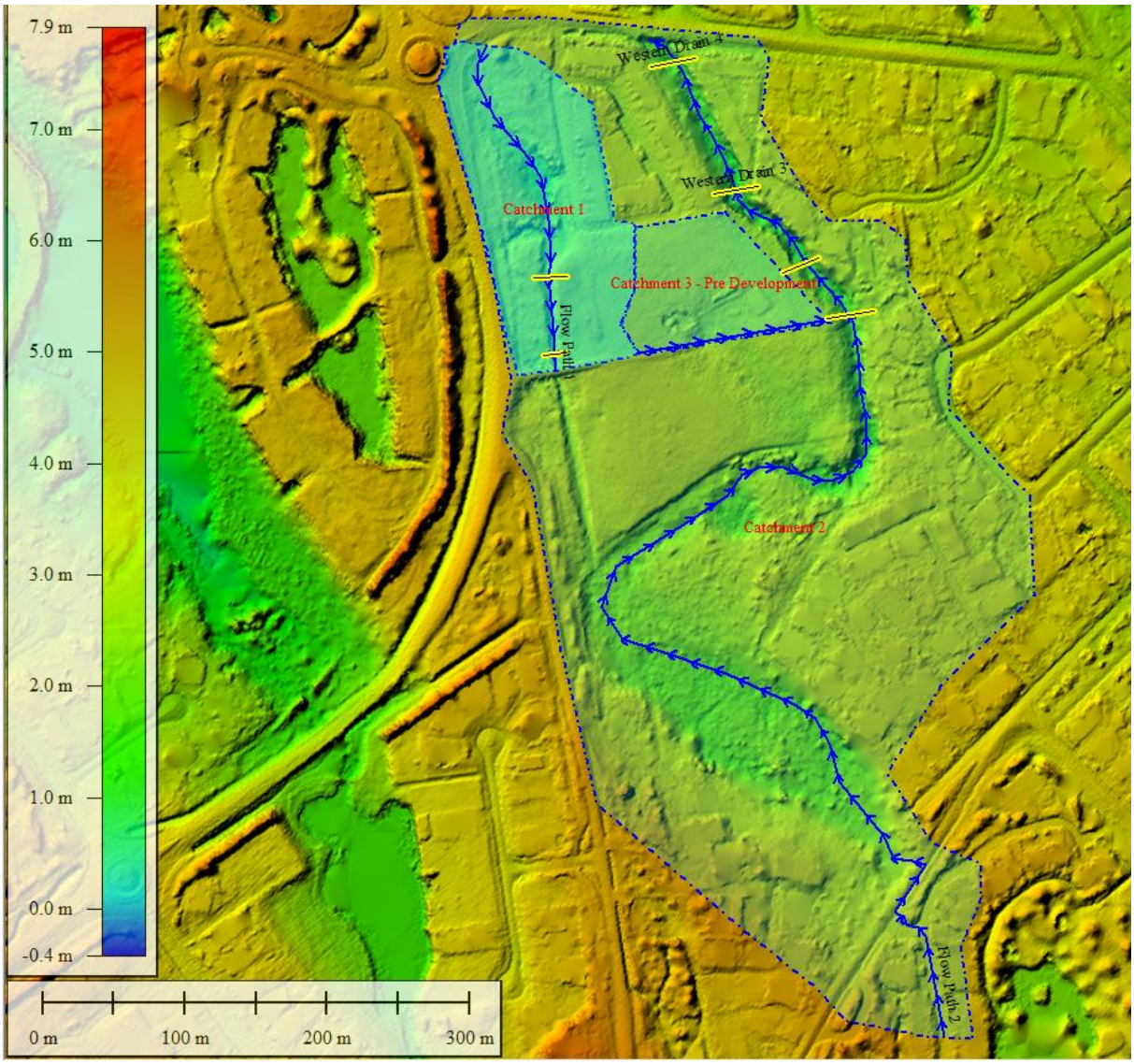


Figure 1: Pre Development Catchment

The post development catchments have been broken into five (3) individual catchments. The drainage regime has generally been maintained.

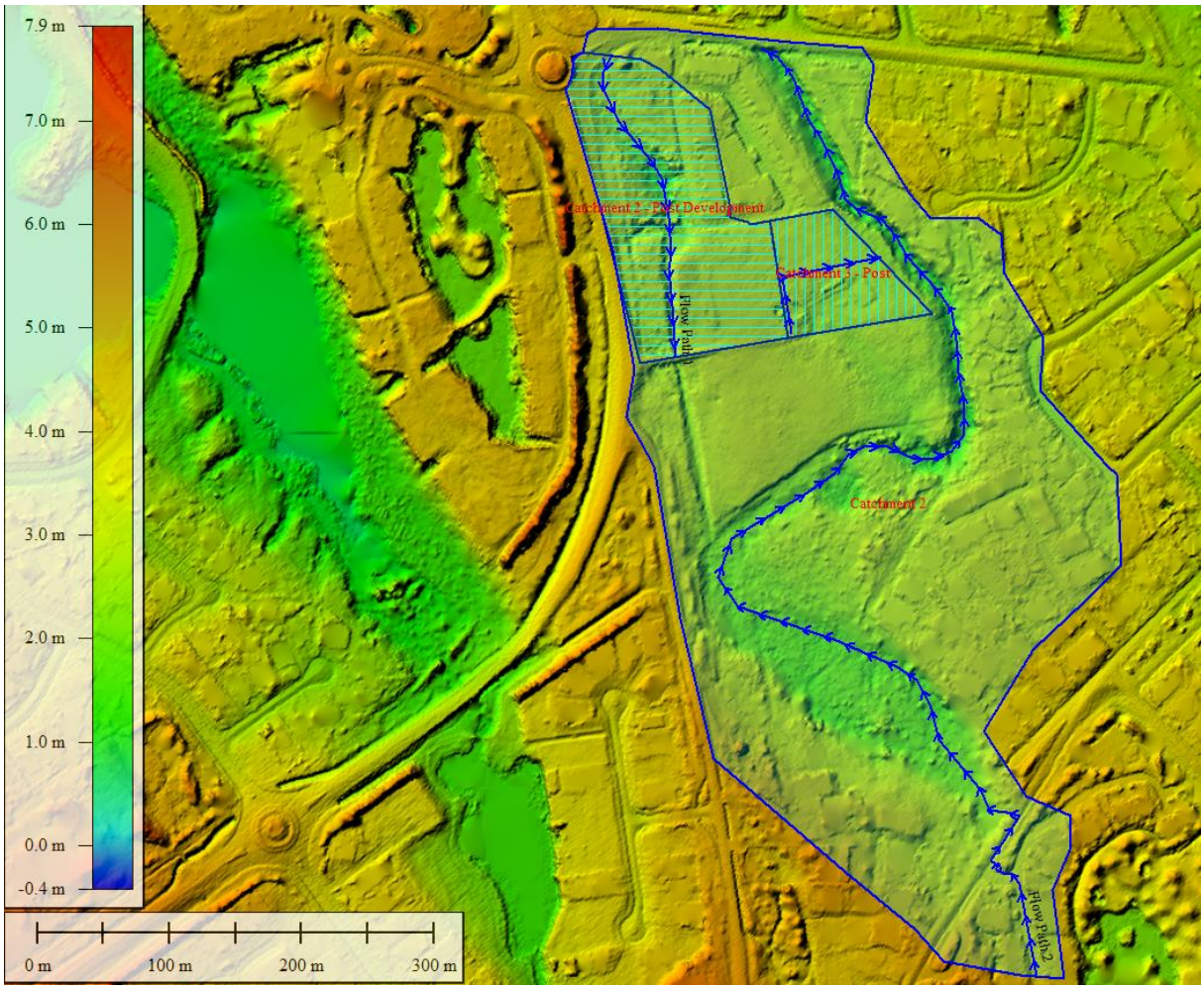


Figure 2: Post Development Catchment

Flows

Stormwater flows from the catchments have been calculated for pre-development and post-development conditions as summarised in the table below.

As the flow regimes of the site are proposed to generally remain. The impact of the development will generally be associated with the change in fraction impervious of the developed site over the existing lesser developed site.

The pre and post development fraction impervious for each catchment is presented in the table in Appendix B.

Table 1: Pre and Post Development Flows

Point of Reference	Design storm (AEP %)	Pre-Development Peak Flow (m^3/s)	Post-Development Peak Flow (m^3/s)	Difference (m^3/s)
Frontage Drain (existing culvert crossing)	18%	0.515	0.597	+0.082
	1%	1.027	1.194	+0.167
Rear drainage path in Lot 10 on RP729037	18%	2.924	2.962	+0.038
	1%	5.729	5.804	+0.075

From the table above it can be seen that there would be an increase in runoff from the site associated with the increased impervious area.

Drainage Philosophy

The proposed lot is to be filled to provide flood immunity. Each residential lot will discharge stormwater runoff to the internal road which will be captured and conveyed underground to the drains at the Port Douglas Road frontage and to the drain at the rear of the lot.

The development site is contained within the wider catchment area for the drainage path at the rear of the lot. The peak discharge from the development site will not coincide with the larger catchments peak. Notwithstanding, the modelling has assumed that the peaks coincide.

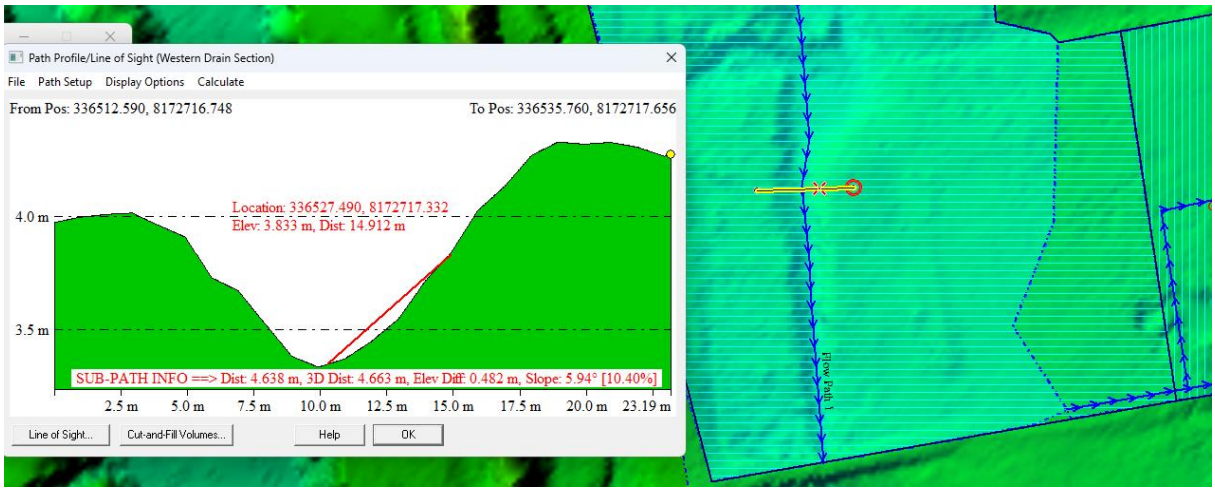
The pre and post development stormwater runoff depth within the adjacent drains are presented in Appendix A. The analysis of the capacity of the drains shows that the increased runoff equates to an increase in depth of 50mm and 6mm in the front (Western) and rear (Eastern) drains, respectively. Minimum freeboard of 300mm is maintained to all adjacent properties.

Summary

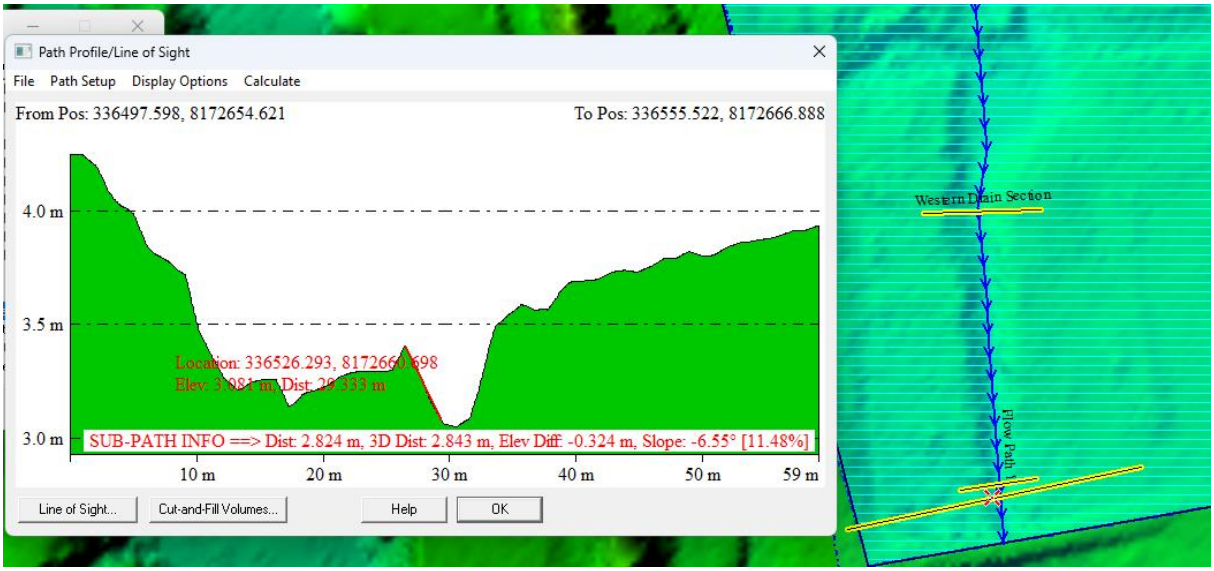
The development produces a negligible increase in runoff into the existing drainage system and does not adversely affect private and public assets. This file note demonstrates that there is no actionable nuisance to upstream or downstream properties as a result of the proposed development.

Appendix A1: Capacity of Western Drain (Road Frontage)

Representative Section 1

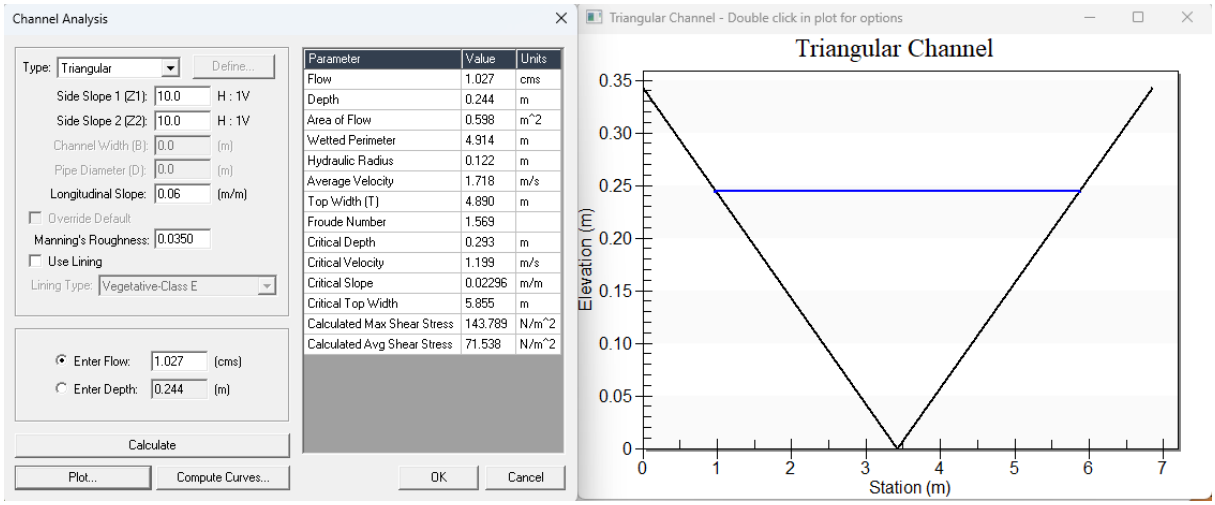


Representative Section 2

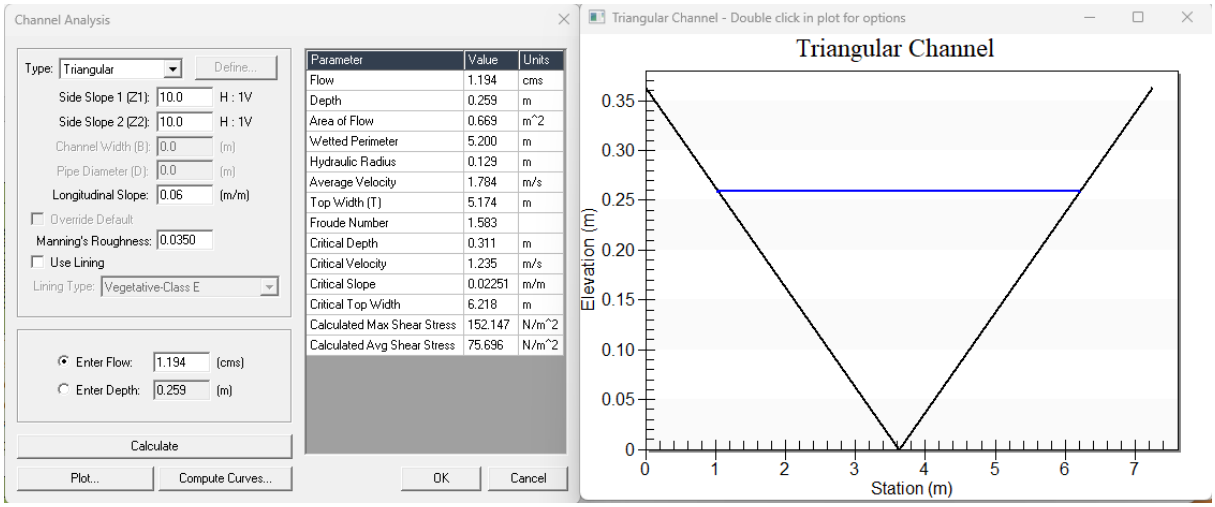


<u>Adopt 10% slopes triangular channel with 600mm allowable depth</u>

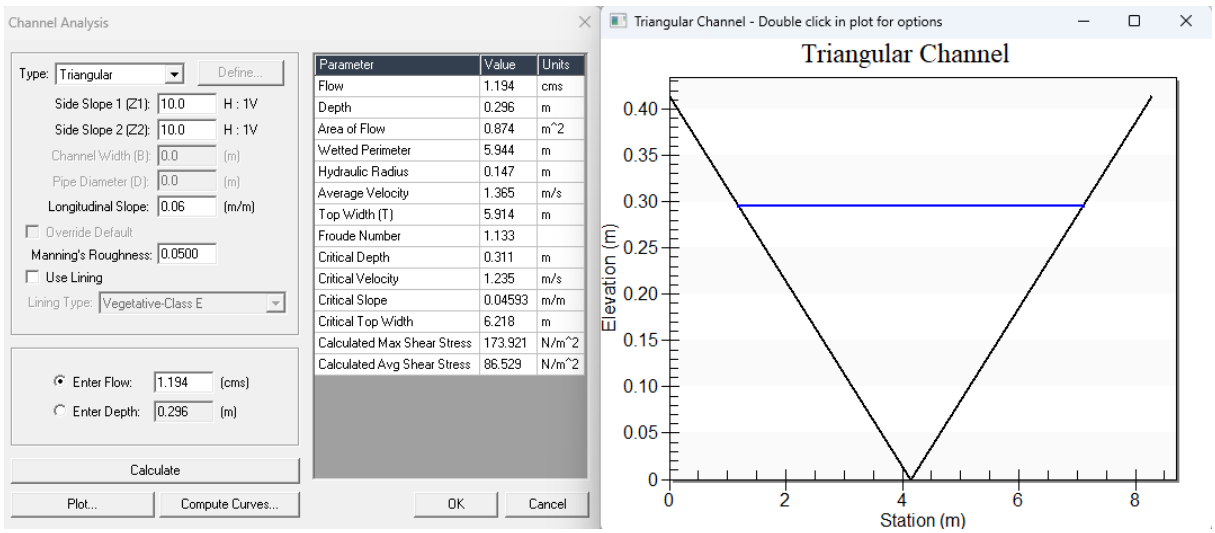
Predevelopment flow (1% AEP) (depth = 244mm)



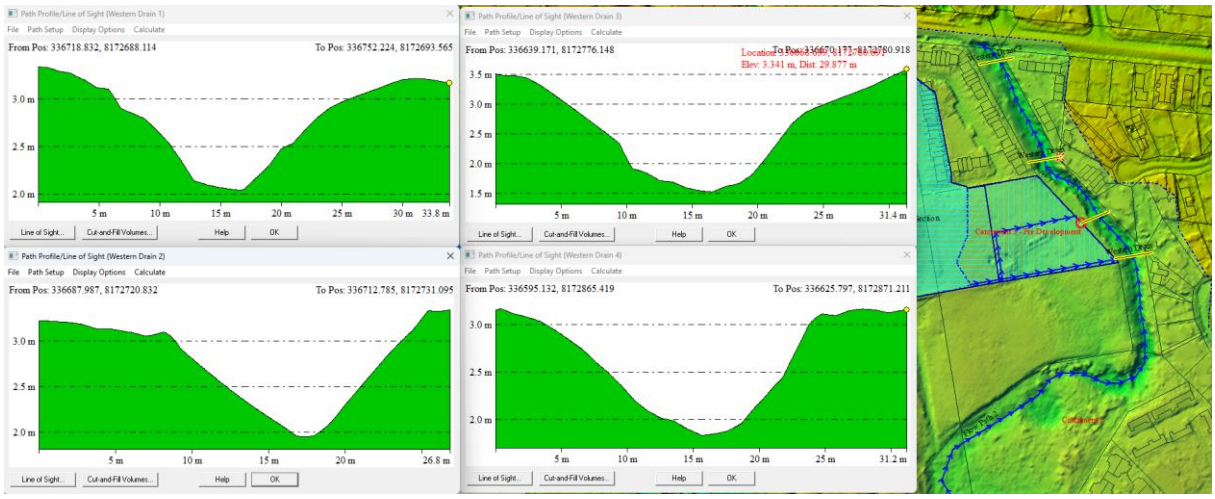
Post development flow (1% AEP) (lower limit Manning's) (depth = 259mm)



Post development flow (1% AEP) (upper limit Manning's) (depth = 296mm)

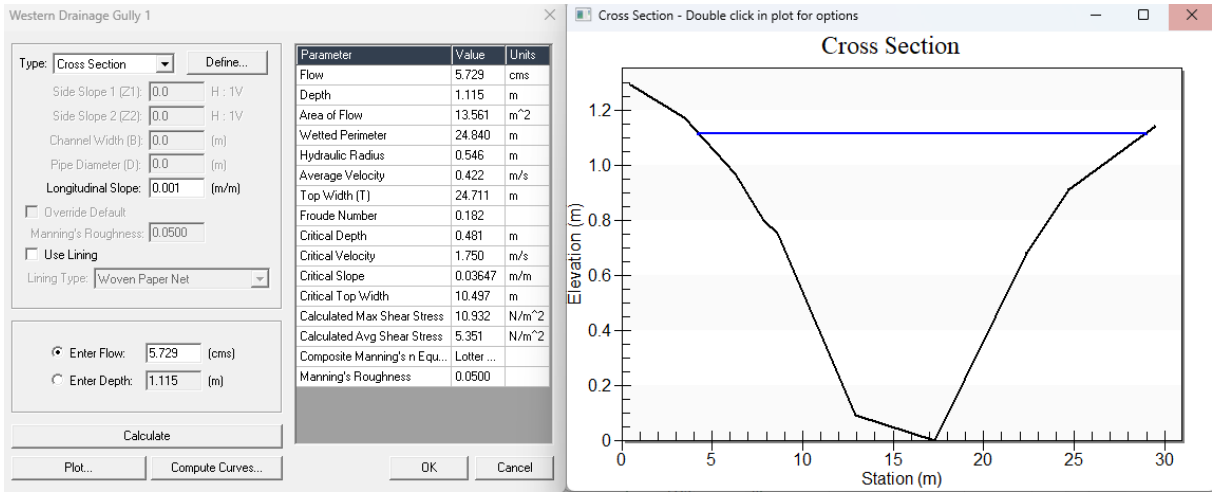


Appendix A2: Capacity of Eastern Drain (Rear Drainage Path)

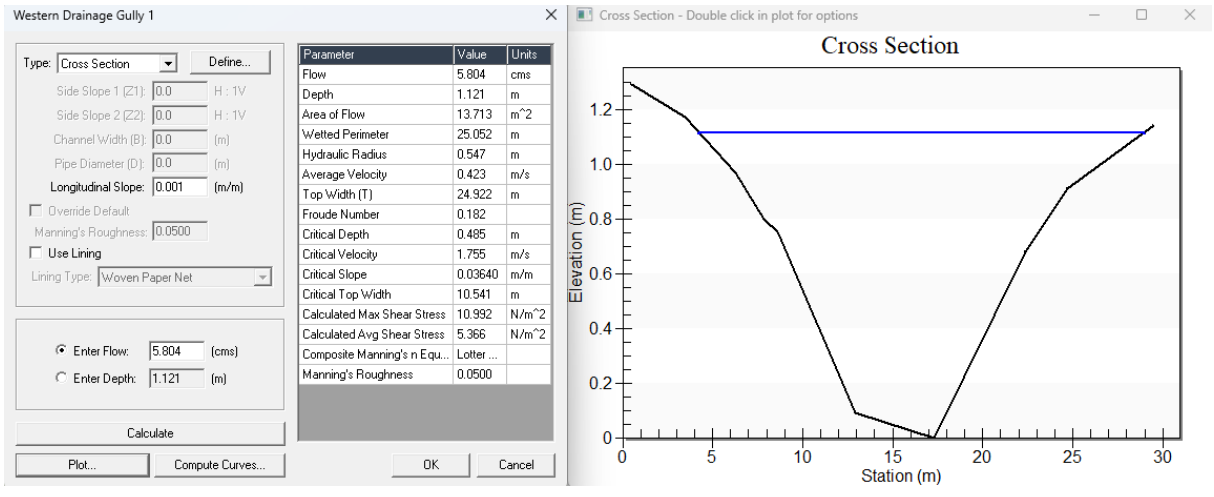


Eastern Drainage Gully Section 1 (1% AEP) Minimum Manning's Roughness n = 0.05 vegetated channel

Predevelopment flow (depth = 1.115m velocity =0.422m/s)

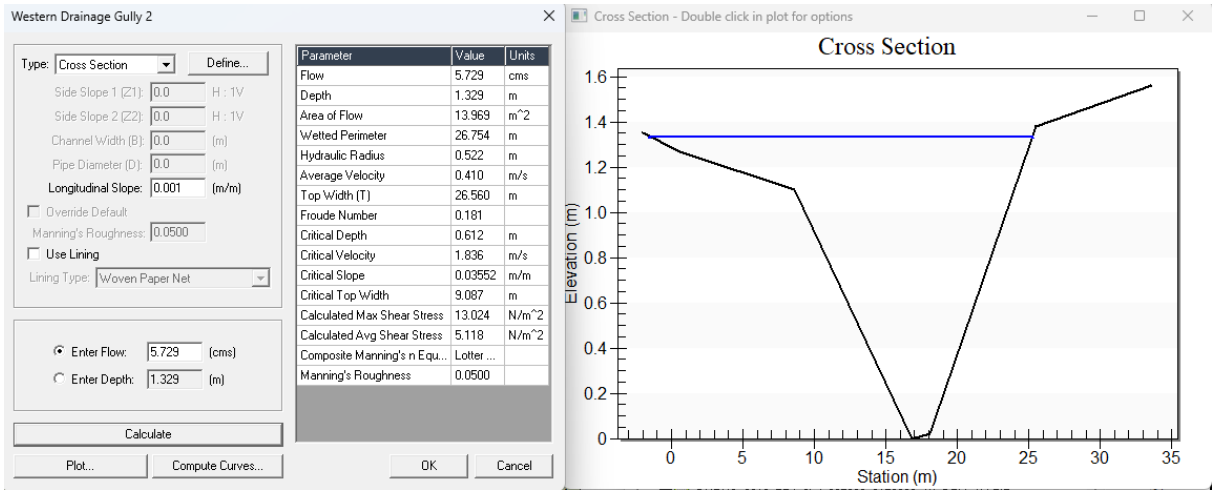


Post development flow (depth = 1.121m velocity =0.423m/s)

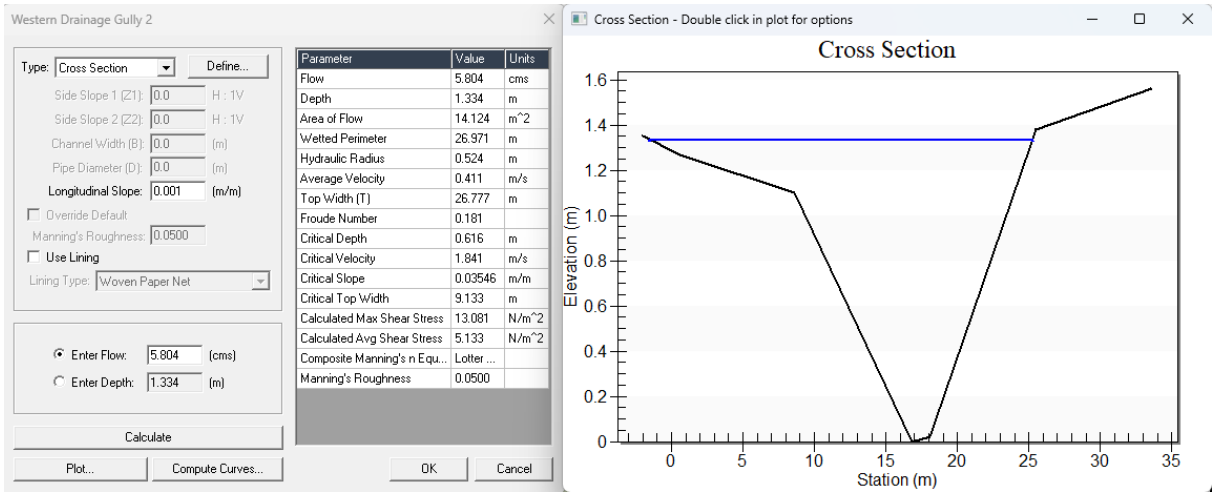


Eastern Drainage Gully Section 2 (1% AEP) Minimum Manning's Roughness n = 0.05 vegetated channel

Predevelopment flow (depth = 1.329m velocity =0.410m/s)

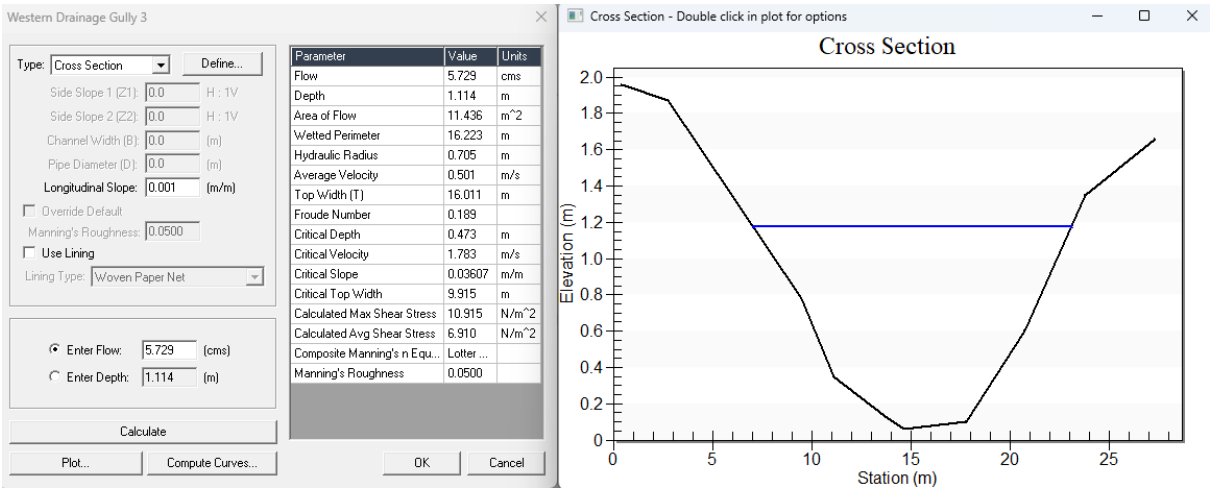


Post development flow (depth = 1.334m velocity =0.411m/s)

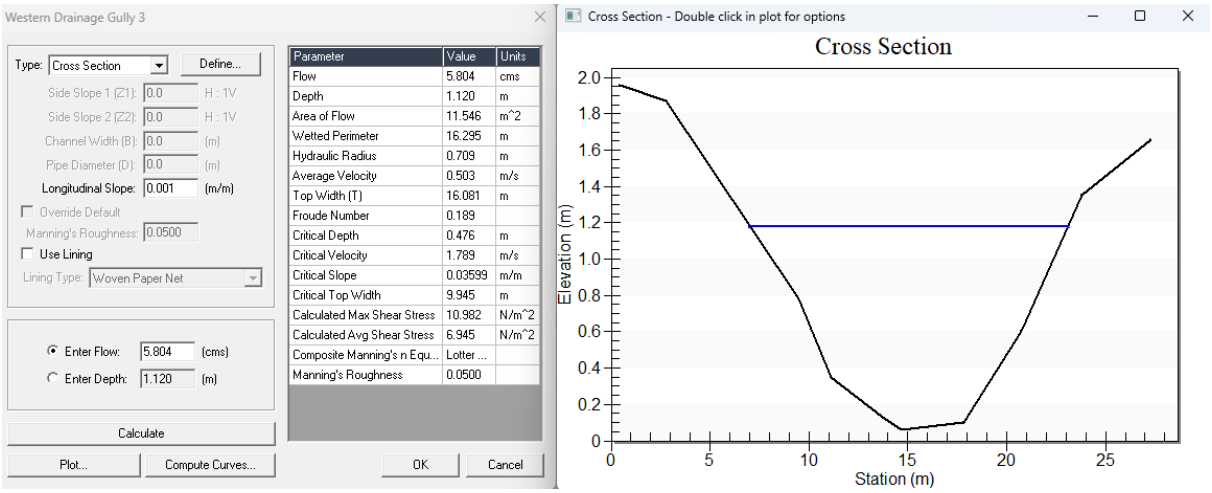


Eastern Drainage Gully Section 3 (1% AEP) Minimum Manning's Roughness n = 0.05 vegetated channel

Predevelopment flow (depth = 1.114m velocity =0.501m/s)

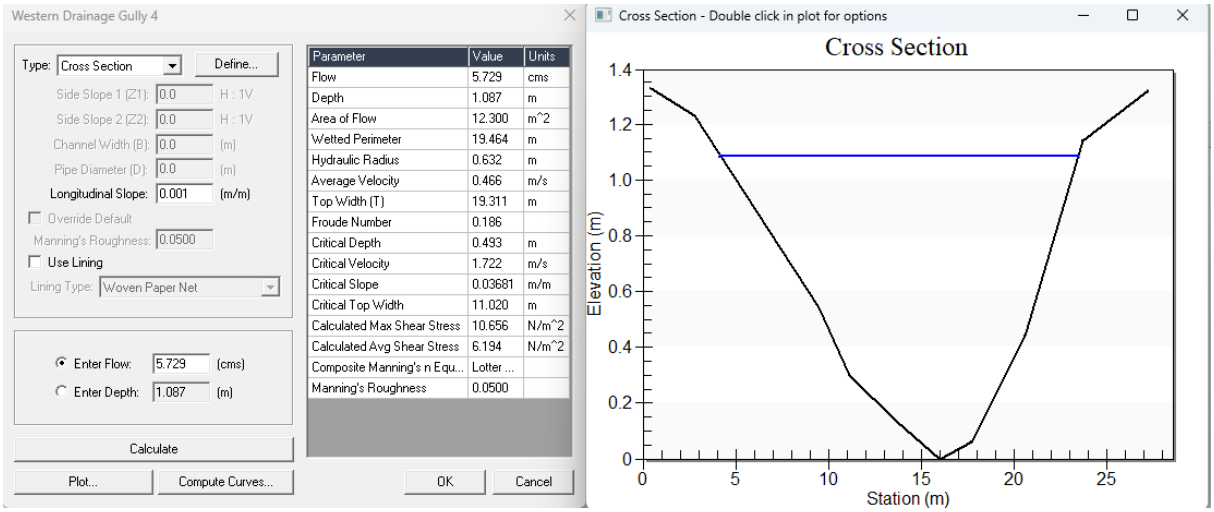


Post development flow (depth = 1.120m velocity =0.503m/s)

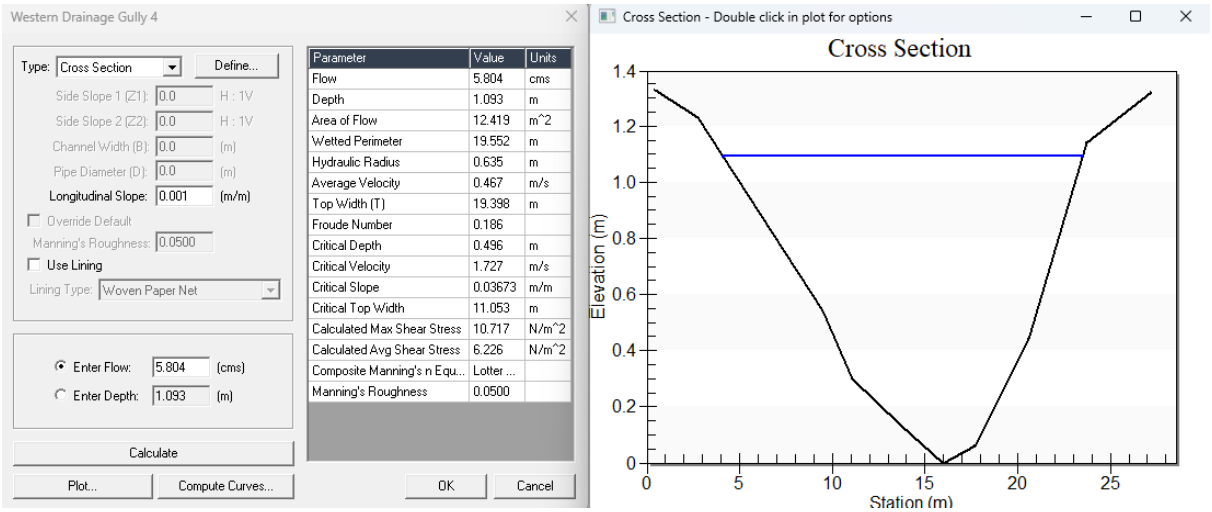


Eastern Drainage Gully Section 4 (1% AEP) Minimum Manning's Roughness n = 0.05 vegetated channel

Predevelopment flow (depth = 1.087m velocity =0.632m/s)



Post development flow (depth = 1.093m velocity =0.635m/s)



Appendix B: Catchment Calculations

	Catchment Properties						Time of Concentration (min)								Catchment Properties		
Catchment ID	Area (ha)	Min Elevation (m)	Max Elevation (m)	Length (m)	Equal Area Slope (%)	Mannings ($s/m^{1/3}$)	Condition	Overland Sheet Flow (Friend)	Concentrated Overland Flow (Bransby-Williams)	Creek Flow	Standard Inlet	Kerb Flow	Pipe Flow	Stream Flow	TOTAL	BOM Weather Station ID	$^1I_{10}$ (mm/hr)	Fraction Impervious
Catchment 1 - Pre Development	2.136	3.0	3.8	245.0	0.3	0.035		29.81	16.76						**20.00**		81.16	0.20
Catchment 1 - Post Development	2.357	3.0	3.8	245.0	0.3	0.035		29.81	16.59						**20.00**		81.16	0.40
Catchment 2 - Pre development	17.99	2.0	4.0	1040.0	0.1	0.030		51.54	71.61						**50.00**		81.16	0.31
Catchment 2 - Post development	17.99	2.0	4.0	1040.0	0.1	0.030		51.54	71.61						**50.00**		81.16	0.34
Catchment 3 - Pre development	0.900	3.3	4.1	135.0	0.6	0.030		18.28	8.79						**15.00**		81.16	0.25
Catchment 3 - Post Development	0.714	3.2	4.6	120.0	1.1	0.015		7.73	7.03						**7.00**		81.16	0.60

	Runoff Coefficient							Rainfall Intensity (mm/hr)							Peak Flow Rate (m^3/s)				
Catchment ID	63% AEP	39% AEP	18% AEP	10% AEP	5% AEP	2% AEP	1% AEP	63% AEP	39% AEP	18% AEP	10% AEP	5% AEP	2% AEP	1% AEP	63% AEP	39% AEP	18% AEP	10% AEP	1% AEP
Catchment 1 - Pre Development	0.59	0.63	0.70	0.74	0.78	0.85	0.89	80	101	123	136	154	177	195	**0.281**	**0.378**	**0.515**	**0.597**	**1.027**
Catchment 1 - Post Development	0.62	0.66	0.74	0.78	0.82	0.90	0.94	80	101	123	136	154	177	195	**0.327**	**0.440**	**0.598**	**0.694**	**1.194**
Catchment 2 - Pre development	0.61	0.65	0.72	0.76	0.80	0.87	0.91	53	67	81	89	100	115	126	**1.619**	**2.168**	**2.924**	**3.374**	**5.729**
Catchment 2 - Post development	0.62	0.65	0.73	0.77	0.81	0.89	0.92	53	67	81	89	100	115	126	**1.640**	**2.197**	**2.962**	**3.419**	**5.804**
Catchment 3 - Pre development	0.60	0.64	0.71	0.75	0.79	0.86	0.90	90	114	139	153	174	200	221	**0.135**	**0.181**	**0.247**	**0.288**	**0.496**
Catchment 3 - Post Development	0.66	0.70	0.78	0.82	0.86	0.94	0.98	118	149	184	203	231	267	295	**0.153**	**0.206**	**0.284**	**0.331**	**0.575**

Attachment 5- Tree Health and Condition Report 2023

Tree Health and condition Report

Lot 3 Port Douglas road, Port Douglas.

Diploma of Arboriculture: J*ames Watts passionate about trees.*

E: sales@mpdt.com.au

Table of Contents

1. Introduction

MPDT Pty Ltd engaged to provide a tree and health assessment report. The aim of this survey was to establish the impact of significant trees at lot 3 Port Douglas road.
These trees were assessed from the ground level using accepted modern arboriculture techniques – no aerial or underground inspections were made.

2. Objectives

The objectives of this report are:

1) Assess the Heath of the Trees
2) The Aesthetic value both now and in the future
3) The suitability of these trees long term for where they are situated.

3. Information and Documentation Provided

At the time of the actual site inspection for assessment and health condition report James Watts met with the landowner to gain accesses to the property so he could identify and document the location of trees reported on. He was also provided with maps and plans for the proposed layout of residential development.

4. Site Survey

On Wednesday 01-02-2023 James watts conducted an onsite inspection at lot 3 Port Douglas road . It was overcast day with a slight breeze.

4.1 Site Description

All trees inspected where in the grounds of lot 3 Port Douglas road .

5. Materials & Methodology

The following is a description of elements included in the tree assessment.

- Species: the tree's botanical or common name as is most appropriate.
- Age: an estimation of the tree's age
    - Young (Y): from establishment, up to one third expected life span
    - Semi-mature (SM): between one and two thirds expected life span
    - Mature (M): between two thirds expected life span up to full maturity
    - Over mature (OM): trees older than expected life span or veteran trees
- Condition: the tree's overall health and condition
    - Good: good form, typical of species with no major defects present. Long safe useful life expectancy
    - Reasonable: Good or reasonable form. Any defects are easily rectifiable or can be managed
    - Poor: Poor form. Major defects present.
    - Dead

- DBH: the diameter of the tree in centimetres, measure at a height of approximately 1.5m. Used as a means of identification and gauge of future growth.
- Height: the height of the tree in metres, estimated using surveyor's own judgement (no measuring instruments were used in this survey).
- Spread: the crown spread in one direction only
- Comments: comments relating to the general health and condition of the tree.
- Recommendations: recommendations for remedial work or other relevant advice.
- Priority: Priority of recommended works
    - High (H): action required within one month
    - Medium (M): action advised within 3 months
    - Low (L): action not critical but advisable for longer term health of the tree/amenity value

The process of risk identification and controls have been carried out in accordance with AS/NZS 4360:2004 – Risk Management

Tree heights were determined with the use of a range finder

Biomechanical stability of the examined trees and tree components where determined utilising VTA (Mattheck and Breloer 1994).

6. Collection of Data

The data collected for this tree health and condition report was done so of a preliminary nature. All data was collected from visible access points at ground level. No climbing or use of elevated work platforms was utilised. Due to the visual nature of this assessment, there may be other issues that remain undetected.

7. Tree Protection Zone

All plants consist of three main sections, a crown (leaves), a stem or trunk and a root system. Each one of these sections carries out specific functions necessary for the survival of the tree as all parts interact. Above ground and below ground these sections if damaged the entire tree will suffer and symptoms may appear in any part of the tree. Therefore, any demolition and construction operations that occur around trees must be carried out in such a way as to minimize the impact on the health of the tree.

The principles of a tree protection zone are the combination of root area and crown area requiring protection. It is an area isolated from construction disturbance, so the tree remains viable. This needs to be incorporated before and during works carried out to minimise the impact of encroachment to surrounding trees. We work to the recommendations of the Australian Standards (AS 4970-2009).

If required, we will utilise temporary protection measures to avoid any damage to surrounding vegetation. This will include the use of barrier tape, signage and star pickets to keep people out of the encroachment area. These will remain in place until all works are completed and your project manager is satisfied and requests us to remove it.

Other considerations within the TPZ include temporary watering to maintain soil moisture levels which need to be regularly monitored, the application of mulch around base of trees at a uniform cover of 150mm in depth (using coarse organic materials which comply with AS 4454-2003 - Soil conditioner, Compost and Mulches) and the supervision of any other activities within the TPZ such as landscaping etc.

As head arborist, I will be inspecting the site to ensure exclusion zones are in place and not encroached by other contractors.

8. Tree Protection Plan

A tree protection plan must be available on site prior to commencement of and during works. This must be accessible to the site manager, project arborist and contractors at all times so they are aware of its requirements.

Development Stage - Planning	**Considerations**	**Actions to be taken**
Detail surveys	• Council plans & policies • Heritage • Threatened species	• Existing trees to be accurately plotted on survey plan
Preliminary tree assessment	• Hazard/Risks • Tree retention value	• Evaluate trees suitable for retention and mark on plan • Provide preliminary arboriculture report & indicative TPZs to guide development layout
Preliminary development design	• Condition of trees • Proximity to buildings • Location of services • Roads • Level changes • Building operations space • Long term management	• Planning section of trees for retention • Design modifications to minimize impact to trees

Development submission	• Identify trees for retention through comprehensive arboriculture impact assessment of proposed construction • Determine tree protection measures • Landscape design	• Provide arboriculture impact assessment including tree protection plan and specification
Development approval	• Development controls • Conditions of consent	• Review consent conditions relating to trees

Development Stage - Pre-construction	**Considerations**	**Actions to be taken**
Initial site preparation	• State based OHS requirement for tree work • Approved retention/removal, pruning of amenity trees as per AS 4373 • Specifications for tree protection measures	• Compliance with conditions of consent • Tree removal/tree retention/transplanting • Tree pruning • Certification of tree removal and pruning • Establish TPZs • Install protective measures • Certification of tree protection measures

Development Stage - Construction	**Considerations**	**Actions to be taken**
Site Establishment	• Temporary infrastructure • Demolition • Bulk earthworks • Hydrology	• Locate temporary infrastructure to minimize impact on retained trees • Maintain protective measures • Certification of tree protection measures
Construction work	• Liaison with site manager	• Protection measures in place as per arborist

	• Compliance • Deviation from approved plan	report and in the correct locations • TPZ's inspected & certified by onsite arborist • Does tree protection plan need modification
Implement hard and soft landscape works	• Installation of irrigation services, control of compaction work • Installation of pavement and retaining walls	• Remove selected protective measures as necessary • Remedial tree works • Supervision and monitoring
Practical completion	• Tree vigour and structure	• Remove all remaining tree protection measures • Certification of tree protection

Development Stage - Post construction	**Considerations**	**Actions to be taken**
Defects liability/maintenance period	• Tree vigour and structure	• Maintenance and monitoring • Final remedial works • Final certification of tree condition

9. Survey Schedule

Species: Fig Ficus virgata tree number 124

Age: Mature

Condition: Poor

Comments: DBH 1.90m DRF 2.81m spread 6.20m height 8.97m
Tree has poor form with cavities at base extent of rot pockets unknown, would appear to be mechanical. Also, several wounds in upper crown with cambium die back.
Location isn't the best for tree health and appears to be stressed and low in vigour.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 125

Age: Mature

Condition: Poor

Comments: DBH 1.60m DRF 1.67m spread 6.10m height 9.23m
Poor form with improper pruning wounds from the past that have become cavity's which will be a concern in the future.
Tree is suffering from crown die back which is associated with a form of root disorder.
Located in a poor environment for tree health and appears to be in a state of stress.
White ants also present which will not help tree health.

Recommendations: Removal

Priority: High

Species: Fig Ficus virgata tree number 126

Age: Mature

Condition: Reasonable

Comments: DBH 1.60m DRF 6.40m spread 8.30m height 8.26m
Bifurcation at base which is weak architecture with hollow pockets from aerial roots compensating for structural support.
Tree has noticeable rot pockets in old pruning wounds in lower and upper canopy, not a concern at this stage.
A good third of the tree is surrounded by cement to which the tree is impacting on. This will be a concern if cement is removed due to damage to tree roots and cause the tree to be structurally unsound for the tree has modified its roots and grown and established its root system to overcome the cement in the structural root zone.
The tree appears to be well maintained with regular crown reduction and crown lifting. If this regime is lapsed with more weighted limbs on extremities of the upper crown the wind shearing on the sail space will cause concerns with rot pockets throughout the crown therefore being structurally unsound.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 127

Age: Mature

Condition: Poor

Comments: DBH 3.47m DRF 4.70m spread 5.30m height 13.76
Bifurcation with included bark running down to ground level or below, (require further inspection with resistograph to be certain) but a concern due to being week union with enormous weight above being supported by weak architecture, as tree grows the weight on this union pulls either way pulling itself apart.
Fungus bracket also present at base suspect Russula Kalimna. Not aggressive but lives on dead wood which is an indication of a rot pocket at the base of this tree.
The foliage is of low vigour for this time of year which also a concern.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 129

Age: Mature

Condition: Poor

Comments: DBH 1.78m DRF 2.84m spread 5.90m height 11.20m
Bifurcation at base running up to 1m above ground level. Weak union prone to failure especially in bad weather, wind shear and weighted canopy support by poor architecture. High risk hazard in the future.
Upper crown has low vigour. This could be root disturbance or a root disorder from soil compaction.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 130 and tree 131.

Age: Semi Mature

Condition: Reasonable

Comments: DBH 1.50m DRF 1.70m spread 4.90m height 10.78m measurements taken from tree 130 the larger of the two. (canopy's interlocked).
Both trees have either had storm damage or are suffering from crown die back. Both main leaders have been removed significantly with large wounds as evidence.
Low in vigor in upper canopy with large diameter deadwood present. Indications of root damage or another form of root disorder.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 132

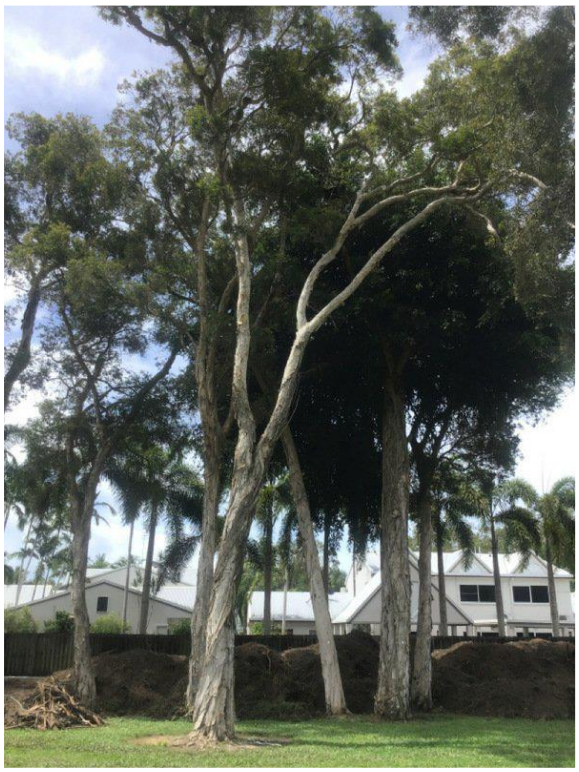
Age: Mature

Condition: Poor

Comments: DBH 1.66m DRF 2.18m spread 8.70m height 10.87m
Large cavity at base 0.80m in length,0.17m in width, knocked with sounding hammer and decay would be extensive, great sap wood around wound indicating wound repair is good but the extent of wound is too extensive for this tree to remain structurally sound.

Recommendations: Removal

Priority: High



Species: Melaleuca leucadendra tree number 133

Age: Mature

Condition: Poor

Comments: DBH 1.30m DRF 1.92m spread 13.87m height 10.32m
Has large cavity at base and runs below ground level over half the tree at base is compromised. Has the potential to impact on infrastructure on neighboring property.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 134

Age: Mature

Condition: Poor

Comments: DBH 2.34m DRF 2.75m spread 14.04m height 14.84m
Has large cavity at base size of cavity indicates high percentage of wood is unsound.
Would require resistogram to determine exact percentage but sounding hammer also indicates tree is compromised.
Fig has also colonised upper canopy adding more weight and strain from wind shearing.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree number 135

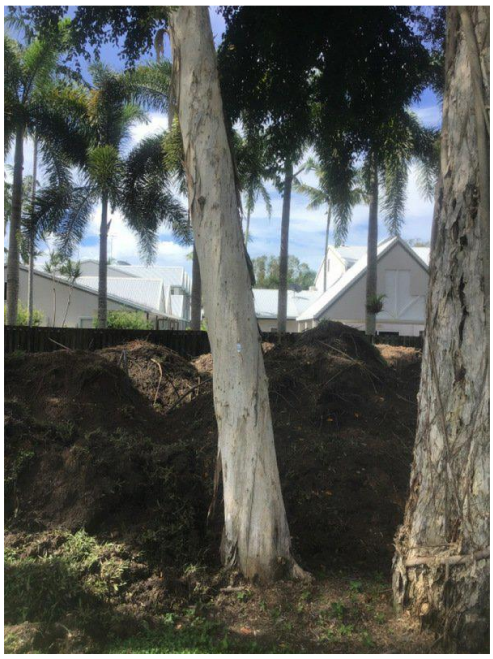
Age: Mature

Condition: Poor

Comments: DBH 1.23m DRF 1.62m spread 7.30m height 13.62m
Has small cavity at base with root damage and cambium die back. Not biological but mechanical damage in the past, estimated damage is a third on the north side at base is compromised. Has a swept crown towards the northeast being weight on the lee ward side of tree.

Recommendations: Removal

Priority: High



Species: Melaleuca leucadendra tree number 136

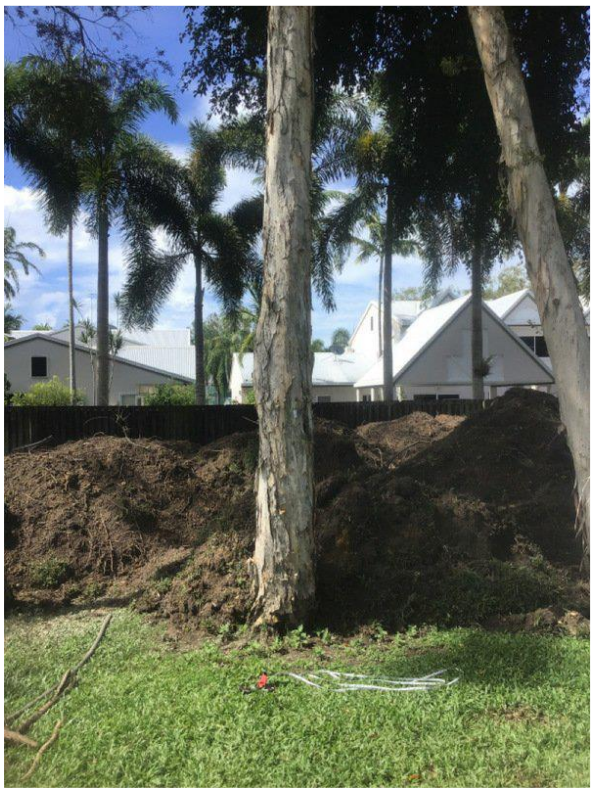
Age: Mature

Condition: Poor

Comments: DBH 1.26m DRF 1.54m spread 5.10m height 11.23m
Has cavity on north side suspect mechanical damage from the past. This has compromised the structural integrity of the tree. Will only progress, making it a high-risk hazard.

Recommendations: Removal

Priority: High



Species: Melaleuca leucadendra tree number 137

Age: Mature

Condition: Poor

Comments: DBH 1.26m DRF 1.74m spread 4.90m height 9.15m
Has large cavity at base north side at ground level. Approximately a third in percentage on lee ward side tree. Suspect mechanical damage from the past.

Recommendations: Removal

Priority: High

Species: Melaleuca leucadendra tree numbers 138-139-140,141.

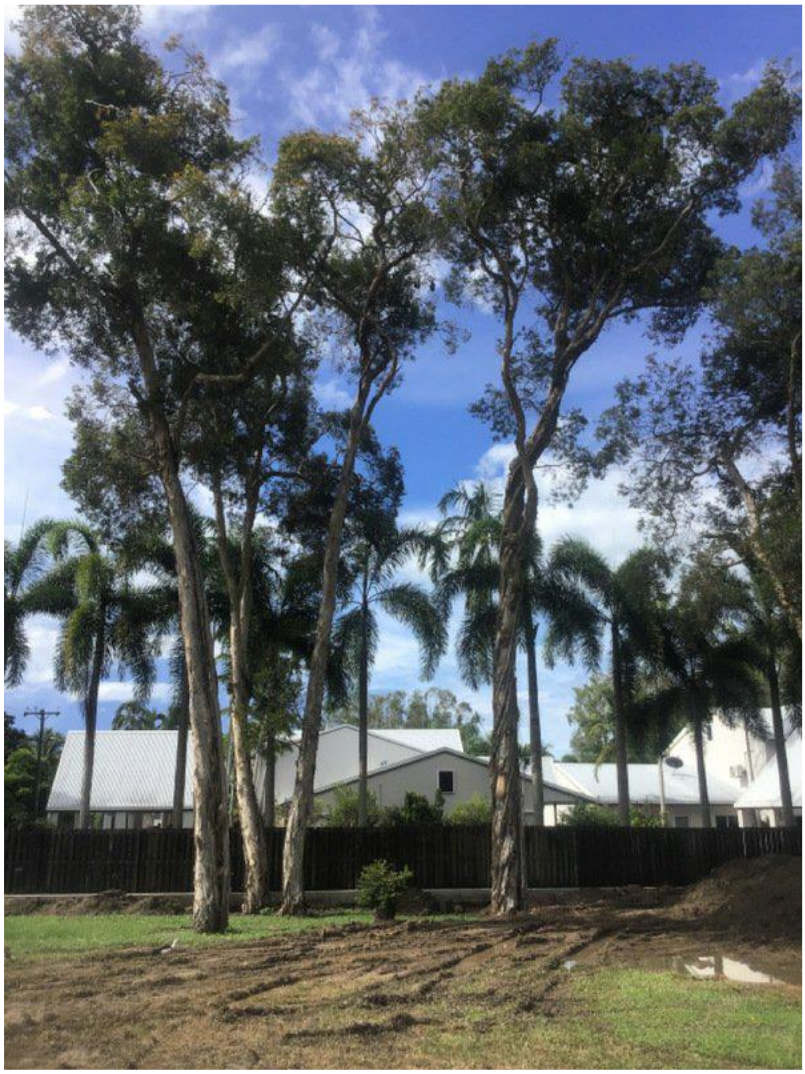
Age: Mature

Condition: Reasonable

Comments: DBH 2.10m DRF 2.43m spread 6.90m height 14.82m measurements taken from tree 138 the largest of the trees.
Trees appear to be sound with no major defects. They will require a tree protection zone before works. This is a TPZ of 15m with room for 10% encroachment into the TPZ if there is 10% compensation for the encroachment into the TPZ elsewhere. This is in keeping with the AS4970-2009 protection of trees on development sites.
The storage of soil and excavations in this area is not allowed.
Raising soil level isn't permitted in this area.
Refer to Tree protection plan and tree protection zone summary.

Recommendations: Dead Wood, Crown lift, Rebalance, Crown Shape, Monitor

Priority: High



11 Recommendations and Observations

Assessed as an extended group, surveyed tree is currently in reasonable and poor condition. A total 17 trees assessed 2- figs 15 melaleuca leucadendra.. 13 trees to be removed tree numbers 124-137 and 4 trees to be retained tree numbers 138-141. The 13 trees to be removed were deem unsuitable for long term retention due to health defects, these mainly being root related disorders or major wound cavities from the past making them structurally unsound. The major consideration being land use change from open private land with no risk of harm from failing to residential land use .The option of a planting scheme is more desirable than trying to maintain trees in ill health.

If contractors are to be engaged for remedial work, they should be fully qualified and experienced, being able to demonstrate a comprehensive OHS policy specific to tree work, with relevant insurances in place.

Appendix 1: Index of Arboricultural terms used

Amenity	**The quality of being pleasant or agreeable**
Arboriculture	The culture and management of trees as groups and individuals, primarily for amenity and other non-forestry purposes
Assessment	In relation to tree hazards, the process of estimating the risk that a tree or group of trees poses to persons or property
Basal Area	Area of tree around stem base, including visible buttress roots
Bifurcated	A tree with two main stems
Biomechanics	Mechanical loading of the tree's structure
Branch collar	A swelling at the base of a branch
Buttress roots	Angled roots at stem base
Cable braces	Branch or stem supporting system
Clean out	Removal process of dead, dying and diseased branches
Crown	The part of the tree comprising of limbs, branches and foliage
Crown lifting	Remove lower branches to a specified height
Crown reduction	Reduce the overall size of the crown proportionally
Crown spread	Distance from stem to crown edge
Crown thinning	The reduction of the volume of a crown without changing the overall height and spread. Often referred to as reducing the "sail area". The extent of thinning is dependent on tree species, tree health and site requirements
D.B.H	Tree diameter measured at breast height (approximately 1.5m)
Dead wood	Dead branches and stubs
Decline	A deterioration of a tree's general condition and vigour
Defect	In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of stress
Dieback	The death of part of a tree, often progressive
D.R.F	Diameter of root flare, diameter measured immediately above root buttress
Epicormic growth	Growth arising on mature stems, often following previous pruning or injury.
Failure	In relation to tree hazards, a partial or total fracture of wood or loss of cohesion between tree and soil
Formative Pruning	Selective pruning to promote good future shape and integrity
Included Bark	Branch union where there is bark to bark contact which results in a structural weakness.
Leader	Dominant Stem
Lopping	Removal of branches, now generally applied to heavy or excessive trimming
Multi stemmed	A tree with many main stems
Phototropic lean	Lean due to a tree's growth towards available light.
Root Plate	The base of the tree stem with major support roots
Slime Flux	Liquid exudation from the tree, bacterial based
S.R.Z	Structural root zone (the woody root growth and soil cohesion in this area for structural stability)
Sucker Growth	Growth from stem base and/or exposed roots
Topping	The removal of all or a large portion of a tree's canopy
T.P.O	Tree Preservation Order
T.P.Z	Tree Protection Zone (specified area for the protection of roots and crown for viability and stability)

Trifurcated	A tree with three main stems

Appendix 1: Index of Arboricultural terms used

V.T.A	Visual Tree Assessment
Vigour	Ability of a tree to sustain its life processes
Widow maker	Dead unattached branches in tree
Witch's Broom	Foliage disorder resulting in clustered and dense area of twigs
Q.T.R.A	Quantified tree risk assessment
P.O.F	Probability of failure
R.O.H	Risk of acceptable harm

Appendix 2: Tree Protection Zone Summary

The tree protection zone (TPZ) is the principal means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable.

When determining potential impacts of encroachment into the TPZ, we should consider the following:

a) Location and distribution of the roots to be determined through non-destructive investigation methods (pneumatic, hydraulic, hand digging or ground penetrating radar). Photographs should be taken and a root zone map prepared.
b) Potential loss of root mass resulting from the encroachment: number and size of roots.
c) Tree species and tolerance to root disturbance
d) Age, vigour and size of tree
e) Lean and stability of the tree
f) Soil characteristics and volume, topography and drainage
g) The presence of existing or past structures or obstacles affecting root growth
h) Design factors

Tree sensitive construction measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling can minimize the impact of encroachment.

When siting a structure near to a tree, the future growth of the tree, both above and below ground should be considered. Precautions should be taken at the planning and design stage to minimize potential conflict between trees and new structures.

When the reach structure is reactive clay, techniques such as localised pier and beam (bridged), screw pile footings or root and soil moisture control barriers may be appropriate to minimize effects on structures.

The structural root zone (SRZ) is the area required for tree stability. A larger area is required to maintain a viable tree.

Some factors of the SRZ are tree height, crown area, soil type and soil moisture. These may influence built structures such as rocks and footings. The most common cause of damaged trees on development sites is root damage, as roots are far more extensive and closer to the surface than commonly thought. When using, heavy machinery is it important to take due care not only to not damage the tree directly, but to avoid soil compaction as this will suffocate the tree.

Crown Protection

Tree crowns may be injured by machinery and the removal of surrounding trees. Where crown protection is required it will be usually located at least one metre outside the drip line of the crown. Crown protection may include pruning, tying back of branches or other measures. If pruning is required, this should be undertaken before the establishment of the tree protection zone.

The TPZ is a restricted area usually delineated by protective fencing. This is installed prior to site establishment and retained intact until completion of work.

Some works and activities within a TPZ may be authorised by the determining authority. These may be supervised by the project arborist. Any additional encroachment that becomes necessary as the site works progress must be reviewed by the project arborist and be acceptable to the determining authority before being carried out.

Approved tree removal and pruning should be carried out before the installation of tree protection measures.

Activities restricted within the TPZ include but are not limited to –

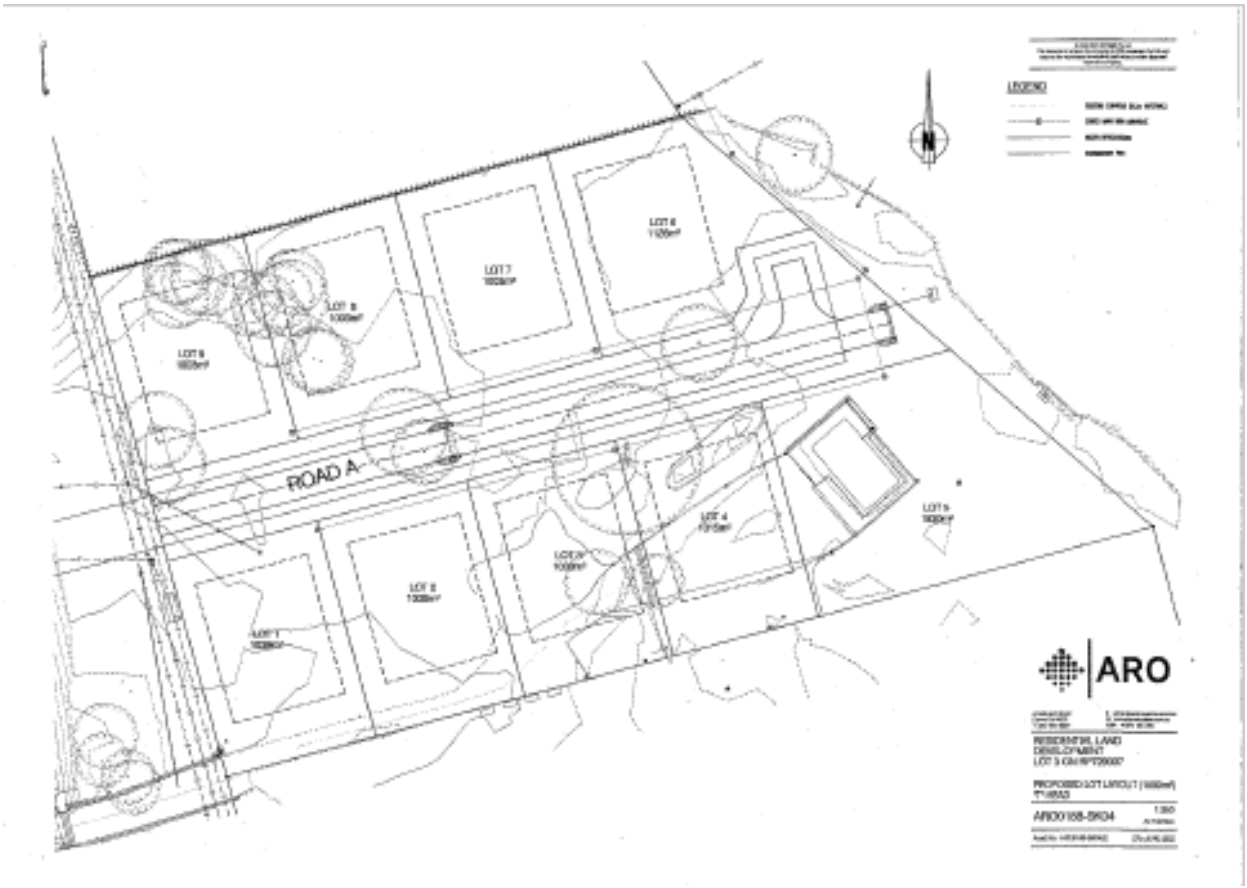
a) Machine excavation including trenching
b) Excavation for silt fencing
c) Cultivation
d) Storage
e) Preparation of chemicals, including preparation of cement products
f) Parking of vehicles and plant
g) Refuelling
h) Dumping of waste
i) Wash down and cleaning of equipment
j) Placement of fill
k) Lighting of fires
l) Soil level changes
m) Temporary installation of utilities and signs
n) Physical damage to the tree

Protective fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval from the project arborist. The TPZ should be secured to restricted access.

The negative impacts of inadequate development design, planning and supervision are cumulative and very difficult to remediate after development is completed. The best way to ensure the long-term retention of established trees is to follow the guidelines of the Australian Standards AS 4970-2009. (Reference material in Tree Protection Zone taken from AS 4970-2009).

References:

- Pirones Tree maintenance 7th addition
- Dr Alex Shigo – Pruning amenity trees
- AS 4373-2007 Pruning of amenity trees
- AS 4970-2009 – Tree protection on construction sites
- Diagnosis of Ill health in trees By R.G Strouts and T.G Winter (Forestry commission)
- The body language of trees (A handbook for failure analysis) by Claus Mattheck and Helge Breloer, edited by David Lonsdale from a translation by Robert Strouts


ROAD A
LOT 7
LOT 6
LOT 5
LOT 4
LOT 3
LOT 2
LOT 1
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