



# 10-12 Boondah Road Warriewood Traffic Impact Assessment

Prepared for:  
Henroth Group

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The Transport Planning Partnership

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# 10-12 Boondah Road Warriewood

## Traffic Impact Assessment


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## References

AECOM (2011), *Warriewood Valley Strategic Transport Review*.

Northern Beaches Council (2018), *Warriewood Valley Roads Masterplan*.

Northern Beaches Council (effective 1 September 2018), *Warriewood Valley Development Contributions Plan* (Amendment 16, Revision 3)

Pittwater Council (effective 13 January 2018), *Warriewood Valley Strategic Review Addendum Report*.

Pittwater Council, *Pittwater 21 Development Control Plan*.

Roads and Traffic Authority (2002), *Guide to Traffic Generating Developments*.



# 1 Introduction

This report has been prepared on behalf of Henroth Group to present the findings of an assessment of the transport implications of a Planning Proposal to rezone the land at 10-12 Boondah Road at Warriewood. A Concept Plan for the Planning Proposal has been prepared comprising 44 terrace-style residential dwellings including four affordable housing dwellings, and vehicular access via three internally connected roadways to and from Boondah Road. The Planning Proposal site lies within the Warriewood Valley Land Release Area, and has a recommended land use designation for “Active Recreation”.

The remainder of this report is set out as follows:

- Section 2 describes the background road transport environment and planning context in the vicinity of the subject site, including peak period traffic volumes, public transport accessibility and operating characteristics of key intersections.
- Section 3 describes the Planning Proposal.
- Section 4 presents the assessment of the implications of the Planning Proposal on the road transport environment, including its peak period traffic generation, the proposed internal road layout and access to the public road network, the future operation of intersections and on-site parking provision.
- Section 5 presents the conclusions of the study.

## 2 Background Conditions

### 2.1 Site Location

The subject site is located at 10-12 Boondah Road, Warriewood, and lies on the western side of Boondah Road south of Spine Bill Drive as shown in Figure 2.1. It is located within the Northern Beaches Council local government area.

### 2.2 Planning Context

A staged land release was commenced in Warriewood Valley in 1997, and now encompasses an anticipated 2,544 dwellings<sup>1</sup>, associated facilities and infrastructure and 3.7 hectares of employment-generating development. Properties not already rezoned and developed in accordance with Sector Masterplans are now subject to the controls and recommendations contained in the *Warriewood Valley Strategic Review Addendum Report*.

The subject site lies at the northern end of the Southern Buffer Area of the Warriewood Valley Land Release Area, as shown in Figure 2.1. The currently recommended land use designation for the subject site is "Active Recreation". The subject site is included in the land to which the *Warriewood Valley Development Contributions Plan* (Amendment 16, Revision 3) applies. That Plan notes that this land "could be embellished and integrated with the existing playing fields in Boondah Road." Should Council not purchase and embellish the land, one option presented is that Council would "further embellish the existing active recreation areas with the view to upgrading the playing surfaces to a higher standard to facilitate more intensive usage (for example, replacing a turf playing surface with a synthetic surface to allow 7 days per week continued usage regardless of weather conditions and in turn, facilitate increase in number of users)." Council has purchased and developed 3 Boondah Road with new hardcourts, but has not been successful in purchasing the other potential active open space site including the subject site.

The *Warriewood Valley Roads Masterplan* presents requirements for road cross-sections, traffic calming and management measures, pedestrian and cycle routes to be implemented in the Warriewood Valley Urban Release Area. That masterplan identifies the following measures in the vicinity of the subject site that have not yet been completed:

- Boondah Road to be widened and raised above the 5% AEP storm event level adjoining new land release development, and widened and strengthened (not necessarily above flood levels) adjoining existing zoned land and public open space;
- two-lane bridge with shared paths on both sides of the road on Boondah Road over Narrabeen Creek near Jacksons Road;

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<sup>1</sup> Source: <https://www.northernbeaches.nsw.gov.au/planning-and-development/planning-future/urban-release-and-renewal/warriewood-valley>



- Jacksons Road and Boondah Road is listed under priority intersection controls. In 2013, the intersection was upgraded from STOP sign control to a single-lane roundabout, retaining raised marked footcrossings with kerb blisters on the north and west approaches. The Works Schedule contained in the *Warriewood Valley Development Contributions Plan* includes upgrading of the roundabout although no details of the upgrade requirements are presented in the *Warriewood Valley Roads Masterplan*;
- traffic signal upgrades at the intersections of Pittwater Road with Warriewood Road and with Jacksons Road, and new traffic signals at the intersection of Mona Vale Road and Ponderosa Parade.

Draft Amendment 16 Revision 4 of the *Warriewood Valley Development Contributions Plan* proposes revising the total expected dwelling yield in the Warriewood Valley to 2,078 dwellings, down from the 2,394 dwellings assumed in the 2018 Contributions Plan and the 2,544 dwellings referred to on Council's website. This reduction in dwellings would result in a significant decrease in the volume of traffic compared with that assumed to generate the need for the road and intersection upgrades contained in the *Warriewood Valley Roads Masterplan*.

## 2.3 Road Network

The road network serving the site is described below.

**Boondah Road** provides a north-south link between Macpherson Street and Jacksons Road, and is identified as a Collector Street in the *Warriewood Valley Roads Masterplan*. It has a single travel lane in each direction, with a speed limit of 50 kilometres per hour (km/h) between Macpherson Street and the Northern Beaches Council Depot, reducing to a High Pedestrian Activity area 40 km/h limit between the Council Depot and Jacksons Road. The transition between the two speed limits is reinforced via a speed hump adjacent to the Council Depot.

The intersections of Boondah Road with Macpherson Street and with Jacksons Road are both controlled with a single-lane roundabout. Vehicular access to the residential development to the north of the subject site is provided via a private roadway known as Spine Bill Drive, which forms a cul de sac and intersects with Boondah Road via a driveway crossing at which all turning movements in and out are permitted.

**Jacksons Road** provides an east-west link between Pittwater Road and Garden Street. West of Boondah Road, it provides access to the Warriewood Square shopping centre and Northern Beaches Indoor Sports Centre. Jacksons Road has a single travel lane in each direction, with two eastbound lanes marked west of Boondah Road approaching Pittwater Road. It has a speed limit of 50 km/h to the east of Boondah Road, and is signposted with both a 40 km/h High Pedestrian Activity Area speed limit and a 40 km/h school zone speed limit west of Boondah Road. The *Warriewood Valley Roads Masterplan* nominates the intersection of Jacksons Road with Pittwater Road for upgrading, however does not provide



any specific upgrade requirements (noting a previous release nominated that an additional short left turn lane be provided in Warriewood Road).

**Macpherson Street** is identified as a Sub-Arterial Street in the *Warriewood Valley Roads Masterplan*. It has a single travel lane in each direction, and a posted speed limit of 50 km/h. Together with Ponderosa Parade and Warriewood Road, it provides a link through Warriewood Valley between Pittwater Road and Mona Vale Road. The intersections of Macpherson Street with Warriewood Road, Boondah Road, Gahnia Lane/Anglicare Warriewood Brook, Garden Street, Casuarina Drive/Forest Road and Ponderosa Parade/Ponderosa Small Business Centre are each controlled with single lane roundabout.

**Warriewood Road** is identified in the *Warriewood Valley Roads Masterplan* as a Sub-Arterial Street east of Macpherson Street, and a Collector Street north of Macpherson Street. It forms part of the subarterial link between Pittwater Road and Mona Vale Road, and a collector link between Mona Vale Road and Macpherson Street. It typically has a single travel lane in each direction, with a posted speed limit of 50 km/h. The *Warriewood Valley Roads Masterplan* nominates the intersection of Warriewood Road with Pittwater Road for upgrading, with the concept sketch suggesting the existing two eastbound and one westbound lane in Warriewood Road at the intersection would be widened to include an additional short eastbound lane and two westbound lanes.

**Pittwater Road** is a State Road (164) forming part of a link between Crows Nest and Palm Beach. In the vicinity of the subject site, Pittwater Road typically has three travel lanes in each direction, with a raised concrete median island, and posted speed limit of 70 km/h, reducing to 60 km/h on approach to Mona Vale Road. The southbound kerbside lane in Pittwater Road is a BUS LANE during weekday mornings (6am to 10am), and the northbound kerbside lane is a BUS LANE during weekday evenings (3pm to 7pm).

**Mona Vale Road** is a State Road (162) forming part of a link between Ryde and Mona Vale via Lane Cove Road, De Burghs Bridge, and Ryde Road. Through Warriewood, Mona Vale Road has a posted speed limit of 60 km/h, and has one or two eastbound travel lanes, and two westbound travel lanes, with additional lanes at major intersections. West of Warriewood, it narrows to a single travel lane in each direction. Its intersections with Pittwater Road, Bungan Street, and Foley Street are controlled by traffic signals.

## 2.4 Traffic Volumes

To quantify existing traffic conditions in the vicinity of the site, TTPP conducted surveys of intersection turning movements during AM and PM periods on Tuesday 5 April (PM) and Wednesday 6 April (PM) 2022 at the intersections of:

- Boondah Road and Jacksons Road
- Boondah Road and Macpherson Street
- Jacksons Road and Pittwater Road



- Warriewood Road and Pittwater Road; and
- Mona Vale Road and Pittwater Road.

The results of the traffic surveys are summarised in Appendix A. The overall busiest hour during the morning occurred between 8:00am and 9:00am, and the busiest hour during the evening occurred between 3:45pm and 4:45pm. Table 2.1 summarises the surveyed peak hour volumes at key locations.

**Table 2.1: Surveyed Peak Hour Volumes 2022 (vehicles per hour)**

Road and Location	AM Peak Hour 8:00am to 9:00am			PM Peak Hour 3:45pm to 4:45pm		
	Light Vehicles	Heavy Vehicles	Total Vehicles	Light Vehicles	Heavy Vehicles	Total Vehicles
Boondah Road North of Jacksons Road	374	12	386	368	4	372
Boondah Road South of Macpherson Street	362	11	373	342	3	345
Jacksons Road West of Boondah Road	812	32	844	1,181	29	1,210
Jacksons Road East of Boondah Road	874	40	914	1,197	26	1,223
Jacksons Road West of Pittwater Road	737	34	771	1,040	28	1,068
Macpherson Street West of Boondah Road	531	25	556	444	18	462
Macpherson Street East of Boondah Road	565	24	589	456	17	473
Mona Vale Road East of Pittwater Road	1,502	131	1,633	1,646	122	1,768
Pittwater Road North of Mona Vale Road	3,002	239	3,241	3,857	247	4,104
Pittwater Road South of Mona Vale Road	2,502	162	2,664	3,261	171	3,432
Pittwater Road North of Warriewood Road	2,346	140	2,486	2,674	160	2,834
Pittwater Road South of Warriewood Road	2,747	143	2,890	3,003	169	3,172
Pittwater Road North of Jacksons Road	2,705	141	2,846	3,172	154	3,326
Pittwater Road South of Jacksons Road	2,730	139	2,869	3,284	156	3,440
Warriewood Road East of Pittwater Road	942	26	968	823	12	835

The surveyed peak hour volumes demonstrate the dominance of Pittwater Road in the regional road network, carrying over 4,100 vehicles per hour north of Mona Vale Road.

Boondah Road currently carries approximately 350 to 390 vehicles per hour during the peak hours. This is consistent with the desired approximate upper limit of 5,000 vehicles per day for

its Collector Street status in the *Warriewood Valley Roads Masterplan*, with peak hour volumes typically being in the order of 8 to 12 percent of daily volumes.

Macpherson Street currently carries approximately 460 to 590 vehicles per hour during the peak hours. This is well below the desired approximate upper limit of 10,000 vehicles per day for its Subarterial Street status in the *Warriewood Valley Roads Masterplan*.

Warriewood Road east of Pittwater Road currently carries approximately 830 to 970 vehicles per hour during the peak hours. This is consistent with the desired approximate upper limit of 10,000 vehicles per day for its Subarterial Street status in the *Warriewood Valley Roads Masterplan*.

## 2.5 Public Transport

Regular bus services operate along Pittwater Road, Macpherson Street and Jacksons Road, including:

- Route 185 operates between Narrabeen and Mona Vale, travelling via Pittwater Road, Jacksons Road past Boondah Road, Garden Street, Macpherson Street past Boondah Road, Warriewood Road and Mona Vale Road;
- Route 182 operates between Narrabeen shops and Mona Vale via Elanora Heights and, North Narrabeen, travelling via Jacksons Road past Boondah Road, Garden Street, Macpherson Street, Ponderosa Parade, Samuel Street, and Waratah Street;
- Route 199 operates between Palm Beach and Manly via Pittwater Road;
- Route 190X operates between Avalon Beach and the City, with limited stops south of Narrabeen; and
- B-Line Route B1 operates between Mona Vale and the City, with park and ride car parks including adjacent to Rat Park at Warriewood.

Forest Coach Lines operates the following services along Mona Vale Road:

- Route 196 between Gordon and Mona Vale; and
- Route 197 between Macquarie University and Mona Vale, via Gordon.

Table 2.2 summarises frequencies of the bus services in the area during peak periods.

**Table 2.2: Bus Frequencies**

Route Number	Route Name	AM Frequency	PM Frequency
182	Mona Vale to Narrabeen	1 per hour	1 per hour
185	Mona Vale to Narrabeen via Warriewood Valley	2-3 per hour	2-3 per hour
199	Manly to Palm Beach via Dee Why	5-7 per hour	6 per hour
190X	Avalon Beach to City Wynyard	4 per hour	1 per hour
B1	B-Line Mona Vale to City Wynyard	7-11 per hour	7-10 per hour
196	Mona Vale to Gordon	2 per hour	2 per hour
197	Mona Vale to Macquarie University via Gordon	2 per hour	2 per hour

Source: General Transit Feed Specification for NSW, data valid at 02/05/22

## 2.6 Background Traffic Changes

### 2.6.1 Potential Local Area Development Traffic

The *Warriewood Valley Strategic Transport Review* was released in 2011, and assessed the road network implications of various levels of development in the Warriewood Valley based on committed and proposed development opportunities relevant at that time. That assessment recommended the following mitigation measures relevant to development of the Southern Buffer in addition to development of 40 dwellings per hectare for undeveloped land across Warriewood Valley (at that time):

- Development of 18,000m<sup>2</sup> GFA retail, 2,000m<sup>2</sup> commercial and 80 dwellings in the Southern Buffer (generating 350 vehicle trips per hour in the AM peak and 688 vehicle trips per hour in the PM peak), lengthen the right turn bay in Pittwater Road northern approach to 200m at the Jacksons Road intersection.
- Development of 25,000m<sup>2</sup> GFA retail, 30,000m<sup>2</sup> bulky goods, 5,000m<sup>2</sup> commercial and 160 dwellings in the Southern Buffer (generating 1,110 vehicle trips per hour in the AM peak and 1,587 vehicle trips per hour in the PM peak), new 140m right turn bay in Pittwater Road northern approach to Jacksons Road, additional lane on Jacksons Road creating two westbound lanes, additional 70m unsignalised left slip lane from Jacksons Road to Pittwater Road, and remarking the eastbound lanes on Jacksons Road to create a double right turn.

No update to the *Warriewood Valley Strategic Transport Review* has been released relating to the *Warriewood Valley Strategic Review Addendum Report* or revision of the *Warriewood Valley Roads Masterplan*, which includes requirements for intersection upgrades, including at the intersection of Pittwater Road and Jacksons Road as described in Section 2.2.

The *Warriewood Valley Strategic Review Addendum Report* identified sectors within the Warriewood Valley that remain undeveloped. Table 2.3 summarises the results of that review, updated by TTPP, with reference to the maximum dwelling yields set out in the Pittwater LEP.

**Table 2.3: Development Potential in Warriewood Valley**

Sector	Comments	Pittwater LEP 2014
Sectors 201, 204, 702, 901H, 10A.1 and 10A.2	Undeveloped and limited capacity for development due to various constraints	-
Sector 202	Little potential for future development, low density development subject to access and topography constraints	Not more than 1 dwelling
Sector 203	Access constrained by ROW and site is bushfire prone.	Not more than 4 dwellings
Sector 10B	Currently 1 dwelling	Not more than 45 dwellings or less than 28 dwellings
Sector 10C	Developed as seniors living, has potential for redevelopment at similar scale to neighbouring developments	Not more than 17 dwellings
901D and 901E	-	Not more than 16 dwellings
901C, 901G and 9 Fern Tree Road	-	Not more than 33 or less than 26 dwellings
Sector 801	Residential townhouses and Focal Neighbourhood Centre now constructed. No further development expected.	-
120 and 122 Mona Vale Road	120 Mona Vale Road rezoned as part E4 Environmental Living, R2 Low Density Residential and E2 Environmental Conservation, and 122 Mona Vale Road rezoned E2 Environmental Conservation	Yield subject to DCP
Sector 301	Existing retail garden centre	Not more than 53 dwellings or less than 42 dwellings
Sector 303	-	Not more than 29 dwellings or less than 23 dwellings
Buffer 2	Anglican Retirement Village, unlikely to be redeveloped in short to medium term. No further yield expected.	-
Buffer 2A	-	Not more than 29 dwellings or less than 20 dwellings
Buffer 1B	Application lodged and withdrawn for 21 dwelling subdivision at 53A Warriewood Road DA2021/1478	Not more than 24 dwellings or less than 17 dwellings
Buffer 1F, 1G, 1H	Application lodged for 34 residential terrace apartments at 43-49 Warriewood Road DA2021/2600	Not more than 45 dwellings or less than 31 dwellings (combined)
Buffer 1L	Aged care centre completed, part undeveloped, deferred consent for 43 townhouses and units DA2020/0579.	-
Buffer 1M	22 dwelling residential subdivision and road under construction 2022	-
Sector 802	Existing development precludes any future residential development	-
Employment sectors	Already zoned to permit employment generating land uses, redevelopment constrained due to size, typically requiring consolidation	-

Table 2.2 indicates that some potential development remains in the vicinity of the Southern Buffer Area, including sites within Buffer Area 1, accessed via Warriewood Road north of Macpherson Street, and Sectors 301, 303 accessed via Macpherson Street west of Boondah Road, and Buffer 2A and 1M accessed via Macpherson Street east of Boondah Road.

To account for the potential trip generation of those under-developed lands on roads in the vicinity of the subject site, vehicle trips expected to be generated by those sites if developed have been estimated on the same basis used in the *Warriewood Valley Strategic Transport Review*, which applied a rate of 0.65 vehicle trips per dwelling per hour during the morning and evening peak hours. For the purpose of this assessment, the potential generation of Sector 301 has not been considered, as it is expected that the garden centre would be generating comparable trips as would be generated if the site was developed for residential use.

**Table 2.4: Additional Residential Trip Generation**

Sites	Approximate Yield (dwellings)	Vehicular Access to Public Roads	Vehicle Trip Generation (vehicles per hour)
Buffer 1B, 1F, 1G, 1H, 1L (part)	24+34+43+22 = 123	Warriewood Road north of Macpherson Street	80
Buffer 2A and 1M	29+22 = 51	Macpherson Street east of Boondah Road	33
Sector 303	29	Macpherson Street west of Boondah Road	19
<b>Total</b>			<b>132</b>

Using a similar trip distribution as that applied in the *Warriewood Valley Strategic Transport Review* for potential residential developments, the additional residential trips are estimated to be spread on the local road network as summarised in Table 2.5 during the peak hours.

**Table 2.5: Additional Peak Hour Trips Resulting from Local Developments (vehicles per hour)**

	AM Peak Hour	PM Peak Hour
Boondah Road south of Macpherson Street	30	28
Jacksons Road west of Boondah Road	21	20
Jacksons Road east of Boondah Road	9	8
Macpherson Street west of Boondah Road	18	17
Warriewood Road east of Macpherson Street	12	11

With this additional traffic, Boondah Road would be expected to carry up to approximately 420 vehicles per hour during the peak hours, which is consistent with the volumes expected for its Collector Street status in the *Warriewood Valley Roads Masterplan*.



With the additional local development traffic, Macpherson Street would be expected to carry currently up to approximately 610 vehicles per hour during the peak hours, which remains well below the desired volume for its Subarterial Street status in the *Warriewood Valley Roads Masterplan*.

With the additional local development traffic, Warriewood Road east of Pittwater Road would be expected to carry up to 980 vehicles per hour during the peak hours, which is consistent with the desired volume for its Subarterial Street status in the *Warriewood Valley Roads Masterplan*.

## 2.6.2 Background Traffic Growth

TTPP has reviewed Annual Average Daily Traffic (AADT) data collected by TfNSW on Pittwater Road and Mona Vale Road, which is summarised in Table 2.4, noting the 2022 data is limited.

**Table 2.6: Annual Average Daily Traffic**

Year	Pittwater Road North Narrabeen Station 55028	Mona Vale Road Ingleside Station 57024
2008	57,007	-
2009	56,750	31,025
2010	55,429	31,834
2011	-	30,981
2012	57,203	30,857
2013	57,493	31,192
2014	56,715	-
2015	57,758	32,721
2016	58,499	33,317
<b>2017</b>	<b>58,781</b>	<b>34,122</b>
2018	58,244	34,020
2019	57,363	33,488
2020	54,536	31,303
2021	52,280	27,984
2022	42,956 (Jan)	27,267 (Mar)

The AADT data demonstrates that traffic volumes on the main roads serving the Northern Beaches have steadily declined since peaking in 2017. While some reduction in travel would be expected during 2020-21 due to travel restrictions, the decline in AADT commenced prior to that period, noting that the B-Line rapid bus service commenced operating between Mona Vale and Wynyard in late 2017.

## 2.7 Operation of Intersections

The surveyed intersections have been analysed using SIDRA INTERSECTION 9, an analysis program which determines characteristics of intersection operating conditions including the degree of saturation, average delays, and levels of service. The degree of saturation, or x-value, is the ratio of the arrival rate of vehicles to the capacity. The average delay, expressed in seconds per vehicle, is measured over all movements at signalised intersections, and over the movement with the highest average delay at roundabout and priority intersections. Average vehicle delay is the commonly used measure of intersection performance defined by TfNSW (RTA, 2002). Table 2.2 shows the criteria adopted by TfNSW for assessing the level of service.

**Table 2.7: Intersection Level of Service Criteria**

Level of Service (LoS)	Average Delay per vehicle (sec/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

*Adapted from RTA (2002)*

Table 2.3 summarises the results of the analyses of the intersection operating conditions under the surveyed traffic demands, and with the additional traffic expected to be generated by likely developments as described in Section 2.6. Due to the proximity of the intersections of Jacksons Road with Boondah Road and with Pittwater Road, those intersections were modelled together using SIDRA's network functionality.

**Table 2.8: Surveyed and Baseline Operating Conditions of Surveyed Intersections**

Intersection	Control	Degree of Saturation		Average Delay (sec/veh)		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2022 Surveyed							
Boondah Road and Jacksons Road	Roundabout	0.837	0.910	15	8	B	A
Jacksons Road and Pittwater Road	Signals	0.748	0.841	24	28	C	C
Boondah Road and Macpherson Street	Roundabout	0.263	0.213	10	10	A	A
Warriewood Road and Pittwater Road	Signals	0.662	0.689	24	27	B	B
Mona Vale Road and Pittwater Road	Signals	0.804	0.948	33	40	C	C
2022 Baseline Surveyed Plus Expected Local Developments <sup>A</sup>							
Boondah Road and Jacksons Road	Roundabout	0.971	0.926	24	8	C	A
Jacksons Road and Pittwater Road	Signals	0.754	0.851	25	28	C	C
Boondah Road and Macpherson Street	Roundabout	0.295	0.238	10	10	A	A
Warriewood Road and Pittwater Road	Signals	0.682	0.707	25	29	B	C
Mona Vale Road and Pittwater Road	Signals	0.818	0.949	33	39	C	C

<sup>A</sup> No allowance has been made for traffic generated by potential active recreational use of the subject site.

The results indicate that the surveyed intersections all operate at an acceptable Level of Service (LOS C or better) based on intersection delays, both with and without the expected local developments. It is noted however that the degree of saturation is high at some intersections, meaning that those intersections are operating near capacity:

- Boondah Road and Jacksons Road – the eastern approach has a high degree of saturation during peak periods, with high demands for through movements in both directions along Jacksons Road during the PM peak.
- Mona Vale Road and Pittwater Road – a number of movements are operating close to capacity in the PM peak, including the right turn from Pittwater Road to Mona Vale Road, the right turn from Mona Vale Road to Pittwater Road, and the northbound through movement.

### 3 Planning Proposal

The Concept Plan for the site envisages rezoning of the land at 10-12 Boondah Road from its current RU2 Rural Landscape zoning, and development of 44 terrace-style residential dwellings including four affordable housing dwellings, supported by internal roads linking to Boondah Road.

Three vehicular connections to Boondah Road are proposed, with the central intersection being controlled with a single lane roundabout. The northern and southern intersections would be priority-controlled, with only left turn movements into the northern access which would be for one way inbound traffic only, and only left turns out of the southern access which would be for one way outbound traffic only. The central access road would be for two-way traffic, and the roundabout would facilitate right turn access into and out of the site for residents and visitors.

The Concept Plan is presented in Appendix B.

## 4 Implications of the Planning Proposal

### 4.1 Traffic Generation

The traffic generation of the Concept Plan development has been estimated using the trip generation rates presented in the RTA's (now TfNSW) *Guide to Traffic Generating Developments*. That document recommends a rate of 0.5 to 0.65 vehicle trips per dwelling per hour during the morning and evening peak hours for medium density residential dwellings, and for the purpose of this assessment, the higher rate has been applied. This is consistent with the rates used in the *Warriewood Valley Strategic Transport Review*, which assessed the feasibility of development opportunities in the undeveloped land parcels in the Warriewood Valley Urban Release Area. That study assumed 90 percent of residential trips would depart and 10 percent would return to the area in the morning peak, with the reverse in the evening peak.

On this basis, the 44 dwellings proposed in the Concept Plan would be expected to generate 29 vehicle trips per hour (rounding up), of which 26 trips would be in the peak direction and 3 trips would be in the contra peak direction.

By way of comparison, under the recommendations of the *Warriewood Valley Strategic Review Addendum Report*, it would be expected that the subject site may be developed for active recreation with additional playing field(s) or other sporting infrastructure (e.g., netball courts, cricket nets, tennis courts). The trip generation of such facilities would be dependent upon the nature of the facilities and their operational management. If used by local community sports teams for games and training sessions, it would be expected that the site would be used on a formal basis during weekday evenings and weekdays, and on a less formal basis on weekday mornings. A single netball court would attract in the order of 10 to 12 people for a formal training session, or double that for a game. The vehicular trip generation of active recreation facilities during formal activities could reasonably be considered comparable to that of the Concept Plan, and potentially more intense, with trips generated in short periods at the end of formal games or training sessions.

So while the *Warriewood Valley Strategic Transport Review* has not specifically considered future trip generation of the Planning Proposal, it has also not considered the comparable future trip generation of active recreation use of the site as recommended in the *Warriewood Valley Strategic Review Addendum Report*.

### 4.2 Traffic Distribution

The *Warriewood Valley Strategic Transport Review* assessed likely trip distributions to and from Warriewood Valley based on Journey to Work data. That found that commuter journeys from the Pittwater area are to nearby areas and major employment regions within the subregion, while commuter trips to Pittwater have their origins in nearby areas. For the purpose of this



assessment, a similar distribution has been applied to the traffic expected to be generated by the Concept Plan, with the trips internal to the local area allocated to the route between the subject site and the nearby Warriewood Square shopping centre. Table 4.1 summarises the estimated distribution of the trips generated by the Concept Plan during peak hours.

**Table 4.1: Concept Plan Trip Distribution (vehicles per hour)**

	South via Pittwater Road	North via Pittwater Road	West via Mona Vale Road	Internal	Total
<b>AM Peak</b>					
Inbound	1	1	1	0	3
Outbound	13	3	6	4	26
<b>PM Peak</b>					
Inbound	11	5	6	4	26
Outbound	2	0	1	0	3

### 4.3 Impact on Traffic Volumes

Considering the peak hour trips expected to be generated by the Concept Plan, and its distribution on the surrounding road network, the Concept Plan would be expected to increase peak hour traffic volumes on key roads as shown in Table 4.2.

**Table 4.2: Additional Peak Hour Trips Resulting from the Concept Plan (vehicles per hour)**

	AM Peak Hour	PM Peak Hour
Boondah Road north of Site	11	12
Boondah Road south of site	18	17
Jacksons Road west of Boondah Road	4	4
Jacksons Road east of Boondah Road	14	13
Macpherson Street west of Boondah Road	7	7
Macpherson Street east of Boondah Road	4	5

With the additional traffic generated by the Concept Plan, traffic volumes on the access roads would remain consistent with their desired ranges according to their status in the hierarchy outlines in the *Warriewood Valley Roads Masterplan*.

## 4.4 Internal Road and Access Design

The Concept Plan proposes internal (private) roadways that connect to Boondah Road, and also provide direct access to individual properties/garages. The Concept Plan layout allows for footpaths, however the internal roads may also be appropriately be developed as a shared road space environment without dedicated footpaths, i.e., in which the road space is shared by pedestrians, cycles and vehicles.

The *Warriewood Valley Roads Masterplan* does not include a specific road cross-section guideline relevant to a private shared carriageway on which parking is not permitted. The Masterplan's "Access Street" permits on-street parking on one side of the street, with a separate footpath. The Masterplan's "Laneway" has similarities with the proposed internal roads, being a shared roadway for two way traffic, pedestrians and cyclists with a 10 km/h shared zone speed limit. The Concept Plan proposes that the internal roads have a nominal carriageway width of 6.0 m within a 9.0 m wide reserve, with the carriageway widened on bends to assist vehicle manoeuvrability. This road width allows for a moving car to pass a truck, but is clearly too narrow for cars to park opposite each other without blocking the street. It exceeds the minimum requirements for "Laneway" widths contained in the Masterplan. Dedicated parking bays are proposed along the internal roads, which would allow for car parking to occur clear of the travel path of vehicles. Some minor amendments to the Concept Plan layout of these parking bays is recommended for compliance with the parking bay length requirements contained in Australian Standard 2890 (see Appendix C).

Appropriate signposting and linemarking to provide effective management of traffic and parking associated with the site would be identified during detailed design.

TPP has undertaken swept path analyses of the internal road network for a Heavy Rigid Vehicle (HRV) design vehicle, being a 12.5m long rigid truck in accordance with Australian Standard 2890.2 (2018). This is the largest vehicle expected to require access on the internal road network, and is consistent with pre-lodgement request from Council. The results are presented in Appendix C, and demonstrate that the Concept Plan layout permits access for an HRV throughout the site. The internal road network would therefore adequately cater for garbage collection, removalists/delivery trucks and emergency vehicles.

Sight distances at the proposed intersection locations have been observed on-site, and compared with Austroads requirement for Safe Intersection Sight Distance (SISD). SISD provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation and to decelerate to a stop before reaching the collision point. For the posted speed limit of 50 km/h, the general requirement for SISD on level roads is 97m.

Northbound drivers approaching on Boondah Road would be able to observe a vehicle waiting to exit the southern access road or slowing to turn into the northern access from a distance exceeding 150m, noting that there would be no conflict between the southbound vehicles on Boondah Road and the vehicles entering or exiting the development via left turns

(only) at the two minor accesses. Nevertheless, sight distance for southbound drivers to observe vehicles at the proposed minor accesses exceeds the SISD requirement. Sight distances to and from the proposed roundabout also exceed the required SISD in all directions.

The Concept Plan layout provides two vehicular evacuation points for vehicles exiting the site and travelling north along Boondah Road to Macpherson Street in the event of a flood evacuation.

## 4.5 Future Operation of Intersections

To quantify the impact of the Concept Plan on intersections, the operating characteristics of the surveyed intersections have been reassessed using SIDRA INTERSECTION 9, with the additional traffic expected to generated by the proposed development, and together with the background changes as discussed in Section 2.6. The results of the analyses are summarised in Table 4.2.

**Table 4.3: Impact of Concept Plan Traffic on Operating Conditions of Intersections**

Intersection	Control	Degree of Saturation		Average Delay (sec/veh)		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2022 Baseline Surveyed Plus Expected Local Developments <sup>A</sup>							
Boondah Road and Jacksons Road	Roundabout	0.971	0.926	24	8	C	A
Jacksons Road and Pittwater Road	Signals	0.754	0.851	25	28	C	C
Boondah Road and Macpherson Street	Roundabout	0.295	0.238	10	10	A	A
Warriewood Road and Pittwater Road	Signals	0.682	0.707	25	28	B	B
Mona Vale Road and Pittwater Road.	Signals	0.818	0.949	33	39	C	C
2022 Baseline Plus Concept Plan <sup>B</sup>							
Boondah Road and Jacksons Road	Roundabout	0.979	0.941	27	8	C	A
Jacksons Road and Pittwater Road	Signals	0.765	0.851	25	28	C	C
Boondah Road and Macpherson Street	Roundabout	0.296	0.243	10	10	A	A
Warriewood Road and Pittwater Road	Signals	0.682	0.707	25	28	B	B
Mona Vale Road and Pittwater Road.	Signals	0.818	0.949	33	39	C	C
Boondah Road and Site Access <sup>B</sup>	Roundabout	0.179	0.141	9	9	A	A

<sup>A</sup> No allowance has been made for traffic generated by potential active recreational use of the subject site.

<sup>B</sup> Assumes all site-generated traffic uses the proposed roundabout as a robust assessment.

The results indicate that the surveyed intersections are forecast to operate at an acceptable Level of Service (LOS C or better), both with and without the expected local developments. The Concept Plan's traffic would have negligible impact on the average delays experienced at the intersections. As for the existing and baseline conditions, some movements would be expected to operate at close to capacity with the additional traffic generated by the Concept Plan.

As described in Section 2.6, traffic demands in the region have been steadily declining since 2017, thus the impact of the Concept Plan on the operation of the intersections has been considered with regard to its impact on the design life of the intersections should demands increase in the future. For the purpose of the comparison, an indicative linear growth rate of 1% per annum has been applied, and the nominal future year at which any movement reaches capacity is summarised in Table 4.3.

**Table 4.4: Years Until Capacity is Reached at 1% pa uniform growth on all movements**

Intersection	Control	Baseline <sup>A</sup>		Baseline plus Concept Plan	
		AM Peak	PM Peak	AM Peak	PM Peak
Boondah Road and Jacksons Road	Roundabout	10 years	0 years	10 years	0 years
Jacksons Road and Pittwater Road	Signals	10 years	0 years	10 years	0 years
Boondah Road and Macpherson Street	Roundabout	>20 years	>20 years	>20 years	>20 years
Warriewood Road and Pittwater Road	Signals	>20 years	>20 years	>20 years	>20 years
Mona Vale Road and Pittwater Road	Signals	14 years	7 years	14 years	7 years

<sup>A</sup> No allowance has been made for traffic generated by potential active recreational use of the subject site.

Table 4.3 demonstrates that the traffic generated by the Concept Plan would not shorten the design life of the surveyed intersections under the comparable growth scenarios. The Concept Plan traffic would therefore not introduce any additional need for intersection upgrades, nor changes to timing of any intersection upgrades accounted for in the *Warriewood Valley Roads Masterplan*. The subject site is included in the land to which the *Warriewood Valley Development Contributions Plan* (Amendment 16, Revision 3) applies, and so appropriate contributions would be made towards the relevant upgrades.

## 4.6 Car Parking

Car parking requirements for the Warriewood Valley are set out in the *Pittwater 21 Development Control Plan*, which indicates that multi-dwelling housing provide one off-street parking space per one-bedroom dwelling, and two off-street parking spaces per two or more bedroom dwelling. With the exception of the affordable housing dwellings, each dwelling is proposed to have three bedrooms, with two parking spaces, being one space in a garage and one off-street space between the footpath and garage.

Parking requirements for the affordable housing dwellings are set out in the *State Environmental Planning Policy (Housing) 2021*, which requires that for a development application not made by a social housing provider, one-bedroom dwellings be provided with 0.5 parking spaces, two-bedroom dwellings be provided with one parking space, and three (or more) bedroom dwellings be provided with 1.5 parking spaces. The mix of dwelling types for the affordable housing dwelling has not yet been determined, but is indicatively anticipated to be one three-bedroom dwelling, two two-bedroom dwellings and one one-bedroom/studio dwelling. The Concept Plan proposes four car parking spaces for the four dwellings, which would meet the SEPP parking requirements for the indicative mix of dwellings. As the design development progresses, the number of bedrooms would be clarified and car parking would be in accordance with the SEPP requirements.

The DCP requires that separate visitor parking is to be provided at a rate of one space per three dwellings (rounded up), and a vehicle wash bay is to be provided for developments with ten or more dwellings. Application of the DCP requires 15 visitor car parking spaces, and the Concept Plan indicates that 16 parking bays are proposed within the site for visitors, which would allow for inclusion of a car wash bay.

## 4.7 Public Transport, Bicycles and Pedestrians

The subject site is approximately 800m walking distance (10 minutes) from the B-Line bus stop on the eastern side of Pittwater Road (citybound buses), approximately 700m walking distance (9 minutes) from the B-Line bus stop on the western side of Pittwater Road, approximately 500m walking distance (6 minutes) from the Route 185 bus stops on Macpherson Street, and 550m walking distance from the Route 182 bus stops on Jacksons Road. There is currently no formal footpath to the south along Boondah Road, however the *Warriewood Valley Roads Masterplan* anticipates that shared paths be provided on both sides of the carriageway on collector streets, which includes Boondah Road (with the exception of Boondah Road adjoining the STP).

Residents of the site would generate additional demand for bus services, and it would be expected that current timetables may be supplemented by additional buses should the demand warrant expansion of services. As a collector street, provision of bus services along Boondah Road would be appropriate should future demands warrant the addition of new routes.

The Concept Plan includes provision for pedestrian and bicycle access throughout the site, noting the internal roads may be appropriately developed as a shared road space environment without dedicated footpaths, i.e., in which the road space is shared by pedestrians, cycles and vehicles. The shared path on the western side of Boondah Road north of the site facilitates pedestrian and bicycle access to and from the site. As above, the *Warriewood Valley Roads Masterplan* anticipates that shared paths be provided on both sides of the carriageway on collector streets such as Boondah Road, and would appropriately be implemented to the south of the site.



## 5 Conclusions

This study has investigated the transport implications of a Planning Proposal to rezone the land at 10-12 Boondah Road at Warriewood, with a Concept Plan prepared that comprises 44 terrace-style residential dwellings, including four affordable housing dwellings, and vehicular access via three internally connected private access roads to and from Boondah Road. The northern access road would be for one way inbound vehicles turning left into the site only. The southern access road would be for one way outbound vehicles only, turning left only on to Boondah Road. Right turns in and out of the site would be facilitated by the proposed roundabout at the central access road, which would be for two way traffic.

The traffic generated by the Concept Plan would have negligible impact on the operation of key intersections, and would not trigger any need for intersection upgrades. Assuming constant growth in traffic over time, the traffic generated by the Concept Plan would not reduce the time forecast until capacity of the key intersections is reached. The volume of traffic generated by the proposed Concept Plan is noted to be comparable with that which may be expected should the site not be rezoned and designated as "Active Recreation".

The access and internal layout arrangements of the Concept Plan are satisfactory, and comply with the general access requirements of the *Warriewood Valley Roads Masterplan* for the internal road system and the Boondah Road frontage. Vehicular access would be available throughout the site by a Heavy Rigid Vehicle for garbage collection and deliveries, consistent with the pre-lodgement advice from Council. The Concept Plan layout allows for footpaths, however the internal roads may also be appropriately developed as a shared road space environment without dedicated footpaths, i.e., in which the road space is shared by pedestrians, cycles and vehicles.

Sight distances at the proposed access intersections on Boondah Road exceed the required minimum Safe Intersection Sight Distance. Some minor amendments to the Concept Plan layout of visitor parking bays is recommended for compliance with the parking bay length requirements contained in *Australian Standard 2890*.

Car parking provision complies with the *Pittwater 21 Development Control Plan* and subject to determination of the affordable housing dwelling sizes, will comply with the parking requirements of the *State Environmental Planning Policy (Housing) 2021* where relevant.

To the extent that residents of the site increase demand for public transport, the existing bus services may be increased to accommodate the demand. Pedestrian and bicycle access to and from the site is available via a shared path to the north along Boondah Road. The *Warriewood Valley Roads Masterplan* anticipates that shared paths be provided on both sides of the carriageway on collector streets such as Boondah Road to the south of the site.

# Appendix A

## Traffic Surveys

Pittwater Road and Warriewood Road														
15-min Flows		South Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	31	1	32	177	17	194	12	0	12	0	0	0	5
7:15	7:30	43	2	45	227	16	243	16	0	16	0	0	0	1
7:30	7:45	42	1	43	188	16	204	6	0	6	0	0	0	3
7:45	8:00	74	1	75	246	16	262	5	0	5	0	0	0	1
8:00	8:15	76	1	77	221	21	242	3	0	3	0	0	0	0
8:15	8:30	61	2	63	258	11	269	7	0	7	0	0	0	4
8:30	8:45	69	2	71	212	13	225	11	0	11	0	0	0	1
8:45	9:00	79	1	80	201	22	223	17	0	17	0	0	0	2
15:00	15:15	51	2	53	267	13	280	10	0	10	1	0	1	4
15:15	15:30	55	3	58	251	13	264	7	0	7	2	0	2	8
15:30	15:45	46	0	46	306	20	326	11	0	11	0	0	0	1
15:45	16:00	52	1	53	278	16	294	12	1	13	0	0	0	12
16:00	16:15	41	3	44	362	27	389	10	0	10	1	0	1	6
16:15	16:30	60	1	61	325	21	346	10	0	10	0	0	0	4
16:30	16:45	80	1	81	316	19	335	17	0	17	0	0	0	2
16:45	17:00	65	0	65	359	14	373	9	0	9	0	0	0	5
17:00	17:15	56	0	56	305	10	315	13	0	13	1	0	1	6
17:15	17:30	79	1	80	355	10	365	14	0	14	0	0	0	1
17:30	17:45	69	0	69	370	5	375	9	0	9	0	0	0	3
17:45	18:00	58	0	58	354	11	365	14	0	14	0	0	0	2
18:00	18:15	46	1	47	224	5	229	5	0	5	0	0	0	5
15-min Flows		East Approach												
		Warriewood Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	2	0	2	0	0	0	0	0	0	0	0	0	2
7:15	7:30	10	0	10	0	0	0	0	0	0	0	0	0	1
7:30	7:45	6	0	6	0	0	0	0	0	0	0	0	0	5
7:45	8:00	7	0	7	0	0	0	0	0	0	0	0	0	0
8:00	8:15	10	0	10	0	0	0	0	0	0	0	0	0	1
8:15	8:30	8	0	8	0	0	0	0	0	0	0	0	0	2
8:30	8:45	16	1	17	0	0	0	0	0	0	0	0	0	1
8:45	9:00	13	1	14	0	0	0	0	0	0	0	0	0	1
15:00	15:15	3	0	3	0	0	0	0	0	0	0	0	0	0
15:15	15:30	4	0	4	0	0	0	0	0	0	0	0	0	0
15:30	15:45	4	0	4	0	0	0	0	0	0	0	0	0	0
15:45	16:00	3	0	3	0	0	0	0	0	0	0	0	0	1
16:00	16:15	2	0	2	0	0	0	0	0	0	0	0	0	2
16:15	16:30	8	0	8	0	0	0	0	0	0	0	0	0	2
16:30	16:45	7	0	7	0	0	0	0	0	0	0	0	0	1
16:45	17:00	3	0	3	0	0	0	0	0	0	0	0	0	0
17:00	17:15	8	0	8	0	0	0	0	0	0	0	0	0	2
17:15	17:30	7	0	7	0	0	0	0	0	0	0	0	0	1
17:30	17:45	3	0	3	0	0	0	0	0	0	0	0	0	1
17:45	18:00	4	0	4	0	0	0	0	0	0	0	0	0	1
18:00	18:15	2	0	2	0	0	0	0	0	0	0	0	0	1
15-min Flows		North Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	0	0	0	280	17	297	26	1	27	0	0	0	3
7:15	7:30	0	0	0	300	20	320	25	0	25	0	0	0	2
7:30	7:45	1	0	1	308	19	327	27	1	28	0	0	0	3
7:45	8:00	2	0	2	227	16	243	37	0	37	0	0	0	2
8:00	8:15	3	0	3	312	19	331	31	3	34	0	0	0	1
8:15	8:30	5	0	5	321	14	335	46	2	48	0	0	0	2
8:30	8:45	2	0	2	291	13	304	45	0	45	0	0	0	2
8:45	9:00	1	1	2	249	14	263	38	1	39	0	0	0	1
15:00	15:15	5	0	5	279	25	304	25	0	25	0	0	0	0
15:15	15:30	3	0	3	250	19	269	33	2	35	0	0	0	0
15:30	15:45	2	0	2	301	10	311	23	0	23	0	0	0	0
15:45	16:00	9	2	11	326	22	348	45	0	45	0	0	0	0
16:00	16:15	0	0	0	284	13	297	26	0	26	0	0	0	3
16:15	16:30	4	0	4	267	22	289	31	0	31	0	0	0	3
16:30	16:45	1	0	1	263	17	280	38	0	38	0	0	0	4
16:45	17:00	3	0	3	267	24	291	31	0	31	0	0	0	4
17:00	17:15	1	0	1	253	10	263	42	0	42	0	0	0	1
17:15	17:30	3	0	3	286	17	303	36	0	36	0	0	0	1
17:30	17:45	3	0	3	229	8	237	28	0	28	0	0	0	1
17:45	18:00	1	0	1	226	7	233	28	0	28	0	0	0	0
18:00	18:15	1	0	1	196	7	203	23	0	23	0	0	0	2
15-min Flows		West Approach												
		Warriewood Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	10	0	10	13	0	13	74	0	74	0	0	0	2
7:15	7:30	14	0	14	18	0	18	105	2	107	0	0	0	1
7:30	7:45	16	1	17	16	0	16	96	0	96	0	0	0	4
7:45	8:00	18	0	18	21	0	21	75	1	76	0	0	0	2
8:00	8:15	25	2	27	18	0	18	88	3	91	0	0	0	2
8:15	8:30	33	3	36	12	0	12	86	3	89	0	0	0	4
8:30	8:45	31	1	32	28	0	28	93	1	94	0	0	0	3
8:45	9:00	21	0	21	17	0	17	65	1	66	0	0	0	1
15:00	15:15	14	0	14	14	0	14	71	5	76	0	0	0	1
15:15	15:30	28	3	31	15	0	15	62	1	63	0	0	0	3
15:30	15:45	19	3	22	12	0	12	69	0	69	0	0	0	8
15:45	16:00	15	0	15	22	0	22	47	2	49	0	0	0	4
16:00	16:15	39	0	39	11	0	11	65	1	66	0	0	0	5
16:15	16:30	26	0	26	23	0	23	88	0	88	0	0	0	2
16:30	16:45	19	0	19	17	0	17	78	2	80	0	0	0	3
16:45	17:00	22	0	22	11	0	11	80	2	82	0	0	0	3
17:00	17:15	35	0	35	19	0	19	91	0	91	0	0	0	4
17:15	17:30	22	1	23	23	0	23	97	0	97	0	0	0	1
17:30	17:45	34	0	34	14	0	14	71	1	72	0	0	0	4
17:45	18:00	17	0	17	16	0	16	67	0	67	0	0	0	1
18:00	18:15	15	0	15	10	0	10	54	2	56	0	0	0	10

Pittwater Road and Mona Vale Road														
15-min Flows		South Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Peds
7:00	7:15	28	2	30	227	19	246	0	0	0	0	0	0	3
7:15	7:30	32	3	35	260	16	276	0	0	0	0	0	0	4
7:30	7:45	55	3	58	243	15	258	0	0	0	0	0	0	6
7:45	8:00	45	6	51	230	14	244	0	0	0	0	0	0	5
8:00	8:15	67	5	72	251	14	265	0	0	0	0	0	0	5
8:15	8:30	64	1	65	290	20	310	0	0	0	0	0	0	8
8:30	8:45	71	6	77	306	15	321	0	0	0	0	0	0	8
8:45	9:00	46	4	50	257	17	274	0	0	0	0	0	0	4
15:00	15:15	57	8	65	259	5	264	0	0	0	0	0	0	3
15:15	15:30	52	8	60	287	11	298	0	0	0	0	0	0	6
15:30	15:45	46	6	52	316	11	327	0	0	0	0	0	0	4
15:45	16:00	65	6	71	356	16	372	0	0	0	0	0	0	2
16:00	16:15	64	3	67	401	26	427	0	0	0	0	0	0	3
16:15	16:30	52	3	55	365	15	380	0	0	0	0	0	0	5
16:30	16:45	51	7	58	378	18	396	0	0	0	0	0	0	3
16:45	17:00	53	3	56	330	12	342	0	0	0	0	0	0	5
17:00	17:15	46	2	48	339	17	356	0	0	0	0	0	0	4
17:15	17:30	56	4	60	380	8	388	0	0	0	0	0	0	5
17:30	17:45	49	1	50	414	3	417	0	0	0	0	0	0	7
17:45	18:00	47	2	49	365	11	376	0	0	0	0	0	0	3
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15-min Flows		North Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Peds
7:00	7:15	0	0	0	309	17	326	134	23	157	0	0	0	2
7:15	7:30	0	0	0	268	20	288	177	5	182	0	0	0	1
7:30	7:45	0	0	0	298	26	324	179	13	192	0	0	0	2
7:45	8:00	0	0	0	285	26	311	140	14	154	0	0	0	0
8:00	8:15	0	0	0	226	25	251	164	10	174	0	0	0	3
8:15	8:30	0	0	0	260	12	272	181	14	195	0	0	0	0
8:30	8:45	0	0	0	194	12	206	178	13	191	0	0	0	3
8:45	9:00	0	0	0	217	20	237	152	17	169	1	0	1	1
15:00	15:15	0	0	0	221	24	245	118	16	134	0	0	0	6
15:15	15:30	0	0	0	251	18	269	115	17	132	0	0	0	4
15:30	15:45	0	0	0	276	12	288	129	17	146	0	0	0	5
15:45	16:00	0	0	0	329	17	346	151	13	164	0	0	0	5
16:00	16:15	0	0	0	277	11	288	175	17	192	0	0	0	9
16:15	16:30	0	0	0	331	28	359	175	17	192	0	0	0	5
16:30	16:45	0	0	0	299	17	316	139	12	151	0	0	0	6
16:45	17:00	0	0	0	289	26	315	111	6	117	0	0	0	10
17:00	17:15	0	0	0	309	14	323	129	6	135	0	0	0	7
17:15	17:30	0	0	0	312	13	325	126	4	130	0	0	0	5
17:30	17:45	0	0	0	252	8	260	101	3	104	0	0	0	6
17:45	18:00	0	0	0	260	7	267	138	5	143	0	0	0	2
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15-min Flows		West Approach												
		Mona Vale Road												
		Left			Through			Right			U-turn			
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Peds
7:00	7:15	68	9	77	0	0	0	36	2	38	0	0	0	0
7:15	7:30	68	14	82	0	0	0	50	1	51	0	0	0	0
7:30	7:45	72	6	78	0	0	0	44	5	49	0	0	0	0
7:45	8:00	73	8	81	0	0	0	68	2	70	0	0	0	0
8:00	8:15	79	13	92	0	0	0	42	6	48	0	0	0	0
8:15	8:30	66	18	84	0	0	0	73	2	75	0	0	0	0
8:30	8:45	89	8	97	0	0	0	58	3	61	0	0	0	0
8:45	9:00	92	11	103	0	0	0	80	0	80	0	0	0	0
15:00	15:15	79	6	85	0	0	0	93	7	100	0	0	0	0
15:15	15:30	98	6	104	0	0	0	72	1	73	0	0	0	0
15:30	15:45	138	11	149	0	0	0	84	2	86	0	0	0	0
15:45	16:00	129	5	134	0	0	0	63	1	64	0	0	0	0
16:00	16:15	131	18	149	0	0	0	54	1	55	0	0	0	0
16:15	16:30	123	11	134	0	0	0	89	1	90	0	0	0	0
16:30	16:45	98	6	104	0	0	0	87	1	88	0	0	0	0
16:45	17:00	101	5	106	0	0	0	75	1	76	0	0	0	0
17:00	17:15	140	3	143	0	0	0	107	1	108	0	0	0	0
17:15	17:30	116	1	117	0	0	0	90	1	91	0	0	0	0
17:30	17:45	106	2	108	0	0	0	75	0	75	0	0	0	0
17:45	18:00	93	2	95	0	0	0	67	0	67	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0

Pittwater Road and Jacksons Road														
15-min Flows		South Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	20	1	21	222	17	239	0	0	0	0	0	0	4
7:15	7:30	32	0	32	290	16	306	0	0	0	0	0	0	9
7:30	7:45	20	3	23	269	17	286	0	0	0	0	0	0	5
7:45	8:00	29	4	33	328	20	348	0	0	0	0	0	0	3
8:00	8:15	31	2	33	241	16	257	0	0	0	0	0	0	6
8:15	8:30	43	2	45	322	15	337	0	0	0	0	0	0	4
8:30	8:45	42	3	45	231	9	240	0	0	0	0	0	0	2
8:45	9:00	45	0	45	282	20	302	0	0	0	0	0	0	2
15:00	15:15	25	2	27	279	13	292	0	0	0	0	0	0	19
15:15	15:30	39	2	41	266	16	282	0	0	0	0	0	0	3
15:30	15:45	60	1	61	283	17	300	0	0	0	0	0	0	1
15:45	16:00	47	0	47	336	18	354	0	0	0	0	0	0	3
16:00	16:15	50	5	55	340	26	366	0	0	0	0	0	0	4
16:15	16:30	72	1	73	358	20	378	0	0	0	0	0	0	1
16:30	16:45	69	2	71	384	21	405	0	0	0	0	0	0	1
16:45	17:00	58	0	58	336	13	349	0	0	0	0	0	0	1
17:00	17:15	73	1	74	363	11	374	0	0	0	0	0	0	4
17:15	17:30	51	4	55	372	9	381	0	0	0	0	0	0	4
17:30	17:45	41	1	42	386	5	391	0	0	0	0	0	0	6
17:45	18:00	38	3	41	390	10	400	0	0	0	0	0	0	5
18:00	18:15	37	3	40	252	8	260	0	0	0	0	0	0	1
15-min Flows		North Approach												
		Pittwater Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	0	0	0	332	19	351	20	1	21	0	0	0	4
7:15	7:30	0	0	0	406	32	438	28	0	28	0	0	0	2
7:30	7:45	0	0	0	382	22	404	23	1	24	0	0	0	11
7:45	8:00	0	0	0	363	20	383	29	3	32	0	0	0	8
8:00	8:15	0	0	0	363	18	381	43	2	45	0	0	0	10
8:15	8:30	0	0	0	344	16	360	45	0	45	0	0	0	4
8:30	8:45	0	0	0	302	12	314	70	2	72	0	0	0	39
8:45	9:00	0	0	0	264	17	281	57	0	57	0	0	0	11
15:00	15:15	0	0	0	286	26	312	46	3	49	0	0	0	16
15:15	15:30	0	0	0	288	20	308	54	2	56	0	0	0	7
15:30	15:45	0	0	0	299	9	308	56	1	57	0	0	0	20
15:45	16:00	0	0	0	349	24	373	64	2	66	0	0	0	5
16:00	16:15	0	0	0	288	10	298	45	1	46	0	0	0	29
16:15	16:30	0	0	0	329	22	351	47	1	48	0	0	0	16
16:30	16:45	0	0	0	324	20	344	65	1	66	0	0	0	16
16:45	17:00	0	0	0	275	21	296	55	1	56	0	0	0	27
17:00	17:15	0	0	0	290	22	312	55	1	56	0	0	0	15
17:15	17:30	0	0	0	356	14	370	32	2	34	0	0	0	21
17:30	17:45	0	0	0	321	9	330	27	0	27	0	0	0	22
17:45	18:00	0	0	0	273	5	278	42	1	43	0	0	0	29
18:00	18:15	0	0	0	222	10	232	40	1	41	0	0	0	32
15-min Flows		West Approach												
		Jacksons Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	14	2	16	0	0	0	15	4	19	0	0	0	3
7:15	7:30	22	2	24	0	0	0	51	5	56	0	0	0	3
7:30	7:45	31	1	32	0	0	0	37	4	41	0	0	0	5
7:45	8:00	40	2	42	0	0	0	46	6	52	0	0	0	7
8:00	8:15	23	4	27	0	0	0	44	1	45	0	0	0	6
8:15	8:30	31	2	33	0	0	0	46	4	50	0	0	0	5
8:30	8:45	47	5	52	0	0	0	66	3	69	0	0	0	3
8:45	9:00	40	3	43	0	0	0	64	1	65	0	0	0	5
15:00	15:15	57	4	61	0	0	0	92	5	97	0	0	0	20
15:15	15:30	54	2	56	0	0	0	76	3	79	0	0	0	9
15:30	15:45	58	1	59	0	0	0	78	5	83	0	0	0	21
15:45	16:00	63	2	65	0	0	0	66	4	70	0	0	0	9
16:00	16:15	52	1	53	0	0	0	86	1	87	0	0	0	28
16:15	16:30	58	2	60	0	0	0	104	1	105	0	0	0	16
16:30	16:45	70	3	73	0	0	0	82	1	83	0	0	0	4
16:45	17:00	78	1	79	0	0	0	92	2	94	0	0	0	9
17:00	17:15	63	1	64	0	0	0	96	2	98	0	0	0	5
17:15	17:30	72	1	73	0	0	0	10	2	12	0	0	0	6
17:30	17:45	55	1	56	0	0	0	94	2	96	0	0	0	5
17:45	18:00	57	0	57	0	0	0	60	1	61	0	0	0	11
18:00	18:15	55	1	56	0	0	0	77	0	77	0	0	0	5

15-min Flows		Boondah Road and Macpherson Street												
		South Approach												
		Boondah Road												
Start	End	Left			Through			Right			U-turn			Peds
		Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	11	0	11	0	0	0	9	0	9	0	0	0	6
7:15	7:30	18	1	19	0	0	0	7	0	7	0	0	0	5
7:30	7:45	12	0	12	0	0	0	8	1	9	0	0	0	3
7:45	8:00	19	1	20	0	0	0	10	0	10	0	0	0	1
8:00	8:15	11	2	13	0	0	0	15	0	15	0	0	0	2
8:15	8:30	17	2	19	0	0	0	8	0	8	0	0	0	0
8:30	8:45	21	0	21	0	0	0	15	1	16	1	0	1	0
8:45	9:00	24	0	24	0	0	0	19	0	19	0	0	0	2
15:00	15:15	20	0	20	0	0	0	23	0	23	0	0	0	2
15:15	15:30	22	3	25	0	0	0	23	0	23	0	0	0	4
15:30	15:45	31	0	31	0	0	0	21	0	21	0	0	0	2
15:45	16:00	24	1	25	0	0	0	22	0	22	0	0	0	4
16:00	16:15	21	0	21	0	0	0	16	0	16	0	0	0	7
16:15	16:30	23	0	23	0	0	0	17	0	17	0	0	0	0
16:30	16:45	21	0	21	0	0	0	27	0	27	0	0	0	3
16:45	17:00	29	0	29	0	0	0	12	0	12	0	0	0	0
17:00	17:15	25	1	26	0	0	0	27	0	27	0	0	0	2
17:15	17:30	24	0	24	0	0	0	22	1	23	0	0	0	4
17:30	17:45	21	0	21	0	0	0	28	0	28	0	0	0	5
17:45	18:00	16	0	16	0	0	0	20	0	20	0	0	0	2
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15-min Flows		East Approach												
		Macpherson Street												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	9	0	9	23	2	25	0	0	0	0	0	0	4
7:15	7:30	4	0	4	23	2	25	0	0	0	0	0	0	1
7:30	7:45	12	0	12	19	3	22	0	0	0	0	0	0	1
7:45	8:00	17	1	18	26	1	27	0	0	0	0	0	0	5
8:00	8:15	20	1	21	36	5	41	0	0	0	0	0	0	4
8:15	8:30	36	2	38	39	1	40	0	0	0	0	0	0	2
8:30	8:45	52	0	52	38	1	39	0	0	0	0	0	0	1
8:45	9:00	32	0	32	36	1	37	0	0	0	0	0	0	1
15:00	15:15	14	0	14	27	4	31	0	0	0	0	0	0	0
15:15	15:30	17	2	19	45	1	46	0	0	0	0	0	0	0
15:30	15:45	17	0	17	25	1	26	0	0	0	0	0	0	0
15:45	16:00	28	1	29	21	1	22	0	0	0	0	0	0	0
16:00	16:15	26	0	26	24	1	25	0	0	0	0	0	0	2
16:15	16:30	22	0	22	38	1	39	0	0	0	0	0	0	1
16:30	16:45	20	0	20	35	1	36	0	0	0	0	0	0	2
16:45	17:00	25	0	25	34	1	35	0	0	0	0	0	0	3
17:00	17:15	28	0	28	29	0	29	0	0	0	0	0	0	2
17:15	17:30	23	0	23	36	1	37	0	0	0	0	0	0	2
17:30	17:45	14	0	14	29	0	29	0	0	0	0	0	0	8
17:45	18:00	19	0	19	29	1	30	0	0	0	0	0	0	1
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15-min Flows		North Approach												
		Private Resident Access												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	4
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	16:00	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	4	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0
15-min Flows		West Approach												
		Macpherson Street												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	0	0	0	47	2	49	10	1	11	0	0	0	1
7:15	7:30	0	0	0	54	1	55	12	0	12	0	0	0	3
7:30	7:45	0	0	0	32	1	33	18	1	19	0	0	0	6
7:45	8:00	0	0	0	53	1	54	15	1	16	0	0	0	2
8:00	8:15	0	0	0	45	3	48	13	0	13	0	0	0	8
8:15	8:30	0	0	0	61	5	66	24	0	24	0	0	0	4
8:30	8:45	0	0	0	63	2	65	30	0	30	0	0	0	4
8:45	9:00	0	0	0	50	2	52	23	1	24	0	0	0	2
15:00	15:15	0	0	0	38	3	41	16	1	17	1	0	1	3
15:15	15:30	0	0	0	57	3	60	20	1	21	0	0	0	2
15:30	15:45	0	0	0	61	3	64	16	1	17	0	0	0	5
15:45	16:00	0	0	0	35	5	40	17	0	17	0	0	0	3
16:00	16:15	0	0	0	45	0	45	18	1	19	0	0	0	1
16:15	16:30	0	0	0	31	2	33	20	0	20	1	0	1	3
16:30	16:45	0	0	0	49	2	51	20	0	20	0	0	0	3
16:45	17:00	0	0	0	43	4	47	15	0	15	1	0	1	7
17:00	17:15	0	0	0	46	1	47	35	0	35	2	0	2	1
17:15	17:30	0	0	0	43	2	45	44	0	44	1	0	1	4
17:30	17:45	0	0	0	32	1	33	20	0	20	0	0	0	3
17:45	18:00	0	0	0	32	2	34	10	0	10	0	0	0	3
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0

Boondah Road and Jacksons Road														
15-min Flows		East Approach												
		Jacksons Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	0	0	0	33	2	35	9	1	10	0	0	0	8
7:15	7:30	0	0	0	51	1	52	14	0	14	0	0	0	1
7:30	7:45	0	0	0	49	1	50	10	2	12	0	0	0	9
7:45	8:00	0	0	0	53	6	59	13	1	14	2	0	2	3
8:00	8:15	0	0	0	66	3	69	12	2	14	3	0	3	11
8:15	8:30	0	0	0	83	4	87	23	0	23	2	0	2	5
8:30	8:45	0	0	0	120	3	123	20	2	22	4	0	4	11
8:45	9:00	0	0	0	134	1	135	33	0	33	3	0	3	3
15:00	15:15	0	0	0	95	4	99	27	3	30	7	0	7	11
15:15	15:30	0	0	0	112	3	115	16	3	19	3	0	3	6
15:30	15:45	0	0	0	112	1	113	19	1	20	2	0	2	3
15:45	16:00	0	0	0	111	1	112	28	0	28	2	0	2	6
16:00	16:15	0	0	0	125	6	131	21	0	21	1	0	1	11
16:15	16:30	0	0	0	118	2	120	32	0	32	3	0	3	23
16:30	16:45	0	0	0	126	3	129	22	0	22	1	0	1	1
16:45	17:00	0	0	0	119	1	120	30	0	30	3	0	3	4
17:00	17:15	0	0	0	109	1	110	28	0	28	1	0	1	3
17:15	17:30	0	0	0	67	4	71	35	1	36	2	0	2	4
17:30	17:45	0	0	0	62	1	63	32	0	32	3	0	3	6
17:45	18:00	0	0	0	64	4	68	20	0	20	3	0	3	4
18:00	18:15	0	0	0	84	3	87	18	1	19	3	0	3	3
15-min Flows		North Approach												
		Boondah Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	17	3	20	0	0	0	6	1	7	0	0	0	1
7:15	7:30	13	0	13	0	0	0	10	1	11	0	0	0	1
7:30	7:45	23	3	26	0	0	0	11	1	12	0	0	0	0
7:45	8:00	26	2	28	0	0	0	15	2	17	0	0	0	3
8:00	8:15	26	2	28	0	0	0	14	0	14	0	0	0	3
8:15	8:30	28	2	30	0	0	0	30	1	31	0	0	0	5
8:30	8:45	37	1	38	0	0	0	40	0	40	0	0	0	7
8:45	9:00	27	1	28	0	0	0	35	0	35	0	0	0	8
15:00	15:15	14	1	15	0	0	0	12	1	13	0	0	0	5
15:15	15:30	20	0	20	0	0	0	10	1	11	0	0	0	3
15:30	15:45	16	0	16	0	0	0	25	0	25	0	0	0	1
15:45	16:00	16	1	17	0	0	0	18	0	18	1	0	1	6
16:00	16:15	21	0	21	0	0	0	17	1	18	0	0	0	3
16:15	16:30	11	0	11	0	0	0	21	1	22	0	0	0	2
16:30	16:45	33	0	33	0	0	0	16	0	16	1	0	1	1
16:45	17:00	19	0	19	0	0	0	23	0	23	1	0	1	4
17:00	17:15	33	0	33	0	0	0	22	0	22	0	0	0	2
17:15	17:30	23	0	23	0	0	0	19	0	19	1	0	1	2
17:30	17:45	27	0	27	0	0	0	29	0	29	0	0	0	2
17:45	18:00	17	0	17	0	0	0	18	0	18	0	0	0	2
18:00	18:15	24	0	24	0	0	0	25	0	25	0	0	0	3
15-min Flows		West Approach												
		Jacksons Road												
		Left			Through			Right			U-turn			Peds
Start	End	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	Lights	Heavies	Total	
7:00	7:15	7	0	7	24	2	26	0	0	0	0	0	0	1
7:15	7:30	5	0	5	47	7	54	0	0	0	0	0	0	2
7:30	7:45	4	1	5	47	2	49	0	0	0	0	0	0	2
7:45	8:00	9	0	9	62	4	66	0	0	0	0	0	0	3
8:00	8:15	10	1	11	48	3	51	0	0	0	0	0	0	3
8:15	8:30	8	0	8	49	5	54	0	0	0	0	0	0	4
8:30	8:45	15	0	15	79	7	86	0	0	0	0	0	0	2
8:45	9:00	16	0	16	65	4	69	0	0	0	0	0	0	5
15:00	15:15	23	1	24	102	4	106	0	0	0	0	0	0	52
15:15	15:30	31	3	34	105	4	109	0	0	0	0	0	0	14
15:30	15:45	23	0	23	115	6	121	0	0	0	0	0	0	11
15:45	16:00	25	0	25	125	6	131	0	0	0	0	0	0	14
16:00	16:15	19	0	19	127	0	127	0	0	0	1	0	1	19
16:15	16:30	40	1	41	145	4	149	0	0	0	0	0	0	10
16:30	16:45	24	0	24	122	3	125	0	0	0	1	0	1	8
16:45	17:00	33	0	33	143	4	147	0	0	0	0	0	0	6
17:00	17:15	37	2	39	136	3	139	0	0	0	0	0	0	3
17:15	17:30	36	0	36	128	3	131	0	0	0	0	0	0	8
17:30	17:45	16	0	16	118	3	121	0	0	0	0	0	0	16
17:45	18:00	28	0	28	113	1	114	0	0	0	0	0	0	14
18:00	18:15	28	0	28	112	1	113	0	0	0	0	0	0	3



## Appendix B

### Concept Plan





Site Plan  
SCALE 1 : 500

Project  
**WARRIEWOOD**  
10 Boondah Rd, Warriewood, New South Wales 2102

Project Number  
10

Status

Rev.	Date	Description	Iss.	Appr.
1	28/04/2022	DRAFT	SA	AP
2	05/05/2022	DRAFT	SA	AP
3	13/05/2022	DRAFT	RW	AP
4	18/05/2022	DRAFT	RW	AP
5	24/05/2022	DRAFT	RW	AP
6	27/05/2022	DRAFT	RW	AP

Drawing Number  
**AMP-0102**

Nominated Architect: Anthony Palamara NSW ARN 7274  
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0 10 20 40 60M

Scale  
As indicated  
@A1



Revision  
**6**

**WARRIEWOOD  
SQUARE**

**BUCHAN**

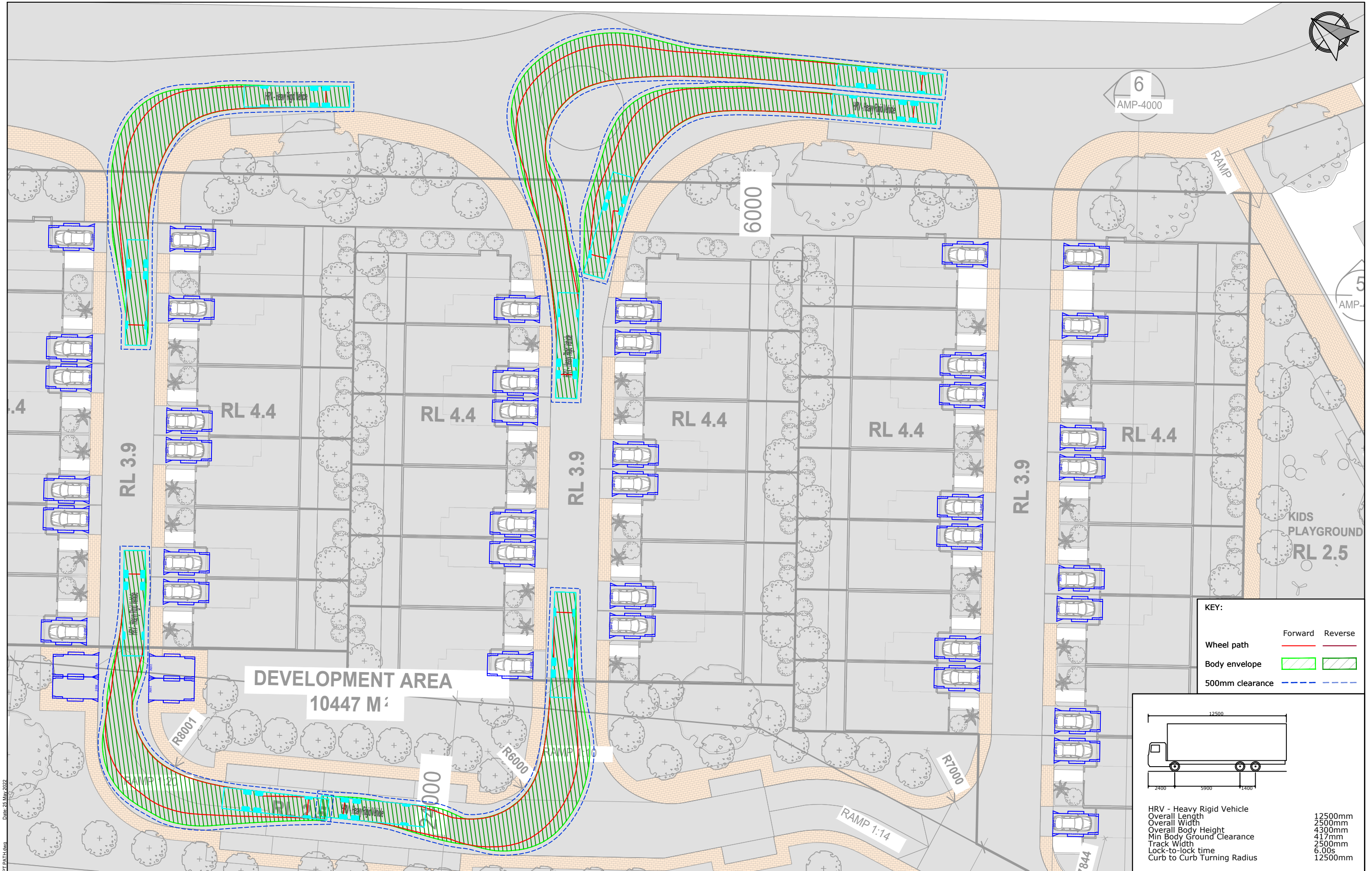
Sydney Studio  
+ 61 2 9566 1611 / buchangroup.com.au

DRAFT



## Appendix C

### HRV Swept Path Assessment



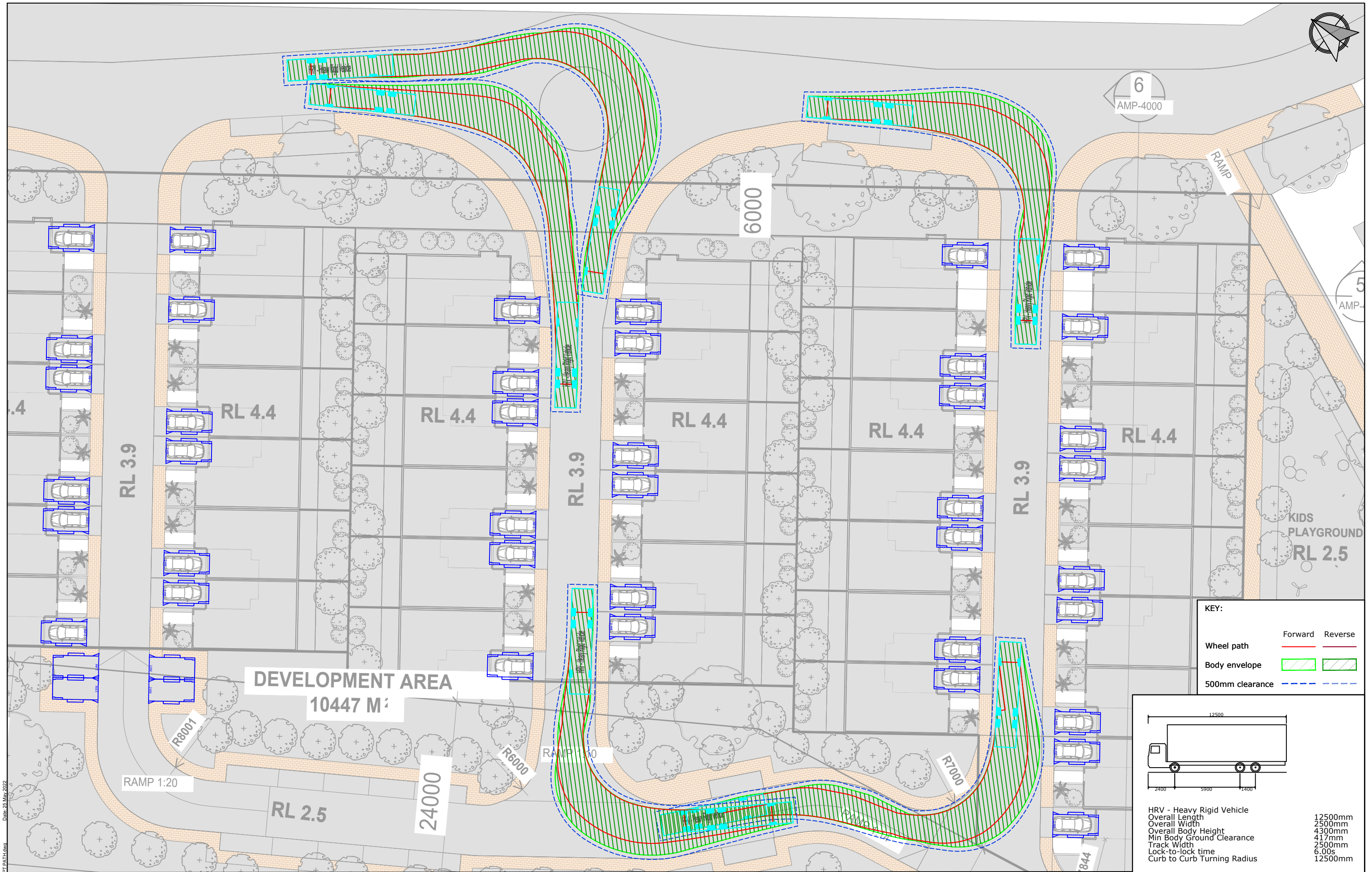
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A	ISSUE FOR DISCUSSION	KM	PD	PD	25/05/22



PROJECT	10-12 BOONDAH ROAD, WARRIEWOOD		
TITLE	SWEPT PATH ANALYSIS AS2890.2 12.5m HEAVY RIGID VEHICLE		

DWG No.	22084CAD004 FIGURE 1		
DATE STAMP	25 MAY 2022		
PROJECT No.	SCALE	REV.	
22084	1:400 @A3	A	





KEY:

Wheel path	Forward	Reverse
Body envelope		
500mm clearance		

HRV - Heavy Rigid Vehicle

Overall Length	12500mm
Overall Width	2500mm
Overall Body Height	4300mm
Min Body Ground Clearance	417mm
Track Width	2500mm
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	12500mm

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	KM	PD	PD	25/05/22



PROJECT

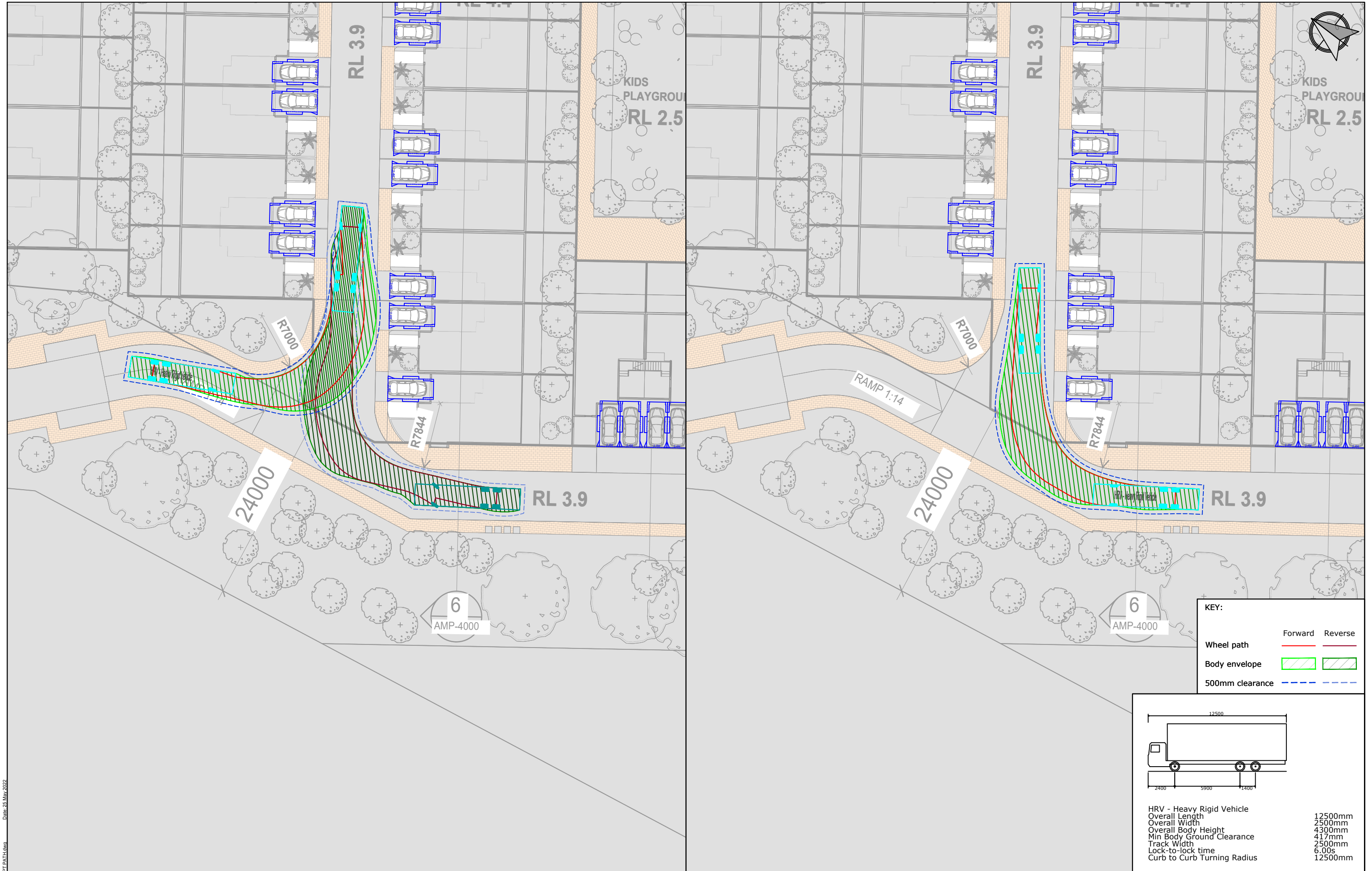
10-12 BOONDAH ROAD, WARRIEWOOD

TITLE

SWEPT PATH ANALYSIS  
AS2890.2 12.5m HEAVY RIGID VEHICLE

DWG No.	22084CAD004 FIGURE 2		
DATE STAMP	25 MAY 2022		
PROJECT No.	SCALE	REV.	
22084	1:400 @A3	A	





KEY:	
Wheel path	Forward Reverse
Body envelope	<div></div> <div></div>
500mm clearance	<div></div>

HRV - Heavy Rigid Vehicle  
Overall Length 12500mm  
Overall Width 2500mm  
Overall Body Height 4300mm  
Min Body Ground Clearance 417mm  
Track Width 2500mm  
Lock-to-lock time 6.00s  
Curb to Curb Turning Radius 12500mm

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	KM	PD	PD	25/05/22

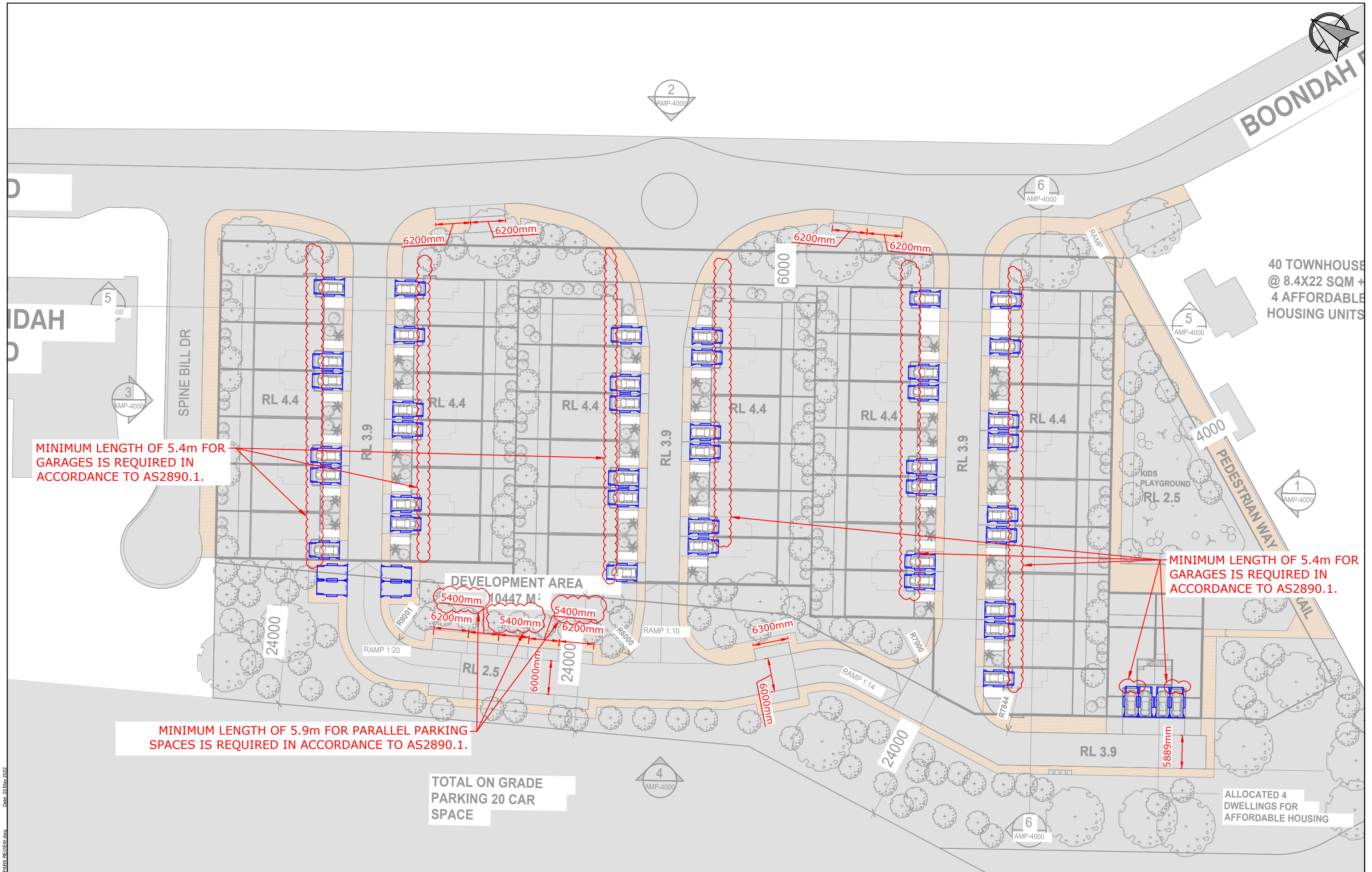


PROJECT	10-12 BOONDAH ROAD, WARRIEWOOD		
TITLE	SWEPT PATH ANALYSIS AS2890.2 12.5m HEAVY RIGID VEHICLE		

DWG No.	22084CAD004 FIGURE 3		
DATE STAMP	25 MAY 2022		
PROJECT No.	SCALE	REV.	
22084	1:400 @A3	A	

Filename: 22084CAD004-220525-SWEPT PATH.dwg Date: 25 May 2022





Filename: 22084CAD005-220525-CAR PARK REVIEW.dwg Date: 25 May 2022

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	KM	PD	PD	25/05/22



PROJECT	10-12 BOONDAH ROAD, WARRIEWOOD		
TITLE	CONCEPT DESIGN REVIEW		

DWG No. 22084CAD005		FIGURE 1	
DATE STAMP		25 MAY 2022	
PROJECT No. 22084	SCALE 1:600 @A3	REV. A	

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