Tolucy Pty Ltd

# Flood Assessment: 58 Laitoki Road, Terrey Hills, NSW

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PROJECT MANAGEMENT



P1504710JR07V01 October 2018

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All enquiries regarding this project are to be directed to the Project Manager.



# **Executive Summary**

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed seniors living development at 58 Laitoki Road, Terrey Hills, NSW (the site). This report documents the procedures and findings of hydrologic and hydraulic modelling of the site in existing and proposed conditions.

Assessment concluded that:

- 1. The site is classified as a 'low flood risk precinct'.
- 2. The site in its existing conditions is partly affected by flood waters during the 1% AEP and PMF events.
- 3. The proposed design effectively renders the entirety of the development area flood free in the 1%AEP and PMF flood events.
- 4. Site evacuation from site egresses to Laitoki Road and Cooyong Road are always accessible during the 1% AEP and PMF flood events and site shelter-inplace is available for all building levels.
- 5. Compliance with Council's flood planning level requirements for the proposed development are achieved.



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# 1 Introduction

# 1.1 Overview

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed seniors living development at 58 Laitoki Road, Terrey Hills, NSW (the site). Refer to Attachment A for site survey and Attachment B for proposed site layout.

# 1.2 Project Scope and Objectives

Project scope and objectives are:

- 1. Prepare a hydrologic model (ILSAX) for the site to determine the peak flow of the 1% annual exceedance probability (AEP) flood and probable maximum flood (PMF) events.
- 2. Prepare a hydraulic model (TUFLOW) for the site under existing and proposed conditions.
- 3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and impacts.
- 4. Comment on flood characteristics and model outcomes in existing and proposed conditions.

# 1.3 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

- 1. Bureau of Meteorology (2003), The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method.
- 2. Commonwealth of Australia (Geoscience Australia) (2016), Australian Rainfall and Runoff – A Guide to Flood Estimation.
- 3. NSW Department of Infrastructure, Planning and Natural Resources (2005), Floodplain Development Manual.
- 4. Warringah Council (2011a), Warringah Local Environmental Plan (LEP).
- 5. Warringah Council (2011b), Warringah Development Control Plan (DCP).



# 1.4 Definitions

- AEP Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
- ARI Average recurrence interval: the average time between flood events occurring. A 100 year ARI flood occurs on average once every 100 years.
- ARR Australian Rainfall & Runoff
- BOM Bureau of Meteorology
- Council Northern Beaches Council (NBC) (formerly Warringah Council)
- DA Development application
- FFL Finished Flood Level
- IFD Intensity frequency duration design rainfall data for frequent and infrequent storm events.
- MA Martens & Associates Pty Ltd
- PMF Probable maximum flood the most extreme flood event possible for a certain location, with an approximate ARI of 1,000,000 to 10,000,000 years.
- PMP Probable maximum precipitation design rainfall data for extreme storm events.



# 2 Site Description and Background Data

# 2.1 Location and Site Description

Existing site description summary is provided in Table 1. Table 1: Existing site description summary.

Address	58 Laitoki Road, Terrey Hills, NSW 2084.			
Lot / DP	Lot 368 DP 752017			
Site Area	1.95 Ha			
Local Government Area (LGA)	Northern Beaches Council (formerly Warringah Council)			
Current Land Use	Rural residential and horse boarding / training establishment.			
Current Zoning	RU4 Primary production small lots			
Site Description	The site grades to the west and is primarily grassed with trees along the site boundary. There are four buildings, a swimming pool, internal driveways and several animal boarding amenities on the site. The site access is via Cooyong Road.			
Surrounding Land Uses	Low density residential to the east and rural residential to the other sides.			
Site Elevation	Approximately 198.0 mAHD at south eastern site boundary falling to 170.2 mAHD at western site boundary.			
Site Grading & Aspect	Approximately 10% with westerly aspect.			
Site Drainage	Neverfail Gully Creek runs along the western site boundary.			

# 2.2 Site Inspection

Site inspection was conducted on 19 July 2018 and included:

- General walkover to identify land forms and site characteristics to understand local drainage behaviour.
- Identification and observation of existing site stormwater infrastructure and natural drainage lines.

# 2.3 Catchment Description

We note the following regarding the catchment upstream of the site:

- The site is located within the Neverfail Gully Creek catchment which is an upper tributary of Kierans Creek.
- Upstream catchment is urbanised to the north and east of the site, and is rural residential to the north and west of the site.



• The total catchment area is 88.4 ha and is shown in Attachment D plan PS04-K000.

# 2.4 Site Flood Mechanisms

The site is likely affected by the following flood mechanisms:

- Overland flows from the local upstream catchment (refer to Section 2.3).
- Flood overbank flows from Neverfail Gully Creek.

# 2.5 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Neverfail Gully Creek catchment. Review did not identify any Council flood studies, but instead identified a previous flood study undertaken by MA which would be relevant to this assessment.

2.5.1 MA (2013) Flood Assessment: 83 Booralie Road, Terrey Hills, NSW

MA has undertaken a flood assessment for a property approximately 190 m upstream of the site at 83 Booralie Road, Terrey Hills. The study was prepared to support a development application for a seniors living development at the site (DA 2013/0796). This flood assessment has been accepted by Warringah Council, and construction of buildings at the above address has been completed. Full details of the flood study are provided in P1203558JR09V01.

# 2.6 Proposed Development

# 2.6.1 Overview

Architectural drawings prepared by Calder Flower Architects (Attachment B) indicate that the proposed development will include:

- Demolition of existing structures on site.
- Construction of a new two storey seniors living residential complex, including basement and ground carparking areas.
- Two access roads to Cooyong Road, internal driveways and multiple footpaths.



The following sections describe various elements of the proposed site layout, which was iteratively and holistically designed to ensure project objectives were met.

# 2.6.2 Earthworks Design Details

Proposed site earthworks plan and proposed road design plan are provided in MA planset P1504710PS05-C100 and P1504710PS05-D100 (not attached to this report) and include:

- Bulk earthworks outside the riparian area to maximise developable area.
- Filling in areas of minor flood affectation to elevate the proposed development above the floodplain, and compensatory cut in flood free areas to achieve balanced earthworks and to minimise offsite impacts.
- Internal site grading design.
- Earthworks at north-western corner of the site to redirect the floodwaters into Neverfail Gully Creek.

# 2.6.3 Stormwater Design Details

Proposed site drainage plan is provided in MA planset P1504710PS05-E100 (not attached to this report) and includes:

- Site drainage pit and pipe network with variable pipe sizes.
- Gross pollutant traps to control site discharge stormwater quality.
- On-site detention (OSD) tank to regulate site discharge stormwater quantity.



# 3 Hydrology Modelling

# 3.1 Overview

For this assessment the previously NBC approved DRAINS model developed for the flood assessment at the upstream site (83 Booralie Road) was used. The catchment area and times of concentration were updated to represent the increased catchment areas arriving at 58 Laitoki Road.

The DRAINS software package (version 2018.06 – 17 July, 2018) was used with the ILSAX hydrological engine to assess the 1% AEP flood and PMF peak flow rates for a range of storm durations between 5 minutes and 6 hours.

# 3.2 Model Setup

Parameters used for the updated DRAINS model are consistent with the flood assessment for 83 Booralie Road and are provided in Table 2 and Table 3. Model inputs are as follows:

- 1. Sub-catchment delineations and flow paths were updated using LIDAR data provided by Land and Property Information NSW (LPI 2013) and site survey provided by Bee & Lethbridge Pty Ltd. Refer to Attachment D PS04-K000 for site catchment plan.
- 2. Sub-catchment impervious areas were adopted based on recent catchment aerials obtained from Nearmaps (2018).
- 3. Sub-catchment times of concentration were calculated based on individual catchment properties and reach flow paths (kerb / overland / channel / pipe flow etc).
- 4. Intensity Frequency Duration (IFD) data, rainfall temporal patterns and Probable Maximum Precipitation (PMP) data were based on the previous MA flood assessment at 83 Booralie Road. Data was based on Australian Rainfall & Runoff (1987) and BOM (2003). Refer to P1203558JR09V01 for details.
- 5. ILSAX parameters have been adopted from the previous MA flood assessment and are based on the suggested values in the DRAINS (2018) user's manual.
- 6. DRAINS model layout is provided in Attachment D PS04-K010.



Table 2: Details of sub-catchments used in ILSAX modelling.

				Time of Conc	entration (min) <sup>3</sup>
Sub-catchment <sup>1</sup>	Area (ha) 1	Impervious (%) <sup>2</sup>	Pervious (%) <sup>2</sup>	Impervious	Pervious
Catchment 1	26.5	60	40	22.5	28.1
Catchment 2	24.8	62	38	14.5	21.5
Catchment 3	15.4	18	82	14.5	20.3
Catchment 4	7.9	21	79	15.9	13.1
Catchment 5	4.2	20	80	8.8	17.1
Catchment 6	9.5	29	71	9.6	19.3
Total	88.4				

## Notes

1. Obtained based on LIDAR data provided by LPI (2013). Refer to Attachment D plan PS04-K000 for site catchment plan.

2. Adopted based on recent catchment aerials obtained from Nearmaps (2018).

3. Calculated based on individual catchment properties and reach flow paths (kerb / overland / channel / pipe flow etc).

Table 3: Probable maximum precipitation data used in DRAINS modelling.

PMP Data 1	Unit	Value
PMP 15 min rainfall intensity	mm/hr	650.0
PMP 30 min rainfall intensity	mm/hr	450.2
PMP 45 min rainfall intensity	mm/hr	379.7
PMP 1 hour rainfall intensity	mm/hr	330.3
PMP 1.5 hour rainfall intensity	mm/hr	275.9
PMP 2 hour rainfall intensity	mm/hr	239.5
PMP 3 hour rainfall intensity	mm/hr	190.3
PMP 6 hour rainfall intensity	mm/hr	125.0

## Notes

1. Adopted based on the previously approved DRAINS model using the BOM (2003) Generalised Short Duration Method.

# 3.3 Results

Results of peak flow rates for sub-catchments arriving at the site for the critical duration 1% AEP flood event and PMF event are summarised in Table 4. The critical storm duration was determined to be 2 hours for the 1% AEP flood event and 30 minutes for the PMF event. DRAINS model results for critical storm durations are provided in Attachment D PS04-K015.



 Table 4: Peak 1% AEP and PMF flow rates for critical duration storms estimated by DRAINS modelling for sub-catchments arriving at the site.

	Peak Catchment Flow Rates (m <sup>3</sup> /s)		
Sub-catchment	1% AEP (2 hrs)	PMF (30 mins)	
1	10.5	34.5	
2	11.2	38.5	
3	6.3	21.8	
4	3.7	13.7	
5	1.9	6.1	
6	4.4	13.7	
Total	<b>37.4</b> <sup>1</sup>	119.1 <sup>1</sup>	

Notes

1. The offset of the timing of each catchment's hydrograph means the total flow rate is not always equal to the sum of all catchment peak flow rates.



# 4 Hydraulic Modelling

# 4.1 Overview

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities, hydraulic hazard and water level impacts for the critical 1% AEP flood and PMF events for existing and proposed conditions.

# 4.2 Scenarios

The hydraulic model was setup to represent the following flood condition scenarios:

- 1. Existing condition: The catchment and site are in their current state as described in Sections 2.1, 2.3 and 2.4.
- 2. Proposed condition: the catchment in its current state and the site in its proposed state as described in Section 2.6.

The hydraulic model was used to assess flooding for the following events:

- 3. 1% AEP 2 hours (critical duration) event.
- 4. PMF 30 minutes (critical duration) event.

In summary, a total of 4 scenarios were modelled as part of this assessment (2 flood condition scenarios and 2 flood events each).

# 4.3 Terrain Data

A 3D surface for the existing catchment site and local floodplain environment was prepared for the TUFLOW model using:

- 1. LIDAR data provided by LPI (2013).
- 2. Site survey data provided by Bee & Lethbridge Pty Ltd (May 2015) (Attachment A).
- 3. Survey data for 83 Booralie Road provided by Bee & Lethbridge Pty Ltd (September 2012).
- 4. Survey data for 85 Booralie Road provided by Bee & Lethbridge Pty Ltd and works as executed Neverfail Gully Creek channel survey downstream of Laitoki Road (May 2016).
- 5. Survey data for 25 Laitoki Road provided by Bee & Lethbridge Pty Ltd (November 2017).



The proposed conditions surface also included site design grading as shown in MA planset P1504710PS05-C100 (not attached to this report).

# 4.4 Model Setup

4.4.1 Existing Conditions

TUFLOW model construction for existing conditions consisted of:

- 1. A 1.0 m topographic grid based on the data listed in Section 4.3.
- 2. The model domain was defined from a point downstream of the Laitoki Road culvert 450 m upstream of the site to a point 240 m downstream of Cooyong Road. Model boundary extents were generally placed along Neverfail Gully Creek ridgelines and connecting high points surrounding the study area.
- 3. Inflow boundary conditions based on the critical duration 1% AEP and PMF hydrographs from DRAINS for each of the six subcatchments discharging to the study area.
- 4. Computed water slopes for downstream model extent boundary conditions based on the slopes from available LIDAR data.
- 5. Manning's zones based on Nearmaps (2018) aerial photography of the study area with roughness coefficients adopted from the MA flood assessment as per Table 5.
- 6. Existing buildings obstructions were represented as elevated cells in the model.
- 7. A 1050 mm pipe at northern property bybassing stormwaters from upstream to downstream (noth-west of the site) was modelled as a 1D element based on the Bee & Lethbridge Pty Ltd survey and LIDAR data, and a 25% blockage was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016).
- 8. The 3 × 1050 mm pipes below Cooyong Road were modelled as a 1D element based on the Bee & Lethbridge Pty Ltd survey data, and a 25% blockage was adopted based on the assessment procedure in Australian Rainfall and Runoff (Weeks & Rigby, 2016). All other pits and pipes in the study area have conservatively been assumed to be 100% blocked.



 Table 5: Manning's roughness values for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient 1
Low Density Vegetation	0.035
High Density Vegetation	0.080
Developed Creek bed	0.045
Roads / Concrete	0.150

## Notes

1. Based on the previous MA flood assessment (83 Booralie Road).

# 4.4.2 Proposed Conditions

The existing conditions model was modified as follows to simulate proposed conditions:

- 1. A 1.0 m topographic grid based on the available proposed site surface.
- 2. Site manning's zones were updated to represent design surfaces as detailed in Section 4.3.
- 3. Site buildings were removed and replaced with proposed buildings to model as flow obstructions.
- 4. Internal stormwater network was conservatively assumed to be 100% blocked.

All other model construction elements remained consistent with the existing conditions model.

# 4.5 Results

## 4.5.1 Flood Results

Flood mapping results (flood levels, depths, velocities provisional hazard categories and flood level impacts) for the critical duration 1% AEP flood event and PMF events in existing and proposed conditions are provided in Attachment D, with drawing references summarised in Table 6.

 Table 6: Flood map drawing references in Attachment D (MA planset P1504710PS04).

Flood Condition Scenario	Critical Duration Flood Event	Water Level & Depth	Water Velocity	Provisional Hydraulic Hazard Categories <sup>1</sup>	Water Level Afflux
Existing	1% AEP	K100	K101	K102	-
Conditions	PMF	K110	K111	K112	-
Proposed	1% AEP	K200	K201	K202	K300
Conditions	PMF	K210	K211	K212	K310

Notes



1. Provisional hydraulic hazard categories are based on NSW Floodplain Development Manual (2005) definitions and are shown in Figure 1.



Figure 1: Provisional hydraulic hazard categories (NSW Floodplain Development Manual, 2005).

## 4.6 Discussion

We note the following regarding modelled flood behaviour:

- 4.6.1 Existing Conditions
  - 1. The primary source of site flooding is overland flow in Neverfail Creek west of Laitoki Road.
  - 2. Flood waters cross Laitoki Road at the sag point and flow onto 35 Laitoki Road upstream of the site.
  - 3. Flood waters affect the western portion of the site as they reach the boundary of Neverfail Gully Creek.
  - 4. Overbank flows from Neverfail Gully Creek upstream of the site also contribute to site flood affectation.
  - 5. Flood waters primarily flow from the north western site boundary toward south western site boundary in the direction of Neverfail Gully Creek.
  - 6. Flood waters encroaching the site development area form a shallow overland flow path with depths of less than 250 mm for the critical PMF and less than 100 mm for the critical 1% AEP event.
  - 7. Provisional flood hazards across the flood affected portion of the site are low in the 1% AEP and PMF events.



# 4.6.2 Proposed Conditions

- 1. Proposed flooding conditions are largely unchanged from existing conditions, and the proposed earthworks do not materially affect local flood characteristics.
- 2. The proposed design effectively renders the entirety of the development area flood free in the 1% AEP flood and PMF events.
- 3. The peak 1% AEP flood level at the site is 175.0 mAHD, and the peak PMF level at the site is 175.5 mAHD.
- 4. Floor level compliance:
  - a. NBC classify the site as a low flood risk planning precinct, and require minimum habitable level for the development to be 'set at the PMF level or the 1% AEP level plus 500 mm freeboard whichever is greater' (Warringah DCP 2011).
  - b. Table 6 demonstrates that proposed habitable finished floor level (FFL) for the proposed development is above NBC's minimum acceptable floor level and indicates that the proposed development achieves compliance with NBC requirements.
- 5. All site habitable floor levels are at or above the peak PMF level of 175.5 mAHD and evacuation from site egresses to Laitoki Road and Cooyong Road is always available during flood events up to and including the PMF. Therefore, no evacuation plan is required for the proposed development.

1% AEP	PMF Water	1% AEP Water	Minimum	Minimum	Complies
Water Level	Level	Level + 500mm	Accepted FFL	proposed FFL	
(mAHD) 1	(mAHD) <sup>2</sup>	(mAHD)	(mAHD) <sup>3</sup>	(mAHD) ⁴	
175.00	175.50	175.50	175.50	175.85	Yes

 Table 7: Minimum accepted habitable floor levels for the proposed development.

## Notes

1. Refer Attachment D PS01-K200 for modelled proposed 1% AEP flood levels.

2. Refer Attachment D PS01-K210 for modelled proposed PMF flood levels.

- 3. NBC requires the minimum habitable floor level to be set at the PMF level or the 1% AEP level plus 500 mm freeboard whichever is greater.
- 4. Refer architectural drawings (Attachment B).

## 4.6.3 Offsite Flood Impacts

1. The proposed development has no offsite impacts above 20 mm on the floodplain environment in the 1% AEP event.



- 2. In addition, the proposed earthworks cause reduction in upstream flood levels, and therefore have a net beneficial effect on the northern property.
- 3. There are small areas of offsite flood level increase above 50 mm in the PMF (up to 100 mm increase) on the northern property.
- 4. Given that the proposed development causes reduction in flood levels and provides a net benefit for the northern property during the more frequent flood events up to and including the 1% AEP flood, small areas of flood level increase during the PMF event are of immaterial significance and are considered acceptable.



# 5 Compliance Assessment

NBC requires compliance with the Warringah Council LEP and DCP (2011) for the proposed development. Flood specific controls are provided in the DCP at clause E11 'Flood Liable Land'. We note that:

- The site development area is classified as a 'low flood risk precinct' by NBC as it is above the flood planning level (FPL of 1% AEP plus 500 mm freeboard).
- The proposed development is a seniors living development which is categorised as a 'vulnerable use'.

A compliance assessment for the proposed development is summarised in Table 8.

This assessment demonstrates that the proposed development complies with the Council flood requirements.



## Table 8: Compliance with Warringah Council DCP (2011) development matrix prescriptive controls.

Warringah Council DCP Requirement	Compliance
A. FLOOD EFFECTS CAUSED BY DEVELOPMENT	
A2. Certification shall be provided in accordance with Northern Beaches Council's Standard Hydraulic Certification Form (Forms A and A1 of Northern Beaches Council's Guidelines for preparing a Flood Management Report) to the effect that works have been designed and can be constructed to adequately address flood risk management issues.	(1) Refer to Attachment C.
A3. The applicant shall include in their submission, calculations to illustrate that any fill or other structures that reduce the total flood storage are replaced by Compensatory Works.	(2) The proposed development will not materially affect the flood storage or flood levels as demonstrated by the impact plots (refer to Attachment D plan PS04-K300 & K310). Comparison of existing and proposed condition velocity plots indicate no material impacts are expected.
A4. Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in Flood Management Report that it been designed and can be constructed so that in a Probable Maximum Flood event:	
<ul> <li>(a) There are no adverse impacts on flood levels and velocities caused by alterations to the flood conveyance;</li> </ul>	(3) As discussed at (2).
(b) There are no adverse impacts on surrounding properties;	(4) As discussed at (2).
(c) It is sited to minimise exposure to flood hazard.	(5) The proposed development minimises exposure to flood hazards due to being constructed at least 250 mm above the flood planning level (175.5 mAHD) and PMF level.
Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Forms A and A1 of Northern Beaches Council)	(6) As discussed at (1).
B. DRAINAGE INFRASTRUCTURE AND CREEK WORKS	
B1. Flood mitigation works or stormwater devices that modify a major drainage system, stormwater system, natural water course, floodway or flood behaviour within or outside the development site may be permitted subject to demonstration through a Flood Management Report that they comply with the Flood Prone Land Design Standard found on Council's webpage.	(7) No major flood mitigation works or stormwater devices are proposed for the development.
B2. A Section 88B notation under the Conveyancing Act 1919 may be required to be placed on the title describing the location and type of flood mitigation works with a requirement for their retention and maintenance.	(8) NA



C. BUILDING COMPONENTS AND STRUCTURAL SOUNDNESS		
C1. All buildings shall be designed and constructed as flood compatible buildings in accordance with Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, Hawkesbury-Nepean Floodplain Management Steering Committee (2006).	(9)	All structural elements, external and internal finishes up to the PMF (175.5 mAHD) are to be constructed from flood compatible building components. Building materials shall be designed considering the forces of the floodwater, debris, buoyancy and inundation. Details will be provided at detailed design stage.
C2. All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Structural certification shall be provided confirming the above. Where shelter-in-place refuge is to be provided the structural integrity is to be to the Probable Maximum Flood level.	(10)	As discussed at (9).
C3. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.	(11)	All electrical services, power points, fittings, and equipment will be above the FPL.
D. STORAGE OF GOODS		
D1. Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.	(12)	Hazardous or potentially polluting materials are not expected to be stored on site.
D2. Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level.	(13)	Products which are highly susceptible to water damage will not be stored below the FPL, and adequate storage room is available at higher levels.
E. FLOOD EMERGENCY RESPONSE		
E1. Development shall comply with Council's Flood Emergency Response Planning for Development in Pittwater Policy and the outcomes of any Flood Risk Emergency Assessment Report where it applies to the land.	(14)	The proposed design effectively renders the entirety of the development area flood free in the 1% AEP flood and PMF flood events. As such, the proposed development will enable safe occupation for all occupants and visitors up to and including the PMF event.
	(15)	In addition, site evacuation from site egresses to Laitoki Road and Cooyong Road are always accessible during the 1% AEP and PMF events.
E2. New development must provide an appropriately sized area to safely shelter-in- place above the Probable Maximum Flood level and appropriate access to this area should be available from all areas within the development.	(16)	As discussed at (14) (15).

Warringah Council DCP Requirement

Flood Assessment: 58 Laitoki Road, Terrey Hills, NSW P1504710JR07V01 – October 2018 Page 22

# martens

## Compliance

Warringah Council DCP Requirement		Compliance
E3. Adequate Warning Systems, Signage and Exits shall be installed to allow safe and orderly evacuation without reliance upon the SES or other authorised emergency services personnel.	(17)	Not applicable as occupants can shelter-in-place for all flood events up to and including the PMF.
F. FLOOR LEVELS		
F2. All development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no loss of flood storage in a 1% AEP Event. Where the dwelling is located over a flow path it must be elevated on suspended pier/pile footings such that the level of the underside of all floors including balconies and decks within the flood affected area are at or above, or raised to the Flood Planning Level to allow clear passage of the floodwaters under the building. The development must comply with the Flood Prone Land Design Standard.	(18)	As discussed at (2) and (9).
For suspended pier/pile footings, there must also be sufficient openings in perimeter walls located below the 1% AEP flood level to allow for the flood waters to flow through unimpeded:	(19)	NA
(a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters.	(20)	NA
(b) 50-75% of the perimeter of the underfloor area is of an open design between the natural ground level and the 1% AEP flood level. Only 25-50% of the perimeter would be permitted to be solid.	(21)	NA
(c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway.	(22)	NA
F3. Where the lowest floor has been elevated to allow the passage of flood waters, a restriction shall be imposed on the title of the land, pursuant to S88B of the Conveyancing Act confirming that the undercroft area is not to be enclosed.	(23)	NA
F7. All floor levels within the development shall be at or above the Probable Maximum Flood level of Flood Planning Level whichever is higher.	(24)	The proposed development ground surface level is at or above 175.5 mAHD which is at the PMF level and the FPL. As such, the lowest habitable level is at175.85 mAHD and therefore, also above the PMF and FPL.
G. CAR PARKING		
G2. The lowest floor level of open carparks and carports (unroofed or with open sides) shall be constructed no lower than the natural ground levels.	(25)	As discussed at (24).
G6. Carports must comply with the Flood Prone Land Design Standard. Car ports must:	(26)	NA



Warringah Council DCP Requirement		Compliance
(a) Be of an open design, where 50-75% of the perimeter walls are 'open' between natural ground level and the Flood Planning Level. Only 25-50% of the perimeter wall would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.	(27)	NA
(b) Constructed of flood compatible material.	(28)	NA
G7. Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1% AEP flood event and no impact on flood conveyance through the site.	(29)	NA
G9. All enclosed carparks must be protected from inundation up to the PMF level or Flood Planning Level whichever is higher. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant PMF Flood Level or Flood Planning Level whichever is higher.	(30)	As discussed at (24).
G10. Enclosed Garages must be located at or above the PMF Level or Flood Planning Level whichever is higher.	(31)	As discussed at (24).
H. FENCING		
H1. Fencing, including pool fencing, shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. Appropriate fencing must comply with the Flood Prone Land Design Standard in addition to other regulatory requirements of pool fencing.	(32)	ΝΑ
Fencing (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be open for passage of flood waters - All new fencing on the property must be flood compatible with 50-75% of the fence being of an open design between the natural ground level and the Flood Planning Level. Only 25-50% of the perimeter fence would be permitted to be solid. Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.	(33)	NA
I. POOLS		
11. Pools located within the 1% AEP flood extent are to be in-ground, with coping flush with natural ground level. Where it is not possible to have pool coping flush with natural ground level, it must be demonstrated that the development will result in no net loss of flood storage and no impact on flood conveyance on or from the site.	(34)	NA
All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level.	(35)	NA



Warringah Council DCP Requirement			Compliance
All chemicals associated with the pool are to be stored at or above the flood planning level.	(36)	NA	



# 6 Summary and Recommendations

A detailed hydrologic and hydraulic model has been developed for the site using the previously accepted MA flood assessment for 83 Booralie Road. Detailed survey data for several sites in the local area and proposed design elements for 83 Booralie Road were used to assess local flood characteristics.

The model was used to determine the existing and proposed flood conditions in the 1% AEP and PMF flood events. Assessment concluded that:

- 1. The site in its existing conditions is partly affected by flood waters during the 1% AEP and PMF events.
- 2. The proposed design effectively renders the entirety of the development area flood free in the 1% AEP flood and PMF events.
- 3. Site evacuation from site egresses to Laitoki Road and Cooyong Road are always accessible during the 1% AEP and PMF flood events and site shelter-in-place is available for all building levels.
- 4. Compliance with Council flood planning level requirements for the proposed development are achieved.

A number of recommendations are made to ensure the NBC requirements. These are summarised in Table 8.

The proposed development has been designed to ensure compatibility with the existing floodplain environment. As the proposed development achieves Council requirements, no further recommendations are considered necessary.



# 7 References

Bureau of Meteorology (2003), The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method.

Commonwealth of Australia (Geoscience Australia) (2016), Australian Rainfall and Runoff – A Guide to Flood Estimation.

DRAINS (2018), DRAINS Content Menu.

Martens & Associates (June 2013) Flooding Assessment, 83 Booralie Road, Terrey Hills, NSW, (REF: P1203558JR09V01, June 2013).

NSW Department of Infrastructure, Planning and Natural Resources (2005), Floodplain Development Manual.

Warringah Council (2011a), Warringah Local Environmental Plan (LEP).

Warringah Council (2011b), Warringah Development Control Plan (DCP).



8 Attachment A: Site Survey









CORNER OF	THE RC	DADS PTY LTD			REF No.	
No. 52 COO	YONG F	ROAD, TERRE	Y HILLS		49	30
A.H.D.	SCALE	1:1000 @ A2	DATE	4/5/2015	SHEET No.	3 of 3
<sup>ED</sup> S.P.	DRAWN	S.P.	DWG No.	4930A-04	REV No.	04

# 9 Attachment B: Proposed site layout







SITE BOUNDARY 98°31'40"

803 A210

retention and removal information.

NOT FOR CONSTRUCTION

NOTES:
Do not scale from this drawing. Use figured dimensions only.
Contact the Calder Flower Architects for clarifications if required.
Calder Flower Architects are not liable for any loss, damage, claim, cost demand as a result of the use or receipt of drawings issued in DWG format.
Refer to Landscape Documentation for external works and all tree retention and removal information.

DRAWING TITLE: FLOOR PLAN-LEVEL 1

S03 A210

# COOYONG ROAD

0 1 2 3 4 5

Scale: Project No Date: Project Status Issue DA

10

18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A101 A

Refer Scale Bar





TERREY HILLS PROPOSED SENIORS COMMUNITY



# COOYONG ROAD

0 1 2 3 4 5

Scale: Refer Scale Bar Project No Date: Project Status Issue DA

10

18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A102 A





Calder Flower Architects Pty Limited • ABN 66 001 900 278 • Nominated Architect: L Calder 6955 • L2 140 Myrtle St Chippendale NSW 2008 • T (02) 9698 9822 • E email@calderflower.com.au •

ARCHITECTS

9/10/18	Issue for Development Application	A	PJ	DM
DATE	ISSUE	Issue ID	Drawn	Check

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retention and removal information. NOT FOR CONSTRUCTION

Project Status 58 LAITOKI ROAD TERREY HILLS, NSW 2084 Issue for Development Issue NORTH Application DRAWING TITLE: Project Status Drawing No. Rev

DA

A103 A

FLOOR PLAN-LEVEL 3







LEVEL 05 1:250

CLIENT: Tolucy Pty Limited

Calder Flower Architects Pty Limited • ABN 66 001 900 278 • Nominated Architect: L Calder 6955 • L2 140 Myrtle St Chippendale NSW 2008 • T (02) 9698 9822 • E email@calderflower.com.au •





0 1 2 3 4 5 10

Refer Scale Bar Scale: Project No Date: Project Status Issue DA

18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A105 A







LEVEL 06

1:250

ARCHITECTS

CLIENT: Tolucy Pty Limited

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0 1 2 3 4 5

Refer Scale Bar Scale: Project No Date: Project Status Issue DA

10

18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A106 A







LEVEL 07 1:250

CLIENT: Tolucy Pty Limited



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18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A107 A







LEVEL 08

1:250

CLIENT: Tolucy Pty Limited



0 1 2 3 4 5

Refer Scale Bar Scale: Project No Date: Project Status Issue DA

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18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A108 A







LEVEL 09

1:250

CLIENT: Tolucy Pty Limited



0 1 2 3 4 5

Refer Scale Bar Scale: Project No Date: Project Status Issue DA

18000 09/07/2018 Issue for Development Application Project Status Drawing No. Rev A109 A

NORTH

10 Attachment C: Northern Beaches Council Standard Hydraulic Certification Form (A)



# Attachment A

NORTHERN BEACHES COUNCIL STANDARD HYDRAULIC CERTIFICATION FORM FORM A/A1 - To be submitted with Development Application

**Development Application for** 

Address of site:	58	Laitok:	Road,	terrey	4:15	NSW
Address of site:	20	Lairon	FUAR /	inrey	+11.3	10 m

Declaration made by hydraulic engineer or professional consultant specialising in flooding/flood risk management as part of undertaking the Flood Management Report:

1. Daniel	Ohincon	on behalf of	raters	+ Associates	Pty Ltd
(In	sert Name)	(Tr	ading or Bu	usiness/ Comp	any Name)
on this the	03.10.18		certi	ify that I am en	gineer or a
	(Da	te)			

professional consultant specialising in flooding and I am authorised by the above organisation/ company to issue this document and to certify that the organisation/ company has a current professional indemnity policy of at least \$2 million.

## Flood Management Report Details:

. .....

Report Litte:
Flood Assessment - 58 Laitaki. Read Three Hills NOW (DISO 4710 SROZINI)
างนั่งมีขึ้นหมายหนึ่งที่มาแก่หน้ามีหมายหมายหมายในการแส่งและแห่งกับที่มาและไปและแล้วและกับและไม่และ
Report Date: October 2013
Author: Al: Attar
Author's Company/Organisation: Martens + Associates Pty L+01

# 1: Daniel Dhiacon

(Insert Name)

Please tick all that are applicable (more than one box can be ticked)

Ave obtained and included flood information from Council (must be less than 12 months old) (This is mandatory)

Ave followed Council's Guidelines for Preparing a Flood Management Report

have requested a variation to one or more of the flood related development controls. Details are provided in the Flood Management Report.

Signature	J. JL	5/10/18
Name	Daniel	Ohiacon

# 11 Attachment D: Flood Assessment Planset



PROJECT:	PROPOSED SENIORS LIVING
PLANSET:	FLOOD ASSESSMENT
CLIENT:	TOLUCY PTY LTD



LOCALITY PLAN N.T.S.

# LGA: NORTHERN BEACHES COUNCIL

58 LAITOKI ROAD, TERREY HILLS, NSW LOT 368 DP 752017

	REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE
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# DEVELOPMENT APPLICATION - NOT FOR CONSTRUCTION

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		GT		
DISCLAIMER & COPYRIGHT				
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# TOLUCY PTY LTD

PROJECT NAME/PLANSET TITLE PROPOSED SENIORS LIVING FLOOD ASSESSMENT 58 LAITOKI ROAD, TERREY HILLS, NSW 2084



Environment Water Geotechnical Civil

Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 999 Email: mail@martens.com.au Internet: www.martens.com

DRAW	NG	LIST
DWG NO.	REV	DWG TITLE
GENERAL	,	
PS04-A000	В	COVER SHEET
FLOODING	<u>ן</u>	
MODEL SETU	P	
PS04-K000	В	CATCHMENT PLAN
PS04-K010	В	DRAINS MODEL SETUP
PS04-K015	В	DRAINS MODEL RESULTS 1% AEP & PMF FLOWS
MODEL RESU	LTS	
PS04-K100	В	1% AEP CRITICAL STORM DURATION EXISTING CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS04-K101	В	1% AEP CRITICAL STORM DURATION EXISTING CONDITION WATER VELOCITY (m/s)
PS04-K102	В	1% AEP CRITICAL STORM DURATION EXISTING CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS04-K110	В	PMF CRITICAL STORM DURATION EXISTING CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS04-K111	В	PMF CRITICAL STORM DURATION EXISTING CONDITION WATER VELOCITY (m/s)
PS01-K112	В	PMF CRITICAL STORM DURATION EXISTING CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS01-K200	В	1% AEP CRITICAL STORM DURATION PROPOSED CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K201	В	1% AEP CRITICAL STORM DURATION PROPOSED CONDITION WATER VELOCITY (m/s)
PS01-K202	В	1% AEP CRITICAL STORM DURATION PROPOSED CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS01-K210	В	PMF CRITICAL STORM DURATION PROPOSED CONDITION WATER LEVEL (mAHD) & WATER DEPTH (m)
PS01-K211	В	PMF CRITICAL STORM DURATION PROPOSED CONDITION WATER VELOCITY (m/s)
PS01-K212	В	PMF CRITICAL STORM DURATION PROPOSED CONDITION PROVISIONAL HYDRAULIC HAZARD CATEGORIES
PS01-K300	В	1% AEP CRITICAL STORM DURATION PROPOSED CONDITION WATER LEVEL AFFLUX (m)
PS01-K310	В	PMF CRITICAL STORM DURATION PROPOSED CONDITION WATER LEVEL AFELUX (m)

Consulting Engineers

COVER SHEET

	PRUJELT NU.	PLANSET NU.	RELEASE NU.	DRAWING NU.	REVISION
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A1 / A3 LANDSCAPE (A1LC\_v02.0.01)

![](_page_46_Figure_3.jpeg)

# 24/07/2017

Rainfall IFD Data System: Water Information: Bureau of Meteorology

Australian Government Bureau of Meteorology

# Location

Label: 85 Booralle Rd, Terrey Hills

Latitude: -33.679627 [Nearest grid cell: 33.6875 (S)]

Longitude:151.219172 [Nearest grid cell: 151.2125 (E)]

# IFD Design Rainfall Intensity (mm/h)

Issued: 24 July 2017

Rainfall Intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP). FAO for New ARR probability terminology

	Annual Exceedance Probability (AEP)											
Duration	63.2%	50%#	20%*	10%	5%	2%	1%					
1 min	142	160	219	261	305	366	416					
2 <u>min</u>	118	132	178	211	245	296	338					
3 min	109	122	165	196	229	276	315					
4 min	103	115	156	186	217	261	298					
5 min	97.0	109	148	177	207	249	283					
10 <u>min</u>	76.7	86.5	119	142	166	199	226					
15 <u>min</u>	63.8	72.0	99.0	118	138	166	188					
20 <u>min</u>	55.0	62.0	85.2	102	119	143	162					
25 <u>min</u>	48.5	54.7	75.1	89.8	105	126	143					
30 <u>min</u>	43.6	49.1	67.4	80.5	94.0	113	128					
45 <u>min</u>	34.0	38.2	52.2	62.3	72.7	87.4	99.4					
1 hour	28.3	31.8	43.3	51.7	60.3	72.5	82.6					
1.5 hour	21.8	24.4	33.2	39.6	46.2	55.7	63.5					
2 hour	18.2	20.3	27.5	32.9	38.4	46.3	52.9					
3 hour	14.1	15.8	21.4	25.5	29.8	36.1	41.2					
4.5 hour	11.1	12.4	16.8	20.1	23.5	28.5	32.5					
6 hour	9.37	10.5	14.3	17.1	20.1	24.3	27.7					
12 hour	6.38	7,18	9.88	11.9	14.0	16.9	19.3					

# Note:

# The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather It corresponds to the 1.44 ARI.

\* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather It corresponds to the 4.48 ARI.

This page was created at 12:48 on Monday 24 July 2017 (AEST)

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http://www.bom.gov.au/water/designRainfalls/revised-ifd/?design=ifds&sdmin=true&sdhr=true&nsd%5B%5D=20&nsdunit%5B%5D=m&nsd%5B%... 1/1

# IFD DATA

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							consent of Marten	s & Associates Pty Ltd	l.	58 LAITOKI ROAD, TERREY HILLS, NSW 2084	Suite 201, 20 George St, Hornsby, NSW 2077 Australia F	Phone: (02) 9476 9
							(C) Copyright I	Martens & Associa	ates Pty Ltd		Email: mail@martens.com.au Interne	t: www.martens.co
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PMF CRITICAL STORM DURATION

![](_page_48_Figure_14.jpeg)

58 LAITOKI ROAD, TERREY HILLS, NSW 2084

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- 1

# DEVELOPMENT APPLICATION - NOT FOR CONSTRUCTION

Consulting Engineers

# DRAINS MODEL RESULTS 1% AEP & PMF FLOWS

& Associates Pty Ltd Geotechnical					
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Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: www.martens.com.au	P1504710	PS04	R02	PS04-K015	В
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CADASTRAL BOUNDARY	

			-								
REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 5 10 15 20 25 30 35 40 45 50	мсл		ст	
Α	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	ADM			
								DISCLAIMER & COPYRIGHT			
								This plan must not be used for construction unless signed as approved by principal certifying authority.			
								All measurements in millimetres unless otherwise specified.			
								This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.			
								(C) Copyright N	lartens & Associa	tes Pty Ltd	
A1 / A3 L	ANDSCAPE (A1LC_v02.0.01)									<b>I</b>	

![](_page_52_Picture_6.jpeg)

![](_page_53_Figure_0.jpeg)

KEY	
SITE BOUNDARY	
CADASTRAL BOUNDARY	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE GRID DATUM PROJECT MANAGER
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES MUA IIIAND UT
							DISCLAIMER & COPYRIGHT
							This plan must not be used for construction unless signed as approved by principal certifying authority.
							All measurements in millimetres unless otherwise specified.
							_ This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.
							(C) Copyright Martens & Associates Pty Ltd
A1 / A3 L	ANDSCAPE (A1LC v02.0.01)						· · ·

![](_page_53_Picture_6.jpeg)

![](_page_54_Picture_0.jpeg)

KEY	
SITE BOUNDARY	
CADASTRAL BOUNDARY	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE GRID DAT	TUM PROJECT MANAGER	2 0		
B	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 5 10 15 20 25 30 35 40 45 50 MCA				
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES MUA INA	יט אין איז			
5							DISCLAIMER & COPY	YRIGHT			
							This plan must not be used a principal certifying authority.	This plan must not be used for construction unless signed as approved by principal certifying authority.			
							All measurements in millime	All measurements in millimetres unless otherwise specified.			
							This drawing must not be re consent of Martens & Assoc	This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.			
							(C) Copyright Martens	s & Associates Pty Ltd			
Δ1 / Δ3 I											

![](_page_54_Picture_8.jpeg)

![](_page_55_Picture_0.jpeg)

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE GRID DATUM PROJECT MANAGER	
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT		
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES MUA IIIAND UT	
							DISCLAIMER & COPYRIGHT	
							This plan must not be used for construction unless signed as approved by principal certifying authority.	
							All measurements in millimetres unless otherwise specified.	
							This drawing must not be reproduced in whole or part without prior written consent of Martens & Associates Pty Ltd.	
							(C) Copyright Martens & Associates Pty Ltd	
A1 / A3 L	ANDSCAPE (A1LC v02.0.01)	1	I	1	1	I		

![](_page_55_Picture_3.jpeg)

![](_page_55_Picture_6.jpeg)

![](_page_55_Picture_7.jpeg)

![](_page_56_Figure_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 <u>5</u> 101520253035404550	МСА		ст
Α	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	MUA	шапр	
								DISCLAIMER 8	COPYRIGHT	
							This plan must not be used for construction u			
								All measurements i	n millimetres unless of	herwise specified.
								This drawing must	not be reproduced in v	vhole or part without prior written
								consent of Martens	& Associates Pty Ltd.	
								(C) Copyright N	lartens & Associa	tes Pty Ltd
A1 / A3 I										

![](_page_56_Picture_7.jpeg)

![](_page_57_Picture_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE							
B	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 5 	10 15	20	25	30	35	40	45
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3)	1:500 (1:1,000	)					1
5														
							]							
ĺ														
A1/A3	ANDSCAPE (A11 C v02 0 01)	•	•	•	•		•							

		DATON	FROJECT HANAGER							
50 ETRES	MGA	mAHD	GT							
	DISCLAIMER & COPYRIGHT									
	This plan must not be used for construction unless signed as approved by principal certifying authority.									
All measurements in millimetres unless otherwise specified.										
	This drawing must not be reproduced in whole or part without prior writt consent of Martens & Associates Pty Ltd.									
(C) Copyright Martens & Associates Pty Ltd										

![](_page_57_Picture_10.jpeg)

![](_page_58_Figure_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 <u>5</u> 10 <u>15</u> 2025 <u>30</u> 35 <u>4045</u> 50	MGA		ст
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	ADM		
								DISCLAIMER 8	& COPYRIGHT	
							This plan must not be used for construction up principal certifying authority.			
								All measurements i	in millimetres unless o	therwise specified.
								This drawing must consent of Martens	not be reproduced in v & Associates Pty Ltd.	vhole or part without prior written
								(C) Copyright N	lartens & Associa	tes Pty Ltd
A1 / A3 L	ANDSCAPE (A1LC_v02.0.01)									

![](_page_58_Picture_6.jpeg)

![](_page_59_Figure_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER
В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 <u>5</u> 10 <u>15</u> 2025 <u>30</u> 35 <u>4045</u> 50	MGA		ст
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	ADM		
								DISCLAIMER {	& COPYRIGHT	
							This plan must not be used for construction unless principal certifying authority.			
								All measurements	in millimetres unless of	therwise specified.
								This drawing must not be reproduced in whole or part without prior w consent of Martens & Associates Pty Ltd.		hole or part without prior written
								(C) Copyright N	lartens & Associa	tes Pty Ltd
A1 / A3 I	ANDSCAPE (A1) C v02 0 01)		•	•	•					· · ·

![](_page_59_Picture_6.jpeg)

![](_page_60_Picture_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV DESCRIPTION B MINOR AMENDMENTS A INITIAL RELEASE

A1 / A3 LANDSCAPE (A1LC\_v02.0.01)

	GRID	DATUM	PROJECT MANAGER	CL					
50 IETRES	MGA	mAHD	GT						
	DISCLAIMER & COPYRIGHT								
	This plan must not be used for construction unless signed as approved by principal certifying authority.								
	All measurements i	n millimetres unless ot	herwise specified.						
	This drawing must not be reproduced in whole or part without prior writ consent of Martens & Associates Pty Ltd.								
	tes Ptv I td								

![](_page_60_Picture_10.jpeg)

![](_page_61_Picture_0.jpeg)

– L												
	REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	CLIENT
٩L	В	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 <u>5</u> 10 <u>15</u> 2025 <u>30</u> 35 <u>4045</u> 50	MGA		CT	
	А	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	MUA	ΙΠΑΠΟ		
20									DISCLAIMER & COPYRIGHT			PROJEC
] ch									This plan must not be used for construction unless signed as approved by principal certifying authority			
1			L						All measurements in millimetres unless otherwise specified.			
			ļ						This drawing must not be reproduced in whole or part without prior written			
			1						consent of Martens	& Associates Pty Ltd.		
LKIN				1					(C) Copyright N	lartens & Associat	tes Pty Ltd	
7	A1 / A3 LANDSCAPE (A1) C v02 0 01)											

![](_page_61_Picture_9.jpeg)

![](_page_62_Picture_0.jpeg)

KEY	
SITE BOUNDARY	
PROPOSED LOT LAYOUT	

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD	SCALE	GRID	DATUM	PROJECT MANAGER	CLIENT
B	MINOR AMENDMENTS	09/10/2018	GM	AA	DD/GT	GT	0 5 10 15 20 25 30 35 40 45 50	MCA		ст	
A	INITIAL RELEASE	05/10/2018	GM	AA	DD	DD	A1 (A3) 1:500 (1:1,000) METRES	MUA		וט	
5								DISCLAIMER & COPYRIGHT			PROJEC
								This plan must not be used for construction unless signed as approved by			
								All measurements in minimetres unless otherwise specified.			
								This drawing must not be reproduced in whole or part without prior			
								consent of Martens	s & Associates Pty Ltd.		
-								(C) Copyright N	Aartens & Associa	tes Pty Ltd	
A1 / A3   ANDSCAPE (A1 C v02 0 01)											

![](_page_62_Picture_10.jpeg)