



van der meer

FLOODPLAIN MANAGEMENT REPORT

Palm Beach Mixed-Use Development
1112-1116 Barrenjoey Road
Palm Beach NSW 2108

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C	Changes to Layout	26 July 2023	Andrew Wallis
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E	Additional Comments	8 September 2023	Andrew Wallis
F	Changes following S34 Conf.	6 August 2024	Andrew Wallis

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2 Executive Summary

This report assesses the flood risk to the proposed development at 1112-1116 Barrenjoey Road, Palm Beach, NSW for compliance with Pittwater 21 Development Control Plan.

The proposed development is a mixed-use development that occupies a site previously used for commercial purposes with attached ancillary car parking.

Assessment of council flood information has indicated inconsistency between measured LiDAR information within the existing carpark and existing road levels. Council's TUFLOW model was analysed in GRC Hydro's Flood Impact Assessment.

The flood impact assessment shows that flooding is confined to the western (road facing) portion of the site. Minor changes to the existing flood extents are expected due to the development of the existing carpark.

A portion of the retail section at the front of the site is below the Flood Planning Level of 3.12m AHD. Council's DCP which allows for a 5m zone at the front of the building below the Flood Planning Level to facilitate street activation, The proposed zone extends 5m and therefore complies with Council's flood controls.

3 Introduction

Van der Meer Consulting has been commissioned to prepare a Flood Management Report for the proposed mixed-use development at 1112-1116 Barrenjoey Road, Palm Beach NSW. This report will be lodged to Northern Beaches Council for the Development Assessment for this development.

The scope of this report includes an assessment of the flood risk for the proposed development and details the design measures and controls needed to achieve compliance with the relevant state and local plans and policies.

3.1 Planning and Policy Background

The following state and local environmental policies and plans are relevant to the development, and are addressed in this report:

- Pittwater Local Environment Plan 2014, Clauses 7.3, 7.4 and 7.5
- State Environmental Planning Policy (Coastal Management) 2018, Clause 15
- Pittwater 21 Development Control Plan, Clauses B3.8, B3.9, B3.12, B3.11

4 Description of Development

4.1 Existing Site

The subject site area is approximately 1,360m² and faces west onto Barrenjoey Road. Currently, the site is utilised by a single-story commercial office and cafe with ancillary car parking supporting the development, with the lot naturally grading towards the west. A retaining wall is located on the eastern side of the carpark, with the upper extents of the lot remaining as thick vegetation. The site is bounded by a commercial building in the south and residential developments on the eastern and northern sides. The location of the subject site is shown in Figure 4.1 below.

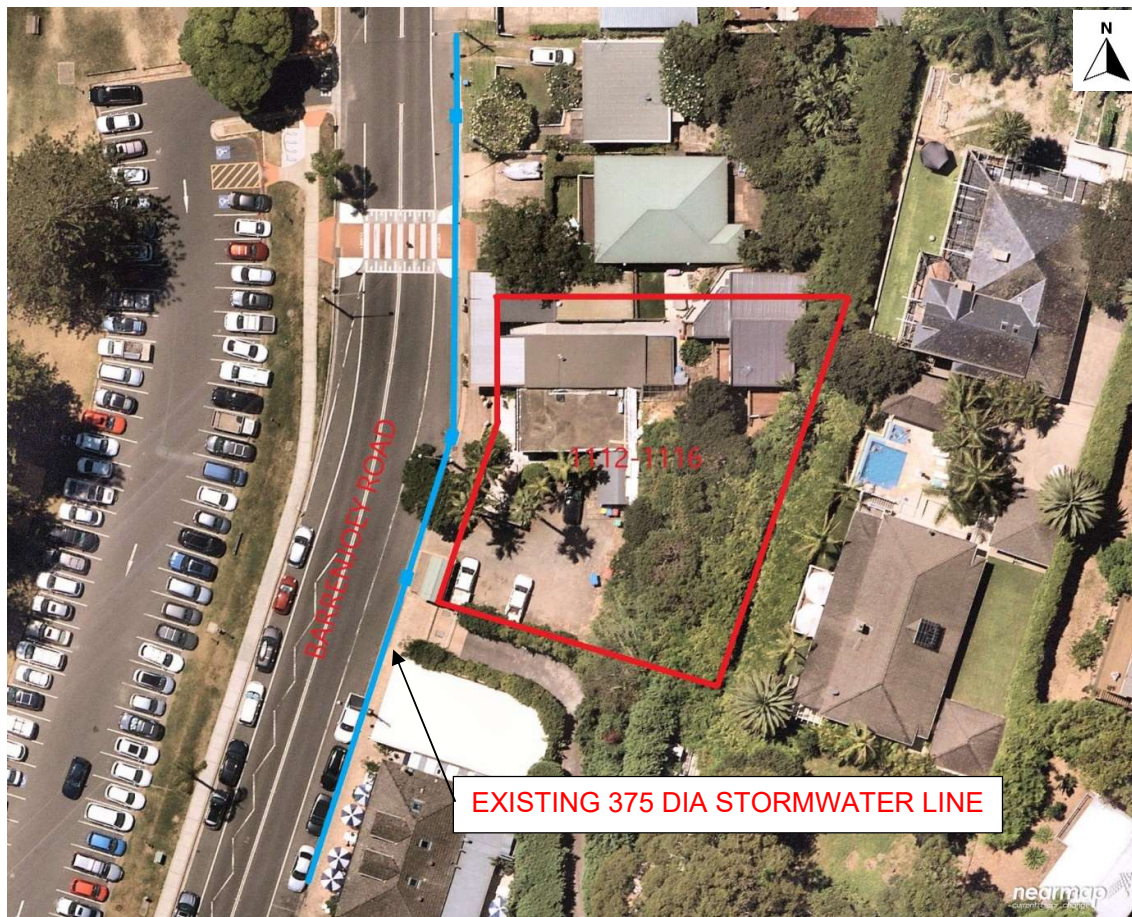


Figure 4.1 - Site Plan (Nearmaps, 2021)

4.2 Proposed Works

The proposed development consists of demolition of all existing structures within the site and construction of a mixed-use shopfront housing development with basement car parking, ground-level retail spaces, and above-ground residential levels as illustrated in Figure 4.2 below. The building footprint will cover most of the property.

6

5 Flood Analysis

Barrenjoey Road is flood liable being a low point where the flow can collect. In the 1%, AEP event the water level is in the order of 2.62m AHD. (GRC Hydro, 2021) The flood planning level is 3.12m (Northern Beach Council, 2021).

The currently existing site is a combination of commercial buildings (at the northern end of the site) with parking to the south. Levels at the site are in order of 2.3m AHD but range up to 15m AHD at the point furthest from the street. Broadly the site does receive runoff from minor catchments in upper areas, but such flows are insignificant relative to the flow path on Barrenjoey road which is the main source of floodwater affecting the site.

The extents of the 1% AEP flood behaviour, as detailed by GRC Hydro (depth, extent and levels) are shown in Figure 5.1 and Figure 4.2.

The PMF level at the subject site is 2.76m AHD, 0.14m deeper than the 1% AEP event.

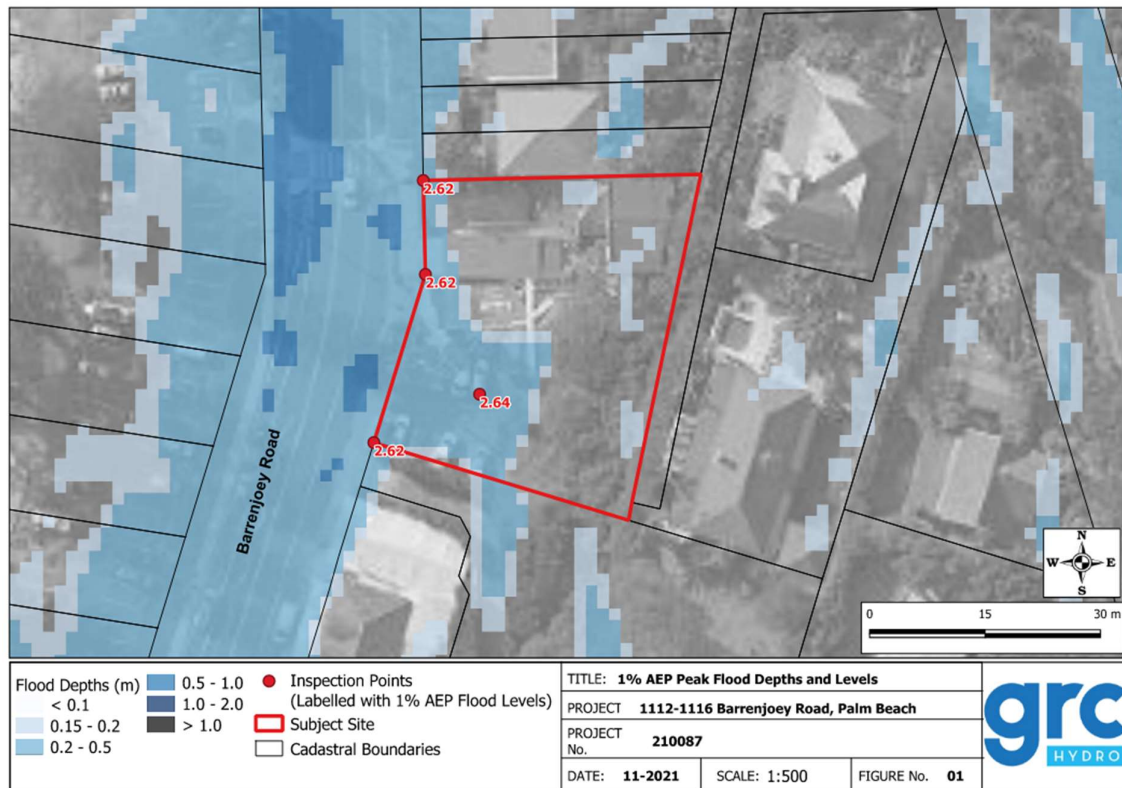


Figure 5.1 – 1% AEP Peak Flood Depths and Levels (GRC Hydro, 2021)

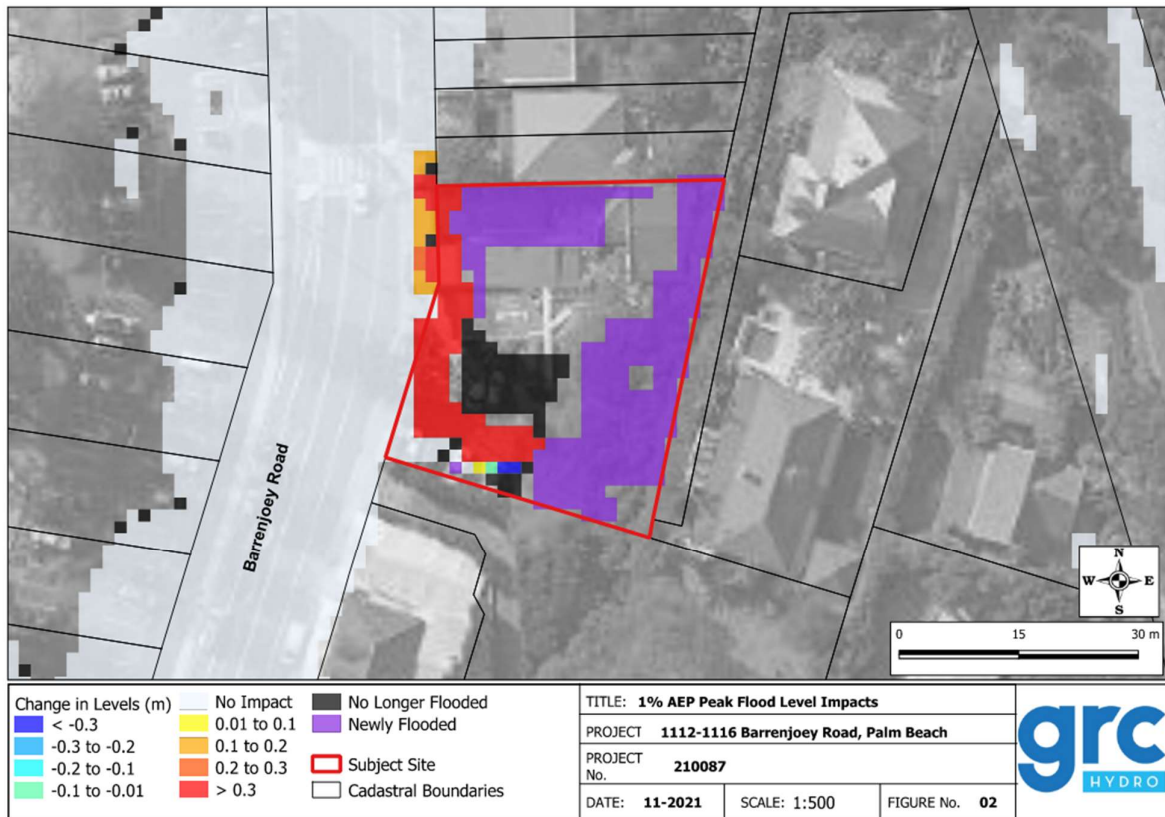


Figure 5.2 - 1% AEP Peak Flood Level Impacts (GRC Hydro, 2021)

5.1 Effects of Climate Change

The impacts of both sea level rise and increased rainfall intensity because of climate change have been assessed in the Avalon to Palm Beach Floodplain Risk Management Study and Plan (Manly Hydraulics Laboratory, 2017) and was provided in the flood information provided by Council. The climate change flood levels provided in the report demonstrates that there is generally a 40mm increase above the 1% AEP flood level for the same corresponding location. The proposed FPL adopted for the development includes a 500mm freeboard, which more than adequately covers the impact of climate change on flood levels.

The rise in flood levels is primarily the result of increased rainfall intensity and sea level rise would have a minimal impact. This is because the 1% AEP still water level in the year 2100 is 2.30 mAHD at nearby Fort Denison (NSW Environment and Heritage, 2010), which is below the water levels on site, as shown in Table 5.1.

Table 5.1 below provides a list of increases in 1% AEP water levels from the effects of climate change. Locations of flood levels are shown in Figure 5.3.

Table 5.1 – Increases in 1% AEP Flood Levels due to climate change

Location ID	1% AEP WL without climate change (mAHD)	1% AEP WL with climate change (mAHD)	Change in 1% AEP WL (mAHD)
1	2.63	2.67	+0.04
2	2.61	2.66	+0.05
3	2.61	2.65	+0.04
4	2.62	2.66	+0.04
5	2.96	2.97	+0.01
6	2.75	2.77	+0.02

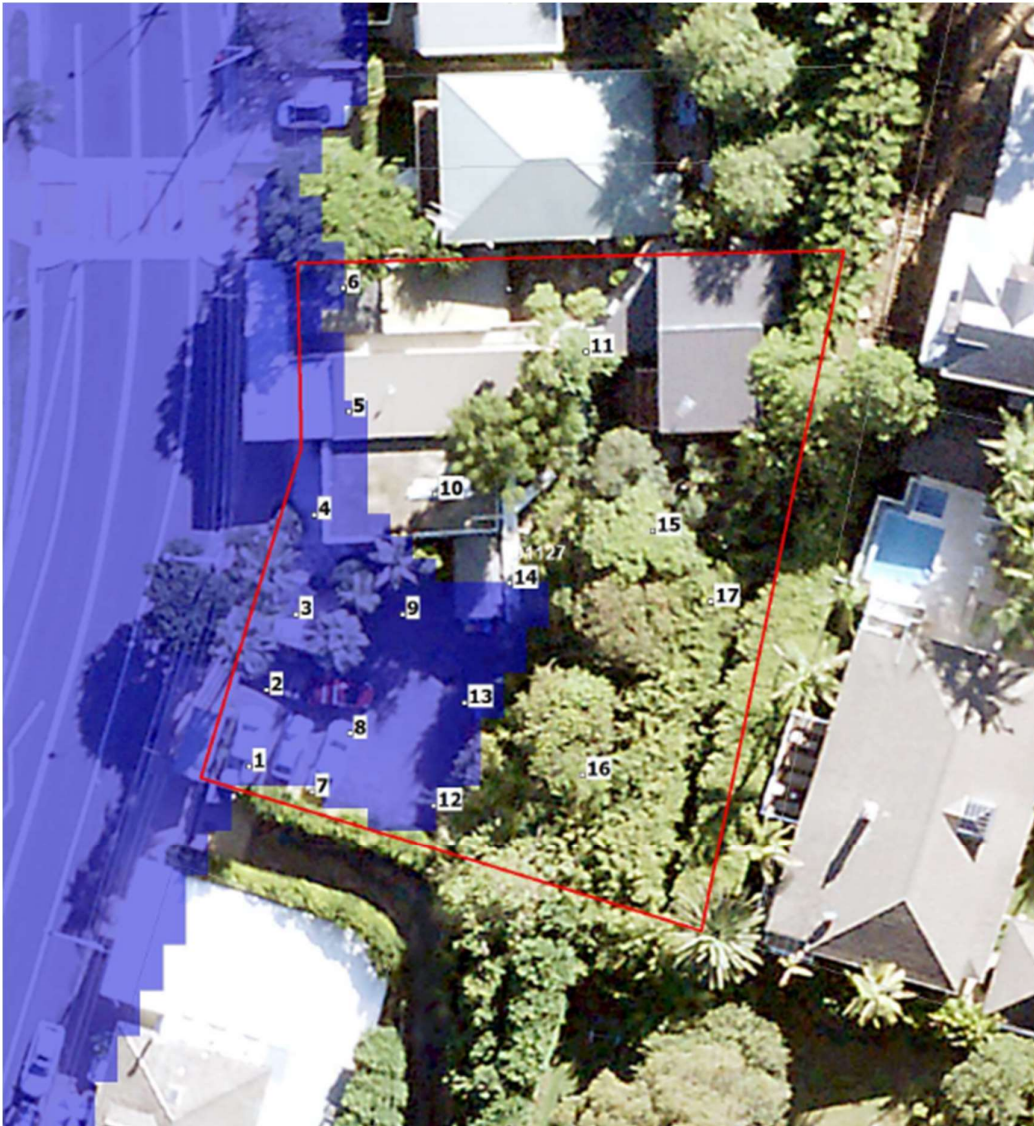


Figure 5.3 – 1% AEP Flood Extents and Flood Level Measurement Locations (GRC Hydro, 2021)

6 Assessment of Impacts

The Pittwater 21 DCP, clause B3.11 specifies prescriptive controls for development on flood-prone land, which vary depending on flood risk and land use. The highest flood risk for the site of the proposed development is a medium risk (Northern Beaches Council, 2021) and the proposed land use is both residential and business & industrial. The controls that apply to the proposed development, their impacts on the development, and the proposed development's compliance with these controls are listed in Table 6.1 below.

Table 6.1 – Flood Risk Management Compliance Table

Item	Description	Impact on Development	Compliance
<i>A. Flood Effects Caused by Development</i>			
A1	<p>Development shall not be approved unless it can be demonstrated in a Flood Management Report that it has been designed and can be constructed so that in all events up to the 1% AEP event:</p> <p>(a) There are no adverse impacts on flood levels or velocities caused by alterations to the flood conveyance; and</p> <p>(b) There are no adverse impacts on surrounding properties; and</p> <p>(c) It is sited to minimise exposure to flood hazards.</p> <p>Major developments and developments likely to have a significant impact on the PMF flood regime will need to demonstrate that there are no adverse impacts in the Probable Maximum Flood.</p>	<p>The residential area of the proposed development complies with the FPL and is located above the 1% AEP event.</p> <p>According to the GRC Hydro Flood Impact Assessment Report (Appendix 2), No Impact on adjacent private property is noted. The GRC Hydro report also states that there is no impact on 1% AEP Flood behaviour.</p>	Y
A2	<p>Development shall not be approved unless it can be demonstrated in a Flood Management Report that in all events up to the 1% AEP event there is no net loss of flood storage. Consideration may be given for exempting the volume of standard piers from flood storage calculations. If Compensatory Works are proposed to balance the loss of flood storage from the development, the Flood Management Report shall include detailed calculations to demonstrate how this is achieved.</p>	<p>Loss of flood storage is not expected as the proposed development footprint is outside of the modelled flood storage footprint for the Flood Planning Level.</p>	Y

Item	Description	Impact on Development	Compliance
<i>B. Building Components and Structural Soundness</i>			
B1	All buildings shall be designed and constructed with flood compatible materials by “Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas”, Hawkesbury-Nepean Floodplain Management Steering Committee (2006).	The proposed building is to be structurally designed and constructed with flood-compatible materials up to the FPL in the architectural and structural specifications.	Y
B2	All new development 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. Where shelter-in-place refuge is required, the structural integrity for the refuge is to be up to the Probable Maximum Flood level. Structural certification shall be provided confirming the above.	The development is to be designed and certified to ensure structural integrity up to the Flood Planning Level and account for the relevant forces associated with this flooding.	Y
B3	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 within the subject structure must have residual current devices installed that turn off all electricity supply to the property when floodwaters are detected.	Electrical, sewerage and other service connections such as Hydrant Boosters are to be located at or above the flood planning level or waterproofed appropriately. Existing electrical equipment to be retained is to have residual current devices installed that turn off all electricity supply to the property when floodwaters are detected.	Y

Item	Description	Impact on Development	Compliance
<i>C. Floor Levels</i>			
C1	New floor levels within the development shall be at or above the Flood Planning Level.	Complies (subject to C7 below).	Y
C3	<p>All new development must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no net loss of flood storage in all events up to the 1% AEP event.</p> <p>(a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of flood water, considering the potential for a small opening to block' and</p> <p>(b) At least 50% of the perimeter of the underfloor area is of an open design from the natural ground level up to the 1% AEP Flood level and</p> <p>(c) No solid area of the perimeter of the underfloor area would be permitted in a floodway</p>	<p>Loss of flood storage is not expected as the proposed development will not alter flood conveyance.</p> <p>Suspended pier/ pile footings are not associated with the proposed development.</p>	Y
C4	<p>A one-off addition or alteration below the Flood Planning Level of less than 30 square meters (in total, including walls) may be considered only where:</p> <p>(a) it is an extension to an existing room; and</p>	A one-off addition or alteration will not be included as part of the proposed development.	N/A

Item	Description	Impact on Development	Compliance
	<p>(b) the Flood Planning Level is incompatible with the floor levels of the existing room; and</p> <p>(c) out of the 30 squares meters, not more than 10 square meters is below the 1% AEP flood level.</p> <p>This control will not be permitted if this provision has previously been utilised since the making of this Plan.</p> <p>The structure must be floodproofed to the Flood Planning Level, and the Flood Management Report must demonstrate that there is no net loss of flood storage in all events up to the 1% AEP event.</p>		
C6	<p>Consideration may be given to the retention of an existing floor level below the Flood Planning Level when undertaking a first-floor addition provided that:</p> <p>(a) it is not located within a floodway; and</p>	An existing floor level is not proposed to be retained as part of the development	N/A
C7	<p>Consideration may be given to a floor level below the Flood Planning Level within the first 5 meters from the street front in an existing business zone provided it can be demonstrated that:</p> <p>(a) The minimum floor level is no lower than the adjacent footpath level, and</p> <p>(b) The maximum internal distance from the front of the building is 5</p>	Some of the retail area at the front of the site is below the Flood Planning Level of 3.12m. Council's DCP allows for a 5m zone at the front of the building to be below the FPL to facilitate street activation. The proposal extends 5m and therefore complies.	Y

Item	Description	Impact on Development	Compliance
	<p>meters, which can only apply to one side of an individual premises, and</p> <p>(c) The maximum area for the floor area to be below the Flood Planning Level for an individual premises are 30 square meters, and</p> <p>(d) There is direct internal access between areas above and below the Flood Planning Level for each individual premises.</p>		
D. Car Parking			
D1	Open carpark areas and carports shall not be located within a floodway.	There are no open car parks or carports associated with the development.	N/A
D2	The lowest floor level of open car parks and carports shall be constructed no lower than the natural ground levels, unless it can be shown that the carpark or carport is free draining with a grade greater than 1% and that flood depths are not increased.		N/A
D3	<p>Carports must be of open design, with at least 2 sides completely open such that flow is not obstructed up to the 1% AEP flood level. Otherwise, it will be considered to be enclosed.</p> <p>When undertaking a like-for-like replacement and the existing garage/carport is located on the street boundary and ramping is infeasible, consideration may be given for dry floodproofing up to the 1% AEP flood level.</p>		N/A

Item	Description	Impact on Development	Compliance
D4	Where there is more than 300mm depth of flooding in a car park or carport during a 1% AEP flood event, vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site. Protection must be provided for all events up to the 1% AEP flood event.	The underground carpark level is below the 1% AEP flood level. Parking facilities will be in the underground basement. All potential points of water ingress to the basement including ramp crest, stairs, utility connections and lift shafts will be complying with the appropriate FPL.	Y
D5	Enclosed Garages must be located at or above the 1% AEP level.		N/A
D6	All enclosed car parks (including basement car park) must be protected from inundation up to the Flood Planning Level. All access, ventilation, driveway crests and any other potential water entry points to any enclosed car parking shall be above the Flood Planning Level. Where a driveway is required to be raised it must be demonstrated that there is no net loss to available flood storage in any event up to the 1% AEP flood event and no impact on flood conveyance through the site. Council will not accept any options that rely on the electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark.		Y
E. Emergency Response			
E1	If the property is affected by a Flood Life Hazard Category of H3 or higher, then Control E1 applies and a Flood Emergency Assessment must be included in the Flood	Refer to Section 7 of this report addressing Flood Emergency Response Plan and Shelter in Place	Y

Item	Description	Impact on Development	Compliance
	<p>Management Report.</p> <p>If the property is affected by a Flood Life Hazard Category of H6, then development is not permitted unless it can be demonstrated to the satisfaction of the consent authority that the risk level on the property is or can be reduced to a level below H6 or its equivalent.</p> <p>If the property is flood affected but the Flood Life Hazard Category has not been mapped by Council, then calculations for its determination must be shown in the Flood Management Report, in accordance with the "Technical Flood Risk Management Guideline: Flood Hazard", Australian Institute for Disaster Resilience (2012).</p> <p>Where flood-free evacuation above the Probable Maximum Flood level is not possible, new development must provide a shelter-in-place refuge where:</p> <ul style="list-style-type: none"> a) The floor level is at or above the Probable Maximum Flood Level; and b) Floor space provides at least 2m² per person where the flood duration is long (6 or more hours) in the Probable Maximum Flood event, or 1m² per person for less than 6 hours; c) It is intrinsically accessible to all people on the site, plainly evident, and self-directing, with sufficient capacity of access routes for all occupants without reliance on an elevator; and 		

Item	Description	Impact on Development	Compliance
	<p>d) It must contain as a minimum: sufficient clean water for all occupants; portable radio with spare batteries; torch with spare batteries; and a first aid kit</p> <p>Class 10 classified buildings and structures (as defined in the Building Codes of Australia) are excluded from this control.</p> <p>In the case of change of use or internal alterations to an existing building, a variation to this control may be considered if justified appropriately by a suitably qualified professional.</p> <p>Note that in the event of a flood, occupants would be required to evacuate if ordered by Emergency Services personnel regardless of the availability of a shelter-in-place refuge.</p>		
F. Fencing			
F1	<p>Fencing, (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. At least 50% of the fence must be of an open design from the natural ground level up to the 1% AEP flood level. Less than 50% of the perimeter fence would be permitted to be solid. Openings should be a minimum of 75 mm x 75mm.</p>	<p>Fencing is not proposed in the areas of the property identified in the flood extents maps.</p>	Y

Item	Description	Impact on Development	Compliance
<i>G. Storage of Goods</i>			
G1	Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.	Storage of goods is to occur above the Flood Planning Level or be adequately designed for in any basement storage.	Y
<i>H. Pools</i>			
H1	<p>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.</p> <p>All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level.</p> <p>All chemicals associated with the pool are to be stored at or above the Flood Planning Level.</p>	<p>The proposed pool is on floor level 3, which is in RL 12.550m.</p> <p>All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level and chemicals associated with the pool area to be stored at or above the Flood Planning Level.</p>	Y

7 Flood Emergency Response Plan

The Northern Beaches Council requires a Flood Emergency Response Plan under control E1 of clause B3.11 of the Pittwater 21 Development Control Plan if the property is affected by a Flood Life Hazard Category of H3 or higher. This applies to this Flood Management Report as the street fronting of this property is affected by an FLC of H3. See Figure 7.1 below for more information.

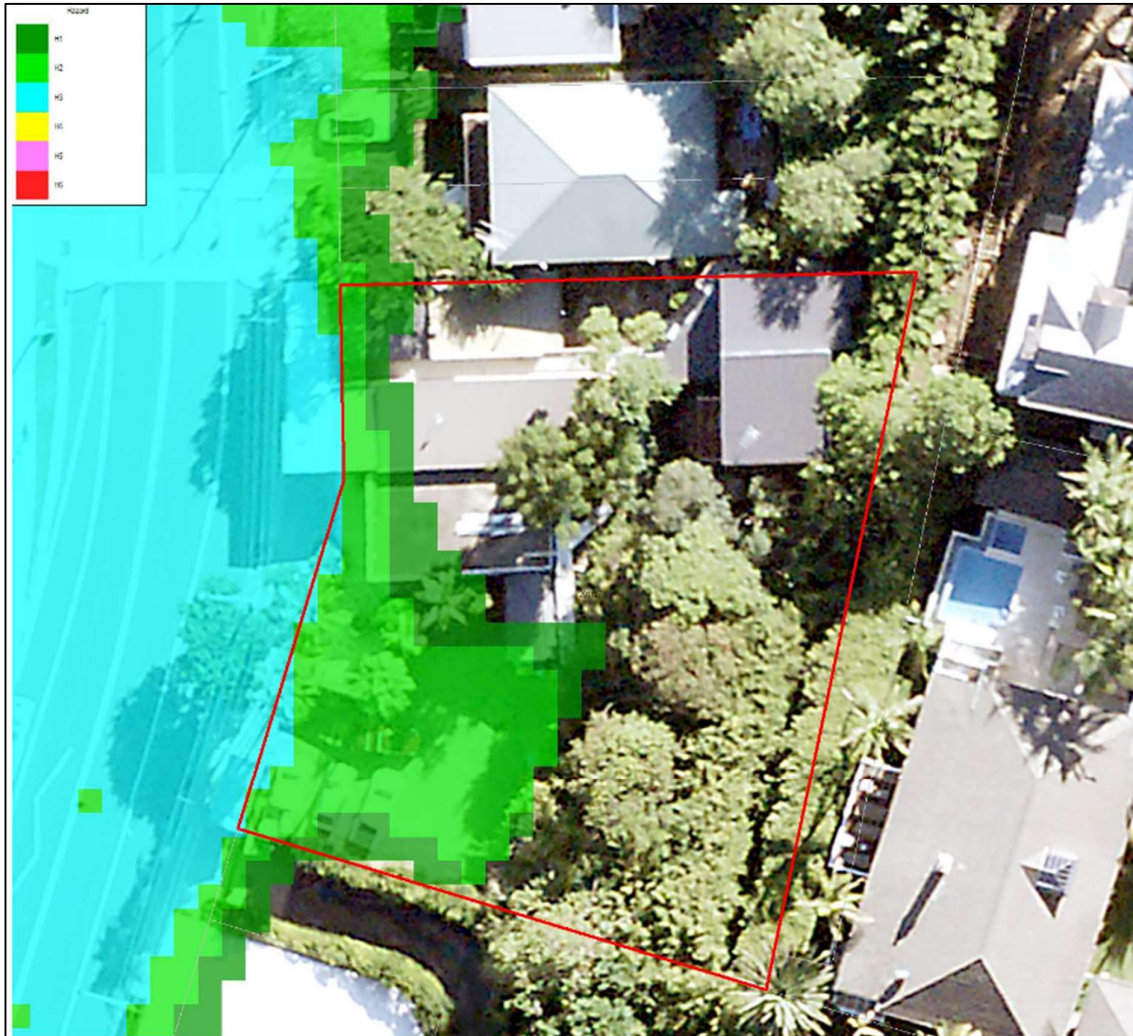


Figure 7 - Flood Life Hazard Category (Manly Hydraulics Laboratory, 2017)

7.1 Shelter in Place

As outlined under E1, B3.11 of the P21 DCP, a shelter-in-place refuge must be developed as evacuation is not possible above the Probable Maximum Flood level.

The following shelter-in-place refuges shall be provided for each occupant(s):

- Residential: Owners and visitors to shelter in their respective apartments

- Retail: Staff and customers to shelter towards the rear of the shops where there is ample floor space above the PMF flood level.
- Registered by-laws are to include a requirement for respective lot owners to maintain appropriate minimum resources for occupants.

The requirements for a shelter-in-place refuge are listed as below:

- The floor level is at or above the PMF level of 2.76 mAHD.
- At least 1 m² of floor space must be provided per person for short (<6 hours) flood events.
- It must be intrinsically accessible to all people on the site, be plainly evident and self-directing, and have sufficient capacity of access routes for all occupants without reliance on an elevator.
- It must contain the minimum resources for occupants:
 - o Sufficient clean water
 - o Portable radio with spare batteries
 - o Torch with spare batteries
 - o First aid kit.

8 Conclusion

This report has sought to assess the flood risk for the proposed mixed-use development at 1112-1116 Barrenjoey Road, Palm Beach NSW. Whilst the site is impacted by flooding in the 1% AEP and PMF floods, most of the proposed development lies outside the extents of flooding. Floor levels and the design of the building frontage means that the development will not be adversely affected by flooding and will not affect flood storage or flood behaviour. The proposed development will not have any adverse impacts on adjacent private property. This is because flood affection in the pre-development (existing) event is relatively minor with shallow flood water on less than one half the lot (GRC Hydro, 2021). The proposed building is to be floodproofed in its structure, materials and utilities connections up to the Flood Planning Level as detailed in this report.

Some of the retail area at the front of the site is below the Flood Planning Level of 3.12m. Council's DCP allows for a 5m zone at the front of the building to be below the FPL to facilitate street activation. The proposed zone extends 5m and therefore complies with Council's flood controls.

9 References

Howley, D. (2021). *Flood Information Report - 1112-1116 Barrenjoey Rd.* Sydney: NorthernBeaches Council.

Pittwater Estuary Mapping of Sea Level Rise Impacts” (Cardno 2015)

Northern Beaches Council. (2021, January). Pittwater 21 Development Control Plan. NSW Australia. Retrieved from <https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/Book.aspx?exhibit=PDGP&hid=12189>

Northern Beaches Council. (2021, February). Pittwater Local Environmental Plan 2014. NSW, Australia: NSW Government. Retrieved from <https://www.legislation.nsw.gov.au/view/html/inforce/current/epi-2014-0320#statusinformation>.

GRC Hydro. (2021, December). 1112 Barrenjoey Road, Palm Beach Flood Impact Assessment

Appendix A- Flood Information Request – Nothern Baech Council (June 2021)

FLOOD INFORMATION REQUEST – COMPREHENSIVE

Property: 1112-1116 Barrenjoey Road PALM BEACH NSW 2108

Lot DP: Lot 21 DP 571298

Issue Date: 15/06/2021

Flood Study Reference: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory

Flood Information for lot ¹:

Flood Risk Precinct – See Map A

Flood Planning Area – See Map A

Maximum Flood Planning Level (FPL) ^{2, 3, 4}: 6.62 m AHD

1% AEP Flood – See Flood Map B

1% AEP Maximum Water Level ^{2, 3}: 6.12 m AHD

1% AEP Maximum Depth from natural ground level³: 0.40 m

1% AEP Maximum Velocity: 0.30 m/s

1% AEP Hydraulic Categorisation: Flood fringe **See Flood Map D**

Probable Maximum Flood (PMF) – See Flood Map C

PMF Maximum Water Level ⁴: 6.14 m AHD

PMF Maximum Depth from natural ground level: 0.54 m

PMF Maximum Velocity: 0.59 m/s

PMF Hydraulic Categorisation: Flood storage **See Flood Map E**

Flooding with Climate Change (See Flood Map F)

The following is for the 30% Rainfall intensity increase and 0.9m Sea Level Rise Scenario:

1% AEP Maximum Water Level with Climate change³: 6.13 m AHD

1% AEP Maximum Depth with Climate Change³: 0.44 m

1% AEP Maximum Velocity with Climate Change³: N/A m/s

Flood Life Hazard Category – See Map G

Indicative Ground Surface Spot Heights – See Map H

¹ The flood information does not take into account any local overland flow issues nor private stormwater drainage systems.

² Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/flood planning levels across the site. The maximum Flood Planning Level may be in a different location to the maximum 1% AEP flood level.

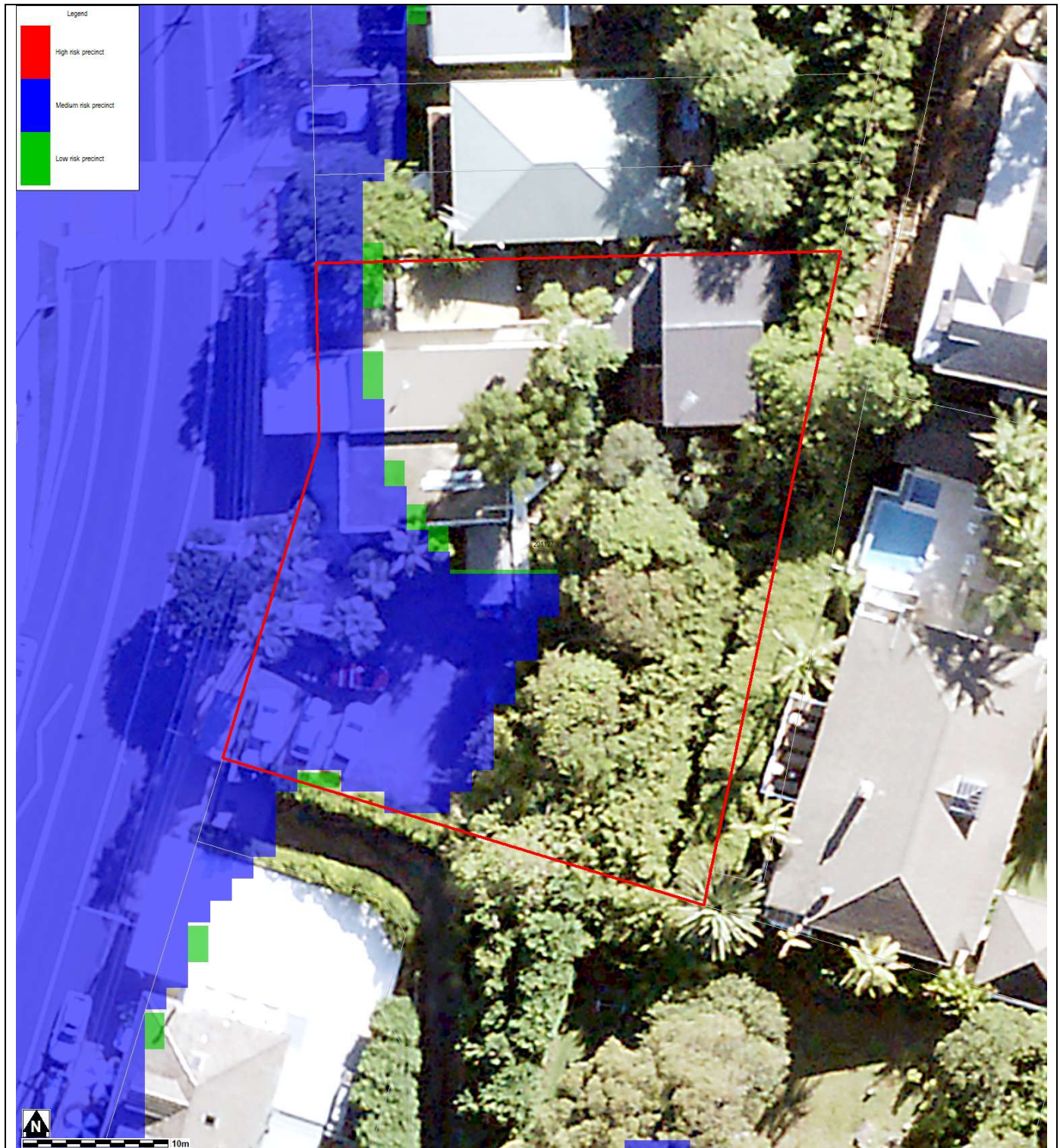
³ Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels.

⁴ Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or FPL.

General Notes:

- All levels are based on Australian Height Datum (AHD) unless otherwise noted.
- This is currently the best available information on flooding; it may be subject to change in the future.
- Council recommends that you obtain a detailed survey of the above property and surrounds to AHD by a registered surveyor to determine any features that may influence the predicted extent or frequency of flooding. It is recommended you compare the flood level to the ground and floor levels to determine the level of risk the property may experience should flooding occur.
- Development approval is dependent on a range of issues, including compliance with all relevant provisions of Northern Beaches Council's Local Environmental Plans and Development Control Plans.
- Please note that the information contained within this letter is general advice only as a detail survey of the property as well as other information is not available. Council recommends that you engage a suitably experienced consultant to provide site specific flooding advice prior to making any decisions relating to the purchase or development of this property.
- The Flood Studies on which Council's flood information is based are available on Council's website.

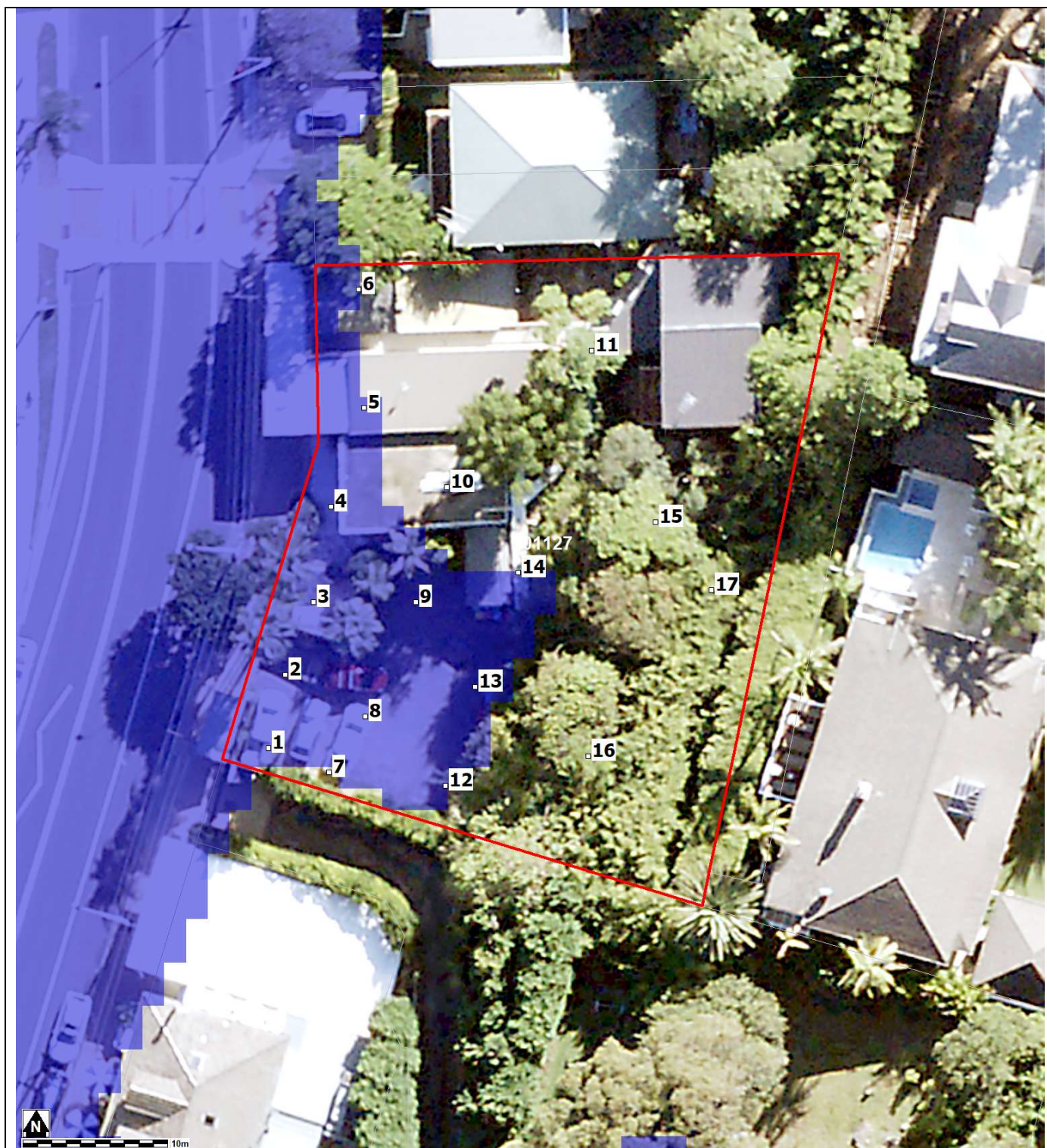
FLOOD MAP A: FLOOD RISK PRECINCT MAP



Notes:

- **Low Flood Risk precinct** means all flood prone land not identified within the High or Medium flood risk precincts.
- **Medium Flood Risk precinct** means all flood prone land that is (a) within the 1% AEP Flood Planning Area; and (b) is not within the high flood risk precinct.
- **High Flood Risk precinct** means all flood prone land (a) within the 1% AEP Flood Planning Area; and (b) is either subject to a high hydraulic hazard, within the floodway or subject to significant evacuation difficulties (H5 or H6 Life Hazard Classification).
- The **Flood Planning Area** extent is equivalent to the Medium Flood Risk Precinct extent, and includes the High Flood Risk Precinct within it. The mapped extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.
- None of these mapped extents include climate change.

FLOOD LEVEL POINTS



Note: Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only.

Flood Levels

ID	5% AEP Max WL (m AHD)	5% AEP Max Depth (m)	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)	1% AEP Max Velocity (m/s)	Flood Planning Level (m)	PMF Max WL (m AHD)	PMF Max Depth (m)	PMF Max Velocity (m/s)
1	2.60	0.19	2.63	0.22	0.12	3.12	2.76	0.35	0.22
2	2.58	0.31	2.61	0.35	0.10	3.11	2.76	0.49	0.29
3	2.58	0.27	2.61	0.30	0.07	3.11	2.76	0.45	0.22
4	2.59	0.27	2.62	0.30	0.05	3.13	2.76	0.44	0.17
5	N/A	N/A	2.96	0.14	0.06	3.46	3.02	0.20	0.15
6	N/A	N/A	2.75	0.17	0.13	3.24	2.84	0.26	0.21
7	N/A	N/A	N/A	N/A	N/A	N/A	2.89	0.17	0.21
8	2.58	0.24	2.62	0.27	0.12	3.12	2.76	0.42	0.25
9	2.68	0.19	2.71	0.21	0.15	3.20	2.82	0.32	0.33
10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12	3.44	0.30	3.45	0.31	0.14	4.04	3.50	0.35	0.16
13	3.50	0.37	3.51	0.38	0.18	4.07	3.55	0.42	0.27
14	5.21	0.20	5.21	0.20	0.14	N/A	5.24	0.23	0.19
15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

WL – Water Level

PMF – Probable Maximum Flood

N/A = no peak water level/depth/velocity available in flood event

Climate Change Flood Levels (30% Rainfall intensity and 0.9m Sea Level Rise)

ID	CC 1% AEP Max WL (m AHD)	CC1 % AEP Max Depth (m)
1	2.67	0.26
2	2.66	0.39
3	2.65	0.35
4	2.66	0.34
5	2.97	0.16
6	2.77	0.19
7	N/A	N/A
8	2.66	0.32
9	2.74	0.25
10	N/A	N/A
11	N/A	N/A
12	3.46	0.32
13	3.52	0.39
14	5.22	0.21
15	N/A	N/A
16	N/A	N/A
17	N/A	N/A

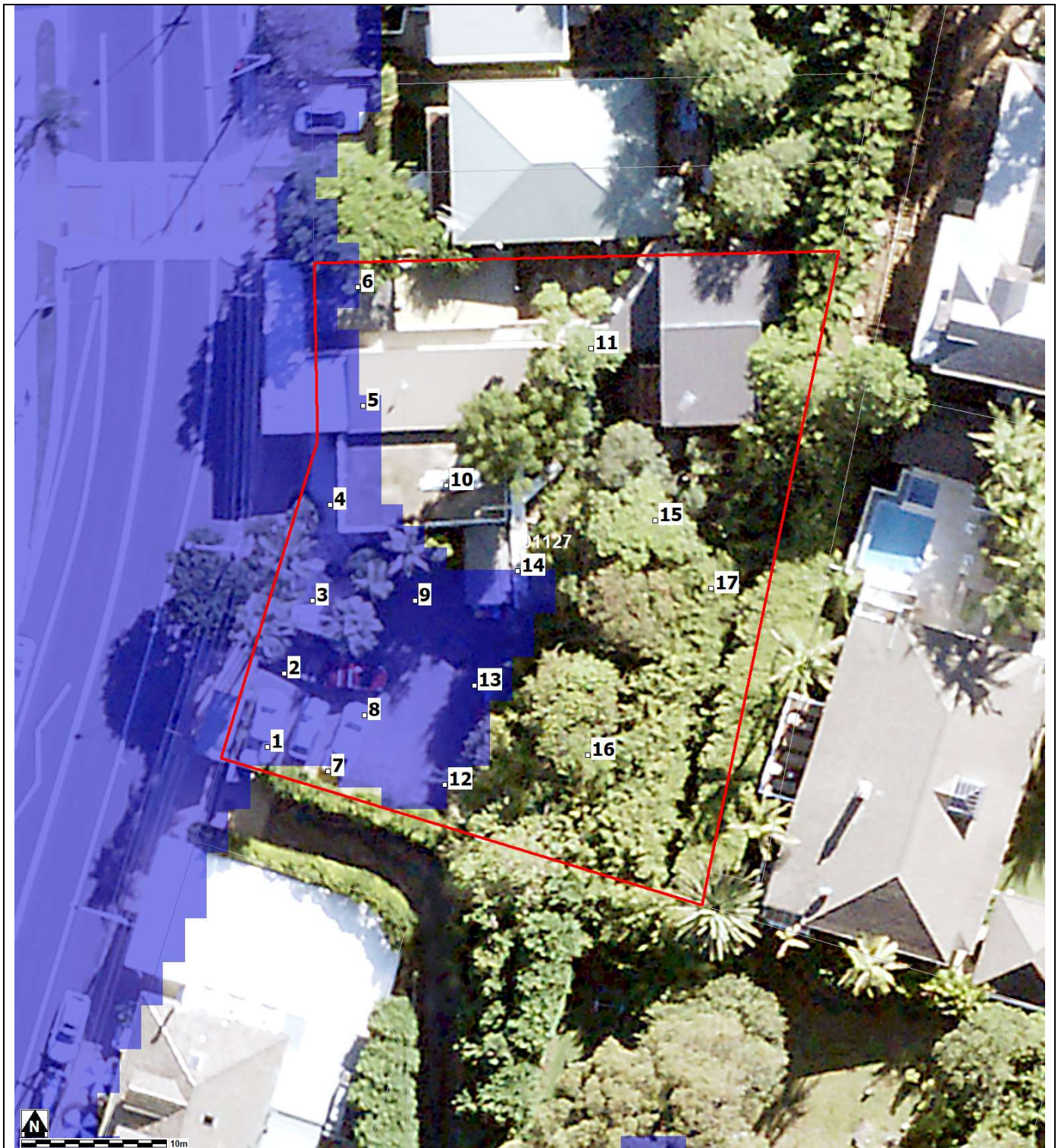
WL – Water Level

PMF – Probable Maximum Flood

N/A = no peak water level/depth/velocity available in flood event.

A variable Flood Planning Level might apply. Freeboard is generally 0.5m above the maximum 1% AEP water level. However for overland flow with a depth less than 0.3m and a VelocityxDepth product less than 0.3m²/s, a freeboard of 0.3m may be able to be justified.

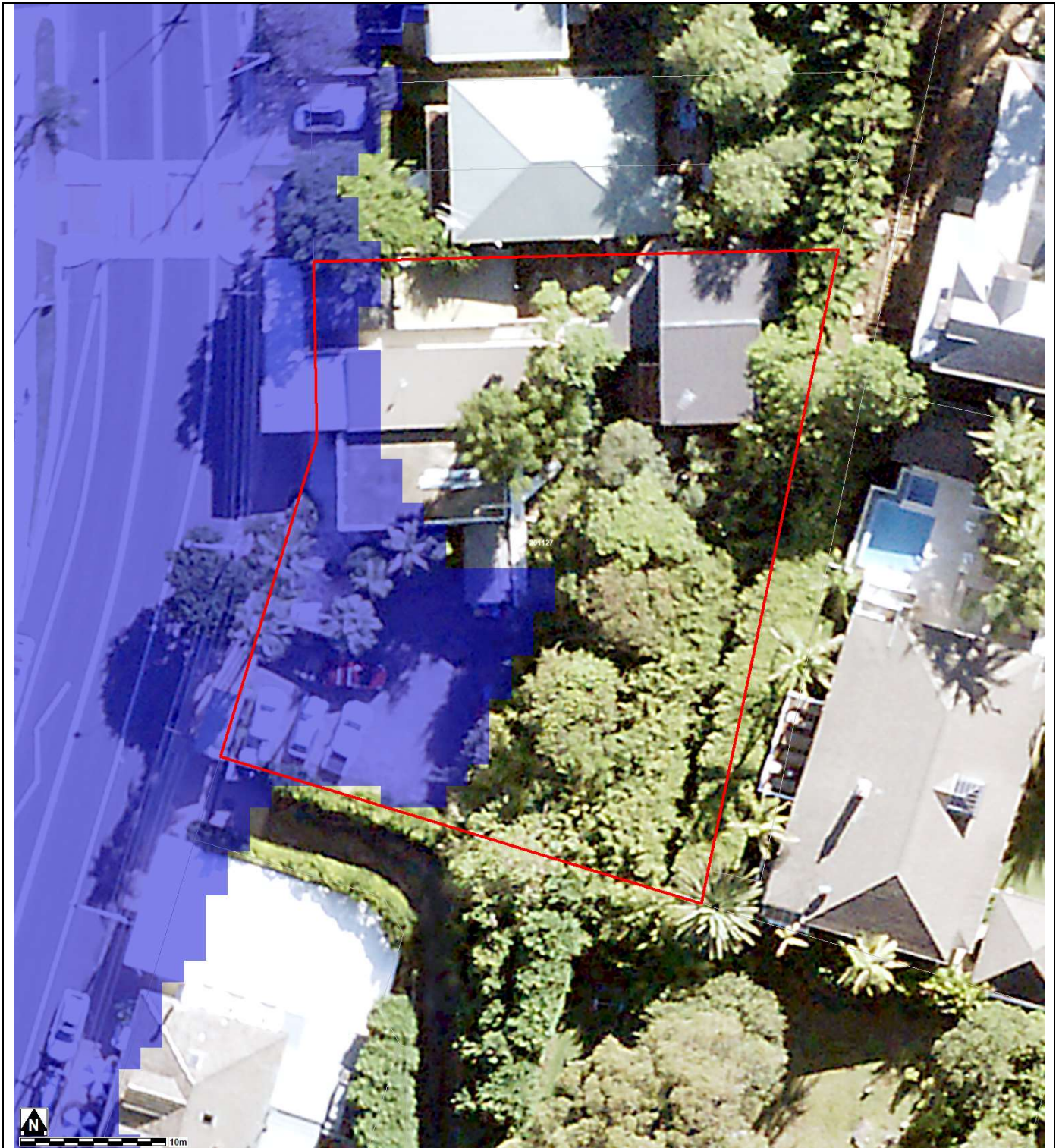
FLOOD MAP B: FLOODING - 1% AEP EXTENT



Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: Near Map 2014) are indicative only.

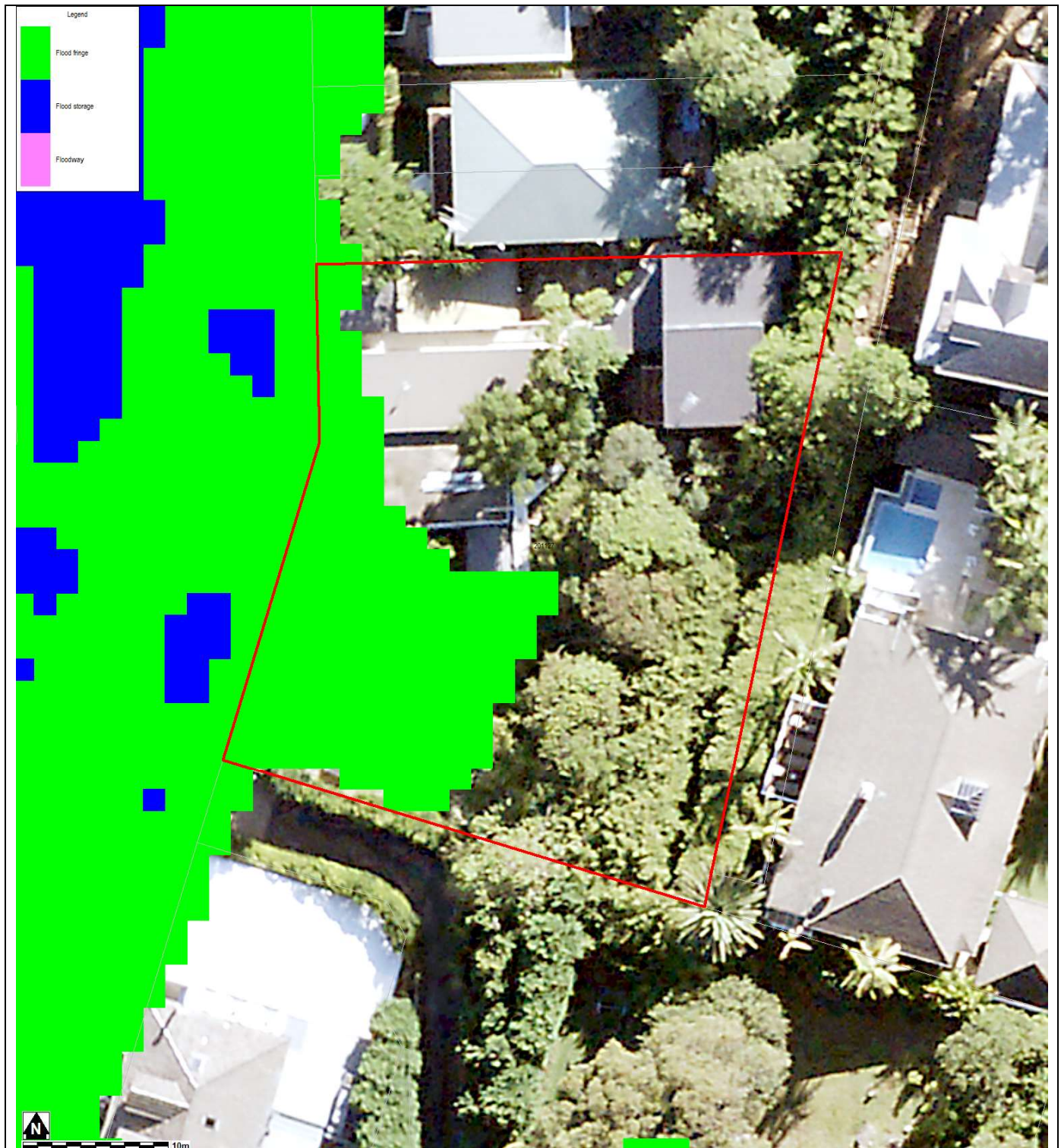
FLOOD MAP C: PMF EXTENT MAP



Notes:

- Extent represents the Probable Maximum Flood (PMF) flood event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only

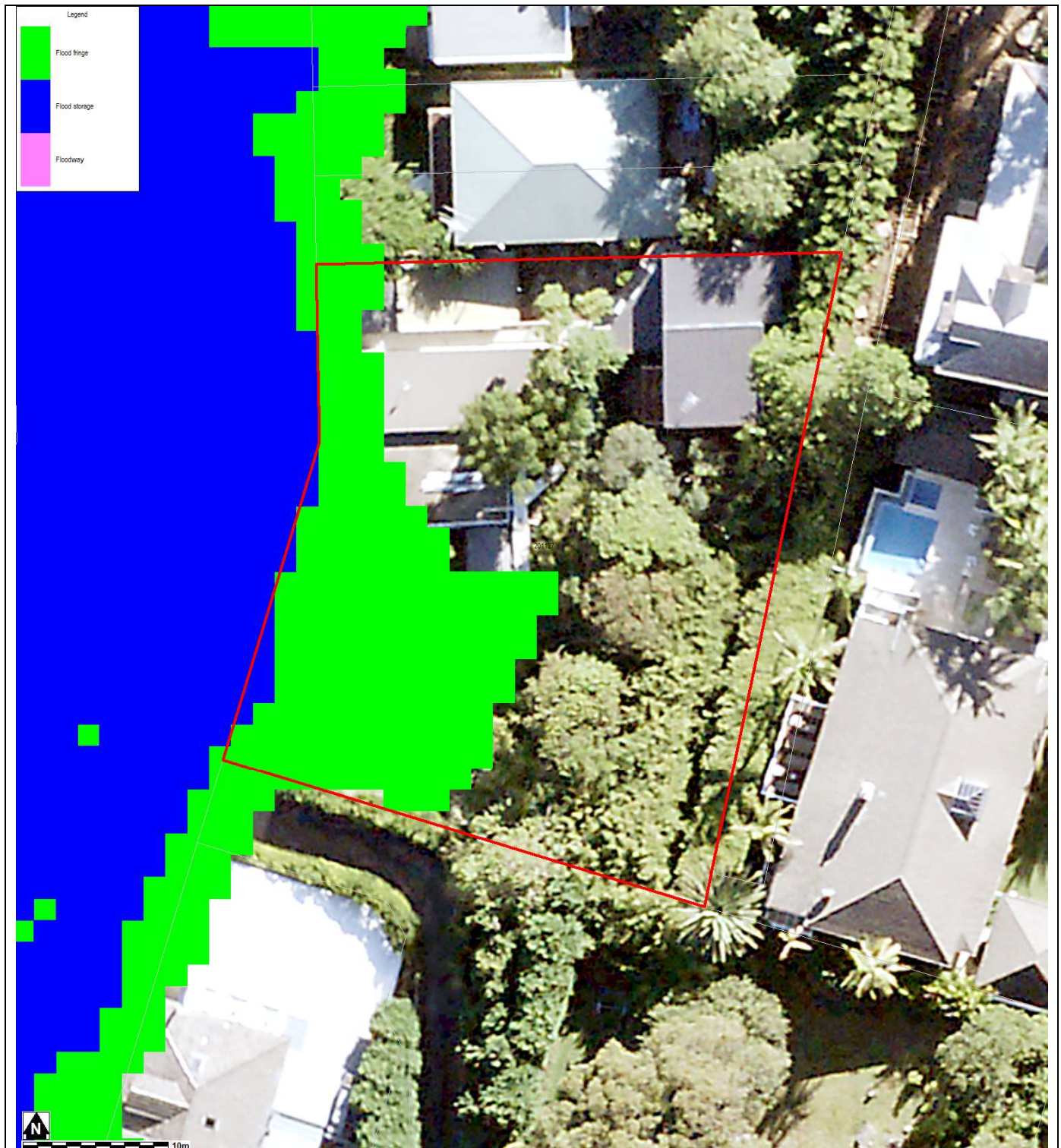
FLOOD MAP D: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only

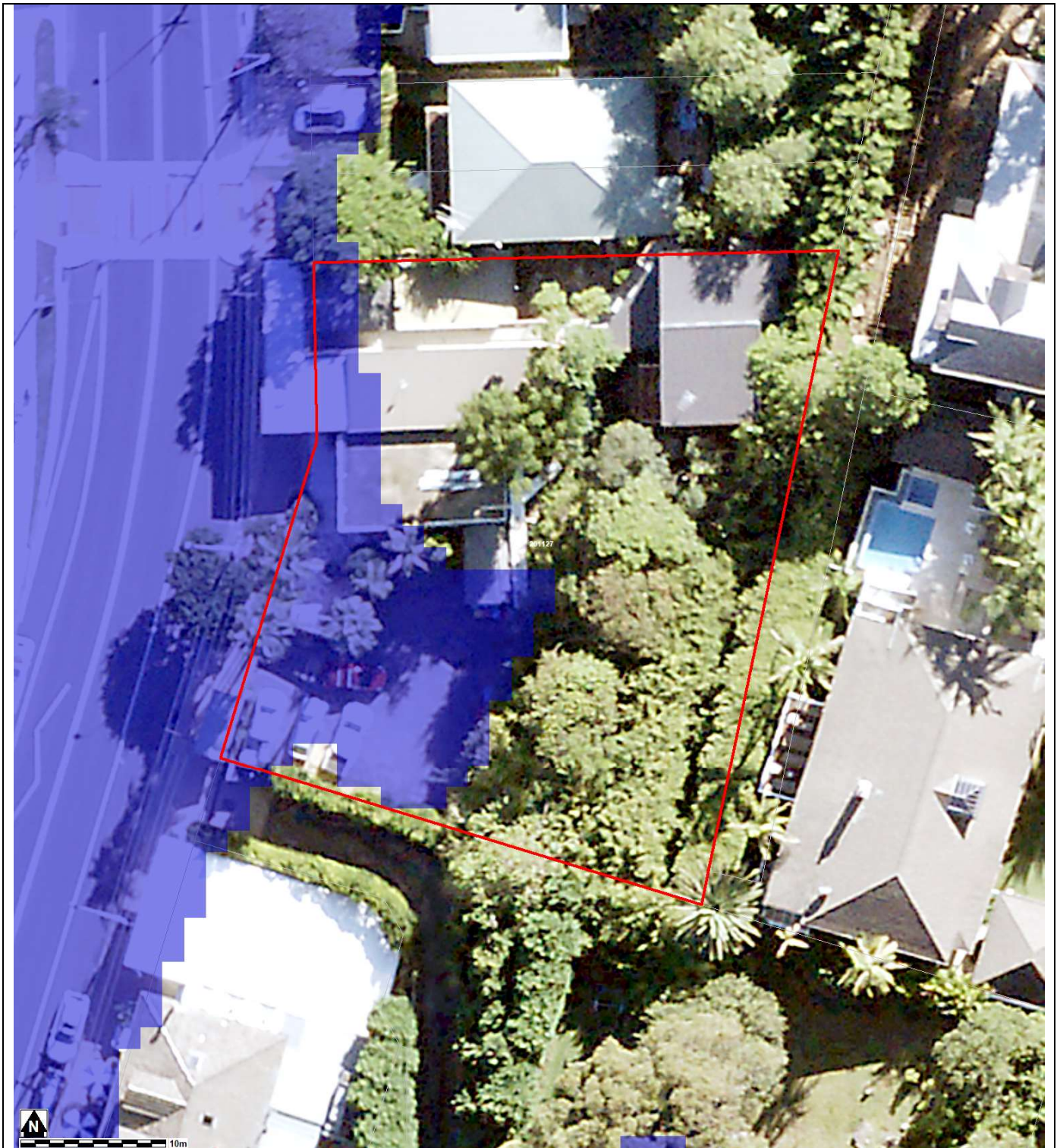
FLOOD MAP E: PMF FLOOD HYDRAULIC CATEGORY EXTENT MAP



Notes:

- Extent represents the Probable Maximum Flood (PMF) event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only

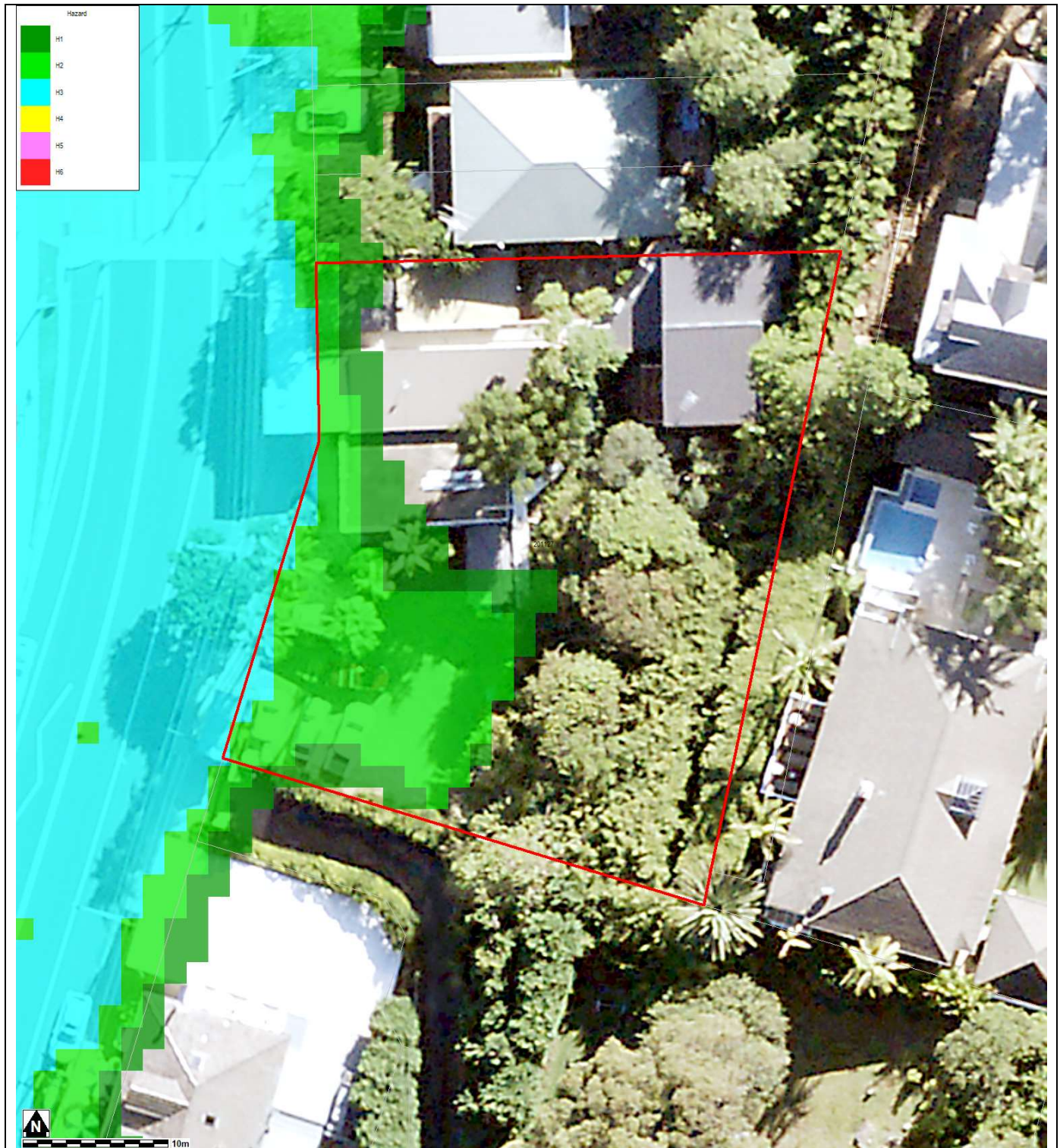
FLOOD MAP F: FLOODING – 1% AEP EXTENT PLUS CLIMATE CHANGE



Note:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event including 30% rainfall intensity and 0.9m Sea Level Rise climate change scenario
- Flood events exceeding the 1% AEP can occur on this site.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: NearMap 2014) are indicative only

FLOOD MAP G: FLOOD LIFE HAZARD CATEGORY



Notes:

- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory) and aerial photography (Source: Near Map 2014) are indicative only.

MAP H: INDICATIVE GROUND SURFACE SPOT HEIGHTS



Notes:

- The surface spot heights shown on this map were derived from Airborne Laser Survey and are indicative only.
- Accuracy is generally within $\pm 0.2\text{m}$ vertically and $\pm 0.15\text{m}$ horizontally, and Northern Beaches Council does not warrant that the data does not contain errors.
- If accuracy is required, then survey should be undertaken by a registered surveyor.

Preparation of a Flood Management Report

Introduction

These guidelines are intended to provide advice to applicants on how to determine what rules apply on flood prone land, and how to prepare a Flood Management Report. The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood related planning requirements.

Planning Requirements for Flood Prone Land

Development must comply with the requirements for developing flood prone land set out in the relevant Local Environment Plan (LEP) and Development Control Plan (DCP). There are separate LEPs and DCPs for each of the former Local Government Areas (LGAs), although preparation of a LGA-wide LEP and DCP is currently under way.

The clauses specific to flooding in the LEPs and DCPs are as follows:

LEP Clauses	DCP Clauses
Manly LEP (2013) – 6.3 Flood Planning	Manly DCP (2013) – 5.4.3 Flood Prone Land
Warringah LEP (2011) – 6.3 Flood Planning Warringah LEP (2000) – 47 Flood Affected Land *	Warringah DCP (2011) – E11 Flood Prone Land
Pittwater LEP (2014) – 7.3 Flood Planning Pittwater LEP (2014) – 7.4 Flood Risk Management	Pittwater 21 DCP (2014) – B3.11 Flood Prone Land Pittwater 21 DCP (2014) – B3.12 Climate Change

* The Warringah LEP (2000) is relevant only for the “deferred lands” which affects only a very small number of properties, mostly in the Oxford Falls area.

Development on flood prone land must also comply with Council's Water Management for Development Policy, and if it is in the Warriewood Release Area, with the Warriewood Valley Water Management Specification. Guidelines for Flood Emergency Response Planning are available for addressing emergency response requirements in the DCP. These documents can be found on Council's website on the [Flooding page](#).

Note that if the property is affected by estuarine flooding or other coastal issues, these need to be addressed separately under the relevant DCP clauses.

When is a Flood Management Report required?

A Flood Management Report must be submitted with any Development Application on flood prone land (with exceptions noted below), for Council to consider the potential flood impacts and applicable controls. For Residential or Commercial development, it is required for development on land identified within the Medium or High Flood Risk Precinct. For Vulnerable or Critical development, it is required if it is within any Flood Risk Precinct.

There are some circumstances where a formal Flood Management Report undertaken by a professional engineer may not be required. However the relevant parts of the DCP and LEP would still need to be addressed, so as to demonstrate compliance. Examples where this may apply include:

- If all proposed works are located outside the relevant Flood Risk Precinct extent
- First floor addition only, where the floor level is above the Probable Maximum Flood level
- Internal works only, where habitable floor areas below the FPL are not being increased

Note that development on flood prone land will still be assessed for compliance with the relevant DCP and LEP, and may still be subject to flood related development controls.

What is the purpose of a Flood Management Report?

The purpose of a Flood Management Report is to demonstrate how a proposed development will comply with flood planning requirements, particularly the development controls outlined in the relevant LEP and DCP clauses. The report must detail the design, measures and controls needed to achieve compliance, following the steps outlined below.

A Flood Management Report should reflect the size, type and location of the development, proportionate to the scope of the works proposed, and considering its relationship to surrounding development. The report should also assess the flood risk to life and property.

Preparation of a Flood Management Report

The technical requirements for a Flood Management Report include (where relevant):

1. Description of development

- Outline of the proposed development, with plans if necessary for clarity
- Use of the building, hours of operation, proposed traffic usage or movement
- Type of use, eg vulnerable, critical, residential, business, industrial, subdivision, etc

2. Flood analysis

- 1% AEP flood level
- Flood Planning Level (FPL)
- Probable Maximum Flood (PMF) level
- Flood Risk Precinct, ie High, Medium or Low
- Flood Life Hazard Category
- Mapping of relevant extents
- Flood characteristics for the site, eg depth, velocity, hazard and hydraulic category, and the relevance to the proposed development

If the property is affected by an Estuarine Planning Level (EPL) which is higher than the FPL, then the EPL should be used as the FPL. If the FPL is higher than the PMF level, then the FPL should still be used as the FPL, as it includes freeboard which the PMF does not.

3. Assessment of impacts

- Summary of compliance for each category of the DCP, as per the table below.

	Compliance		
	N/A	Yes	No
A) Flood effects caused by Development			
B) Building Components & Structural Soundness			
C) Floor Levels			
D) Car parking			
E) Emergency Response			
F) Fencing			
G) Storage of Goods			
H) Pools			

- Demonstration of how the development complies with any relevant flood planning requirements from the DCP, LEP, Water Management for Development Policy, and if it is in the Warriewood Valley Urban Land Release Area, with the Warriewood Valley Water Management Specification (2001)

- For any non-compliance, a justification for why the development should still be considered.
- Calculations of available flood storage if compensatory flood storage is proposed
- Plan of the proposed development site showing the predicted 1% AEP and PMF flood extents, as well as any high hazard or floodway affectation
- Development recommendations and construction methodologies
- Qualifications of author - Council requires that the Flood Management Report be prepared by a suitably qualified Engineer with experience in flood design / management who has, or is eligible for, membership to the Institution of Engineers Australia
- Any flood advice provided by Council
- Any other details which may be relevant

Further information and guidelines for development are available on Council's website at:

<https://www.northernbeaches.nsw.gov.au/planning-and-development/building-and-renovations/development-applications/guidelines-development-flood-prone-land>

Council's Flood Team may be contacted on 1300 434 434 or at floodplain@northernbeaches.nsw.gov.au .

Appendix B- Flood Impact Assessment

Job Number: 210087
Date: 22 December 2021

Andrew Wallis
Van der Meer Consulting
St Leonards NSW 2065

Tel: +61 413 631 447
www.grchydro.com.au

Re: 1112-1116 Barrenjoey Road, Palm Beach Flood Impact Assessment

Development is proposed for 1112-1116 Barrenjoey Road Palm Beach. GRC Hydro have been engaged by Van Der Meer Consulting to carry out a flood impact assessment for the proposed development.

INTRODUCTION

The model was sourced from the Avalon to Palm Beach Floodplain Risk Management Study and Plan (MHL, 2017).

Van Der Meer provided plans (Date: 16/12/2021) describing the existing site and the proposed development.

EXISTING FLOOD BEHAVIOURS

Barrenjoey Road is flood liable being a low point (sag) where flow can collect. In the 1% AEP event the water level is in the order of 2.62 mAHD which indicates a depth of approximately 0.5 m on the road.

Council's 2017 study carried out by MHL was done under the NSW Flood Risk Management Programme and defines design flood levels applicable to the development. It also provides a modelling tool suitable for evaluating the potential impact of the proposed development.

The site as it currently exists is a combination of commercial buildings (at northern end of site) with parking to the south. The site viewed from Barrenjoey Road moving north is shown below in Image 1. Levels at the site are in the order of 2.3 mAHD but range up to 15 mAHD at the point furthest from street. Broadly the site does receive runoff from minor catchments in upper areas but such flows are trivial relative to the overland flow flooding referenced above which affects Barrenjoey Road and does also partially inundate the site.

Existing 1% AEP flood behaviour (depths, extent and levels) are shown in Figure 1 at rear.

The PMF level at the subject site is 2.76 mAHD. This is 0.14 m higher than the 1% AEP event and this indicates the lack of scaling and hence flood risk at the subject site. Based on the writer's experience working in other areas within the Sydney Metropolitan area, a freeboard of 0.3 m (or potentially less) would be appropriate for setting the Flood Planning Level for the subject site.

Image 1 Shops and Carpark and subject site



PROPOSED DEVELOPMENT

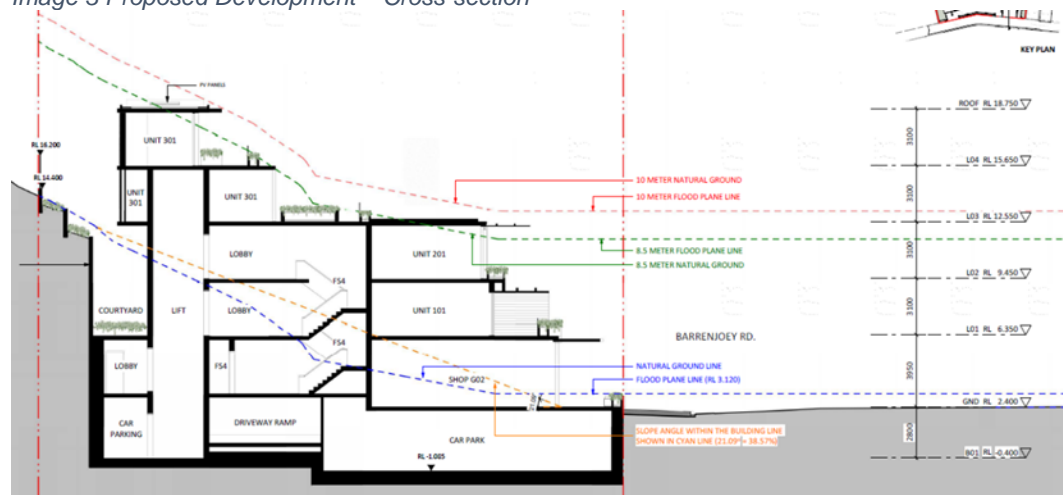
Proposed development sees the entire site developed and an image indicating the development is provided below.

Image 2 Proposed Development



A cross-section of the proposed development is shown below. Note design floor levels etc. are dealt with elsewhere. This report addresses the flood impact issue only.

Image 3 Proposed Development – Cross-section



FLOOD IMPACTS

GRC received the 2017 model from Van Der Meer who in turn requested it from Council.

In assessing impact of the development on 1% AEP flood behaviour, the focus was on the overland flow path in Barrenjoey Road. The model is rainfall on grid which means all parts of the model domain receive rainfall during a modelled design event and become wet. When looking at results from such models it can be helpful to keep in mind that “flooding” is something that happens when a certain flow or depth criteria is met. Criteria for what constitutes flooding are discussed in Section C6 of the NSW Floodplain Development Manual (2005).

As per Figure 2 no impact on adjacent private property is noted. This is due to the fact that flood affectation in the existing event is relatively minor with shallow flood waters on less than one half the Lot. The site does have minor catchments from upper areas draining to it and site storm water design will deal with these.

SUMMARY

Development is proposed at 1112-1116 Barrenjoey Road. The lot is subject to 0.3 m deep flood waters in the 1% AEP event. Development sees the entire Lot developed and the assessment of proposed levels etc. for that development is outside the scope of this report.

Given the assumption of development and exclusion of flood waters from the site, no impact on 1% AEP flood behaviour results and this is indicated in the impact map shown as Figure 2 attached. This result accords with the general lack of serious flood liability of the site in the 1% AEP event.

In summary, development of the subject site does not result in impacts on the 1% AEP flood event.

Yours Sincerely

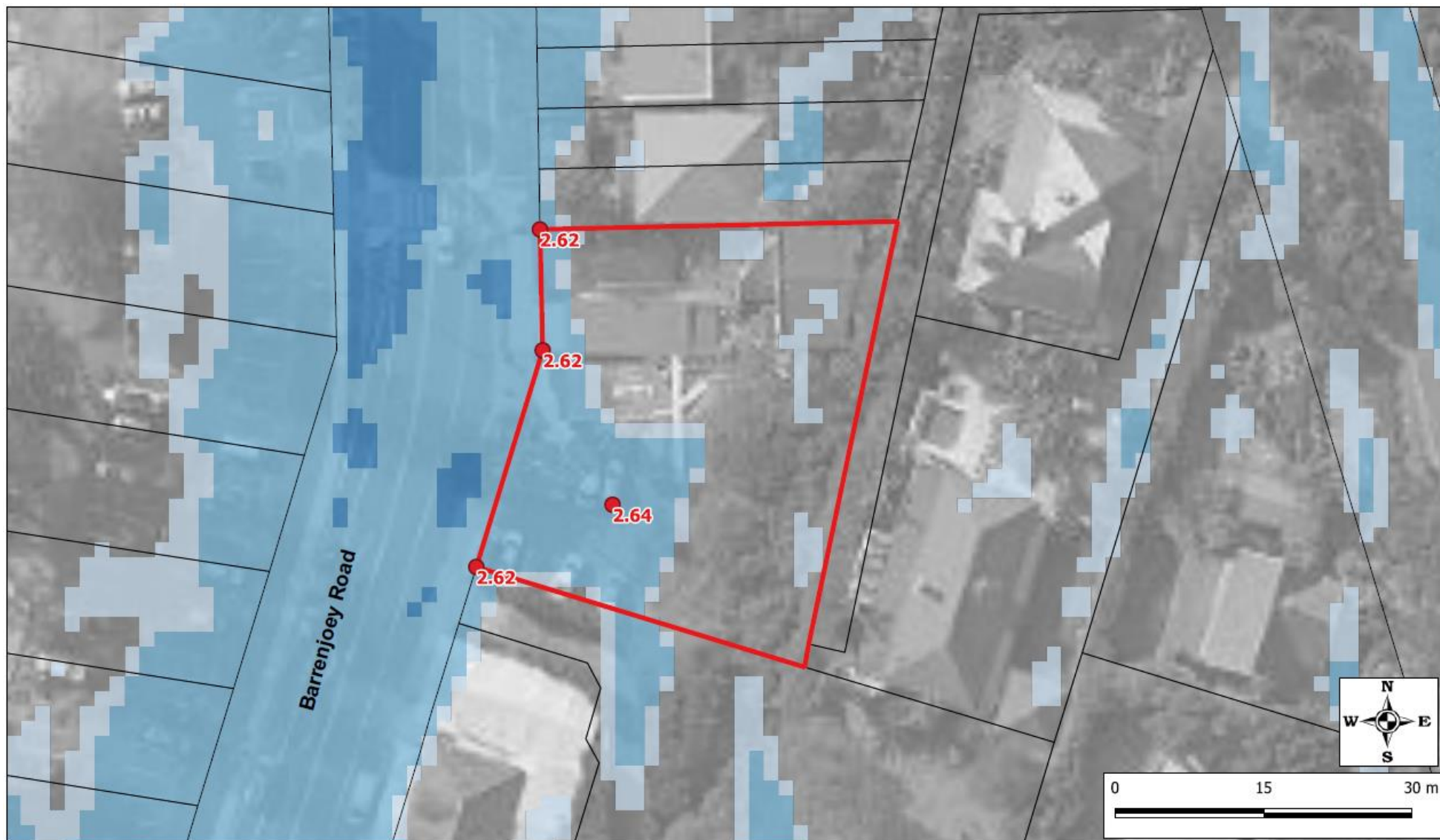
A handwritten signature in blue ink, appearing to read 'Steve Gray', enclosed within a light gray rectangular box.

Steve Gray

Director

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FIGURES



Flood Depths (m)		<div>● Inspection Points (Labelled with 1% AEP Flood Levels)</div> <div>□ Subject Site</div> <div>□ Cadastral Boundaries</div>
	< 0.1	
	0.15 - 0.2	
	0.2 - 0.5	
	0.5 - 1.0	
	1.0 - 2.0	
	> 1.0	

TITLE: **1% AEP Peak Flood Depths and Levels**

PROJECT **1112-1116 Barrenjoey Road, Palm Beach**

PROJECT
No. **210087**

DATE: **12-2021**

SCALE: 1:500

FIGURE No. **01**





Change in Levels (m)	No Impact	No Longer Flooded
Blue < -0.3	Yellow 0.01 to 0.1	Purple Newly Flooded
Light Blue -0.3 to -0.2	Orange 0.1 to 0.2	Pink Proposed Buildings
Cyan -0.2 to -0.1	Dark Orange 0.2 to 0.3	Red Subject Site
Light Green -0.1 to -0.01	Red > 0.3	White Cadastral Boundaries

TITLE: **1% AEP Peak Flood Level Impacts**

PROJECT **1112-1116 Barrenjoey Road, Palm Beach**

PROJECT No. **210087**

DATE: **12-2021**

SCALE: 1:500

FIGURE No. **02**



Appendix C- Flood Planning Level Confirmation- Nothern Baech Council (June, 2021)

From: Liam O'Neil <liam.oneil@vandermeer.com.au>
Sent: Thursday, 2 December 2021 12:44 PM
To: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Subject: FPL and DCP Requirements for 1112-1116 Barrenjoey Rd

Hi Patrick,

I wanted to confirm our discussion over the phone this morning that a FPL of 3.12m AHD (1%AEP + 500mm), is appropriate for the site? This differs from the FPL of 3.2m AHD set out in the Pre-DA lodgement notes.

In addition, requirement C7 in clause B3.11 of the Pittwater 2021 DCP must be complied with in regards to the maximum 5m zone from the street frontage at the level of the existing footpath. Council may consider an increase on the 30m² limit depending on the development's merit as long the zone at the front is a maximum of 5m.

Regards,

Liam O'Neil



van der Meer Consulting
[Brisbane](#) | [Canberra](#) | [Melbourne](#) | [Newcastle](#) | [Sydney](#)

E liam.oneil@vandermeer.com.au

M 0411 434 202

T [contact us](#)





From: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Sent: Thursday, 9 December 2021 4:56 PM
To: Liam O'Neil <liam.oneil@vandermeer.com.au>
Subject: RE: FPL and DCP Requirements for 1112-1116 Barrenjoey Rd

Hi Liam,

Apologies I forgot to get back to you. Yes, your below statements are correct. A FPL of 3.12 is fine for the street frontage.

Regards,
Patrick.

Patrick Stuart
Acting Team Leader, Floodplain Planning & Response

Stormwater, Floodplain Engineering
t 02 8495 6649 m 0435 966 850
patrick.stuart@northernbeaches.nsw.gov.au
northernbeaches.nsw.gov.au

