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Stormwater Structural Civil
abn 13124694917 acn 124694917

FLOOD INUNDATION & RISK ASSESSMENT REPORT PROPOSED RESIDENTIAL ALTERATIONS & ADDITIONS 5 BAREENA RD AVALON BEACH

Job No 181202
Aug 2019
Prepared by
Lucas Molloy
BE CPEng NER

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INTRODUCTION

This report has been prepared in support of the proposed Development Application for residential alterations / additions at No 5 Bareena Road Avalon Beach in respect to potential flood inundation / impacts and Pittwater 21 DCP Section B3.11 Flood Prone Land.

It is proposed to carry out alterations and additions to the existing residence as shown in the architectural plans by *Alwill Architecture* refer Appendix A.

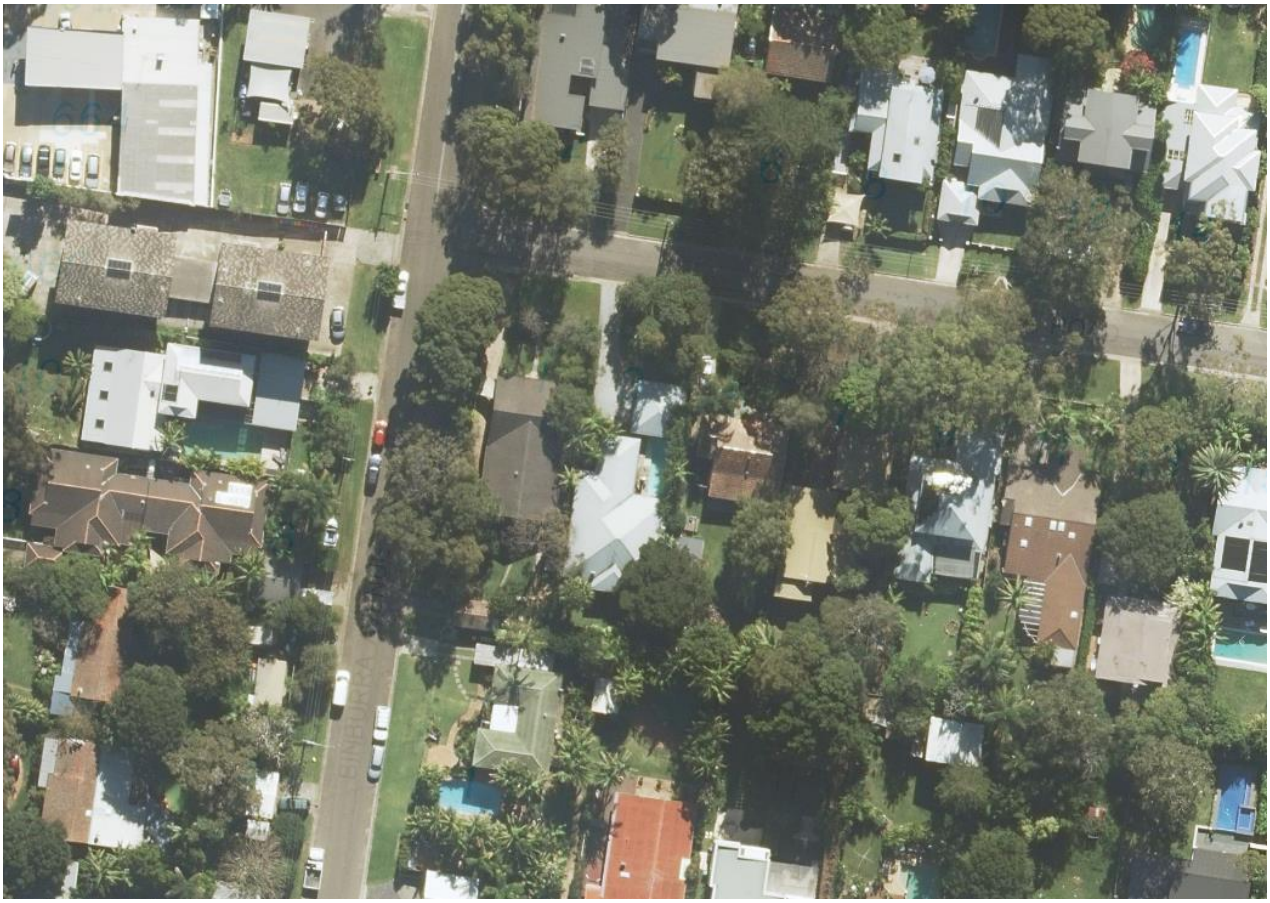
Barrenjoey Consulting Engineers p/l inspected the site on 27th July 2019.

The extent of flooding is as summarized in the "Flood Information Request" data as supplied by Northern Beaches Council, refer Appendix B.

The Flood Planning Level for the site is 11.15m AHD (1% AEP level + 300mm freeboard).

The site is classified -

Flood Hazard	Low
Flood Hydraulic Category	Fringe
Flood Risk Precinct	Low / Medium
Land Use Group	Concessional works (residential alterations and additions)



Aerial Image of Bareena Rd Avalon Beach (Northern Beaches Council web site)

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Pittwater 21 Development Control Plan - 2014
B3.11 Flood Prone Land
1.2 Prescriptive Controls

A. FLOOD EFFECTS CAUSED BY DEVELOPMENT

A1	na
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 the works have been designed and can be constructed to adequately address flood risk management issues. **Refer Appendix D for certification forms**
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. **No compensatory works are proposed as existing extent of flood storage is to be maintained.**
A4	na

B. DRAINAGE INFRASTRUCTURE AND CREEK WORKS

B1	na
B2	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). **Achievable using conventional building practices.**
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. **Achievable using conventional building and engineering practices.**
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. **Achievable using conventional building practices.**

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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. **Achievable using conventional building practices with storage areas signposted "all hazardous/polluting materials to be stored above this level" and a clear indication of the RL11.15m AHD**
D2	Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level. **Achievable using conventional building practices with the studio /kitchen/laundry/mudroom etc signposted "Goods, materials or other products which may be highly susceptible to water damage to be located above this level" and a clear indication of the RL11.15m AHD**

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. **Achievable by adhering to this report.**
E2	na
E3	na
E4	na

F. FLOOR LEVELS

F1	New floor levels within the development shall be at or above, the Flood Planning Level. **FFL 11.28m AHD > FPL 11.15m AHD** A reduced Flood Planning Level may be considered only where it is permitted in this Development Control Plan. The structure must be flood proofed (wet or dry) to the Flood Planning Level. This control cannot be applied to critical or vulnerable uses.
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. **Achievable using conventional building and engineering practices, including the use of open pier / beam construction (ie no new solid walls from FFL to ground level).** 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. **na as development located within a flood fringe area**
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. **na to this development**
F4	**na to this development**
F5	**na to this development**
F6	**na to this development**

F7	na
F8	na
F9	na
F10	na
F11	**na to this development**

G. CAR PARKING

G1	Open carpark areas and carports shall not be located within a floodway. **na to this development as carport locted out of 1% AEP flood extents**
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. **na to this development**
G3	All enclosed car parks must be protected from inundation up to the relevant flood planning level. For example, basement carparks must be provided with a crest at the entrance, the crest of which is at the relevant Flood Planning Level. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Flood Planning Level. Council will not accept any options that rely on electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark **na to this development**
G4	Vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site where there is more than 300mm depth of flooding in a 1% AEP flood event. The minimum height of the vehicle barriers or restraints must be at or above the Flood planning Level. Vehicle barriers or restraints must comply with the Flood Prone Land Design Standard. **na to this development as flow depth < 300mm**
G5	Enclosed Garages must be located at or above the 1% AEP level **na to this development**
G6	Carports must comply with the Flood Prone Land Design Standard **Open construction of flood compatible material achievable using conventional building and engineering practices**
G7	Where a driveway is required to be raised it must be demonstrated that there is no loss to flood storage in the 1% AEP flood event and no impact on flood conveyance through the site **na to this development**
G8	na
G9	na
G10	na

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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. **Achievable and to be conditioned within a development approval. Pool fencing 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.**

I. POOLS

I1	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. All electrical equipment associated with the pool (including pool pumps) is to be All chemicals associated with the pool are to be stored at or above the flood planning level. **Achieved as uphill edge of pool coping to match existing NGLs**

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FLOOD RISK ASSESSMENT

A flood risk assessment was carried out for the 1% AEP and PMF event adopting the following

- Likehood of the hazard occurring
  - Almost Certain 1:10
  - Likely 1:100
  - Possible 1:1000
  - Unlikely 1:10000
  - Rare 1:100000
- Consequence of the hazard to persons and property
  - Insignificant no injury / $ 0 - low
  - Minor first aid injury / $ low - medium
  - Moderate medical treatment required / $ medium – high
  - Major serious injuries / $ major
  - Catastrophic death / $ major ++

	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain					
Likely (1%)					
Possible					
Unlikely (PMF)					
Rare					

Legend

Low - acceptable
Moderate – tolerable
Sever – unacceptable

1 Risk to persons 'shelter in place' provisions as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – minor injuries possible therefore low / tolerable risk assessment
PMF event – minor injuries possible therefore low / acceptable risk assessment
2 Risk to structures adequate structural capacity to resist the flood forces (water and debris) as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – insignificant damage to structures therefore low / acceptable risk assessment
PMF event – moderate damage to structures therefore low / acceptable risk assessment
2 Risk to vehicles no protection of vehicles from flood exposure as not required by DCP B3.11 , therefore risk assessment -
1% event – moderate damage therefore low / tolerable risk assessment
PMF event – major damage therefore low / tolerable risk assessment
3 Risk to services protection of services from flood exposure as per the *Flood Risk Management Report* specified / ensured, therefore risk assessment -
1% event – moderate damage therefore low / tolerable risk assessment
PMF event – major damage therefore low / tolerable risk assessment

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SUMMARY

Assessment of Impacts Compliance Table

	Compliance		
	Not Applicable	Yes	No
A Flood effects caused by Development	-	X	-
B Drainage Infrastructure & Creek Works	-	X	-
C Building Components & Structural	-	X	-
D Storage of Goods	-	X	-
E Flood Emergency Response	-	X	-
F Floor Levels	-	X	-
G Car Parking	-	X	-
H Fencing	-	X	-
I Pools	-	X	-

The proposed works if carried out in accordance with recommendations within this *Flood Inundation & Risk Assessment Report* by Barrenjoey Consulting dated Aug 2019 will satisfy the intent of Clause 1.1 Performance Criteria of Pittwater 21 DCP Section B3.11 Flood Prone Land by complying with Clause 1.2 Prescriptive Controls. Noting the following measures are to be implemented into the works –

- **All occupants are to be informed of the sites flooding potential / impact and available warning services (ie : Councils *Floodwatch*, SES services etc).**
- **All occupants are to be informed of the sites flooding potential / impact and the residences 'shelter in place' capacity.**
- **All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level**
- **All occupants are to be informed of the sites flooding potential and requirements for goods / valuables storage etc.**

It is to be noted that, due to the many complex factors that can affect a site, the subjective nature of a risk analysis, and the imprecise nature of the science of flood analysis, the risk of persons being injured, to life and property cannot be completely removed. The recommendations within this Report do not remove the risk associated with the predicted flooding event, though lower those risks to an acceptable level reasonably anticipated by the community in everyday life.

Regards
BARRENJOEY CONSULTING ENGINEERS pty ltd

Per
Lucas Molloy (Director)
BE CPEng NER

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Appendix A

Architectural Plans by
Alwill Architecture

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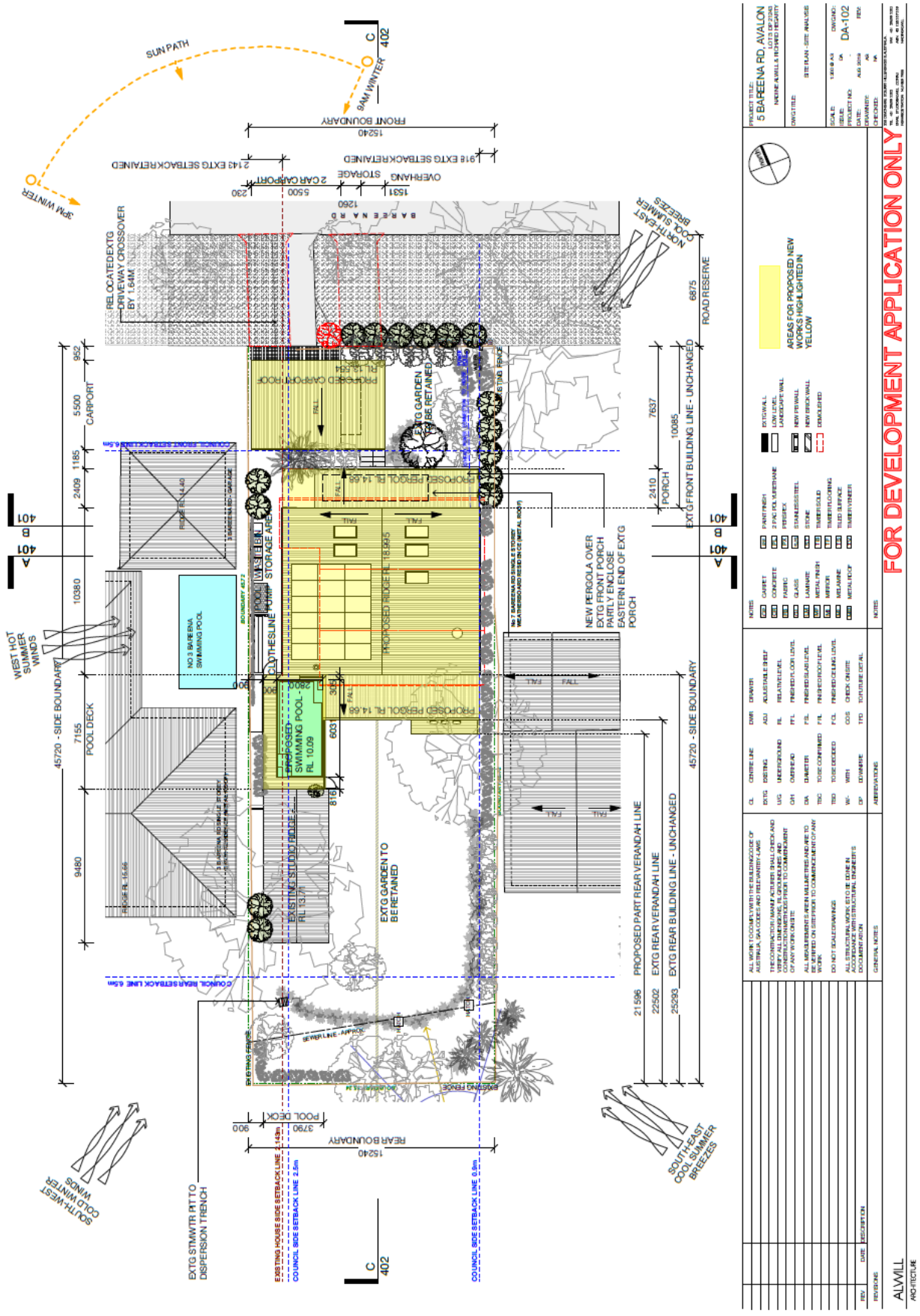

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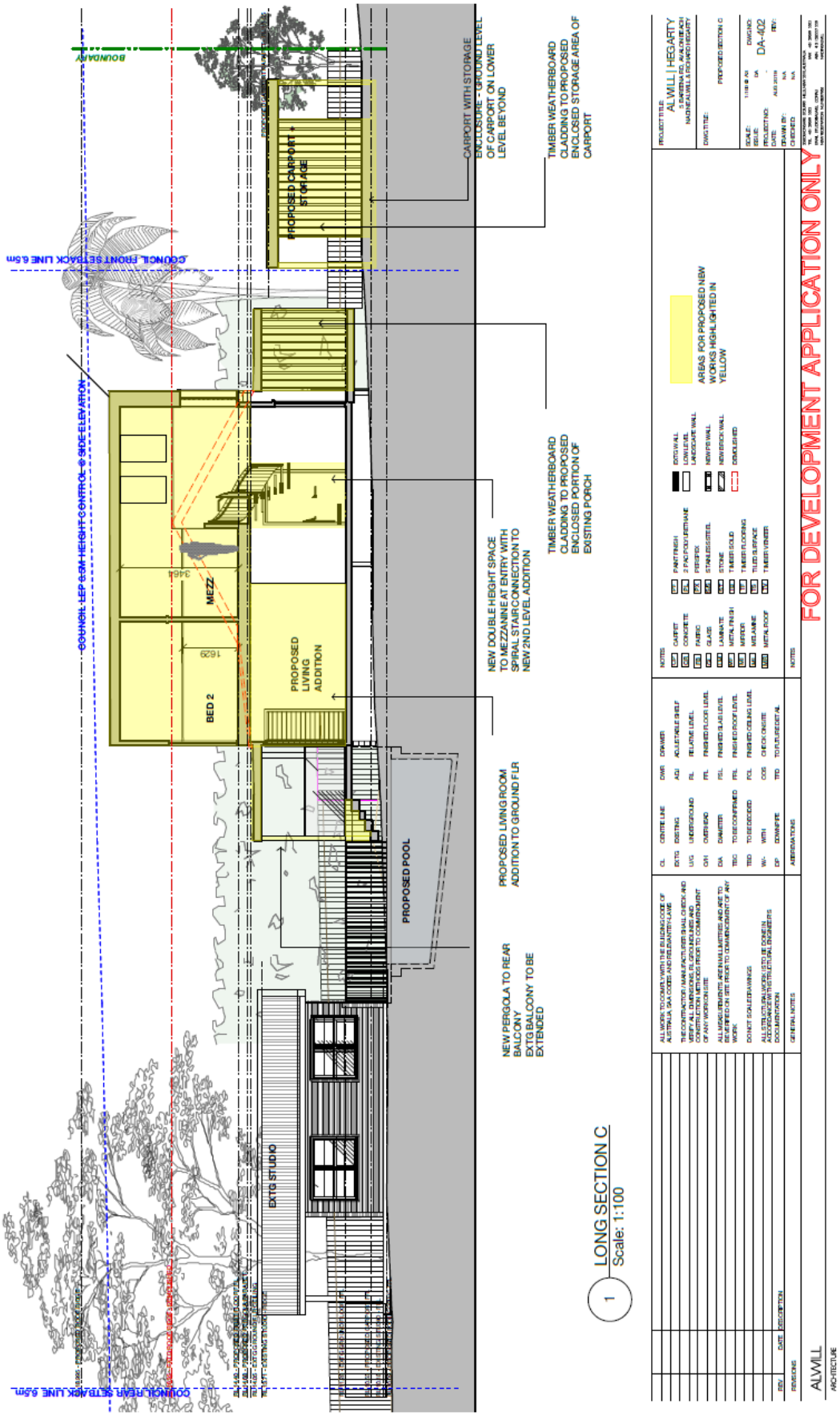

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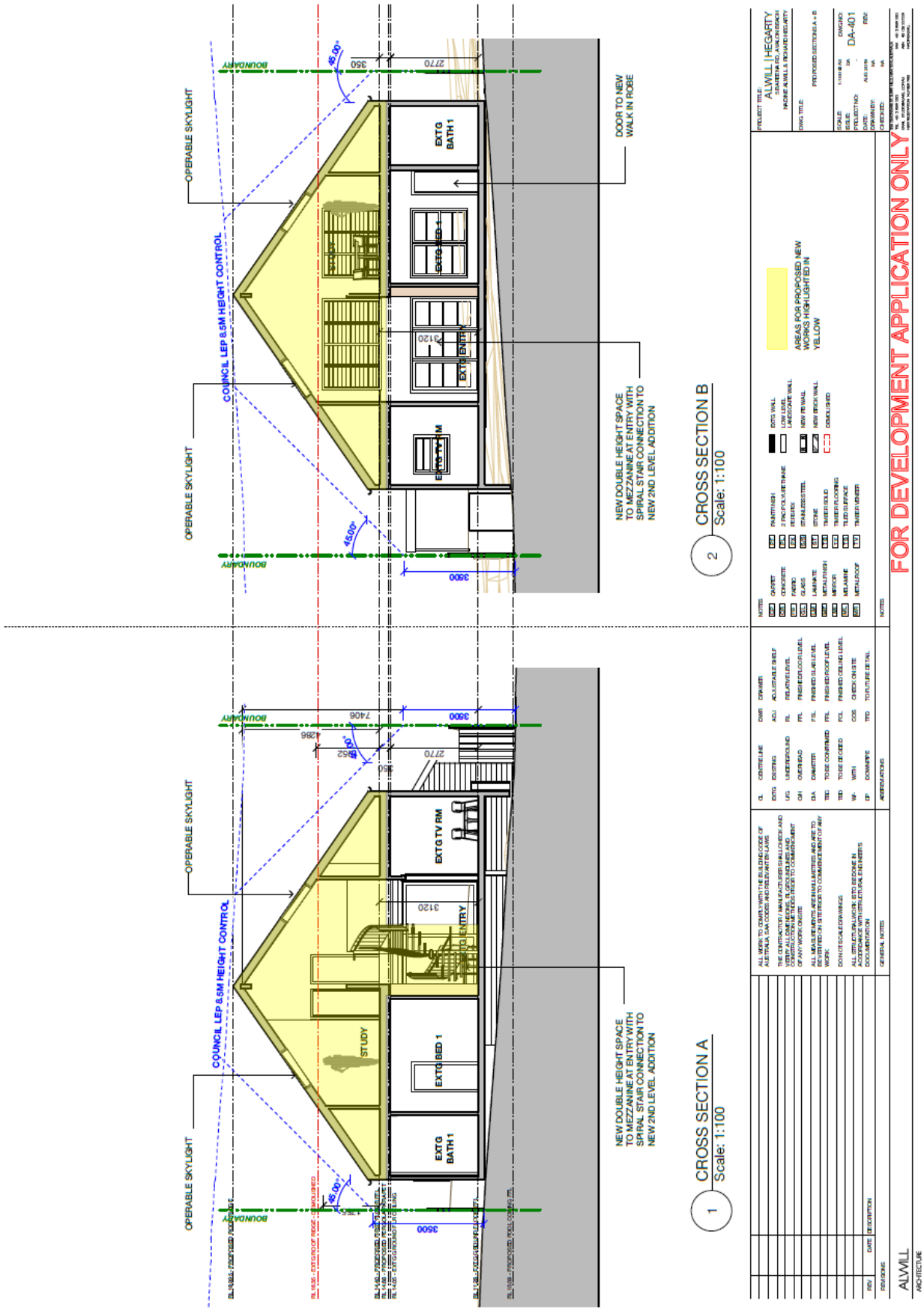

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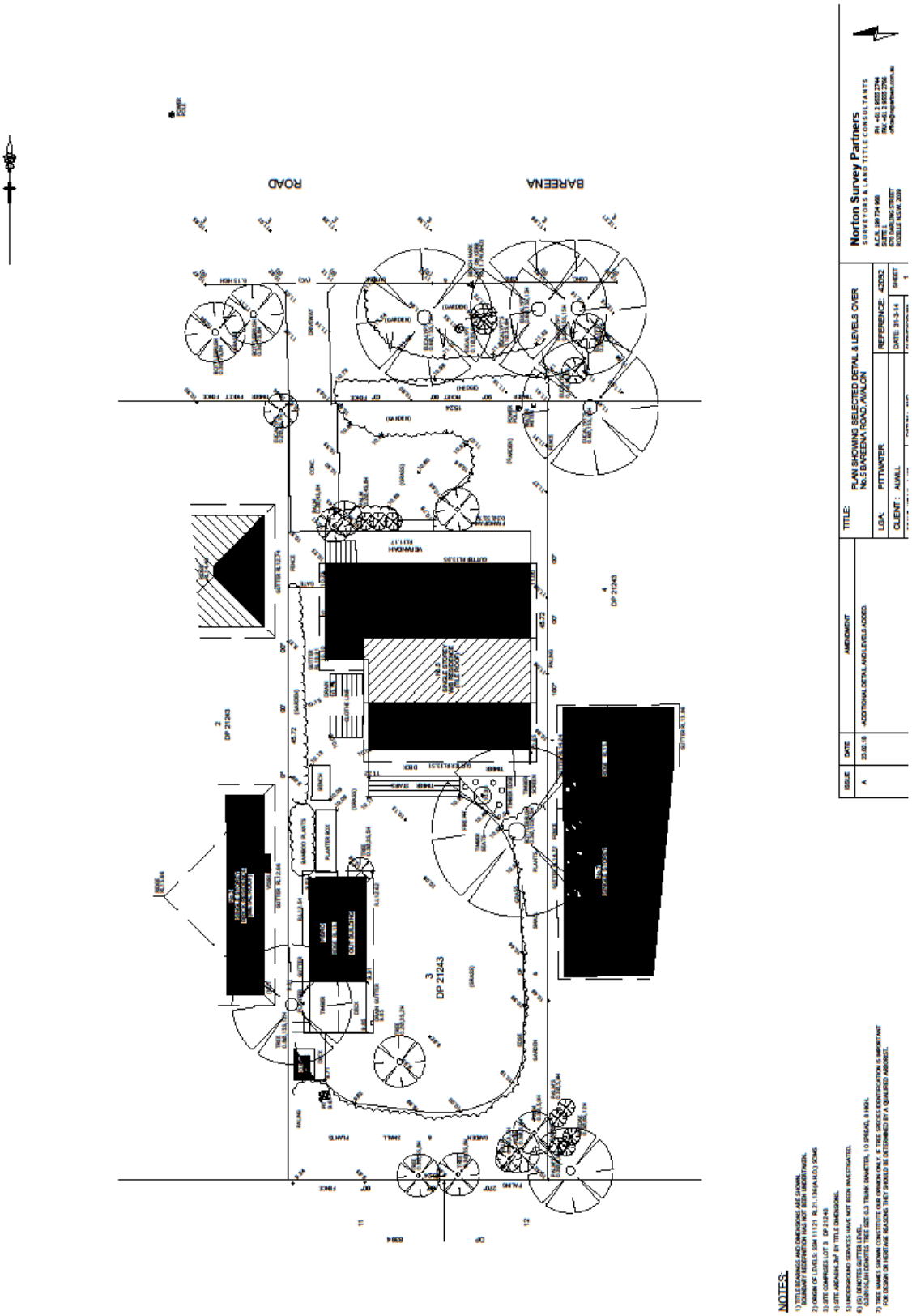

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Appendix B

Flood Information Request – Basic
Northern Beaches Council

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NORTHERN BEACHES
COUNCIL

FLOOD INFORMATION REQUEST - COMMON

Property: 5 Bareena Rd, Avalon Beach
Lot DP: 3//21243
Issue Date: 19/12/2018
Flood Study Reference: Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017, Manly Hydraulics Laboratory

Flood Information for lot:

Flood Life Hazard Category – See Map A

1% AEP – See Flood Map B

1% AEP Maximum Water Level[3]: 10.85 mAHD

1% AEP Maximum Peak Depth from natural ground level[3]: 0.20 m

1% AEP Maximum Velocity: 0.46 m/s

1% AEP Provisional Flood Hazard: Low **See Flood Map E**

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

5% AEP Max Flood Depth: <0.15m (Not affected)

Flood Planning Area – See Flood Map C

Flood Planning Level (FPL)[1,2, 3 &4]: 11.15 m AHD

Probable Maximum Flood (PMF) – See Flood Map D

PMF Maximum Water Level[2]: 11.68 m AHD

PMF Maximum Depth from natural ground level: 0.31 m

PMF Maximum Velocity: 0.71 m/s

Flood Risk Precinct – See Map G

[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.

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[3]Intensification of development in the former Pittwater LGA requires the consideration of climate change impacts which may result in higher minimum floor levels than those indicated on this flood advice.
[4]Vulnerable/critical developments require higher minimum floor levels using the higher of the PMF or Flood Planning Level

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.

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FLOOD MAP A: FLOOD LIFE HAZARD CATEGORY

Notes:

- Refer to 'Flood Emergency Response Planning for Development in Pittwater Policy' for additional information on the Flood Life Hazard Categories and Pittwater 21 DCP Control B3.25.
- 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.

Issue Date: 19/12/2018

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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.

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FLOOD MAP C: FLOOD PLANNING AREA EXTENT

Notes:

- Extent represents the 1% annual Exceedance Probability (AEP) flood event + freeboard.
- 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.

Issue Date: 19/12/2018

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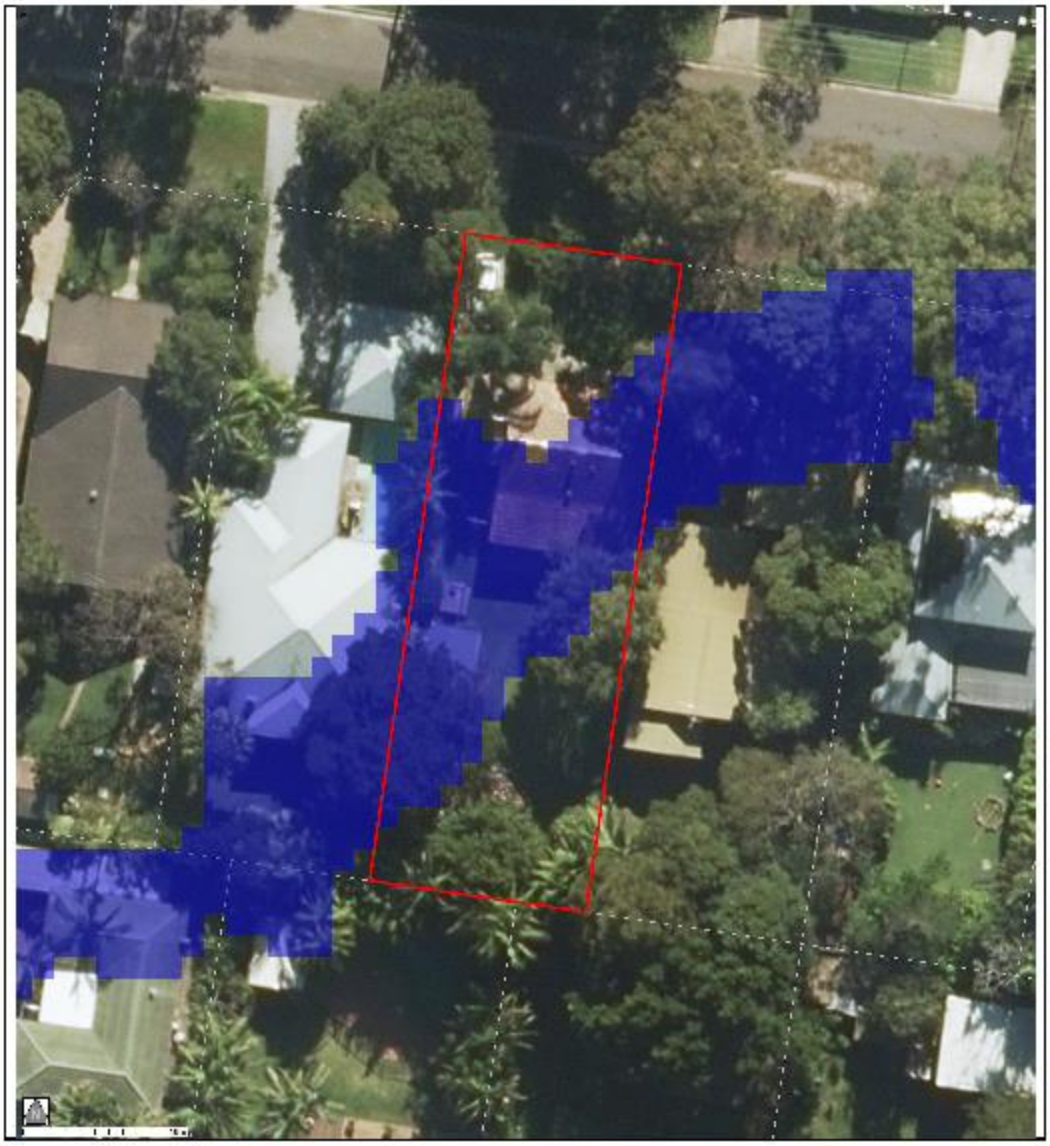
FLOOD MAP D: PROBABLE MAXIMUM FLOOD EXTENT



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 Near Map 2014) are indicative only.

Issue Date: 19/12/2018

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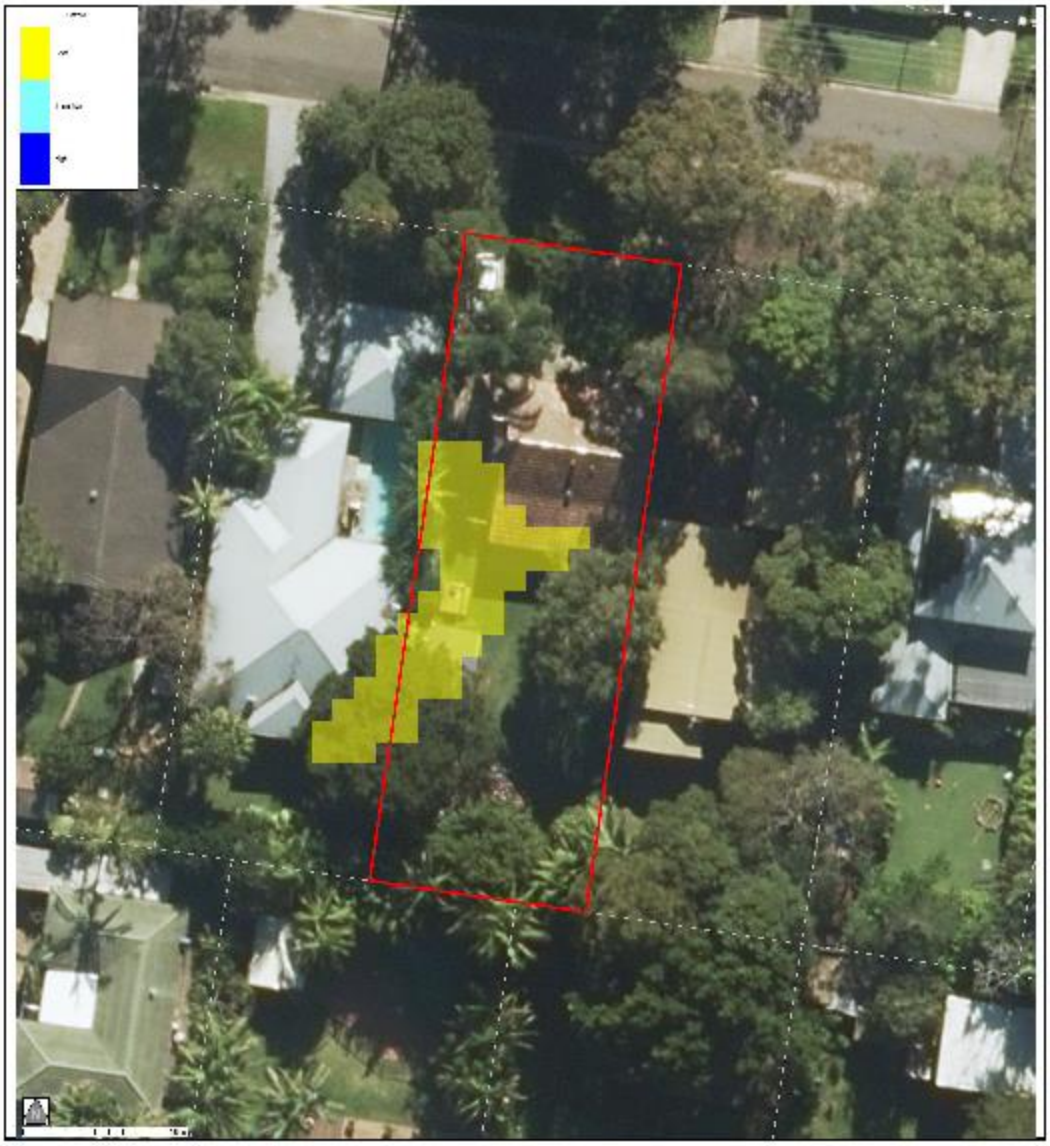
FLOOD MAP E – 1% AEP FLOOD HAZARD EXTENT MAP



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.

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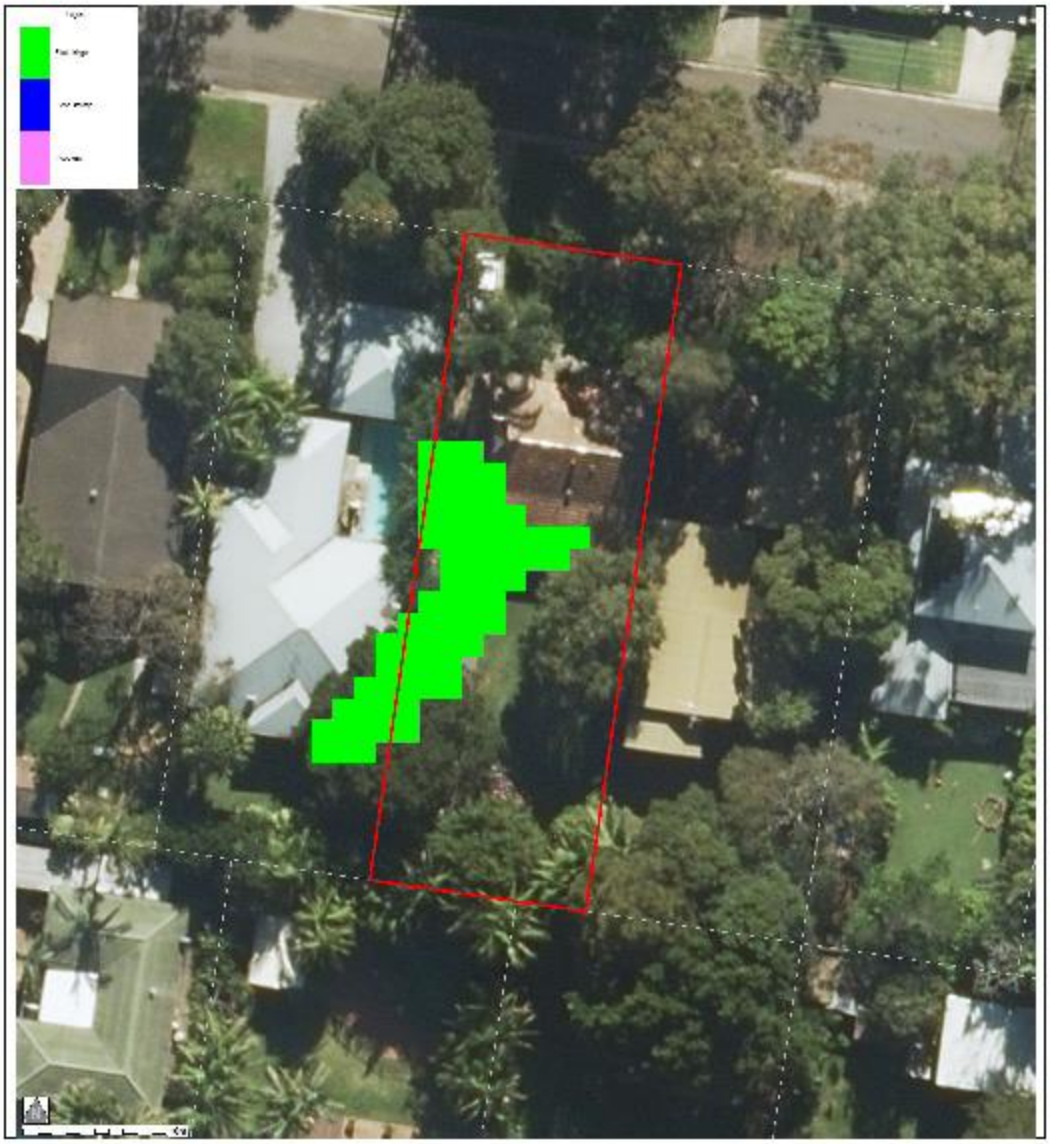
FLOOD MAP F – 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



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.

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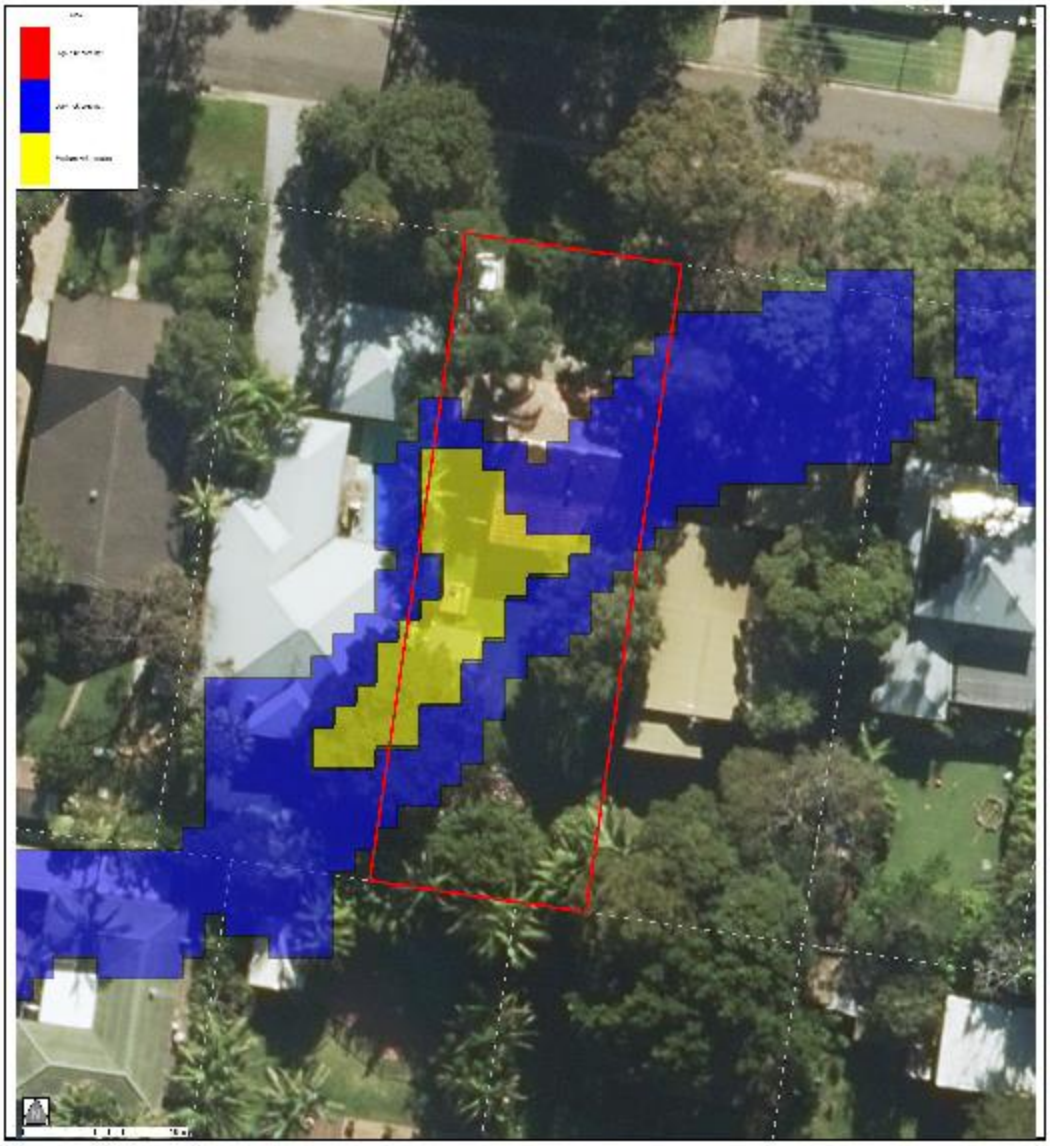
FLOOD MAP G – FLOOD RISK PRECINCT MAP



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 and or H6 Life Hazard Classification).

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Appendix C

Northern Beaches Council
Standard Hydraulic Certification Form

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NORTHERN BEACHES COUNCIL
STANDARD HYDRAULIC CERTIFICATION FORM

FORM A/A1 – To be submitted with Development Application

Development Application for

Address of site: **5 Bareena Rd Avalon Beach**

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

I, **Lucas Molloy** on behalf of **Barrenjoey Consulting Engineers p/l** on this the **6th Aug 2019** certify that I am engineer or a 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 Title:	**FLOOD INUNDATION & RISK ASSESSMENT REPORT RESIDENTIAL ALTERATIONS & ADDITIONS 5 BAREENA RD AVALON BEACH**
Report Date:	**Aug 2019**
Author:	**Lucas Molloy**
Author's Company/Organisation:	**Barrenjoey Consulting Engineers p/l**

I: **Lucas Molloy**

Please tick all that are applicable (more than one box can be ticked)
X have obtained and included flood information from Council (must be less than 12 months old)
X have followed Council's Guidelines for Preparing a Flood Management Report
na have requested a variation to one or more of the flood related development controls. Details are provided in the *Flood Management Report*.

Signature

Name

Lucas Molloy
BE CPEng NER 788184
Director
Barrenjoey Consulting Engineers p/l

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End

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