HYDRACOR
CONSULTING ENGINEERS

Suite 2.01, Level 2
4 Ilya Avenue
ERINA NSW 2250

PO Box 3772
Fountain Plaza
ERINA NSW 2250

T 02 4324 3499

CIVIL ENGINEERING
FLOOD STUDIES
STORMWATER
HYDRAULIC
DEVELOPMENT CONSULTANTS

Flood Risk Management Plan

For a Proposed New Dwelling

Prepared for: **Hopsdal**

Project address: **Lot 1/DP947441 No. 29 Emerald Street, Narrabeen**

Document No.: **CC250002_FRMP**

Version No.: **3.0**

Dated: **17 April 2025**

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VERSION HISTORY

Version	Date	Purpose	Prepared By	Approved By
1.0	25/02/2025	Draft Flood Risk Management Plan	Isaac Kan	
2.0	27/02/2025	Draft Flood Risk Management Plan	Isaac Kan	
3.0	17/04/2025	Issued for Approval	Isaac Kan	Bruce Kenny

Review Panel	
Division/Office	**Name**

Table of Contents

Annexures

1 Introduction

HYDRACOR Consulting Engineers Pty Ltd (HYDRACOR) has been commissioned to prepare a Flood Risk Management Plan in accordance with the requirements of Northern Beaches Council Water Management for Development Policy; Warringah Development Control Plan Section E11 Flood Prone Land and Clause 5.21 of Warringah Local Environmental Plan 2011 (Warringah LEP 2011).

In the preparation of this report, HYDRACOR has relied upon certain data and information contained within the following documents:

- Architectural plans prepared by Ursino Architects, reference 23.09, Sheets A100 – A901 (27 pages), revision A, dated 20 March 2025.
- 'Narrabeen Lagoon Flood Study', published by BMT WBM, revision 4, dated September 2013.
- 'Narrabeen Lagoon Floodplain Risk Management Study and Plan', published by Cardno, revision 3, dated April 2019.
- 'Australian Disaster Resilience Guideline 7-3: Flood Hazard.' published by the Australian Institute for Disaster Resilience (AIDR), dated 2017.
- 'Construction of Buildings in Flood Hazard Areas: Standard' published by Australian Building Codes Board (ABCB), Version 2012.2, dated 2012.
- 'Construction of Buildings in Flood Hazard Areas: Information Handbook' published by Australian Building Codes Board (ABCB), Version 2012.3, dated 2012.
- 'Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas' published by the Hawkesbury-Nepean Floodplain Management Steering Committee (HNFMSC), dated 2006.
- 'Flood Risk Management Manual: the management of flood liable land' published by NSW Department of Planning and Environment (NSW DPE), dated 2023.

The purpose of this report is to provide Northern Beaches Council with sufficient information to assess the proposed new dwelling which is located on flood liable lands.

2 Site Description

The subject site is known as Lot 1/DP947441 (No. 29) Emerald Street, Narrabeen. The site is located on the northern side of Emerald Street. The surrounding developments are residential in nature.

The subject site is a developed site comprising an area of 600.5 square metres and is zoned R2 Low Density Residential under Warringah Local Environmental Plan (LEP) 2011. Current development on the site consists of a single-storey residential dwelling.

The site is relatively level with natural surface elevations generally ranging from RL 2.48 m AHD to RL 1.46 m AHD.

The applicant proposes to demolish the existing dwelling and the construction of a new single storey dwelling with an attached carport. The principal features of the proposed works are depicted in the architectural plans prepared by Ursino Architects, reference 23.09, Sheets A100 – A901 (27 pages), revision A, dated 20 March 2025.

3 Flood Characteristics

The site is impacted by floodwaters generated by the Narrabeen Lagoon Catchment comprising an area of approximately 55 square kilometres. The mainstream flow impacting the site is the subject of 'Narrabeen Lagoon Flood Study' (BMT WBM 2013) & 'Narrabeen Lagoon Floodplain Risk Management Study and Plan' (Cardno 2019). The behaviour of the 1% AEP and PMF flood events in the vicinity of the site is outlined in the Flood Information Report issued by Northern Beaches Council dated 8 June 2023 (copy enclosed under Annexure A).

Referring to the Council Flood Information Report we note the following:

- The property is identified as being located within the High Risk Flood Precinct.
- The property falls within the Flood Life Hazard Category H5 for the PMF storm event.
- The property is generally located within the 1% AEP flood storage category.
- Peak 1% AEP velocity impacts the site at 0.34 m/s and peak PMF velocities impact the site at 0.61m/s.
- Peak 1% AEP floodwaters impact the site to depths up to 1.12 metres and to RL 3.02 m AHD and peak PMF floodwaters impact the site to depths up to approximately 2.91 metres and to RL 4.81 m AHD.
- Regular pedestrian and vehicular ingress and egress to and from the site is not readily available in both the 1% AEP and PMF storm event.
- The Flood Planning Level applicable to the site is to RL 3.52 m AHD.
- The PMF Level applicable to the site is to RL 4.81 m AHD.

4 Flood Risk Management

Based on the foregoing, we offer the following response, having due regard for the requirements of Northern Beaches Council Water Management for Development Policy; Warringah Development Control Plan Section E11 Flood Prone Land and Clause 5.21 of Warringah Local Environmental Plan 2011 (Warringah LEP 2011).

The land is classified as high flood risk residential, and we have adopted a high flood risk for the purposes of the flood risk assessment. We refer to our following responses in relation to each of the planning considerations.

		High Flood Risk Precinct				
		Vulnerable & Critical Use	Residential Use	Business & Industrial Use	Recreational & Environmental Use	Subdivision & Civil Works
A	Flood effects caused by Development	A1 A2	A1 A2	A1 A2	A1 A2	A1 A2
B	Building Components & Structural	B1 B2 B3	B1 B2 B3	B1 B2 B3	B1 B2 B3	
C	Floor Levels	C2 C3	C1 C3 C4 C6	C1 C3 C4 C6 C7	C3	C5
D	Car Parking	D1 D2 D3 D4 D7	D1 D2 D3 D4 D5 D6	D1 D2 D3 D4 D5 D6	D1 D2 D3 D4 D5 D6	D1
E	Emergency Response	E1 E2	E1	E1	E1	E3
F	Fencing	F1	F1	F1	F1	F1
G	Storage of Goods	G1	G1	G1	G1	
H	Pools	H1	H1	H1	H1	H1

4.1 Flood effects caused by Development

The footprint of the proposed new dwelling will encroach beyond of the existing footprint and the proposed carport will need to be raised; however the open carport and the building being constructed as a suspended structure comprising an open subfloor area will not result in any significant loss in flood storage. We also note that the removal of the link wing between the existing boat shed dwelling will increase flood storage.

The 1% AEP maximum water level within the site is RL 3.02. A total existing flood storage volume has been calculated to be approximately 431.3 m^3. Flood storage volume is depicted in HYDRACOR Consulting Engineers Pty Ltd Flood Storage Volume Plan, reference CC250002, Sheet FV1, Revision A, dated 21 February 2025 (copy enclosed under Annexure C).

Based on the foregoing we have formed the view that there will be no loss to the 1% AEP flood storage, adverse impacts on flood levels and velocities or adverse impacts to surrounding properties.

4.2 Floor Levels

In accordance with the requirements of Northern Beaches Council Water Management for Development Policy and Warringah Development Control Plan Section E11 Flood Prone Land, all habitable floors must be located above the Flood Planning Level (FPL).

The 1% AEP flood level occurs at RL 3.02 m AHD resulting in the Flood Planning Level at RL 3.52 m AHD. We note that the proposed dwelling has minimum floor level at RL 3.53 m AHD.

The structure must be flood proofed to the Flood Planning Level and there is no net loss of flood storage in all events up to the 1% AEP event.

4.3 Building Components and Structural.

The proposed works will be constructed from flood compatible materials to elevation RL 3.52 m AHD. Extensive guidance on flood compatible building materials and methods is provided in 'Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas' (HNFMSC 2006) and 'Construction of Buildings in Flood Hazard Areas' Standard and Information Handbook (ABCB 2012a,b); a selection of the flood compatible materials and practices described in these resources is summarised below.

Flood compatible floor and sub-floor materials include reinforced or mass concrete, masonry, steel with corrosion resistant coatings and selected types of timber. Steel sub-floor structures should be constructed from open sections where possible and have holes drilled into the bottom steel plates to allow water to drain from the frame in the event of immersion. Suspended timber sub-floor structures constructed of Class 1 (highly durable), Class 2 (durable) or H3 treated timber are flood compatible; however engineered timber products should not be used unless certified by the manufacturer as being suitable for 96-hour immersion. Hardwood strip flooring with low shrinkage rates is recommended for a timber floor option, with the next best option being marine or exterior grade plywood. Particleboard flooring is not a flood compatible material. Adequate ventilation needs to be provided to timber floors to allow the timbers to dry after flood events to minimise long term timber damage; this may require any under floor insulation to be removable in the event of floodwaters reaching the insulation.

Flood compatible floor coverings include tiled concrete and polished timber flooring. Fixed carpet, seagrass matting and linoleum are not flood compatible materials; however, rugs which are easily removed prior to flooding (to prevent floor cover damage damage) or post flooding (to permit drying of the structural floor) are acceptable.

Suitable wall structure materials include solid brickwork, blockwork, concrete, timber stud walls constructed from Class 1 (highly durable), Class 2 (durable) or H3 treated timber, and steel frames. Steel frames should be constructed from open sections where possible and have holes drilled into the bottom steel plates to allow water to drain from the frame in the event of immersion.

Flood compatible wall linings include fibre-cement board, brick, concrete (including concrete blocks), stone with waterproof grout, clay tiles glazed with waterproof mortar, glass (including glass blocks), plastic sheeting with waterproof adhesive, steel with waterproof applications, exterior grade plywood, and fully sealed solid wood products. Plasterboard is not a flood compatible material as it requires replacement after extended immersion, however for shallow and short duration floods there may be little damage to plasterboard wall linings. It is recommended that sheet wall linings be installed horizontally with a 20-30 mm gap provided between the bottom wall plate and the base of the wall lining to facilitate ventilation and cleaning of the wall cavity after a flood event. The gap may be covered with skirting board when access to the wall cavity is not required.

Insulation should be closed cell type foam. Nails, bolts, hinges and fittings should be made from nylon, brass, stainless steel or hot dipped galvanised steel. Hinges should be of a removable pin type.

Flood compatible doors include solid panel doors with waterproof adhesives, flush doors with marine ply and closed cell foam, metal doors, and aluminium or galvanised steel frame doors. Aluminium frame windows with stainless steel rollers or similar corrosion and water resistant materials suffer least damage during flood events. Timber framed windows which have been full epoxy sealed before assembly and fitted with stainless steel or brass fittings are also considered flood compatible.

Flood compatible building guidelines do not apply in general to household appliances and built-in furniture as they have a high depreciation rate and are expected to be replaced numerous times throughout the life of a building. Occupants should be aware that any items which may not be installed or relocated above the PMF flood level of RL 4.81 m AHD do have some risk of being damaged by floodwaters.

Damage to household appliances such washing machines, fridges and stoves may be minimised by raising them above floodwaters if possible. Built-in furniture such as kitchen and laundry cupboards and built-in wardrobes are often constructed from materials such as particleboard or MDF which are highly susceptible to water damage. Potential damage to built-in furniture may be minimised by installing cupboards on metal or plastic legs which may be covered with removable boards, and avoiding false floors in cupboards and wardrobes.

Ancillary structures such as steps and pergolas shall be constructed of water tolerant materials such as masonry sealed hardwood and corrosion resistant metals. Copper Chrome Arsenate (CCA) treated timber is not a flood compatible material.

Connection to mains power supply, including metering equipment should be located above 3.52 m AHD. All electrical wiring, switches and outlets should, where possible be located above 3.52 m AHD. Earth core leakage systems or safety switches are to be installed. All electrical installations below 3.52 m AHD, including wiring, connections and conduit, should be suitable for submergence in water or appropriately waterproofed. Conduits shall be installed so they will be self-draining in the event of flooding.

Heating and air-conditioning systems, including fuel supply and ducting, should be installed above RL 3.52 m AHD. Where this is not possible, they should be installed in such a manner as to minimise damage from submersion. This may be achieved through measures such as access for cleaning and draining of water after flood events, manually operated cut off valves for fuel supply lines and ducts, securely fastening heating equipment and fuel storage tanks to prevent buoyancy and movement, and venting of fuel supply tanks at an elevation of 4.12 m AHD.

4.3.1 Structural Soundness

The proposed new dwelling is to be constructed to withstand the loads imposed by floodwaters up to the Flood Planning Level (RL 3.52m AHD), including hydrostatic, hydrodynamic, buoyancy and debris impact forces. The structural design will be undertaken and certified by a practicing Structural Engineer with relevant experience designing structures on flood prone lands.

4.4 Car Parking

In accordance with the requirements of Warringah Development Control Plan Section E11 Flood Prone Land, the lowest floor level of open carports shall be constructed no lower than the natural ground level of RL and must be of open design with at least two sides completely open such that flow will not be obstructed up to the 1% AEP flood level of RL 3.02 m AHD.

We note there is more than 300mm depth of flooding in the proposed carport during the 1% AEP flood event hence vehicle barriers/restraints are to be provided to prevent floating vehicles leaving the site.

We note that the new open carport is at a floor level occurring at RL 2.10 m AHD.

Consequently, we are of the view that the proposed carport will meet the intent of the DCP.

4.5 Storage of Goods

Goods and materials which are susceptible to water damage are to be stored above RL 3.52 m AHD.

4.6 Fencing

Any proposed fencing including pool fencing, boundary fencing, balcony balustrades, subfloor screening and accessway balustrades shall be designed so as not to impede the flow of floodwaters and not to increase flood affectation on surrounding land. At least 50% of the subfloor opening must be of an open design from the natural ground level up to the flood planning level of 3.52 m AHD. Fence openings should be a minimum of 75 mm x 75 mm.

4.7 Pools

The application does not propose a swimming pool.

4.8 Flood Emergency Response

The primary flood constraint with the subject site is that the surrounding roads during a 1% AEP event (Emerald Street) will not be trafficable to vehicles meaning occupants will need to remain on site for a period of approximately 8 hours during this event. (Cardno 2019). There is no local evacuation possible for the 1% AEP flood event with the subject site and evacuation route tagged as H3-H4 in the 1% AEP flood event as described in 'Narrabeen Lagoon Floodplain Risk Management Study' (copy enclosed under Annexure B).

We note that future occupants of the site will not have internal access to an upper floor level which provides an appropriate area of refuge free from floodwaters during all storm events up to and including the PMF flood event. We note the ceiling space is above the PMF level of 4.81 m AHD and is to provide at least 2m^2 of floor space per person. The ceiling space is to be intrinsically accessible to all people on the site, plainly evident, and self-directing with sufficient capacity of access routes for all occupants without reliance eon an elevator. The ceiling space is to contain at a minimum sufficient clean water for all occupants; portable radio with spare batteries, torch with spare batteries and a first aid kit.

5 Conclusion

Based on the foregoing, we have formed the view that proposed development can comply with the flood related development controls of Northern Beaches Council Water Management for Development Policy; Warringah Development Control Plan Section E11 Flood Prone Land and clause 5.21 of Warringah Local Environmental Plan 2011 (Warringah LEP 2011).

6 References

Australian Building Codes Board (ABCB). (2012a). *Construction of Buildings in Flood Hazard Areas: Information Handbook*. Version 2012.3.

Australian Building Codes Board (ABCB). (2012b). *Construction of Buildings in Flood Hazard Areas: Standard*. Version 2012.2.

Australian Institute for Disaster Resilience (AIDR). (2017). *Australian Disaster Resilience Guideline 7-3: Flood Hazard*. East Melbourne, VIC: Author.

Bureau of Meteorology (BoM). (2020). *Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13*. Melbourne, VIC: Author.

Hawkesbury-Nepean Floodplain Management Steering Committee (HNFMSC). (2006). *Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas*. Available from http://www.ses.nsw.gov.au/content/documents/pdf/resources/Building_Guidelines.pdf

New South Wales Department of Infrastructure, Planning and Natural Resources (NSW DIPNR). (2005). *Floodplain Development Manual: the management of flood liable land*. Sydney, NSW: Author.

BMT WBM. (2013) *Narrabeen Lagoon Flood Study*. Sydney, NSW: Author.

Cardno. (2019) *Narrabeen Lagoon Floodplain Risk Management Study and Plan*. Sydney, NSW: Author.

Northern Beaches Council *(2022) Warringah Development Control Plan (Amendment No. 21).*

Northern Beaches Council *(2014) Warringah Local Environmental Plan (NSW)*

Annexure A Flood Information Report - Comprehensive issued by Northern Beaches Council, dated 8 June 2022

FLOOD INFORMATION REPORT – COMPREHENSIVE

Property: 31 Emerald Street NARRABEEN NSW 2101 – North Part
Lot DP: Lot 1 DP 946397
Lot 11 DP 133441
Issue Date: 08/06/2022
Flood Study Reference: Narrabeen Lagoon Flood Study 2013, BMT WBM

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]: 3.52 m AHD

1% AEP Flood – See Flood Map B

1% AEP Maximum Water Level [2, 3]: 3.02 mAHD

1% AEP Maximum Depth from natural ground level[3]: 1.49 m

1% AEP Maximum Velocity: 0.42 m/s

1% AEP Hydraulic Categorisation: N/A **See Flood Map D**

Probable Maximum Flood (PMF) – See Flood Map C

PMF Maximum Water Level [4]: 4.83 m AHD

PMF Maximum Depth from natural ground level: 3.28 m

PMF Maximum Velocity: 0.84 m/s

PMF Hydraulic Categorisation: N/A **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 change [3]: 3.89 m AHD

1% AEP Maximum Depth with Climate Change[3]: 2.35 m

1% AEP Maximum Velocity with Climate Change[3]: m/s

Flood Life Hazard Category – See Map G

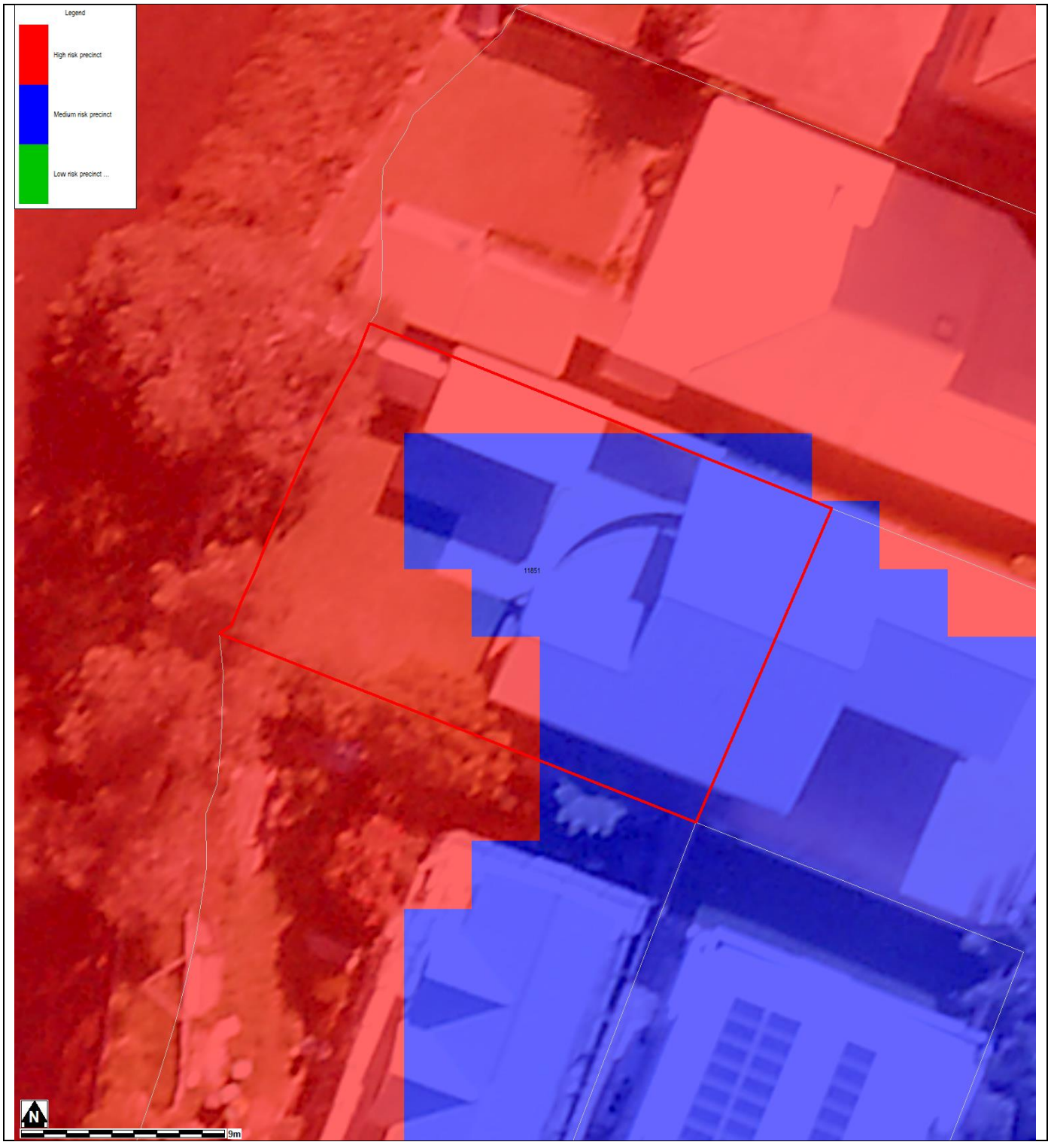
Indicative Ground Surface Spot Heights – See Map H

[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: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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	2.65	1.11	3.02	1.49	0.40	3.52	4.81	3.28	0.79
2	2.65	0.64	3.02	1.02	0.19	3.52	4.81	2.80	0.46
3	2.65	0.73	3.02	1.10	0.24	3.52	4.79	2.88	0.61
4	2.64	0.41	3.02	0.79	0.04	3.52	4.80	2.56	0.09
5	2.65	0.43	3.02	0.80	0.04	3.52	4.81	2.59	0.09
6	2.65	0.23	3.02	0.61	0.06	3.52	4.83	2.42	0.10

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	3.89	2.35
2	3.89	1.88
3	3.89	1.97
4	3.89	1.65
5	3.89	1.67
6	3.89	1.48

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 $0.3m^2/s$, a freeboard of 0.3m may be able to be justified.

FLOOD MAP B: FLOODING - 1% AEP EXTENT

Notes:

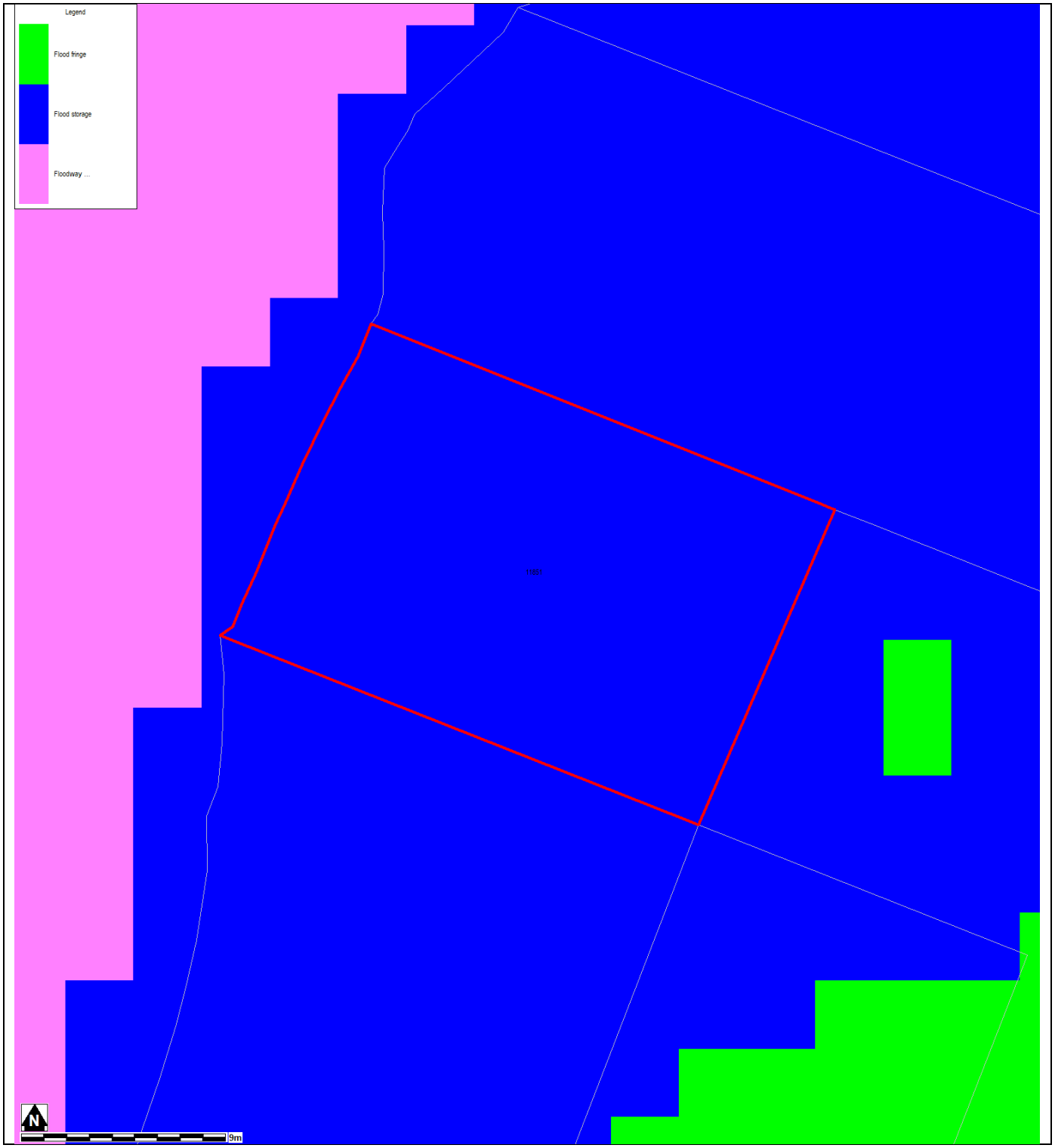
- Extent represents the 1% annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

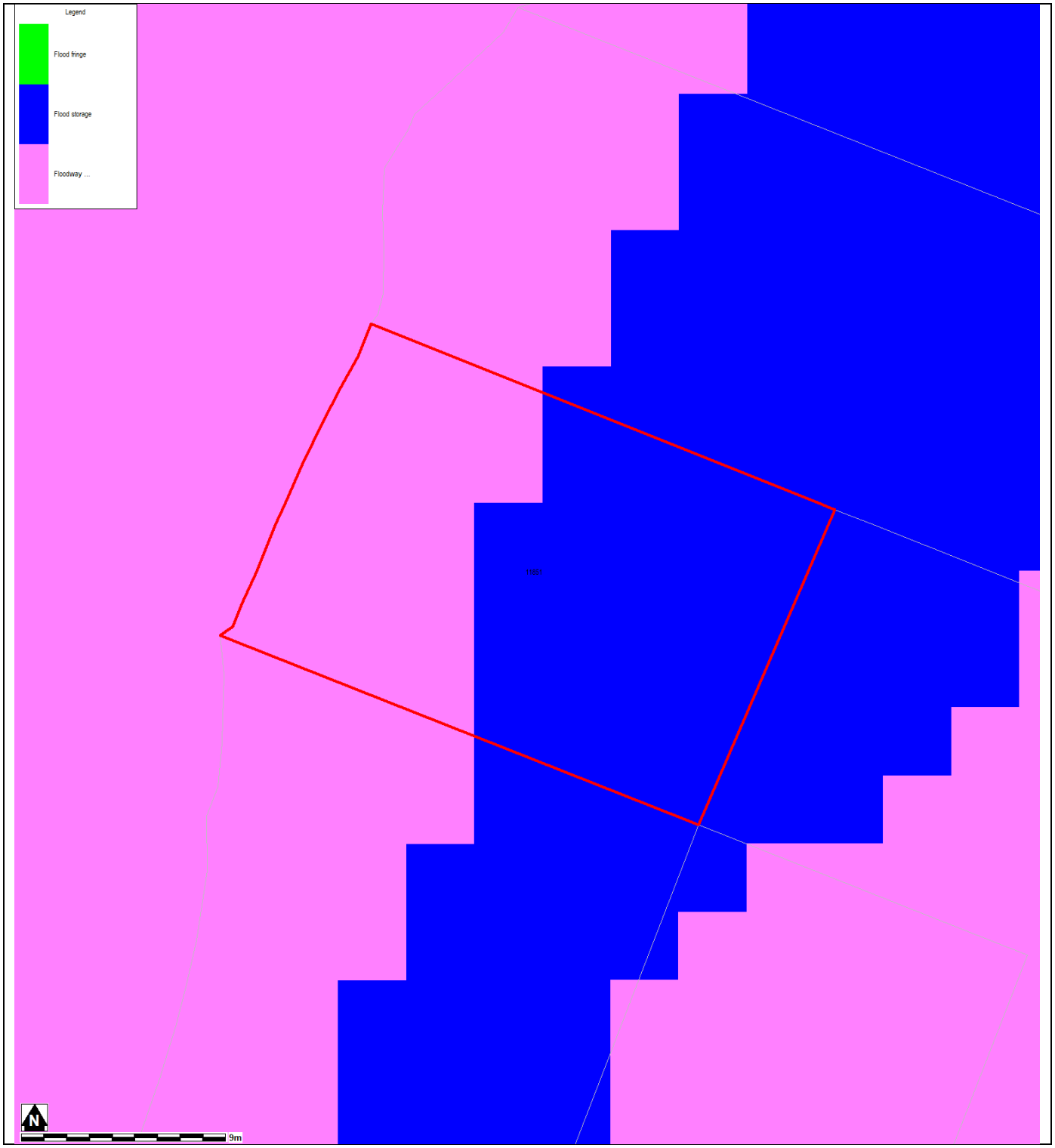
FLOOD MAP D: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



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: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

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

Note:

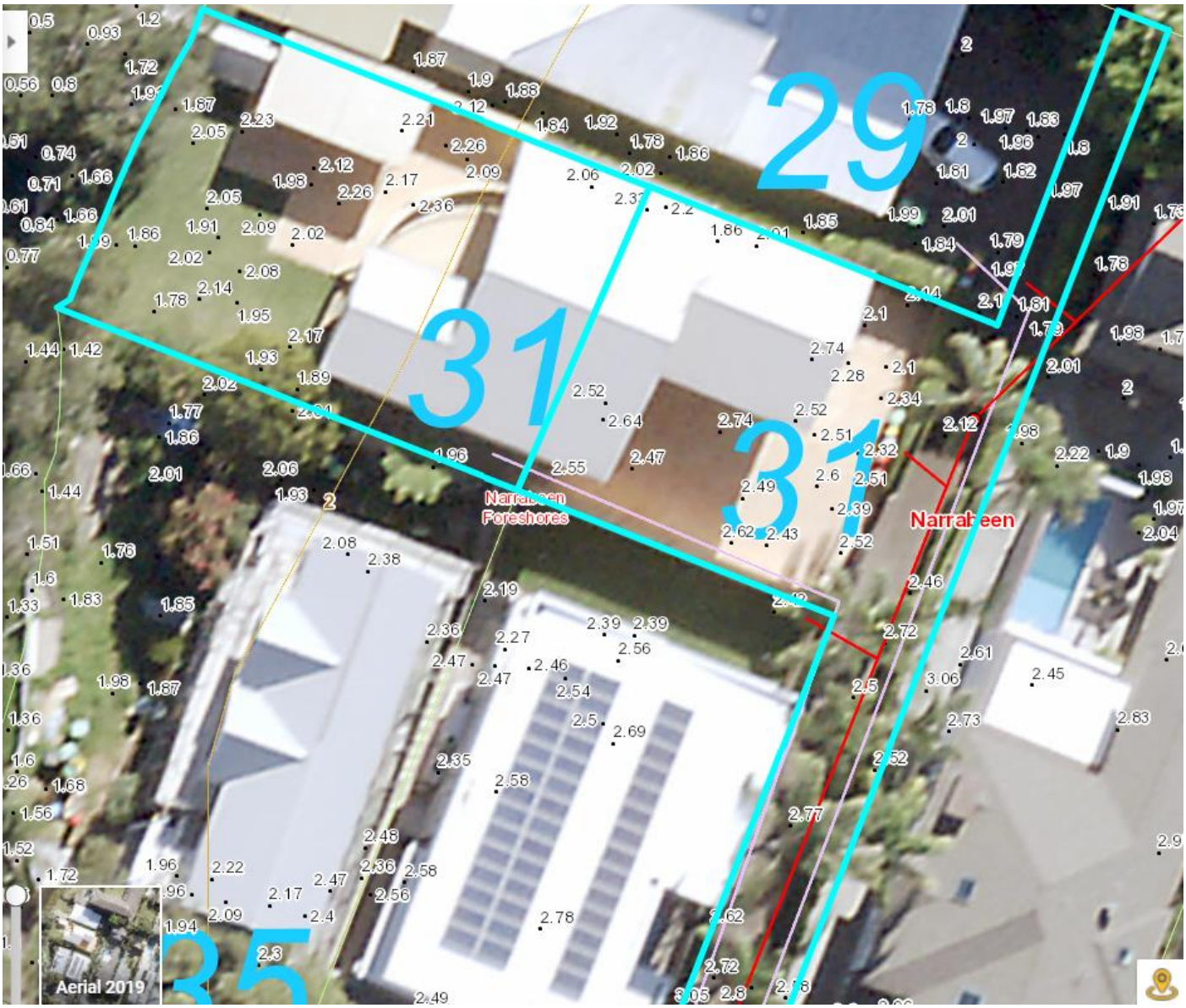
- Extent represents the 1% annual Exceedance Probability (AEP) flood event including 30% rainfall intensity and 0.9m Sea Level Rise climate change scenario
- Flood events exceeding the 1% AEP can occur on this site.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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 ± 0.2m vertically and ± 0.15m 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 .

FLOOD INFORMATION REPORT – COMPREHENSIVE

Property: 31 Emerald Street NARRABEEN NSW 2101
Lot DP: Lot 1 DP 946397
Lot 11 DP 133441
Issue Date: 08/06/2022
Flood Study Reference: Narrabeen Lagoon Flood Study 2013, BMT WBM

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]: 3.53 m AHD

1% AEP Flood – See Flood Map B

1% AEP Maximum Water Level [2, 3]: 3.03 mAHD

1% AEP Maximum Depth from natural ground level[3]: 1.19 m

1% AEP Maximum Velocity: 0.34 m/s

1% AEP Hydraulic Categorisation: N/A **See Flood Map D**

Probable Maximum Flood (PMF) – See Flood Map C

PMF Maximum Water Level [4]: 4.84 m AHD

PMF Maximum Depth from natural ground level: 2.98 m

PMF Maximum Velocity: 0.54 m/s

PMF Hydraulic Categorisation: N/A **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 change [3]: 3.89 m AHD

1% AEP Maximum Depth with Climate Change[3]: 2.06 m

1% AEP Maximum Velocity with Climate Change[3]: m/s

Flood Life Hazard Category – See Map G

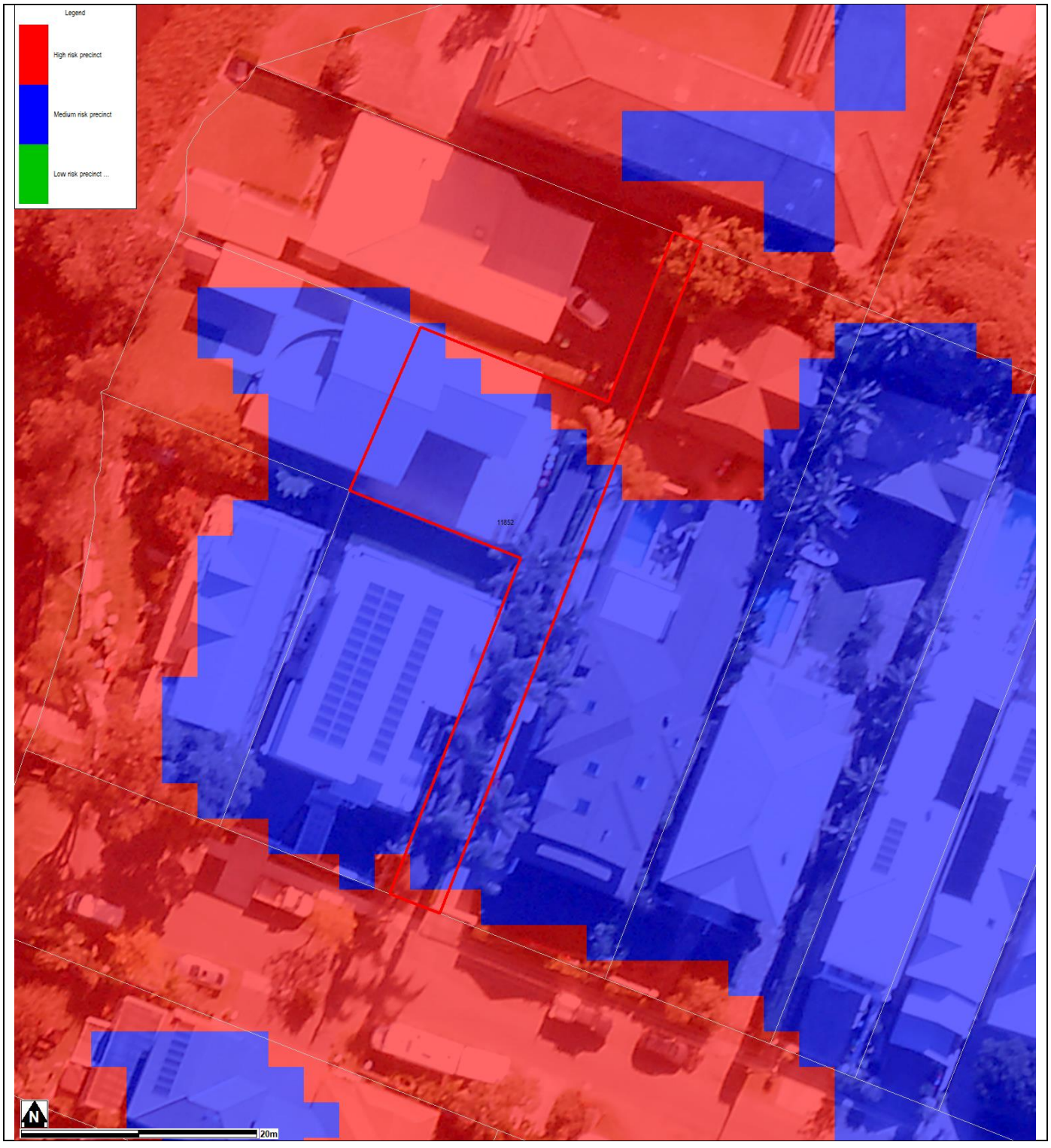
Indicative Ground Surface Spot Heights – See Map H

[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

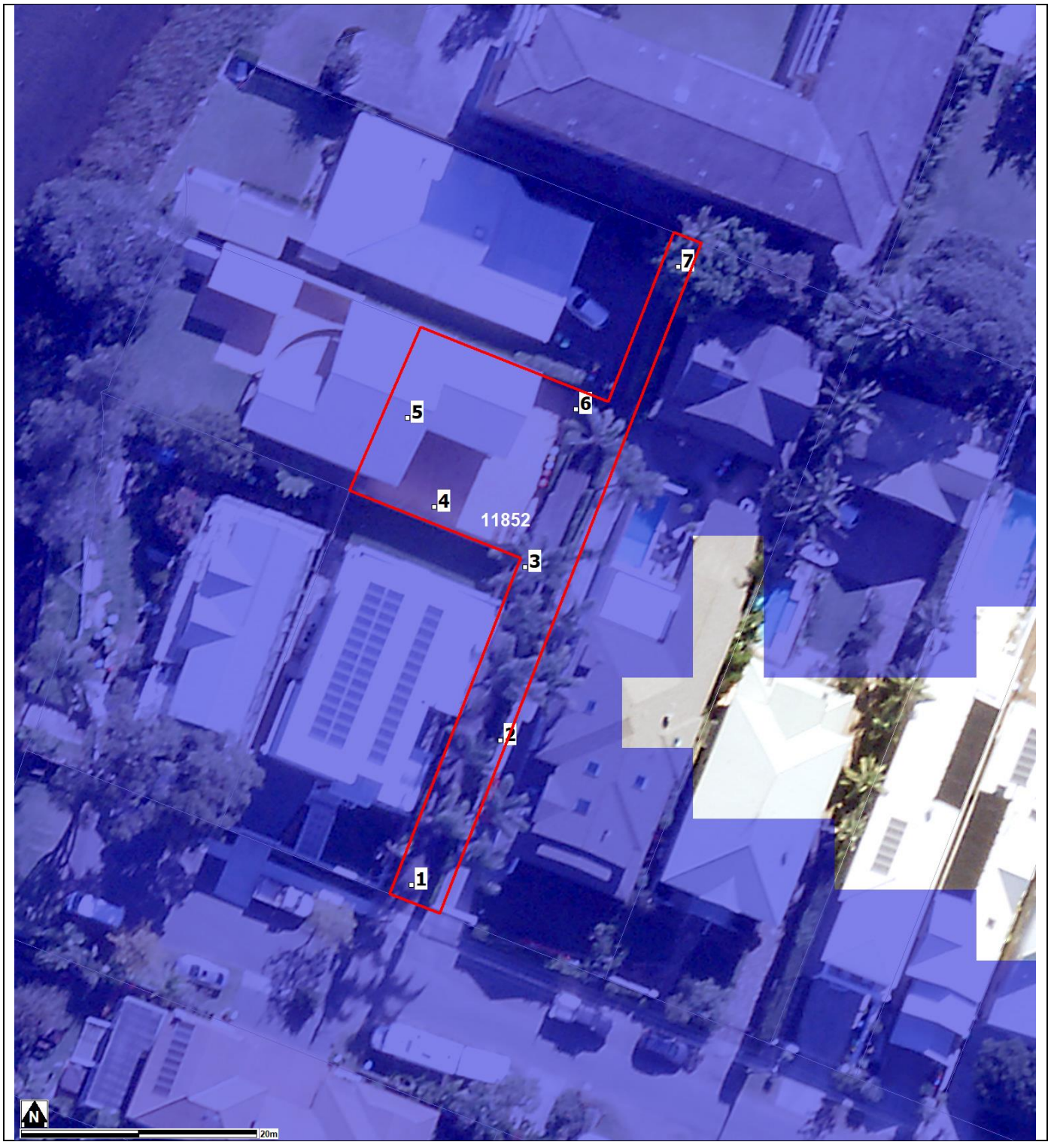


Notes:

- **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: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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	2.65	0.43	3.03	0.81	0.09	3.53	4.84	2.62	0.39
2	N/A	N/A	3.02	0.28	0.20	3.52	4.82	2.08	0.50
3	2.65	0.12	3.02	0.50	0.14	3.52	4.82	2.29	0.46
4	2.65	0.18	3.02	0.56	0.17	3.52	4.83	2.36	0.30
5	2.65	0.24	3.02	0.61	0.02	3.52	4.82	2.41	0.07
6	2.64	0.56	3.02	0.94	0.34	3.52	4.81	2.73	0.32
7	2.64	0.74	3.02	1.12	0.12	3.52	4.81	2.91	0.16

WL – Water Level
PMF – Probable Maximum Flood
N/A = no peak water level/depth/velocity available in flood event

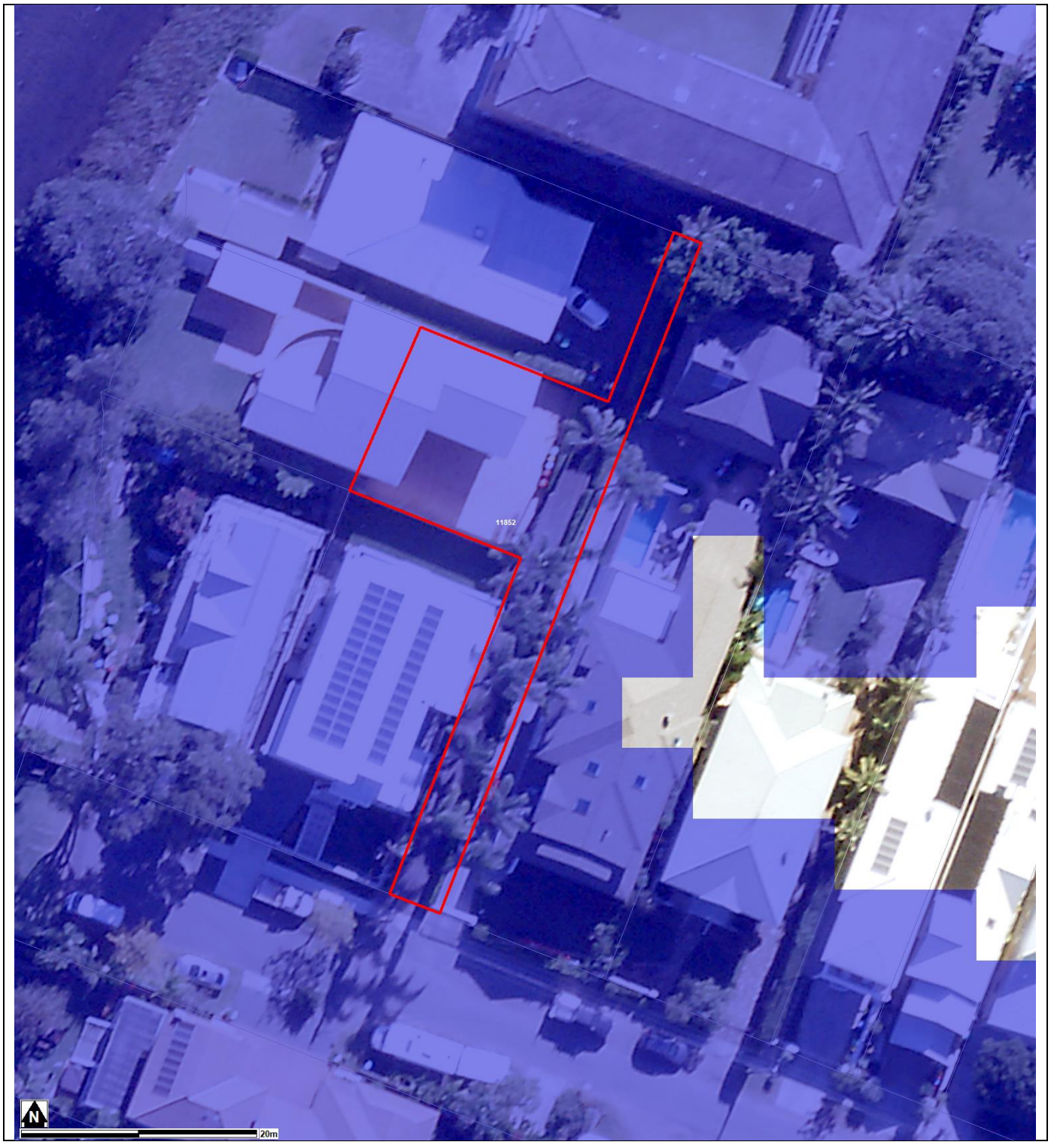
Climate Change Flood Levels (30% Rainfall intensity and 0.9m Sea Level Rise)

ID	CC 1% AEP Max WL (m AHD)	CC1 % AEP Max Depth (m)
1	3.89	1.67
2	3.89	1.15
3	3.89	1.36
4	3.89	1.42
5	3.89	1.48
6	3.89	1.80
7	3.89	1.99

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 $0.3m^2/s$, a freeboard of 0.3m may be able to be justified.

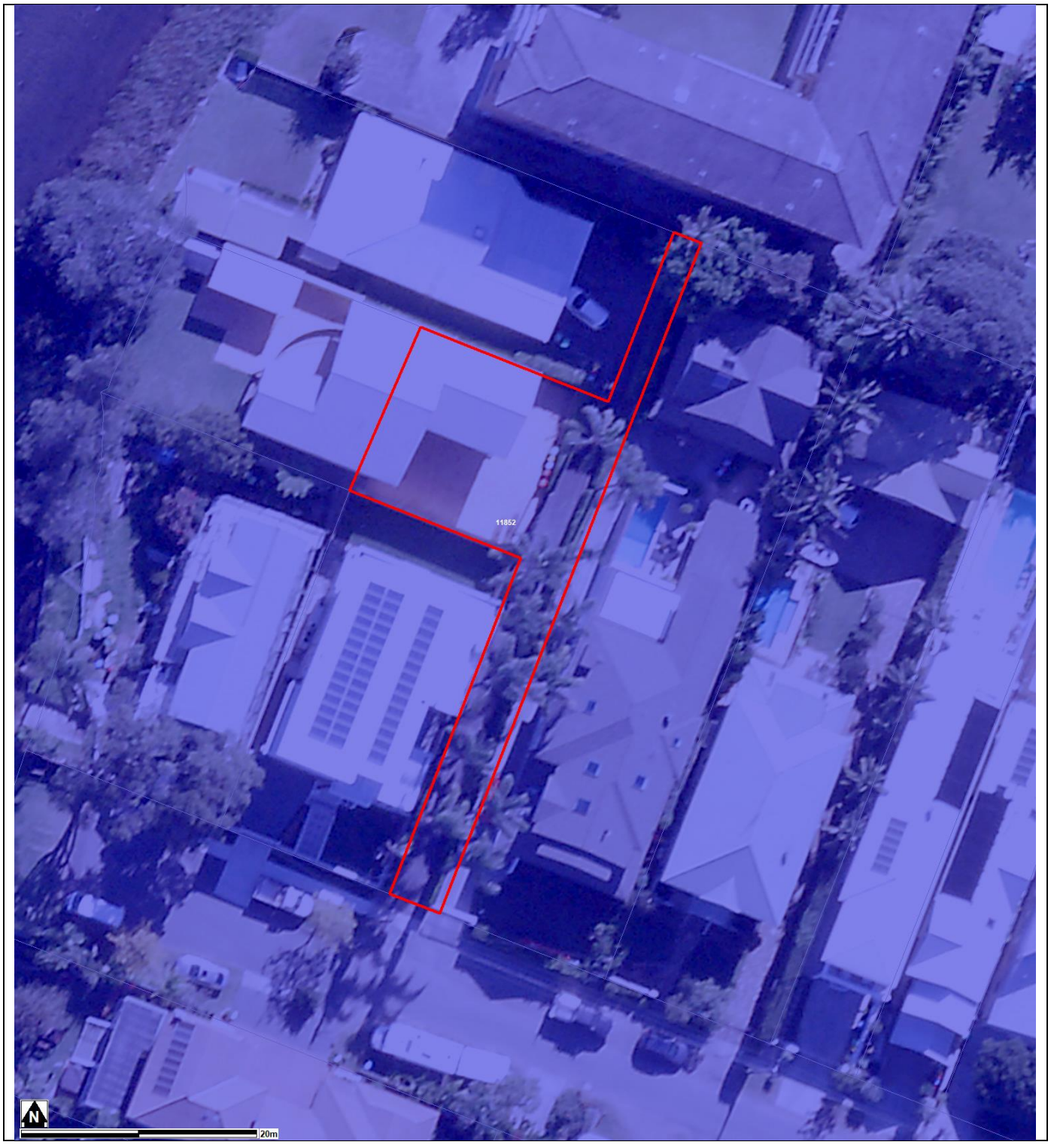
FLOOD MAP B: FLOODING - 1% AEP EXTENT



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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source Near Map 2014) are indicative only.

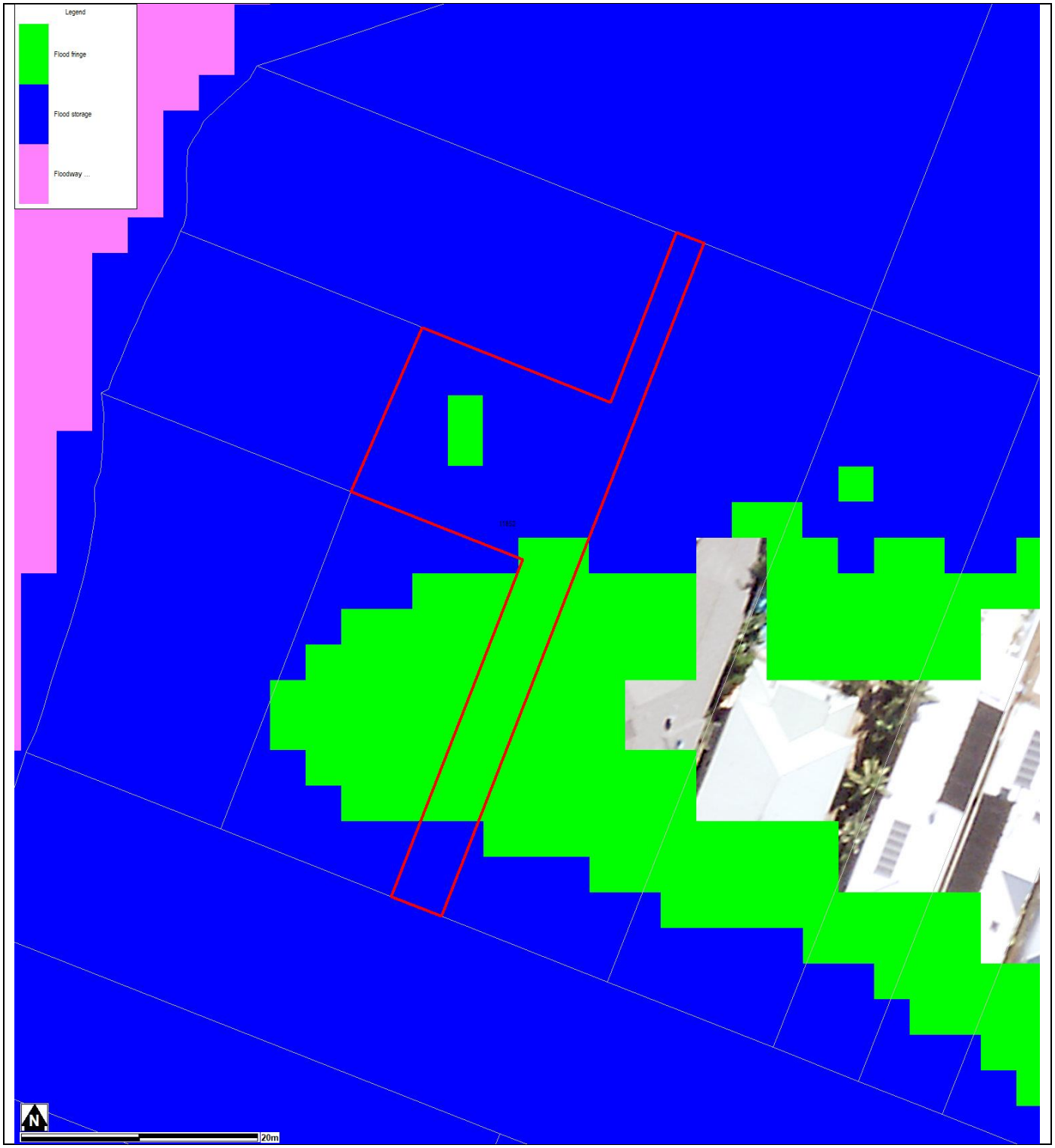
FLOOD MAP C: PMF EXTENT MAP



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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

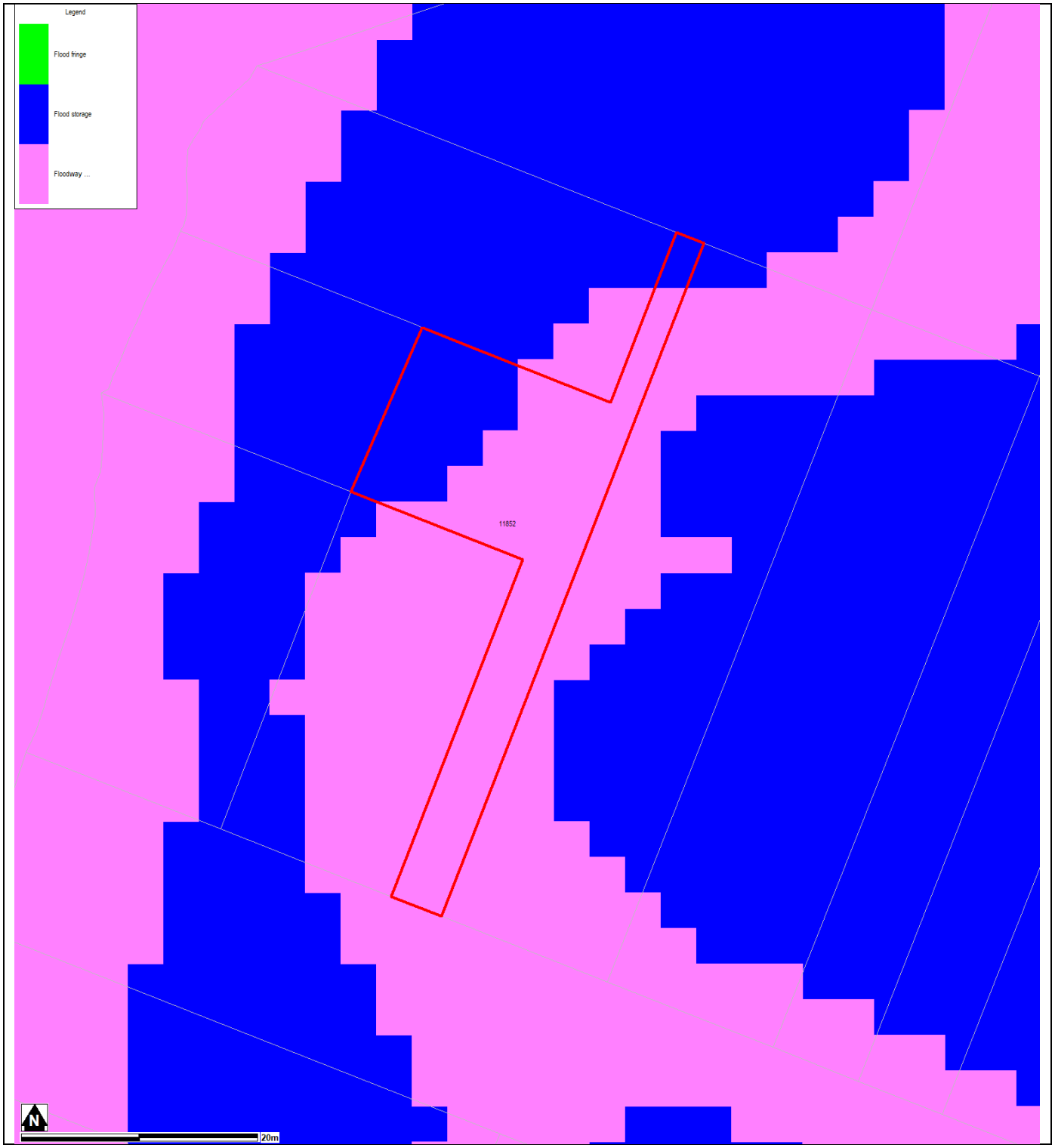
FLOOD MAP D: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

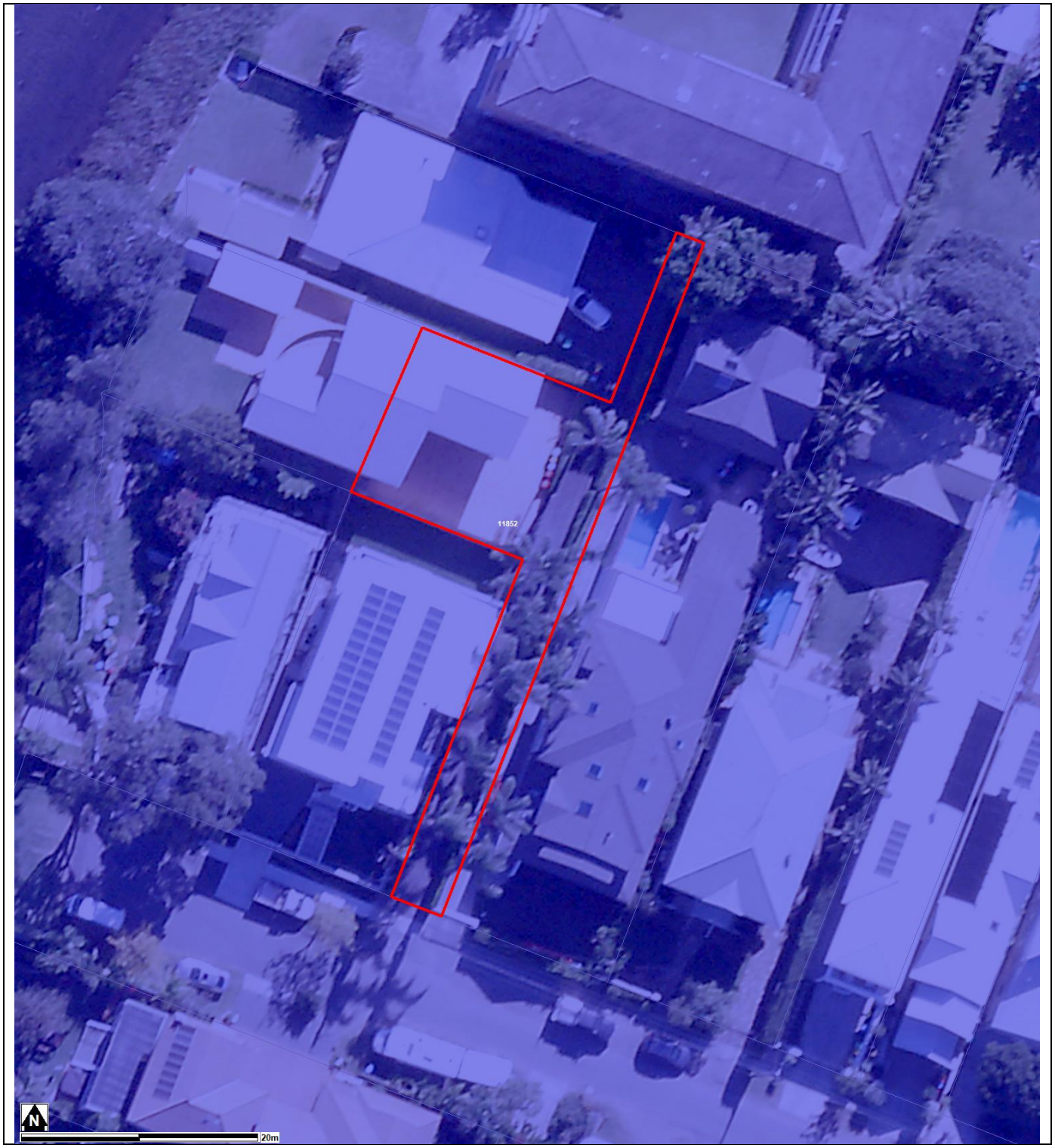
FLOOD MAP E: PMF FLOOD HYDRAULIC CATEGORY EXTENT MAP



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: Narrabeen Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

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



Note:

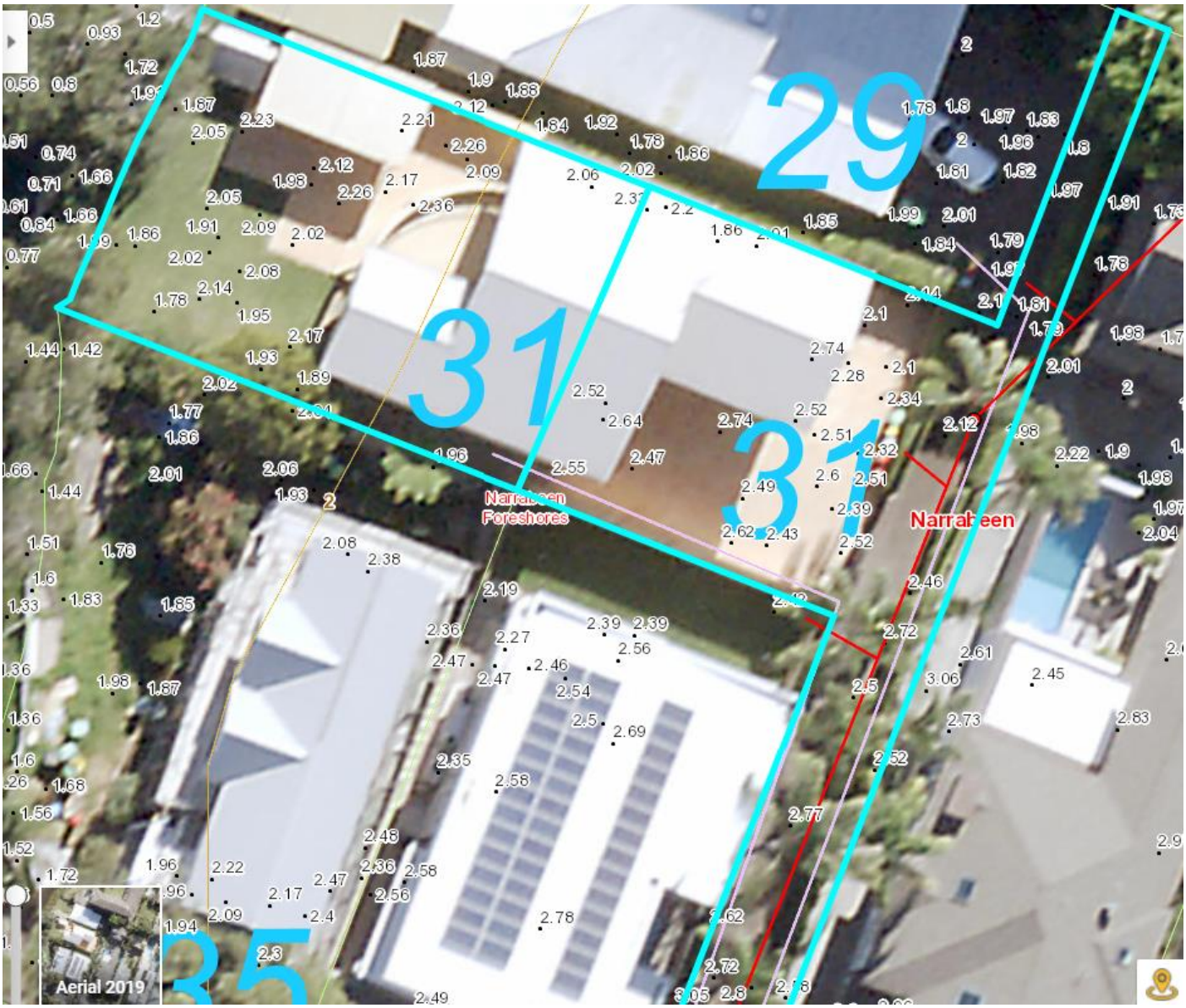
- Extent represents the 1% annual Exceedance Probability (AEP) flood event including 30% rainfall intensity and 0.9m Sea Level Rise climate change scenario
- Flood events exceeding the 1% AEP can occur on this site.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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: Narrabeen Lagoon Flood Study 2013, BMT WBM) 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 ± 0.2m vertically and ± 0.15m 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.

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- 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
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2. Flood analysis
   - 1% AEP flood level
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   - 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 .

Annexure B Narrabeen Lagoon Floodplain Risk Management Study Mapping Extract (Cardno 2019)

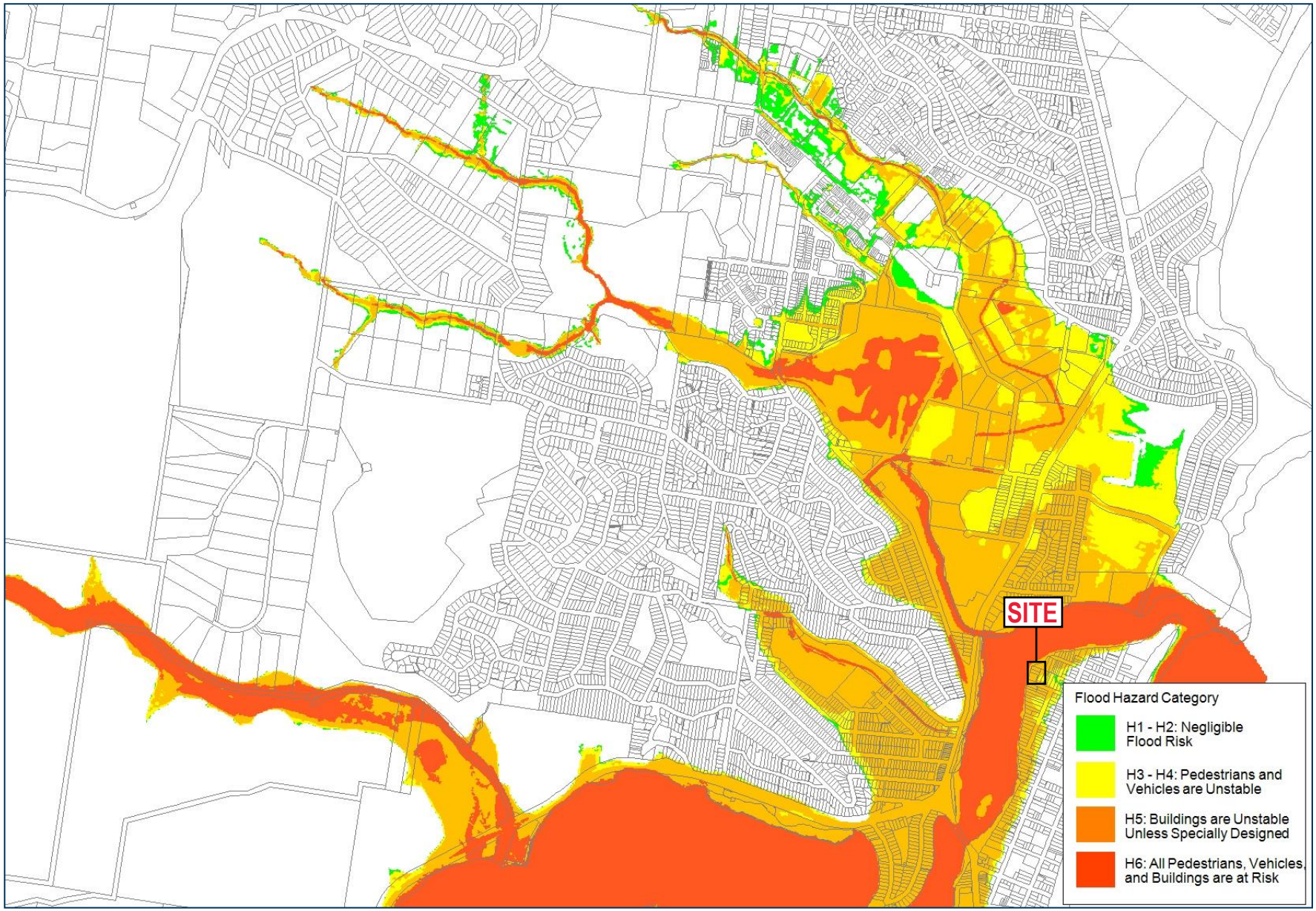


Figure 5-3 Flood Hazard Categories Northern Lagoon Catchment – PMF Event

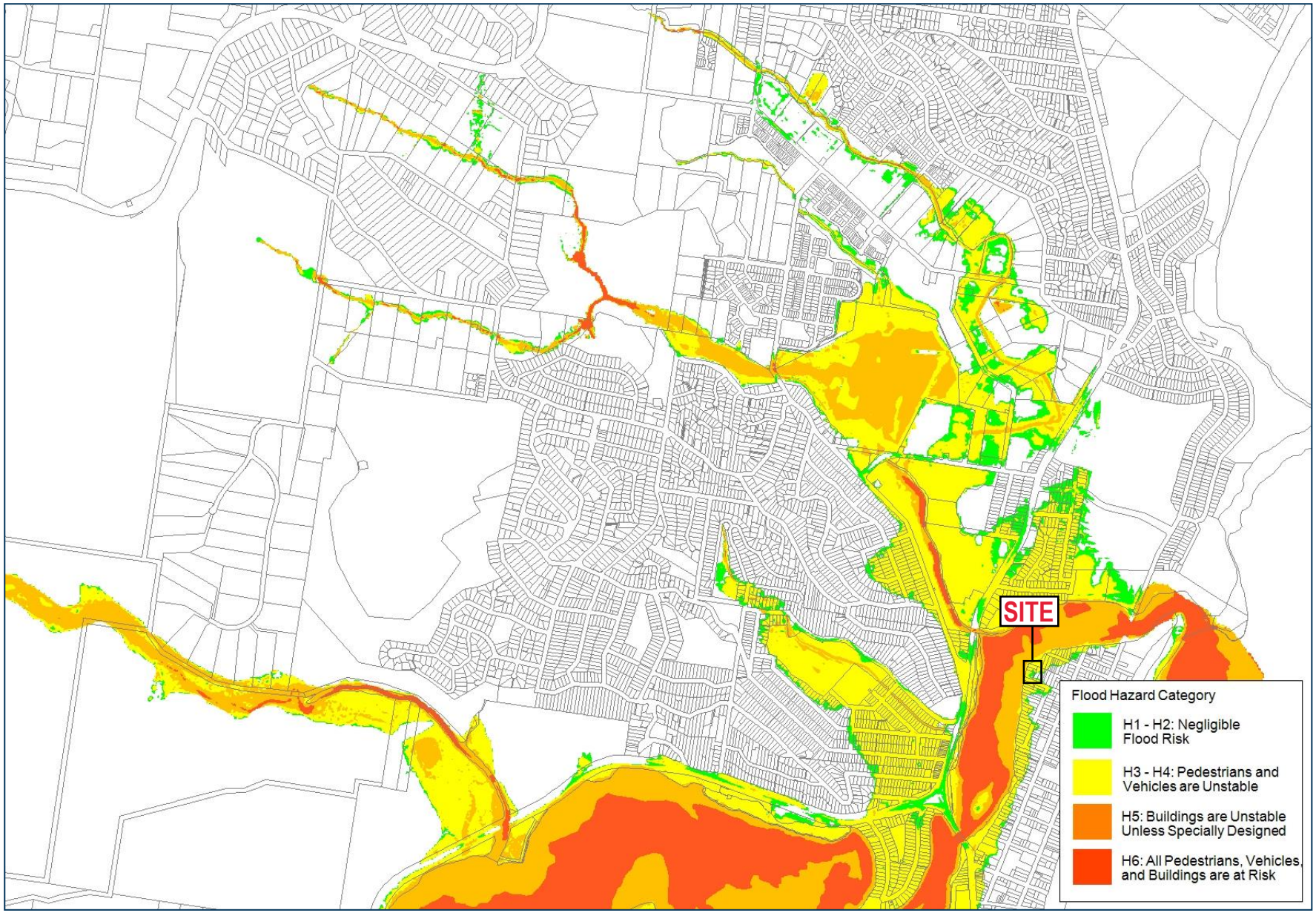
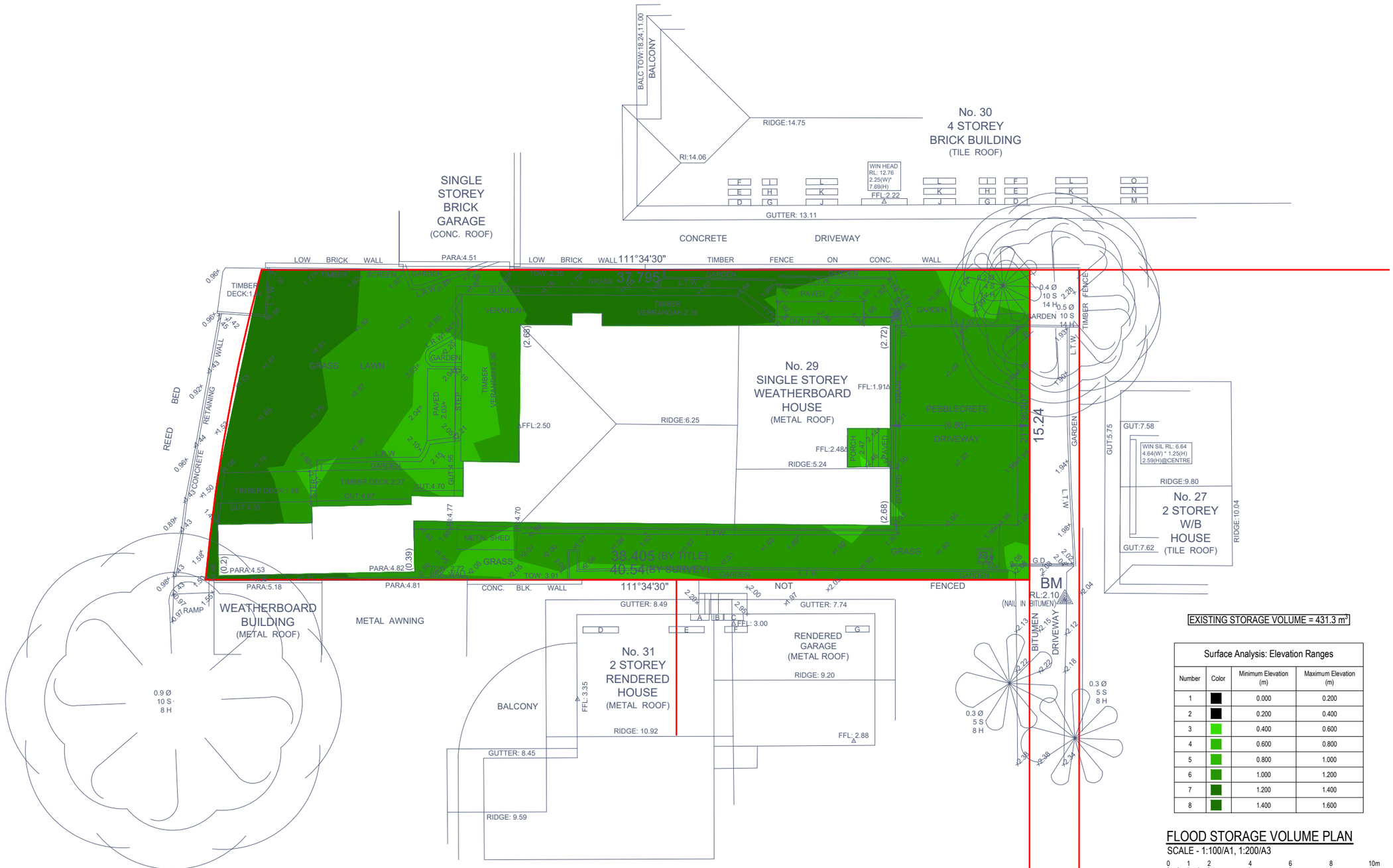


Figure 5-5 Flood Hazard Categories – Northern Lagoon Catchment – 1% AEP Event

Annexure C HYDRACOR Consulting Engineers Pty Ltd Flood Storage Volume Plan, Reference CC250002, Sheet FV1, Revision A, dated 24 February 2025



EXISTING STORAGE VOLUME = 431.3 m³

Surface Analysis: Elevation Ranges			
Number	Color	Minimum Elevation (m)	Maximum Elevation (m)
1		0.000	0.200
2		0.200	0.400
3		0.400	0.600
4		0.600	0.800
5		0.800	1.000
6		1.000	1.200
7		1.200	1.400
8		1.400	1.600

FLOOD STORAGE VOLUME PLAN

SCALE - 1:100/A1, 1:200/A3

0 1 2 4 6 8 10m

Issue	Description	Date	Drawn	Approved
A	ISSUED FOR REVIEW	24.02.25	IK	BK

North

Client: HOPSDAL

Architect: URSINO ARCHITECTS

HYDRACOR Consulting Engineers Pty Ltd
Platinum Building, Suite 2.01, 4 Ilya Avenue
ERINA NSW 2250, Australia
T +61 2 4324 3499
ENGINEERS | CIVIL | FLOOD STUDIES | STORMWATER | HYDRAULIC

Project: PROPOSED RESIDENTIAL DEVELOPMENT
No. 29
EMERALD STREET
NARRABEEN

Drawing Title: FLOOD STORAGE VOLUME PLAN

Drawn	Date	Scale A1	Q.A. Check	Date
IK	FEB 2025	AS SHOWN	-	-
Designed	Project No.		Dwg. No.	Issue
BK	CC250002		FV1	A