COSTIN ROE CONSULTING

CIVIL ENGINEERING REPORT FOR DEVELOPMENT APPLICATION

75 OLD PITTWATER ROAD, BROOKVALE

Prepared for:

Harrison Manufacturing
75 Old Pittwater Road
Brookvale, NSW, 2100

Prepared by:

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4 March 2025	-	Kris Harrison – Harrison Manufacturing
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1 INTRODUCTION

1.1 Introduction

Harrison Manufacturing proposes to upgrade an existing air emissions control system at 75 Old Pittwater Road, Brookvale, NSW. The site consists of a total area of approximately 2.37Ha with the proposed development consisting of approximately 580 square metres.

1.2 Scope

Costin Roe Consulting Pty Ltd has been engaged by Harrison Manufacturing to prepare this Engineering Report in support of the proposed Development Application for the site.

This report provides a summary of the design principles and planning objectives for the following civil engineering components of the project:

- Stormwater Management;
- Flooding/ Overland Flow; and
- Erosion Control.

The engineering objectives for the development are to create a site which, based on the proposed architectural layout, responds to the topography and site constraints and to provide an appropriate and economical stormwater management system which incorporates best practice in water sensitive urban design and is consistent with the requirements of council's water quality objectives.

1.3 Authority Jurisdiction

The consent authority for the development is Northern Beaches Council (NBC). The requirements of the former *Warringah DCP 2011, Warringah Local Environmental Plan 2011 (WLEP)* and *Water Management for Development Policy* apply to the engineering design for the development.

2 DEVELOPMENT SITE

2.1 Location

The proposed development is located in the suburb of Brookvale on the southern side of Old Pittwater Road as shown in **Figure 2.1**.

The development area forms a portion of the centre of a large industrial lot comprising of several single level warehouse buildings, offices, hardstands, internal access roads, and car parking areas.

Figure 2.1 - Locality Map

2.2 Existing Site

The proposal applies to land at 75 Old Pittwater Road, Brookvale, being Lot 2/DP600059 (subject site).

The property has an area of 2.37Ha with the proposed development located at the centre of the site, see **Figure 2.1**. The site is surrounded by a mix of industrial and commercial development including Warringah Mall along the southern boundary. Brookvale Creek is located, and forms, the eastern boundary of the property and conveys run off from the north to the south.

Levels over the site vary between RL 14.7m AHD on the northern boundary (adjacent to Old Pittwater Road), to RL 12.0m AHD on the southern boundary near Brookvale Creek.

2.3 Proposed Development

The proposed development involves removal of the existing vessel, ducting, cooling tower, associated equipment and the installation of a new odour control system and concrete pad that will not include any architectural alterations or modification to the existing building. The proposed site layout has been shown on the architectural layout by Watch This Space Desing PTY LTD as included in **Figure 2.2** below.

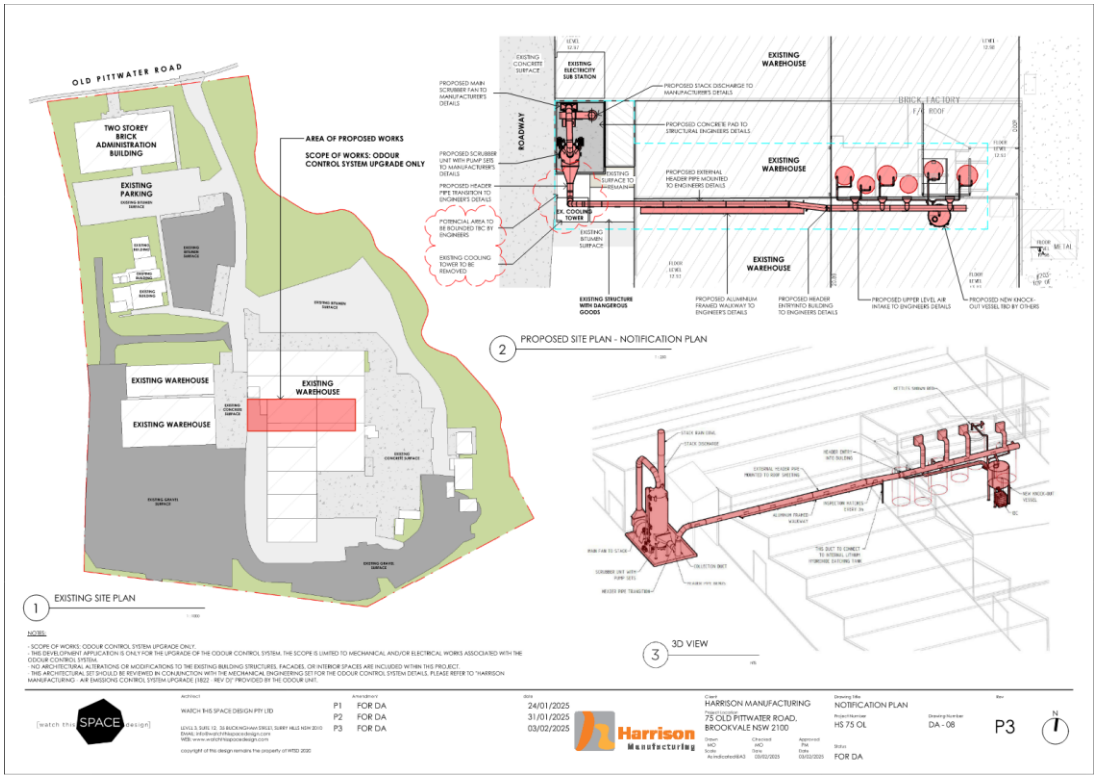


Figure 2.2 - Proposed Development Layout

3 SITE WORKS

3.1 Bulk Earthworks

The proposed development will not require earthworks to be completed as the site is an existing facility.

Minor excavation works will be required to enable the construction of a concrete pad.

Soil Erosion and Sediment Control measures are to be placed in accordance with the Soil and Water Management Plan in **Section 8** of this report.

3.2 Embankment Stability

The proposed development will not require embankments to be prepared as the site is an existing facility.

3.3 Supervision of Site Works

All geotechnical testing and inspections performed during the site works will be undertaken to Level 1 geotechnical control, in accordance with AS3798-2007.

4 STORMWATER MANAGEMENT

4.1 Existing Site Drainage

The existing property comprises of an in-ground drainage system as part of the existing facility.

The current in-ground stormwater drainage system comprises of multiple pit and pipe systems which is understood to mostly convey the stormwater to the east of the site discharging out of several headwalls located along the eastern boundary and into Brookvale Creek.

4.2 Proposed Site Drainage

The existing in-ground stormwater drainage system shall be retained as part of the proposed development. No additional site drainage is proposed nor required for the proposed development.

5 STORMWATER QUANTITY MANAGEMENT

5.1 General Design Principles

Northern Beaches Council requires on-site detention to be provided to limit the runoff discharged from private property into the underground pipe drainage system to pre-developed flow and to assist in mitigation the increased stormwater runoff generated by the development.

Northern Beaches Council adopts the principle of water quantity management, also known as "On-site Detention (OSD)", to ensure the cumulative effect of development does not have a detrimental impact on the existing stormwater infrastructure and watercourse located within their LGA downstream from the development site.

Section 9.2 of the Northern Beaches Councils *Water Management for Development Policy* states, "On-site Detention will not be required where the site of the development is located within a Council established 1% AEP flood plain".

Flood information has been obtained from Northern Beaches Council *Flood Information Report (Comprehensive)* (dated 2 August 2023) included in **Appendix A.** It states the current site is heavily affected by flooding and overland flow during a 1 in 100 year storm, therefore On-site detention is not required.

5.2 Pre-development & Post-development Peak Flows

In relation to the water runoff assessment, the current site can be considered to be predominately comprised of impermeable surfaces. Following construction of the proposed development, the extent of impermeable surface remains consistent with existing, hence it can be concluded the change in peak flows associated with the development should be negligible.

No detention is proposed nor required to limit runoff from the proposed development as the new development will not exceed pre-development runoff levels.

Based on the assessment it is concluded that additional mitigation measures are not required to mitigate impact associated with water quantity during operational phase of the proposed development.

6 STORMWATER QUALITY CONTROLS

6.1 Stormwater Quality Objectives

There is a need to provide a design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Northern Beaches Council.

Northern Beaches Council requirements for stormwater quality are found in *Section 4.1.1* of their *Water Management for Development Policy* and states, "It is necessary to install a filtration device that removes organic matter and coarse sediments from stormwater prior to discharge from the land" for "commercial/industrial lots with a site area less than 1000m^2 that propose to increase impervious area by more than 50m^2".

The sites impervious area remains to that of pre-development conditions, therefore, general stormwater quality requirements including pollutant reduction and MUSIC modelling are not required for this development.

7 FLOODING AND OVERLAND FLOW

7.1 Introduction

A desktop review of overland flow and flooding about the proposed development has been completed. The assessment confirms the requirements of Northern Beaches Council's DCP have been met.

Our assessment has been based on a review of the detailed survey, the proposed development, and the evaluation of the site regarding the flood modelling and documented flood behaviour included in Northern Beaches Council *Flood Information Report (Comprehensive) (dated 02/08/2023)* included in **Appendix A**.

The site is located around 2km north of Manly Dam and has Brookvale creek running adjacent to the eastern boundary. The site is noted as not required to provide stormwater attenuation, as discussed **in Sections 5.1** & **5.2** of this report.

It is understood that the existing buildings on the property discharge their roof water and part of the carparking out of several headwalls located along Brookvale Creek.

Brookvale Creek traverses the eastern boundary of the site and conveys runoff from the north to the south. The creek is comprised of an open channel with roughly trapezoidal shape. The invert of the creek varies between RL 10.9m AHD on the north to RL 9.1m AHD on the south. The Creek continues south of the property as an underground box culvert system (details not known).

7.2 Council Flood Information Report (Comprehensive)

Flood information has been obtained from Northern Beaches Council via a Flood Information Report application. The report involved a hydrological and hydraulic assessment of the site's catchment.

We provide excerpts of flooding associated with the 1% AEP storm event from the report in **Figures 7.1**, **7.2** & **7.3** below. Figure 7.1 is an excerpt of the 1% AEP Flood Extent; **Figure 7.2** is an excerpt of the 1% AEP Flood Category; **Figure 7.3** is an excerpt of the PMF Flood Extent.

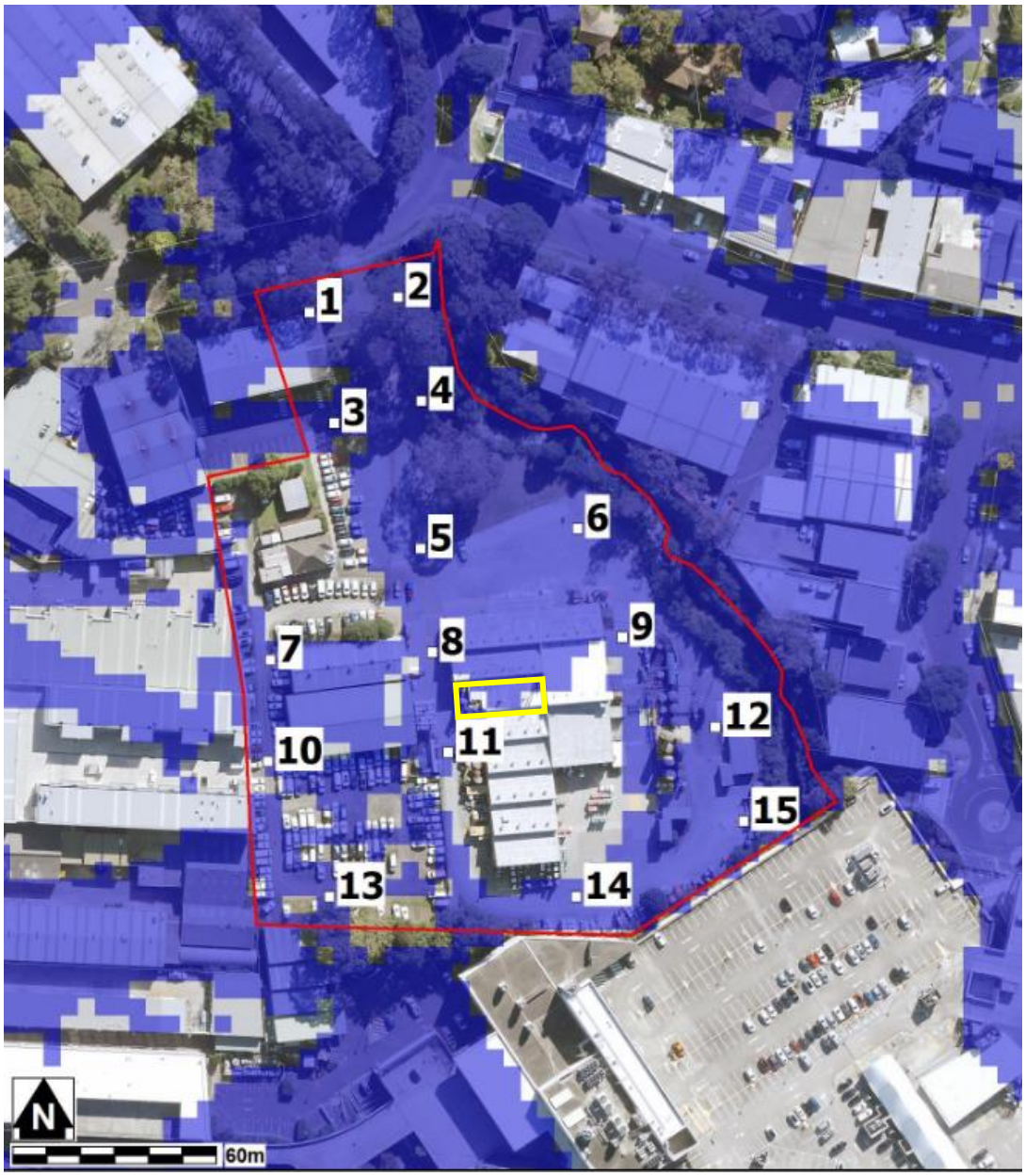


Figure 7.1 – 1% AEP Flooding Extent

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	14.21	0.26	14.38	0.43	1.89	14.88	15.13	1.18	2.45
2	13.04	1.08	13.21	1.24	4.33	13.71	14.73	2.76	3.19
3	N/A	N/A	13.53	0.10	1.25	14.03	14.66	1.23	3.69
4	N/A	N/A	12.97	0.22	2.04	13.47	14.68	1.92	3.82
5	N/A	N/A	12.99	0.37	0.28	13.49	14.68	2.06	0.45
6	12.46	0.24	12.96	0.74	0.88	13.46	14.67	2.45	2.47
7	13.25	0.24	13.35	0.34	0.18	N/A	14.68	1.67	0.88
8	N/A	N/A	12.99	0.08	0.54	13.49	14.67	1.76	1.07
9	N/A	N/A	12.93	0.16	0.45	13.43	14.66	1.89	1.01
10	13.24	0.02	13.31	0.08	0.45	13.81	14.67	1.44	1.93
11	12.92	0.02	12.99	0.09	0.41	13.49	14.67	1.76	0.79
12	N/A	N/A	12.86	0.37	0.54	13.36	14.65	2.17	0.82
13	13.08	0.06	13.10	0.08	0.58	13.60	14.66	1.64	1.39
14	N/A	N/A	12.84	0.41	0.48	13.34	14.67	2.23	1.04
15	12.32	0.10	12.86	0.64	0.76	13.36	14.66	2.44	1.27

Table 7.1 – Key Point Flood Levels and Velocities

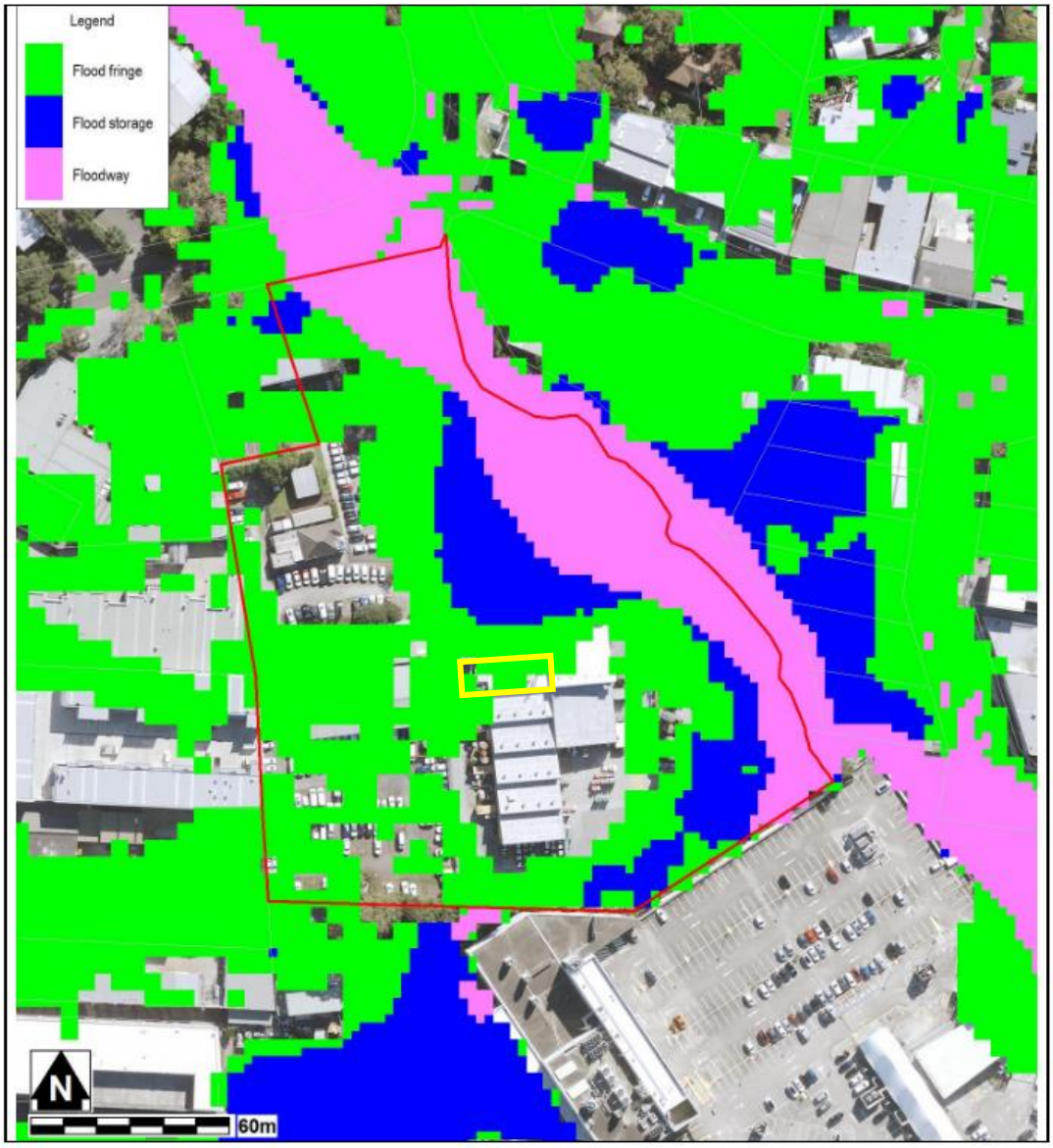


Figure 7.2 – 1% Flood Hydraulic Category Extent

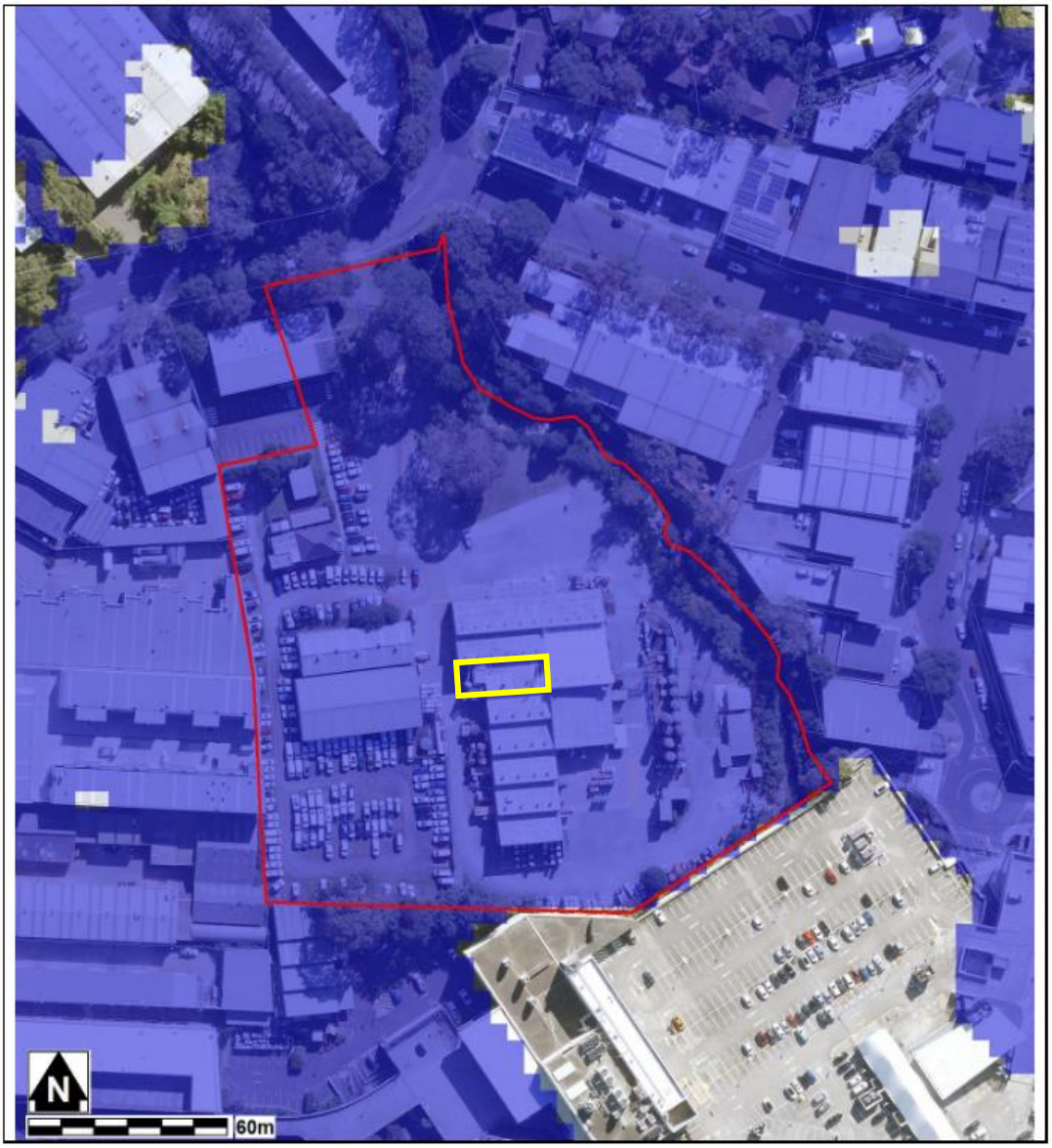


Figure 7.3 – PMF Flooding Extent

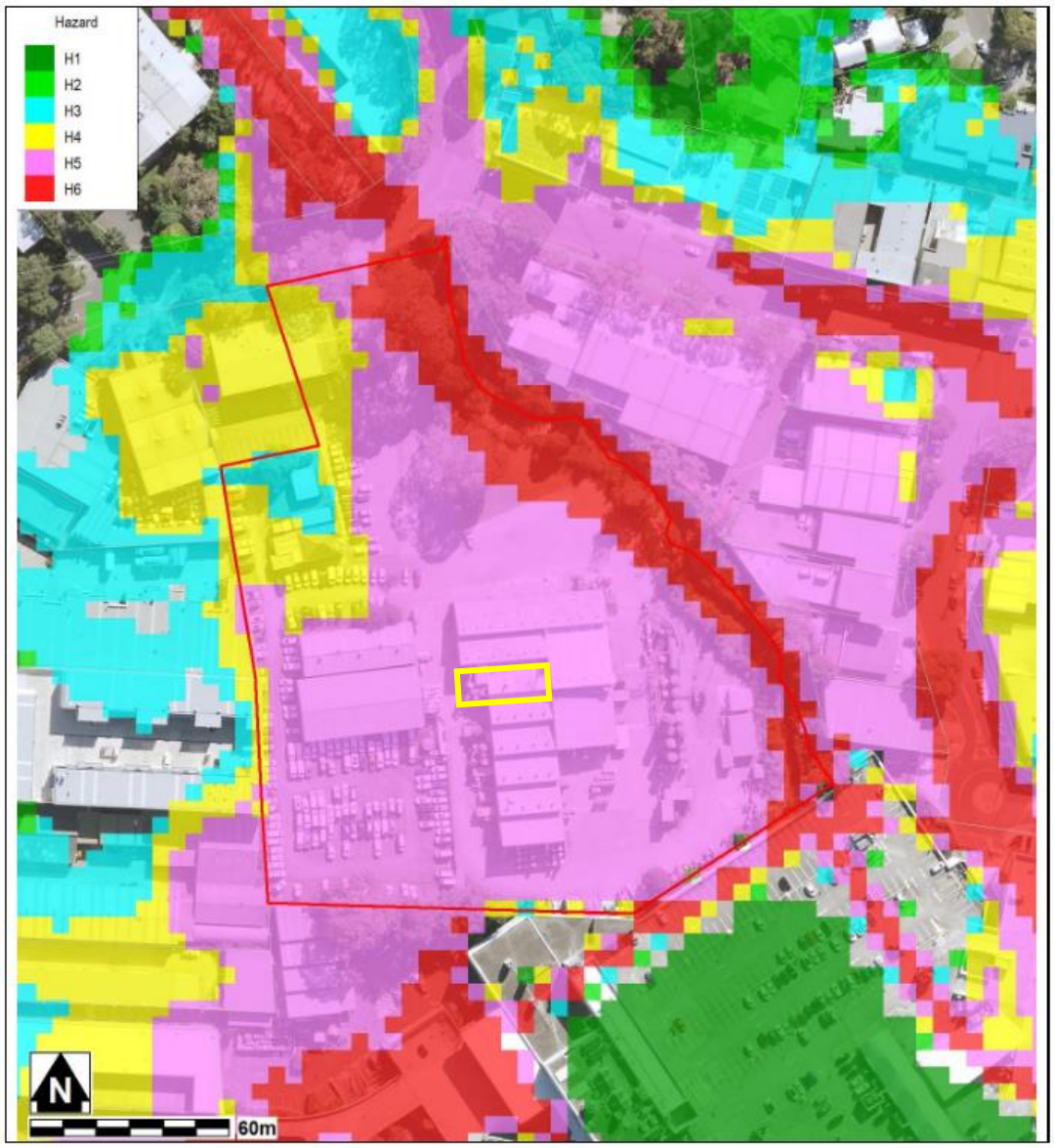


Figure 7.4 – PMF Flood Life Hazard Categories

Figures 7.1 & **7.3** illustrate flood extents for the 1% AEP and PMF events. It is evident that the site is heavily affected by flooding.

During the 1% AEP event, flood levels on the proposed works is approximately at RL 12.99m AHD according to **Table 7.1** and is predominately located at the front of the warehouse.

The flood planning level for the development area should be above RL 13.49m which is 0.5m freeboard above the 1% AEP water level.

7.3 External Catchments and Overland Flow Provisions

Council's flood assessment confirms that the site is affected by mainstream flooding in the local 1% AEP flood event by overland flow from Old Pittwater Road as seen in **Figure 7.5**. With reference to **Figure 7.1**, a significant overland flow path is conveyed through the site from the north to south-east of the entire site. **Figure 7.1** also shows flooding up to 0.09m deep to the west of the proposed works during the 1% AEP event. The site is impacted by the Probable Maximum Flood (PMF) which, per council's flood report, is at approximately RL 14.67m AHD near the proposed works.

Figure 7.5 – Contributing Catchment

As seen in the council figures, a portion of the site located close to the proposed works is affected by slow-moving floodwater. This likely indicates local depressions on the site that provide a minor degree of flood storage.

Given the above, the site is shown to be impacted by flooding during the 1% AEP and in more intense storm events.

7.4 Floodplain Management Considerations

7.4.1 Flood Planning Level

Introducing a Flood Planning Level (FPL) is an important flood risk management measure. FPLs are derived from a combination of a designated flood event, which can either be a historic flood or a design flood of a certain recurrence interval, plus a nominated freeboard depth.

The *NSW Floodplain Development Manual, 2005* recommends that the FPL generally be based on the 100-year ARI event. It suggests that although this event can vary, it should only be done in exceptional circumstances. Adopting the 1% AEP event for the proposed development is considered appropriate.

The freeboard in an FPL is the flood level difference between its base level and the FPL. Freeboard is designed to provide reasonable certainty that the reduced risk exposure provided by the chosen FPL is warranted, taking into account factors such as:

- Uncertainties in the estimate of flood levels;
- Differences in water levels across the floodplain;
- Wave action resulting from wind and vehicular/marine traffic during the flood event;
- Changes in rainfall patterns due to climate change;
- The cumulative effect of subsequent infill development on existing zoned land.

The *Floodplain Development Manual* recommends a freeboard of 0.5m for most new developments, and it is considered appropriate to adopt this freeboard for the proposed development.

The FPL defined in the *Floodplain Development Manual* is noted to be consistent with that of the Northern Beaches Council.

7.4.2 Hydraulic and Hazard Categorisation

Floodwaters can vary significantly, both in time and place across the floodplain. They can flow fast and deep at some locations and slow and shallow at other locations. That can result in large variations in the personal danger and physical property damage from the flood.

The Floodplain Development Manual recognises three hydraulic categories of flood-prone land: floodway, flood storage and flood fringe. These are then further separated into two hazard categories: high and low.

Floodways

Floodways are those areas where a significant volume of water flows during floods and are often aligned with natural channels. They are areas that, even if only partially blocked, would cause a substantial redistribution of flood flow, which could adversely affect other areas. They can also be areas with deeper and higher velocity flow.

Flood Storage

Flood storage areas are the parts of the floodplain that provide temporary storage for floodwaters during the passage of a flood. If a reduction in the flood storage area is experienced due to the filling of land or construction of a levee bank, it can result in adverse effects on the flood levels and peak flow rates in other areas.

Flood Fringe

Flood fringe areas are the remaining area of land affected by flooding. The development of flood fringe land does not generally have any major impact on the pattern of flood flows and/or levels.

The preparation of a flood study is almost always required in the determination of hydraulic categories. That is so that peak depths, velocities and the extent of flooding can be determined across the catchment.

Hazard Categories

Flood hazard categories are divided into high and low hazards for each hydraulic category. High-hazard areas are defined as those with a possible danger to personal safety and the potential for significant structural damage. Non-disabled adults would have difficulty wading to safety. With low-hazard areas, should it be necessary, a truck could evacuate people and their possessions, and non-disabled adults would have little difficulty in wading to safety.

Flood hazard criteria within the site have been defined as H5 in relation to the overland flow path on site.

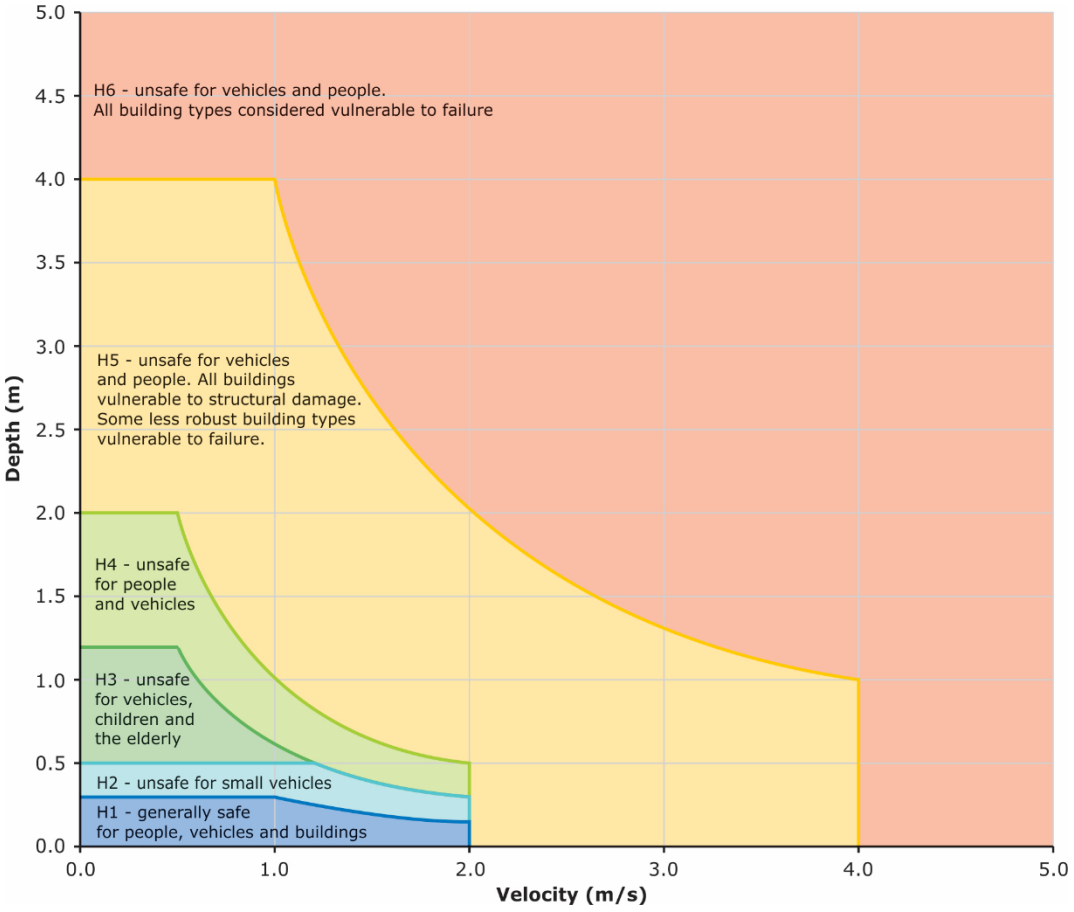


Figure 7.6 – Combine Flood Hazard Curves (Smith et al., 2014)

Table 6.7.3. Combined Hazard Curves - Vulnerability Thresholds (Smith et al., 2014)

Hazard Vulnerability Classification	Description
H1	Generally safe for vehicles, people and buildings.
H2	Unsafe for small vehicles.
H3	Unsafe for vehicles. children and the elderly.
H4	Unsafe for vehicles and people.
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.

Table 6.7.4. Combined Hazard Curves - Vulnerability Thresholds Classification Limits (Smith et al., 2014)

Hazard Vulnerability Classification	Classification Limit (D and V in combination)	Limiting Still Water Depth (D)	Limiting Velocity (V)
H1	D*V ≤ 0.3	0.3	2.0
H2	D*V ≤ 0.6	0.5	2.0
H3	D*V ≤ 0.6	1.2	2.0
H4	D*V ≤ 1.0	2.0	2.0
H5	D*V ≤ 4.0	4.0	4.0
H6	D*V > 4.0	-	-

Figure 7.7 – Adopted Hazard Criteria and Provisional Flood Hazard Chart

7.4.3 Flood Damages

Damage caused by floods is generally categorised as either tangible or intangible. Tangible damages are financial in nature and can be readily measured in monetary terms. They include direct damages, such as damage or loss caused by floodwaters wetting goods and property, and indirect damages, such as lost wages incurred during clean-up periods after the flood event. Intangible damage includes emotional stress and even mental and physical illness caused by the flood. It is difficult, if not impossible, to quantify intangible damages in financial terms.

From a flood planning perspective, it is important to consider the following direct damage categories:

- Contents Damage – refers to damage to the contents of buildings, including carpets, furniture, and other personal property;
- Structural Damage – refers to damage to the structural fabric of buildings, such as foundations, walls, floors, windows, and built-in fittings; and
- External Damage – includes damage to all items external to buildings, such as cars, landscaping, and other outdoor features.

As there is no way to prevent a flood from occurring and excluding all development within flood-prone areas is unrealistic, establishing an FPL is to minimise the risk of direct damage when a flood occurs. By minimising the direct damage, there is a carry-on effect, whereby other associated indirect tangible damages and intangible damages are also minimised.

7.4.4 Emergency Response Planning

Flood planning refers to preparing a formal community-based plan of action to deal with the threat, onset and aftermath of flooding. It involves planning an event equal to or greater than the event used to derive the FPL.

The action plan should include an on-site response plan that addresses what measures should be undertaken once the threat of a flood is imminent. A flood evacuation strategy should also be included so that all persons within the precinct are familiar with the processes required if a flood occurs.

7.5 Flood Assessment Conclusion

In conclusion, the report indicated that the proposed development project in Northern Beaches Council has a high flood risk. The desktop review of overland flow and flooding revealed that the site is susceptible to mainstream flooding in the local 1% AEP flood event and flooding in the PMF flood event from the Brookvale Creek Catchment.

The proposed odour control system is to be designed and constructed to ensure structural integrity up to the FPL, taking into account the forces of floodwater, wave action, flowing water with debris and immersion. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connection must be waterproofed and/or located above the Flood Planning Level. The development does not propose habitable floor areas.

Based on the assessment and management strategy proposed, the development meets current council flood policy and shows acceptable impacts in relation to flooding and flood safety.

8 EROSION & SEDIMENT CONTROL PLANS

8.1 General Conditions

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a sediment load. An Erosion and Sediment Control Plan (ESCP), or equivalent, would be implemented for the construction of the Proposal. The ESCPs would be developed in accordance with the principles and requirements of Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book', Landcom, 2004) with a staged approach.

Controls are to be in accordance with the principles included in the Blue Book. The ESC works are to considers initial site establishment, requirements during construction of the development, and completion of development works.

Section 2 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Demolition and removal of existing services.
- Erosion and sediment control installation.
- Minor grading of existing earthworks to suit building layout and pavements.
- Service installation works.
- Odour Control System construction works.

The section below outlines the proposed controls for management of erosion and sedimentation during construction of the Proposal. The approach is noted to consider initial site establishment, construction of the development and the completion of the development.

8.2 Typical Management Measures

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

9 CONCLUSION

This Civil Engineering Report has been prepared to support a Development Application for the installation of a new odour control system and concrete pad to an existing industrial/commercial facility on the property at 75 Old Pittwater Road, Brookvale NSW.

The stormwater management for the development is in accordance with the Northern Beaches Council's *Water Management for Development Policy*.

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Flooding and overland flow across the site is proposed to be managed by maintaining the existing overland flow path to prevent adverse affectation of water levels upstream or downstream of the property.

The detail contained in this report provides sufficient information to show the consent authority that a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

10 REFERENCES

- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);
- Managing Urban Stormwater, Soils and Construction (1998) – The Blue Book, Landcom
- Northern Beaches Council WSUD & MUSIC Modelling Guidelines (2016)
- Water Management for Development Policy (2021), Warringah
- Warringah Council On-site Stormwater Detention Technical Specification
- Warringah Development Control Plan (2011)
- Manly Lagoon Floodplain Risk Management Study & Plan (2018)
- Managing Urban Stormwater, Soils and Construction (1998) – The Blue Book, Landcom

11 APPENDICES

COSTIN ROE CONSULTING

APPENDIX A
COUNCIL FLOOD LETTER FOR LOT 2/DP600059 (DATED 02.08.2023)

FLOOD INFORMATION REPORT (COMPREHENSIVE)

Property: 75 Old Pittwater Road BROOKVALE NSW 2100
Lot DP: Lot 2 DP 600059
Issue Date: 02/08/2023
Flood Study Reference: Manly Lagoon Flood Study 2013, BMT WBM

Flood Information[1]:

Map A - Flood Risk Precincts
Maximum Flood Planning Level (FPL) [2, 3, 4]: 15.22 m AHD

Map B - 1% AEP Flood & Key points
1% AEP Maximum Water Level [2, 3]: 14.72 m AHD
1% AEP Maximum Depth from natural ground level[3]: 4.62 m
1% AEP Maximum Velocity: 5.84 m/s

Map C - 1% AEP Hydraulic Categorisation
1% AEP Hydraulic Categorisation: Floodway

Map D - Probable Maximum Flood
PMF Maximum Water Level (PMF) [4]: 15.69 m AHD
PMF Maximum Depth from natural ground level: 6.42 m
PMF Maximum Velocity: 7.04 m/s

Map E - Flooding with Climate Change
Climate change flood levels are not available for this property. Based on other similar studies in the LGA it can be assumed in this area that the levels are approximately 0.2m higher than the 1% AEP levels.

Map F - Flood Life Hazard Category in PMF

Map G - Indicative Ground Surface Spot Heights

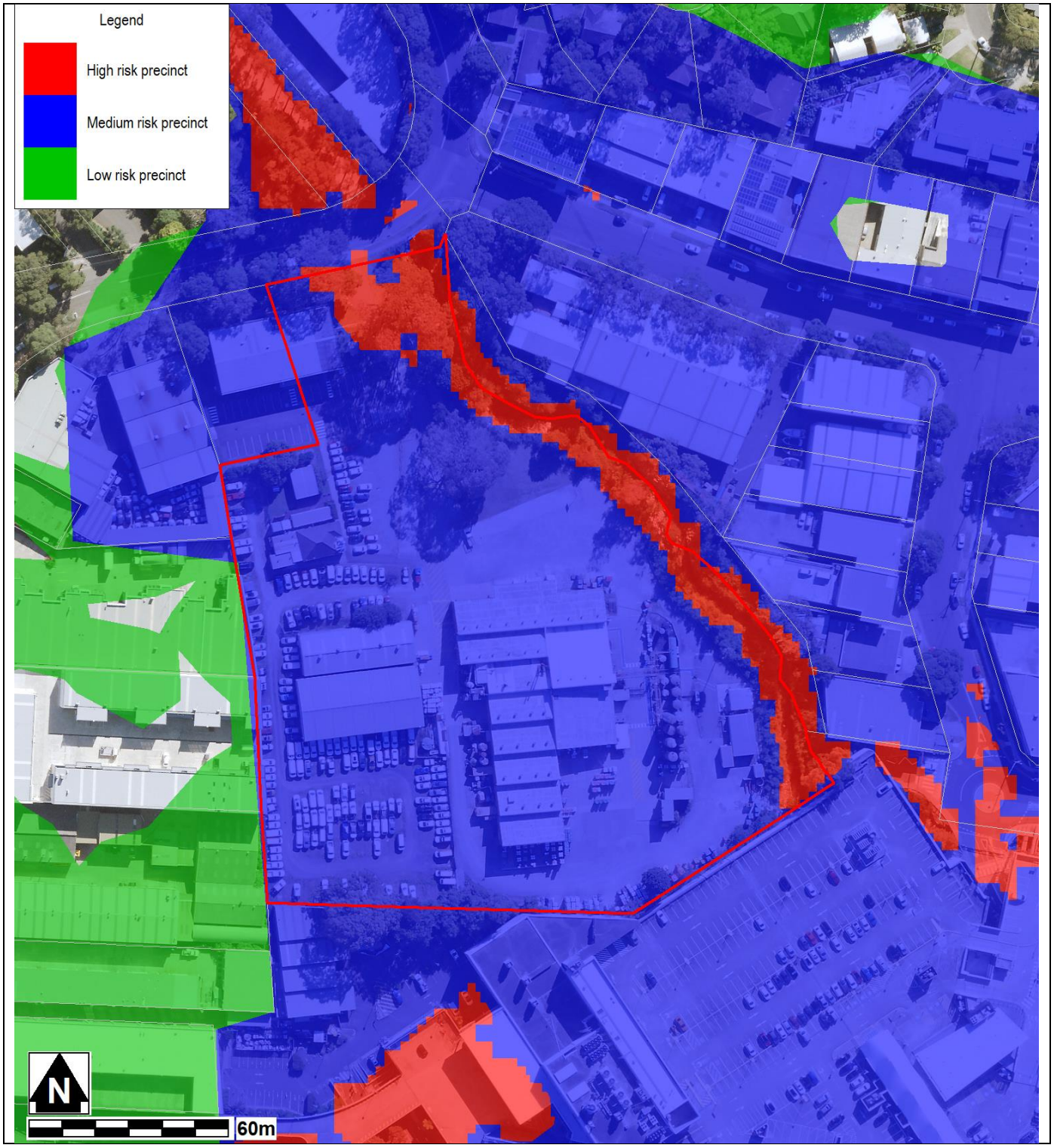
(1) The provided flood information does not account for any local overland flow issues nor private stormwater drainage systems.
(2) Overland flow/mainstream water levels may vary across a sloping site, resulting in variable minimum floor/ flood planning levels across the site. The maximum Flood Planning 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

Notes

General

- 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 online Flood Study Reports webpage.
- 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.
- 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.
- Areas affected by an EPL in the former Pittwater LGA are mapped on Council's online Estuarine Hazard Map. Note that areas in the former Manly LGA affected by an EPL have been identified and will be soon added to this map.
- Council's drainage infrastructure is mapped on Council's Stormwater Map. Note that locations are indicative only and may not be exactly as shown.

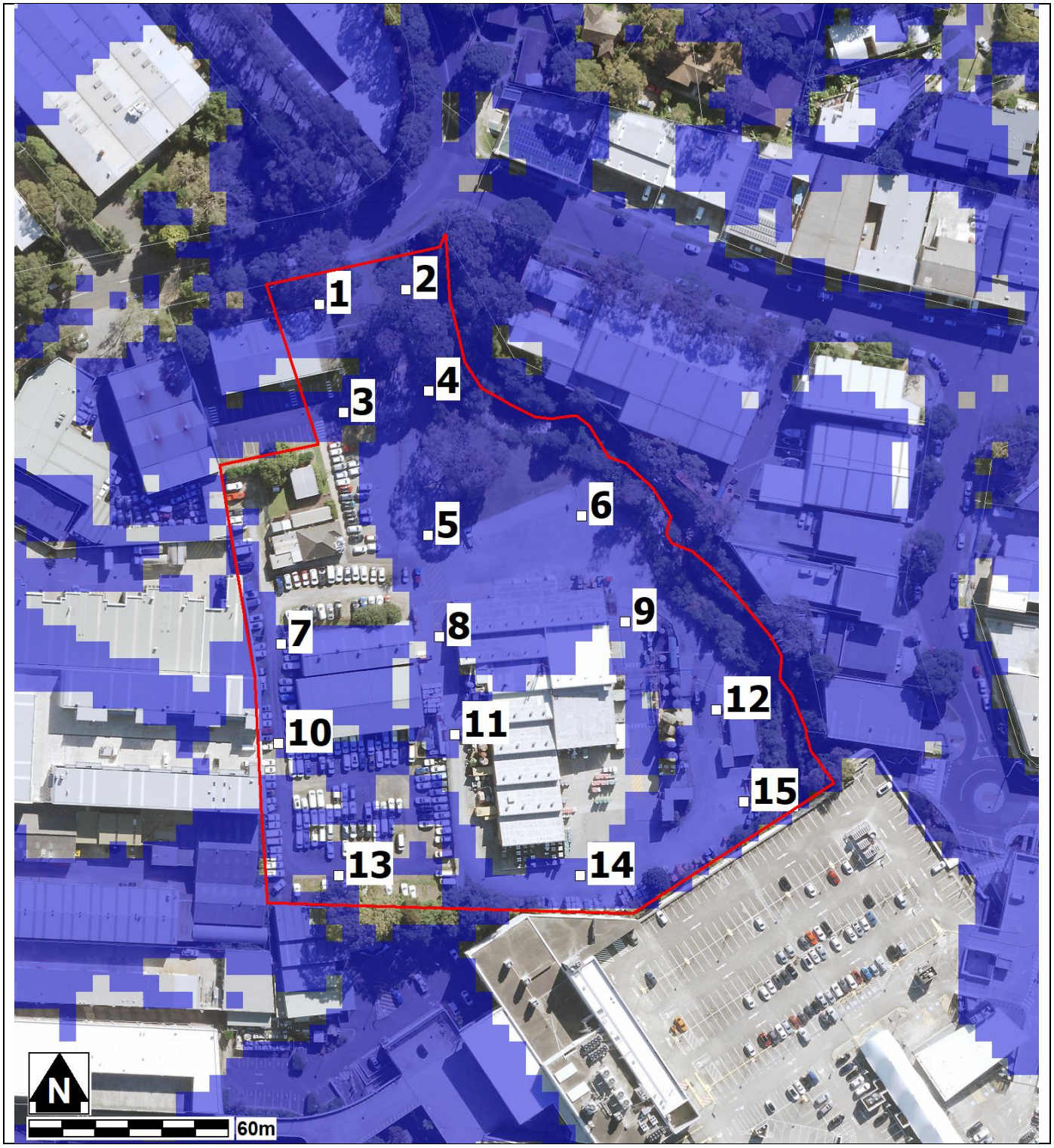
MAP A: FLOOD RISK PRECINCTS



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.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Manly Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only.

MAP B: FLOODING - 1% AEP EXTENT & KEY POINTS



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

Flood Levels

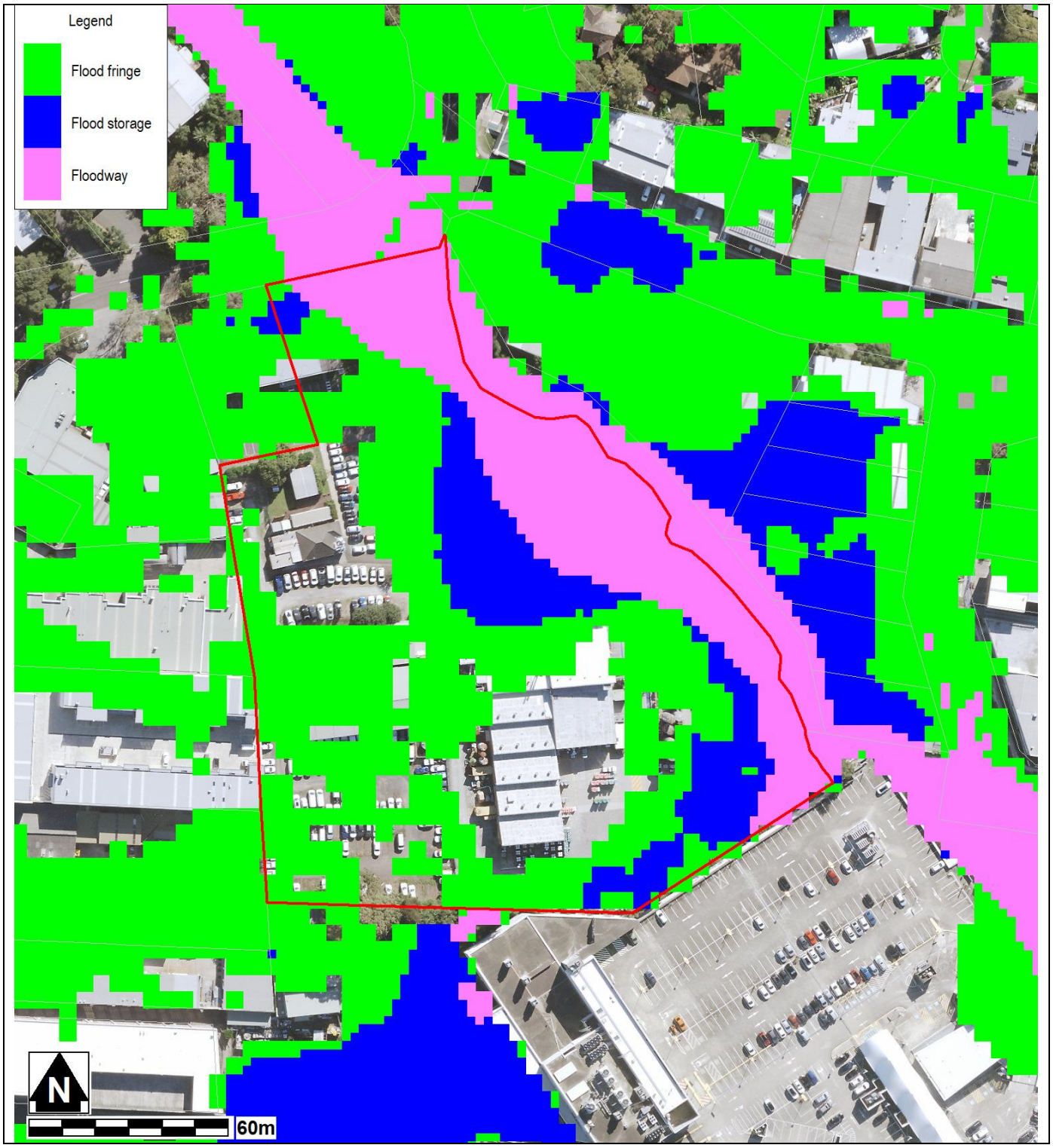
ID	5% AEP Max WL (m AHD)	5% AEP Max Depth (m)	1% AEP Max WL (m AHD)	1% AEP Max Depth (m)	1% AEP Max Velocity (m/s)	Flood Planning Level (m)	PMF Max WL (m AHD)	PMF Max Depth (m)	PMF Max Velocity (m/s)
1	14.21	0.26	14.38	0.43	1.89	14.88	15.13	1.18	2.45
2	13.04	1.08	13.21	1.24	4.33	13.71	14.73	2.76	3.19
3	N/A	N/A	13.53	0.10	1.25	14.03	14.66	1.23	3.69
4	N/A	N/A	12.97	0.22	2.04	13.47	14.68	1.92	3.82
5	N/A	N/A	12.99	0.37	0.28	13.49	14.68	2.06	0.45
6	12.46	0.24	12.96	0.74	0.88	13.46	14.67	2.45	2.47
7	13.25	0.24	13.35	0.34	0.18	N/A	14.68	1.67	0.88
8	N/A	N/A	12.99	0.08	0.54	13.49	14.67	1.76	1.07
9	N/A	N/A	12.93	0.16	0.45	13.43	14.66	1.89	1.01
10	13.24	0.02	13.31	0.08	0.45	13.81	14.67	1.44	1.93
11	12.92	0.02	12.99	0.09	0.41	13.49	14.67	1.76	0.79
12	N/A	N/A	12.86	0.37	0.54	13.36	14.65	2.17	0.82
13	13.08	0.06	13.10	0.08	0.58	13.60	14.66	1.64	1.39
14	N/A	N/A	12.84	0.41	0.48	13.34	14.67	2.23	1.04
15	12.32	0.10	12.86	0.64	0.76	13.36	14.66	2.44	1.27

WL – Water Level
PMF – Probable Maximum Flood
N/A - No Peak Water Level/Depth/Velocity Available.

Notes:

- The flood planning levels above are calculated by adding a 0.5m freeboard to the 1% AEP water level. However, if the depth of flow is less than 0.3m and a Velocity X Depth product is less than 0.3m^2/s, a freeboard of 0.3m may be able to be justified for development.

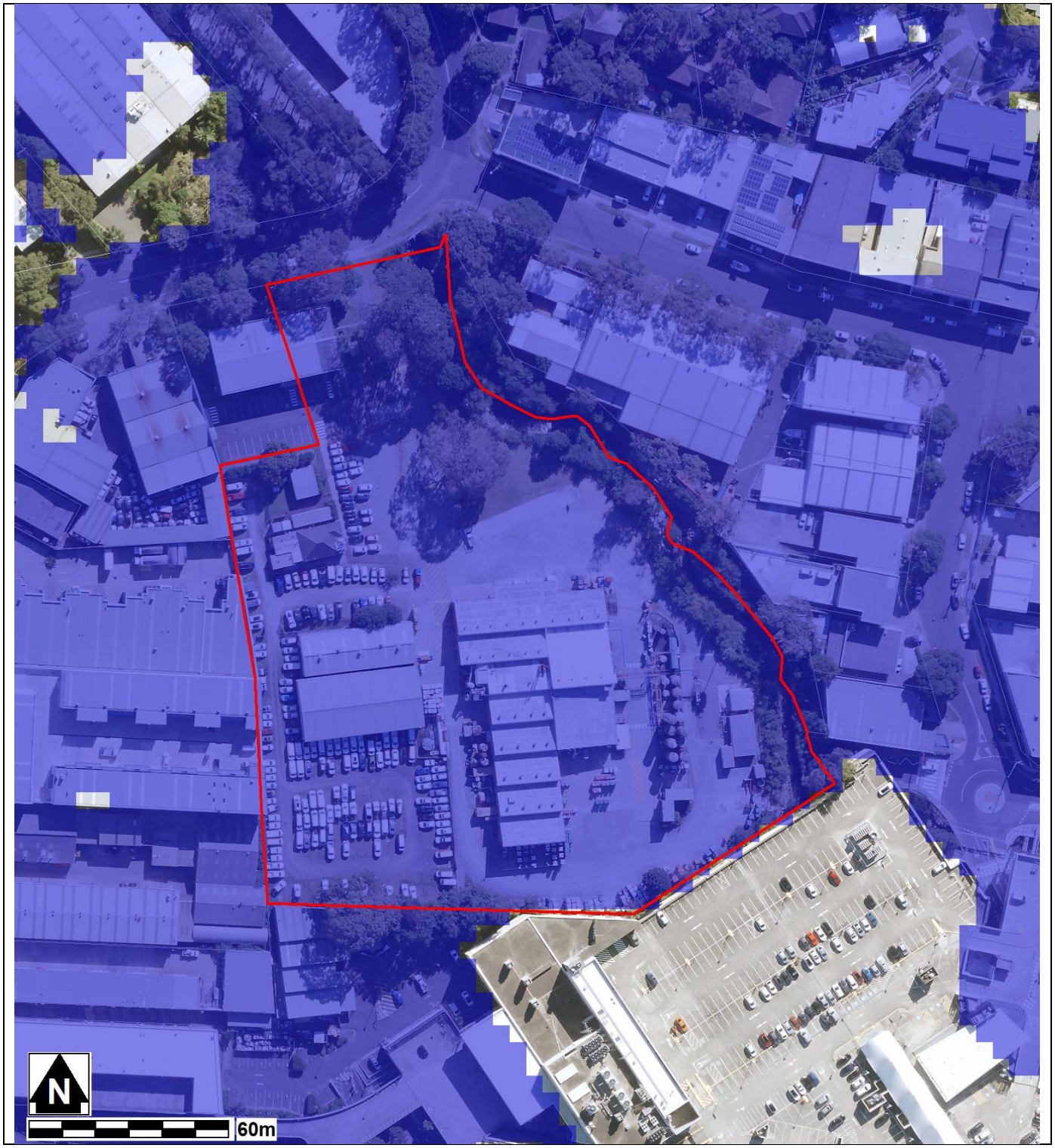
MAP C: 1% AEP FLOOD HYDRAULIC CATEGORY EXTENT MAP



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

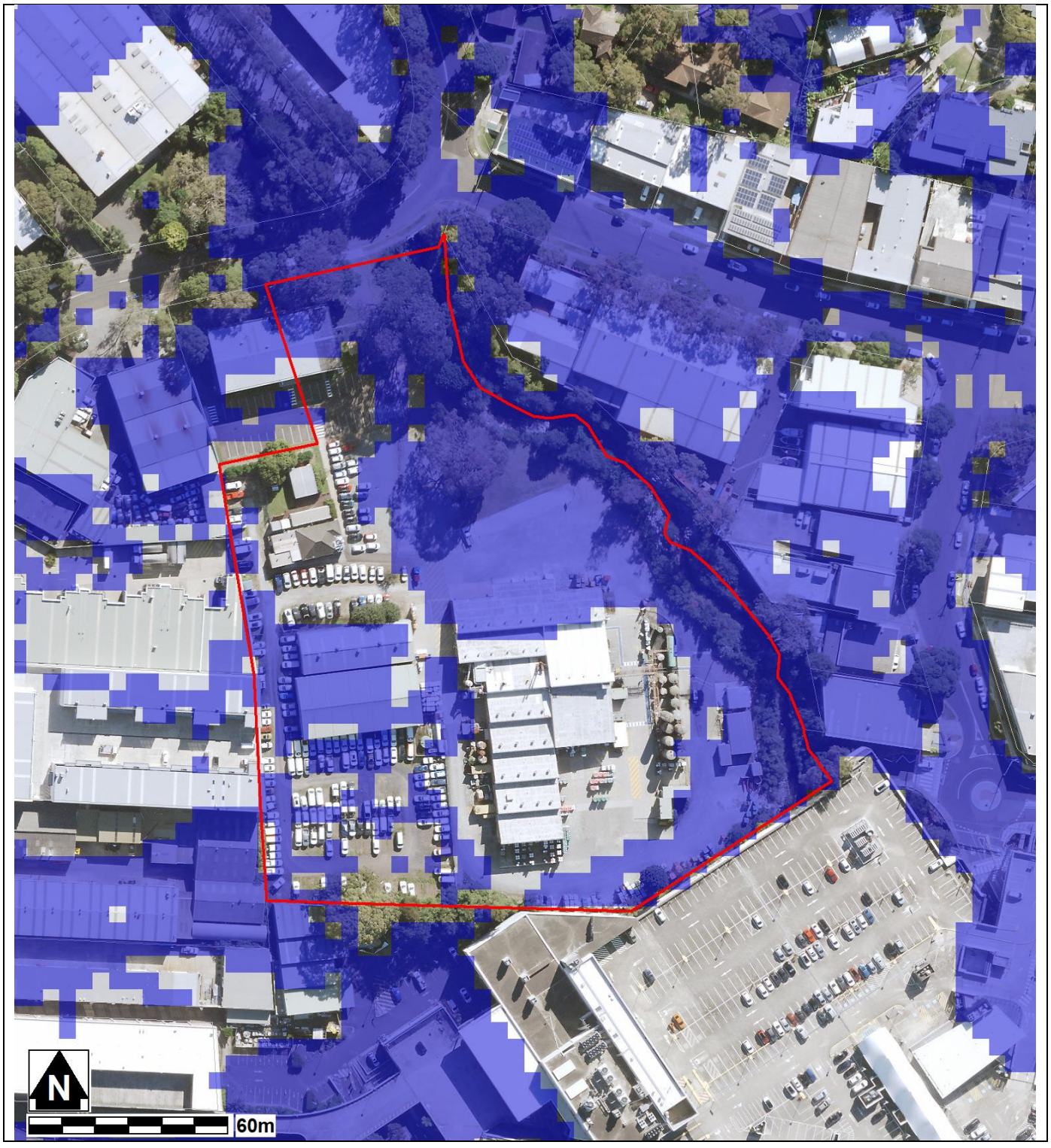
MAP D: PMF EXTENT MAP



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

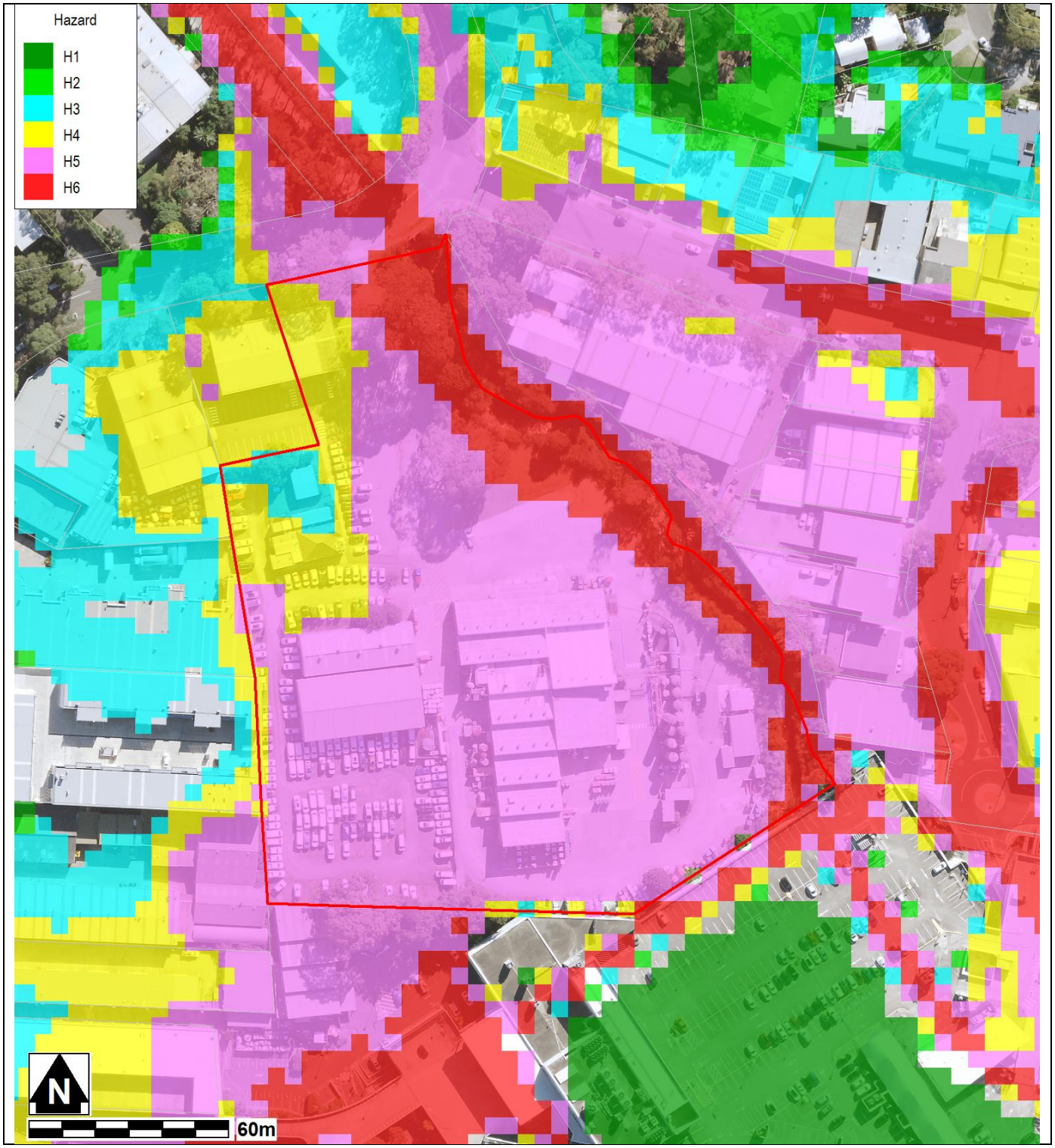
MAP E: FLOODING – 1% AEP EXTENT PLUS CLIMATE CHANGE



Notes:

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

MAP F: FLOOD LIFE HAZARD CATEGORY IN PMF



Notes:

- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Manly Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source Near Map 2014) are indicative only.

MAP G: 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 .

COSTIN ROE CONSULTING

APPENDIX B
EROSION CONTROL CHECK SHEET

COSTIN ROE CONSULTING

EROSION AND SEDIMENT CONTROL
WEEKLY SITE INSPECTION SHEET

LOCATION . . . . . .
INSPECTION OFFICER . . . . . .DATE . . . . . .
SIGNATURE . . . . . .

Legend: ☐ OK ☐ Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	. . . . .
2	Entry/exit pads clear of excessive sediment deposition.	. . . . .
3	Entry/exit pads have adequate void spacing to trap sediment.	. . . . .
4	The construction site is clear of litter and unconfined rubbish.	. . . . .
5	Adequate stockpiles of emergency ESC materials exist on site.	. . . . .
6	Site dust is being adequately controlled.	. . . . .
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	. . . . .
8	Up-slope "clean" water is being appropriately diverted around/through the site.	. . . . .
9	Drainage lines are free of soil scour and sediment deposition.	. . . . .
10	No areas of exposed soil are in need of erosion control.	. . . . .
11	Earth batters are free of "rill" erosion.	. . . . .
12	Erosion control mulch is not being displaced by wind or water.	. . . . .
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	. . . . .
14	Sediment fences are free from damage.	. . . . .
15	Sediment-laden stormwater is not simply flowing "around" the sediment fences or other sediment traps.	. . . . .
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	. . . . .
17	All sediment traps are free of excessive sediment deposition.	. . . . .
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	. . . . .
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	. . . . .
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	. . . . .
21	Stabilised surfaces have a minimum 70% soil coverage.	. . . . .
22	The site is adequately prepared for imminent storms.	. . . . .
23	All ESC measures are in proper working order.	. . . . .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