Upstate

Flood Assessment:
255 Condamine Street, Manly Vale, NSW

P1605609JR05V02
February 2021

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

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Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

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Author(s)	Reviewer(s)	Project Manager	Signature
Paul Dinh	Andrew Norris Daniel Dhiacou	Andrew Norris	

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

Executive Summary

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed boarding house at 255 Condamine Street, Manly Vale, NSW (the site). This report documents the procedures and findings of hydrologic and hydraulic modelling of the site in existing and proposed conditions.

Assessment concluded that:

1. Council's adopted flows and flood characteristics are accurately replicated by the existing conditions flood model.

2. Proposed flooding conditions are largely unchanged from existing conditions, and the proposed suspended building and proposed earthworks do not materially affect local flood characteristics.

3. Shelter-in-place above the PMF level is available at the site.

4. The proposed development would have acceptable offsite flood impacts.

5. The compliance assessment demonstrates the site can be developed in accordance with Council flood planning requirements.

Contents

1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (MA) have prepared this flood assessment to support a development application (DA) for a proposed boarding house at 255 Condamine Street, Manly Vale, NSW (the site). Refer to Attachment A for a local area survey and Attachment B for proposed site layout.

MA previously prepared a flood assessment for a proposed mixed - use multistorey development for the adjacent site to the north, 257-259 Condamine Street (REF: P1605549JR03V03, August 2017), hereafter referred to as 'MA August 2017 assessment'. The flood model for that assessment was prepared based on NBC's regional TUFLOW model at the time, the 'Manly Lagoon Flood Study' prepared by BMT WBM (August 2013). The DA and flood assessment were accepted by Northern Beaches Council (NBC) and has therefore been adopted as the basis for this assessment.

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Adapt the MA August 2017 assessment model to determine flood characteristics in the 1% annual exceedance probability (AEP) flood event and probable maximum flood (PMF) events.

2. Import site survey data to allow detailed hydraulic modelling of the site in proposed conditions.

3. Prepare relevant flood maps including flood extents, depths, levels, velocities, hazards and development impacts.

4. Comment on flood characteristics and model outcomes in existing and proposed conditions.

5. Prepare a compliance assessment in accordance with NBC floodplain development controls.

1.3 Relevant Guidelines

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

1. Commonwealth of Australia (Geoscience Australia) (2016), *Australian Rainfall and Runoff – A Guide to Flood Estimation.*
2. Northern Beaches Council (2017), Guidelines for Preparing a Flood Management Report.
3. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.
4. Warringah Council (2011a), *Warringah Local Environmental Plan (LEP)*.
5. Warringah Council (2011b), *Warringah Development Control Plan (DCP)*.

1.4 Definitions

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
ARI	Average recurrence interval: the average time between flood events occurring. A 100 year ARI flood occurs on average once every 100 years.
ARR	Australian Rainfall & Runoff
BOM	Bureau of Meteorology
Council (NBC)	Warringah Council (WC) / Northern Beaches Council
DA	Development application
FFL	Finished floor level
FPL	Flood planning level
IFD	Intensity frequency duration – design rainfall data for frequent and infrequent storm events.
MA	Martens & Associates Pty Ltd

PMF Probable maximum flood – the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 10,000,000 years.

1.5 Qualifications of the Author

We note that in accordance with the Warringah Council (2014) Flood Risk Assessment Report Guidelines, this document has been prepared by a suitably qualified engineer with experience in flood design or management who is eligible for membership to the Australian Institute of Engineers.

2 Site Description and Background Data

2.1 Location and Site Description

Existing site description summary is provided in Table 1.

Table 1: Existing site description summary.

Address	255 Condamine Street, Manly Vale, NSW
Lot / DP	Lot 8 DP 604034
Site Area	863 m^2
Local Government Area (LGA)	Northern Beaches Council (NBC)
Current Land Use	Vacant
Current Zoning	B2 – Local Centre
Site Description	Burnt Bridge Creek flows through the site from south west to north east. The creek banks generally have steep slopes whereas the portion of land south of the creek bank is flat with a slight slope toward the creek. The land at the creek banks is vegetated whilst the rest is grassed. There is a derelict building at the south eastern side of the site. Site access is via concrete stairs to the east to Condamine Street.
Surrounding Land Uses	Low density residential to the west and commercial area on all other sides.
Site Elevation	Approximately 5.7 mAHD at the creek base rising to 11.0 mAHD at the southern site boundary.
Site Grading & Aspect	Approximately 25% NNW aspect.
Site Drainage	Burnt Bridge Creek flows through the site from south west to north east.

2.2 Site Inspection

Site inspection was conducted on 28 September, 2020 and included:

- General walkover to identify local land forms and site characteristics to understand local drainage behaviour.
- Identification and observation of Burnt Bridge Creek.
- Identification and observation of the Condamine Street Culvert.

2.3 Catchment Description

We note the following regarding the site catchment:

- The site is located within the Manly Lagoon catchment.

- Upstream catchment is primarily urban and riparian areas, and includes the suburbs of Balgowah, North Balgowah, and Seaforth.

- Burnt Bridge Creek runs from west to east through the site.

- The total catchment area is approximately 3.1 km^2 and is shown in Attachment F Map 01.

2.4 Site Flood and Overland Flow Mechanisms

The site is likely affected by the following flood mechanisms:

- Overland flows from the site itself and the local upstream catchment (refer Section 2.3).

- Flood overbank flows from Burnt Bridge Creek.

- Constriction of the Burnt Bridge Creek floodplain downstream of the site due to the culvert crossing beneath Condamine Street, causing flood waters to back up onto the site.

2.5 Previous Flood Studies

2.5.1 BMT WBM (2013) Manly Lagoon Flood Study

BMT WBM conducted a flood assessment for the Manly Lagoon catchment on behalf of Warringah Council (WC) and Manly Council (MC), and the summarised assessment in the report 'Manly Lagoon Flood Study' (August 2013). The BMT WBM flood study was the current Council accepted flood model until it was replaced by the WMAwater study.

2.5.2 WMAwater (2018), Manly Lagoon Floodplain Risk Management Study and Plan

WMAwater were engaged by NBC to update the BMT WBM flood model and prepare the 'Manly Lagoon Floodplain Risk Management Study and Plan' hereafter referred to as the WMAwater flood study.

Flood conditions at the site did not change significantly between the BMT WBM and WMAwater studies, which is shown between the calibration from the BMT WBM flood levels and the WMAwater flood certificate.

2.5.3 MA (2017) Flood Assessment: 257-259 Condamine Street, Manly Vale, NSW

MA prepared a flood assessment for 257-259 Condamine Street (site to the north) which has been approved by Northern Beaches Council, hereafter referred to as the MA (2017) flood study. MA used the Council adopted BMT WBM TUFLOW model and adapted it to enable detailed site flood assessment. In summary changes made were:

1. Added site survey data (Attachment A).
2. Increased the model resolution from a 5 x 5 m grid to a 2 x 2 m grid.
3. Reduced model domain and include boundary conditions at model extents based on the flows and water levels from the BMT WBM model.
4. Removal of morphological module at the ocean boundary.

In addition, the MA model results were compared to the flow rates from the WMA model (which were sent to MA prior to this study being published) and the water levels in the BMT WBM model. The MA model agreed well with these flows and water levels, and was adopted as being appropriate for detailed site modelling.

2.5.4 Council Data

In addition, site flood modelling data has been acquired from NBC (Attachment C) and is based on the BMT WBM flood study. This information includes flood levels, depths and hazards as well as flood mapping data.

2.6 Proposed Development

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

- Demolition of the existing derelict building on site.
- Construction of a suspended multi storey boarding house, including suspended carpark at the ground level.
- Ground floor elements including both residential and common area uses.

Proposed site earthworks involve lowering areas of the site to provide increased overland flow conveyance therefore reducing offsite flood

impacts to an acceptable level, while retaining the creek channel shape and riparian area with no alteration to the existing creek bank.

3 Hydraulic Modelling

3.1 Overview

The MA (2017) TUFLOW model described at Section 2.5.3 has been used as the basis for detailed hydraulic modelling at the site.

3.2 Scenarios

The hydraulic model was further modified to represent the following flood condition scenarios to address NBC requirements:

1. Existing condition: the catchment and site in their current state as described in Sections 2.1, 2.2, 2.3 and 2.4.

2. Proposed condition: the catchment in its current state and the site in its proposed state as described in Section 2.6.

The hydraulic model was used to assess flooding for the 1% AEP critical duration (60 minute) event.

3.3 Model Setup

3.3.1 Existing Conditions

The MA model described in Section 2.5.3 has been used to represent the site existing conditions with the 257-259 Condamine Street development included. The following minor changes were made to the MA August 2017 model:

1. More recent version of TUFLOW (build 2018-03-AC-iSP-w64) was used with the new HPC solver.

2. Inclusion of survey data provided by Bee & Lethbridge Surveying (2020, refer Attachment A). The survey data was merged with the BMT WBM LIDAR and survey data to create a more detailed 3D surface for the site.

3. Removal of BMT WBM Burnt Bridge Creek level modifications adjacent to the site, which were replaced by the detailed survey data.

4. The Condamine Street culvert above Burnt Bridge Creek was changed within the model from a 1D element to a layered flow constriction. Levels were adopted based on DP Surveying data (Attachment A).

5. The existing cantilevered carpark above Burnt Bridge Creek - channel on 257 Condamine Street was added to the model as a layered flow constriction. Levels were adopted based on Bee and Lethbridge survey data (Attachment A).

6. Manning's roughness coefficients were refined to represent the existing site conditions. The site Manning's was changed from industrial to vegetation/riparian in line with its current land use.

All other model inputs and assumptions remained unchanged from the NBC accepted MA (2017) flood model.

3.3.2 Proposed Conditions

The existing conditions model was modified as follows to simulate proposed development of 255 Condamine Street:

1. Lowering of the southern portion of the site (as detailed in Section 2.6) was represented in the model by z-polygon modifications.

2. The proposed lift pit was modelled as a solid obstruction to ground level.

3. Existing derelict building was removed and replaced with the proposed suspended building which was modelled as layered flow constrictions. Levels were adopted based on the ground floor structural details (Attachment B) and structure blockage beneath the ground floor slab of 10% in the 1% AEP event, and 20% in the PMF event - based on the ARR blockage assessment (refer to Attachment D).

4. Manning's roughness coefficients (Table 2) for areas below the building footprint were updated to represent proposed surfaces. The portion of the building footprint over the creek bank was modelled as vegetated / riparian area in accordance with the site revegetation plan. The reminder of the building footprint not over the creek bank was modelled as 'rock lined' which is required to prevent scouring.

Table 2: Manning's roughness values added to proposed TUFLOW modelling.

Material Type	Manning's Roughness Coefficient [1]
Vegetated / riparian	0.080
Rock lined	0.050

Notes
1. Based on typical values from similar catchments.

3.4 Results

3.4.1 Flood Results

Flood mapping results (flood levels, depths, velocities and provisional hazard categories) for the critical duration 1% AEP flood event and PMF events in existing and proposed conditions are provided in Attachment F, with drawing references summarised in Table 3.

Table 3: Flood map drawing references in Attachment F (MA mapset P1605609MS02).[1]

Flood Condition Scenario	Critical Duration Flood Event	Water Level & Depth	Water Velocity	Provisional Hydraulic Hazard Categories [2]	Afflux Plot [3]
Existing Conditions	1% AEP	Map 02	Map 03	Map 04	–
	PMF	Map 05	Map 06	Map 07	–
Proposed Conditions	1% AEP	Map 08	Map 09	Map 10	Map 14
	PMF	Map 11	Map 12	Map 13	Map 15, Map 16

Notes
1. Flood results have been filtered to show areas of greater than 50 mm depth.
2. General flood hazard vulnerabilities are based on ARR (2019) definitions and are shown in Figure 1.

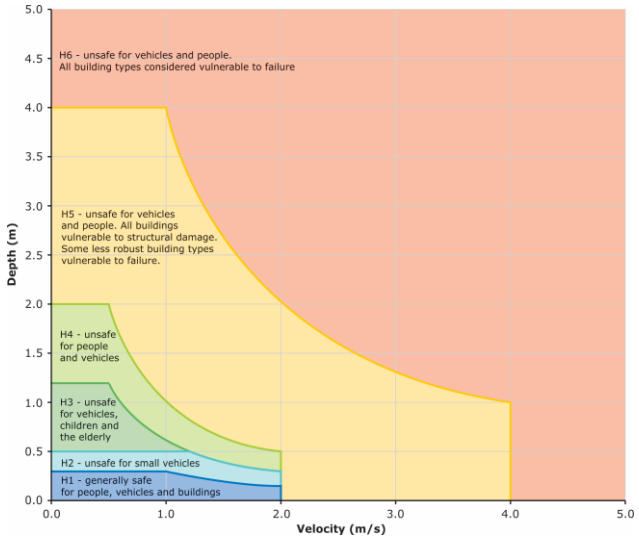


Figure 1: General flood hazard vulnerability curves (*ARR, 2019*).

3. Afflux plots have been derived in accordance with the criteria for adverse flooding impacts in with the Warringah DCP.

3.4.2 Validation

Comparison between BMT WBM (2013) and MA peak flood levels for various flood events is given in Table 4. Comparison is made for the peak flood levels at the 15 locations shown in Attachment C – Flood Level Points.

The comparison shows flood levels as modelled by MA agree well with BMT WBM modelling, and differences are typically ≤ ± 100 mm in the 1% AEP event, and ≤ ± 200 mm in the PMF event, which is considered appropriate.

Differences between modelled flood levels are likely due to the smaller grid cell size (BMT WBM used 5 m, MA used 2 m), the inclusion of site survey data, and the changing of Condamine Street Bridge from a 1D culvert to a layered flow constriction (to better account for the debris build up surveyed along the bed of the bridge). These changes serve to increase the accuracy of the modelled flood levels at the site.

Further, flood levels and extents throughout the MA model domain were compared to those modelled by BMT WBM and were found to have close agreement. The MA model closely matches Council adopted flood characteristics, with slightly improved accuracy of flood predictions due to improved site information (survey). The model is considered adequate for the purposes of detailed site modelling.

Table 4: Comparison between BMT WBM (2013) and MA (2021) modelled peak water levels for 1% AEP event.

	Peak Site Flood Level (mAHD)		Difference	
Calibration Location	BMT WBM [1]	MA	(m)	(%)
01	11.16	11.05	-0.11	-1.0%
02	11.16	11.07	-0.09	-0.8%
03	11.16	11.10	-0.06	-0.6%
04	11.17	11.13	-0.04	-0.4%
05	11.17	11.12	-0.05	-0.5%
06	11.17	11.12	-0.05	-0.5%
07	11.18	11.11	-0.07	-0.6%
08	11.17	11.11	-0.06	-0.5%
09	11.17	11.10	-0.07	-0.6%
10	11.20	11.10	-0.10	-0.9%
11	11.20	11.11	-0.09	-0.8%
12	11.21	11.10	-0.11	-1.0%
13	N/A	11.17	N/A	N/A
14	11.23	11.16	-0.07	-0.7%
15	11.22	11.17	-0.05	-0.4%

Notes

1. Peak site flood level from NBC flood certificate (Attachment C).

Table 5: Comparison between BMT WBM (2013) and MA (2021) modelled peak water levels for PMF event.

	Peak Site Flood Level (mAHD)		Difference	
Calibration Location	BMT WBM [1]	MA	(m)	(%)
01	12.56	12.05	-0.51	-4.1%
02	12.24	12.04	-0.20	-1.6%
03	12.20	12.06	-0.14	-1.2%
04	12.34	12.17	-0.17	-1.4%
05	12.31	12.10	-0.21	-1.7%
06	12.24	12.10	-0.14	-1.2%
07	12.29	12.12	-0.17	-1.4%
08	12.25	12.10	-0.15	-1.2%
09	12.24	12.08	-0.16	-1.3%
10	12.29	12.11	-0.18	-1.4%
11	12.31	12.12	-0.19	-1.5%
12	12.30	12.10	-0.20	-1.6%
13	12.33	12.26	-0.07	-0.6%
14	12.35	12.25	-0.10	-0.8%
15	12.34	12.26	-0.08	-0.6%

Notes

1. Peak site flood level from NBC flood certificate (Attachment C).

3.5 Discussion

We note the following regarding modelled flood behaviour:

3.5.1 Existing Conditions

1. Floodwaters in the 1% AEP and PMF events break the banks of Burnt Bridge Creek upstream of the site and flow onto Burnt Bridge Creek Deviation / Condamine Street.

2. Flood affectation at the site is due to flood levels in Burnt Bridge Creek south of the site, and overland flow in Condamine Street east of the site.

3. Peak flood levels slope to the west across the site, ranging from 11.2 – 11.1 mAHD in the 1% AEP event, and 12.3 – 12.0 mAHD in the PMF event.

4. Velocities and hazards in Burnt Bridge Creek and on Condamine Street are high in existing 1% AEP and PMF conditions (> 3.0 m/s).

5. Hydraulic hazard across the site is generally high in the 1% AEP flood event and PMF event.

3.5.2 Proposed Conditions

1. The proposed site lowering offsets the blockage introduced by the proposed building.

2. Apart from shallow flood depths on the driveway ramp, building entrance, and planter, the proposed development is completely flood free in the 1% AEP event.

3. The peak 1% AEP flood level at the site is 11.15 mAHD, and the peak PMF level at the site is 12.25 mAHD.

4. Floor level compliance:

    a. Council DCP classifies the site as a high flood risk planning precinct. Therefore, both residential and business floor levels are set to be 'at or above the Flood Planning Level' (Warringah DCP 2011).

    b. The flood planning level (FPL) is 11.65 mAHD being defined as the 1% AEP flood level plus a 500 mm freeboard.

    c. The minimum proposed finished floor level (FFL) of the proposed development is 11.73 mAHD, which is 80 mm

higher than the FPL. The entrance and carpark access are below the 1% AEP level, so as to interface with the existing road level. These areas are not habitable and therefore the flood affectation is acceptable.

5. Regarding extreme (PMF) flood events:

    a. The ground floor is below the PMF level of 12.25 mAHD.

    b. The first, second, and third floor levels are above the PMF of 12.25 mAHD.

    c. Occupants and residents of the ground floor are able to shelter on higher levels of the building in the means of corridors and the common room on the third floor. In extreme events a shelter in place evacuation strategy would be appropriate for the site.

    d. The first, second, and third floors each have over 20 m^2 of communal corridors available for shelter plus 23 m^2 of floorspace in the common room on the third floor, for a total of 83 m^2.

    e. Assuming that there are four ground floor residents (two per room), as well as 16 non resident occupants in the ground floor lounge/breakout space, there would be ample area to shelter in place (20 occupants to shelter in place, with 2 m^2 per person, requiring 40 m^2 in total).

3.5.3 Offsite Flood Impacts

Completed modelling concludes:

1. There are no offsite flood level increases above 20 mm in the 1% AEP flood event.

2. There are no offsite flood level increases above 50 mm in the PMF event.

3. There are some offsite velocity increases in the PMF event. These are primarily confined to the Condamine Street road corridor (bridge). As this is a fully paved area where no access will be possible due to inundation, these velocity increases are unlikely to result in additional scour or unacceptable increase in risk.

4. As the proposed development lies above the 1% AEP flood level there is no loss of storage. Proposed excavation underneath the development results in a net increase of flood storage of 450 m^3 in the 1% AEP event.

5. Flood impacts due to the proposed development are not significance and are considered acceptable.

4 Compliance Assessment

Compliance of the proposed development with Council flood planning policies and guidelines relating to flood risk management is outlined in Table 6. Council requires compliance with the Warringah Council LEP and DCP (2011) for the proposed development. Flood specific controls are provided at clause E11 'Flood Liable Land'. We note that:

- The site is classified as a 'high flood risk planning precinct' by Council.
- The proposed development is a boarding house which is categorised as a residential land use with some 'business' uses. However, the residential uses are more 'sensitive' and are therefore considered for assessment.

The prescriptive controls defined by the development matrix table requirements for the proposed development are outlined and addressed in Table 6. This assessment demonstrates that the proposed development complies with Council flood requirements.

Table 6: Compliance with Warringah Council DCP (2011) development matrix prescriptive controls.

Warringah Council DCP Requirement	Compliance
A. FLOOD EFFECTS CAUSED BY DEVELOPMENT	
A1. Development shall not be approved unless it can be demonstrated in a Flood Management Report that it has been designed and can be constructed so that in all events up to the 1% AEP event:	
(a) There are no adverse impacts on flood levels or velocities caused by alterations to the flood conveyance;	(1) There are no offsite impacts on flood levels in the 1% AEP and PMF events. The velocity impacts in the PMF event are confined to the road corridor and channel, and are considered acceptable. Refer Section 3.5.3 and Attachment F.
(b) There are no adverse impacts on surrounding properties; and	(2) As discussed at (1).
(c) It is sited to minimise exposure to flood hazard.	(3) The development lies above the 1% AEP flood level, with the piers to be designed by a suitably qualified engineer to withstand the forces of floodwater, debris and buoyancy.
Major developments and developments likely to have a significant impact on the PMF flood regime will need to demonstrate that there are no adverse impacts in the Probable Maximum Flood.	(4) As discussed at (1).
A2. Development shall not be approved unless it can be demonstrated in a Flood Management Report that in all events up to the 1% AEP event there is no net loss of flood storage. Consideration may be given for exempting the volume of standard piers from flood storage calculations. If Compensatory Works are proposed to balance the loss of flood storage from the development, the Flood Management Report shall include detailed calculations to demonstrate how this is achieved.	(5) The development causes no loss of storage and additional excavation under the site represents an increase of flood storage of 450 m^3 in the 1% AEP flood event. Refer Section 3.5.3.
B. BUILDING COMPONENETS AND STRUCTURAL	
B1. All buildings shall be designed and constructed with flood compatible materials in accordance with "Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas", Hawkesbury-Nepean Floodplain Management Steering Committee (2006).	(6) All structural elements, external and internal finishes up to the FPL of 11.65 mAHD are to be constructed from flood compatible building components. Building materials shall be design considering the forces of the floodwater, debris, buoyancy and inundation. Details will be provided at detailed design stage.

Warringah Council DCP Requirement		Compliance
B2. All new development must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Where shelter-in-place refuge is required, the structural integrity for the refuge is to be up to the Probable Maximum Flood level. Structural certification shall be provided confirming the above.	(7)	All structural elements, external and internal finishes up to the FPL (11.65 mAHD) are to be constructed from flood compatible building components. Building materials shall be design considering the forces of the floodwater, debris, buoyancy and inundation. Details will be provided at detailed design stage.All structures up to 11.65 mAHD (the 1% AEP flood level plus 500 mm freeboard) are to be constructed from flood compatible building components. Details will be provided at detailed design stage.
B3. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level within the subject structure must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.	(8)	All electrical services, power points, fittings, and equipment are to be placed above the PFL and/or waterproofed.
C. FLOOR LEVELS		
C1. New floor levels within the development shall be at or above the Flood Planning Level.	(9)	Minimum floor level of the proposed building is at 11.73 mAHD which is 80 mm above the FPL of 11.65 mAHD.
C3. All new development must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no net loss of flood storage in all events up to the 1% AEP event. (a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, taking into account the potential for small openings to block; and (b) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, taking into account the potential for small openings to block; and (c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway	(10)	The development does not result in a loss of flood storage in the 1% AEP flood event. There are no offsite flood level impacts in the 1% AEP flood event. Refer Section 3.5.3.

Warringah Council DCP Requirement		Compliance
C4. A one-off addition or alteration below the Flood Planning Level of less than 30 square metres (in total, including walls) may be considered only where: (a) it is an extension to an existing room; and (b) the Flood Planning Level is incompatible with the floor levels of the existing room; and (c) out of the 30 square metres, not more than 10 square metres is below the 1% AEP flood level. This control will not be permitted if this provision has previously been utilised since the making of this Plan. The structure must be floodproofed to the Flood Planning Level, and the Flood Management Report must demonstrate that there is no net loss of flood storage in all events up to the 1% AEP event.	(11)	NA
C6. Consideration may be given to the retention of an existing floor level below the Flood Planning Level when undertaking a first floor addition provided that: (a) It is not located within a floodway; and (b) The original foundations are sufficient to support the proposed final structure above them. The Flood Management Report must include photos and the structural certification required as per Control B2 must consider whether the existing foundations are adequate or should be replaced; and (c) None of the structural supports/framing of existing external walls of are to be removed unless the building is to be extended in that location; and (d) The ground floor is floodproofed.	(12)	NA
D. CAR PARKING		
D1. Open carpark areas and carports shall not be located within a floodway.	(13)	As the site is almost completely in a floodway, Council has instead required that carpark to be located above the 1% AEP flood level. Refer to Attachment E for correspondence with Council.
D2. The lowest floor level of open carparks and carports shall be constructed no lower than the natural ground levels, unless it can be shown that the carpark or carport is free draining with a grade greater than 1% and that flood depths are not increased.	(14)	The carpark is located above natural ground levels.
D3. Carports must be of open design, with at least 2 sides completely open such that flow is not obstructed up to the 1% AEP flood level. Otherwise it will be considered to be enclosed. When undertaking a like-for-like replacement and the existing garage/carport is located on the street boundary and ramping is infeasible, consideration may be given for dry floodproofing up to the 1% AEP flood level.	(15)	NA

Warringah Council DCP Requirement		Compliance
D4. Where there is more than 300mm depth of flooding in a car park or carport during a 1% AEP flood event, vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site. Protection must be provided for all events up to the 1% AEP flood event.	(16)	As the carpark is located above the FPL, it is dry in the 1% AEP flood event.
D5. Enclosed Garages must be located at or above the 1% AEP level.	(17)	The proposed carpark is open, and is located above the 1% AEP level.
D6. All enclosed car parks (including basement carparks) must be protected from inundation up to the Flood Planning Level. All access, ventilation, driveway crests and any other potential water entry points to any enclosed car parking shall be above the Flood Planning Level. Where a driveway is required to be raised it must be demonstrated that there is no net loss to available flood storage in any event up to the 1% AEP flood event and no impact on flood conveyance through the site. Council will not accept any options that rely on electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark.	(18)	NA. Refer to (17).
E. EMERGENCY RESPONSE		
E1. If the property is affected by a Flood Life Hazard Category of H3 or higher, then Control E1 applies and a Flood Emergency Assessment must be included in the Flood Management Report. If the property is affected by a Flood Life Hazard Category of H6, then development is not permitted unless it can be demonstrated to the satisfaction of the consent authority that the risk level on the property is or can be reduced to a level below H6 or its equivalent. If the property is flood affected but the Flood Life Hazard Category has not been mapped by Council, then calculations for its determination must be shown in the Flood Management Report, in accordance with the "Technical Flood Risk Management Guideline: Food Hazard", Australian Institute for Disaster Resilience (2012).	(19)	The site currently lies within the Flood Life Hazard Category of H6 in the PMF event. However, as the building is suspended above the floodplain, the ground floor level of the proposed development at 11.73 mAHD experiences depths of 520 mm in the PMF (12.25 mAHD over the site). With a peak depth of 520 mm within the building and velocities under the site, it would be expected that, while there is H6 hazard under the building, the hazard in the site would be, at very most, H5 (where V.D < 4.0). Furthermore, it is noted that the site to the north (257-259 Condamine Street) also has columns within the H6 zone. This suggests that columns can be designed to be structurally adequate in these flood conditions. Details will be provided at detail design stage.
a) The floor level is at or above the Probable Maximum Flood level; and	(20)	The first (and higher) floor levels are above the PMF.

Warringah Council DCP Requirement	Compliance
b) The floor space provides at least 2 m^2 per person where the flood duration is long (6 or more hours) in the Probable Maximum Flood event, or 1 m^2 per person for less than 6 hours; c) It is intrinsically accessible to all people on the site, plainly evident, and self-directing, with sufficient capacity of access routes for all occupants without reliance on an elevator; and d) It must contain as a minimum: sufficient clean water for all occupants; portable radio with spare batteries; torch with spare batteries; and a first aid kit Where flood-free evacuation above the Probable Maximum Flood level is not possible, new development must provide a shelter-in-place refuge where: Class 10 classified buildings and structures (as defined in the Building Codes of Australia) are excluded from this control. In the case of change of use or internal alterations to an existing building, a variation to this control may be considered if justified appropriately by a suitably qualified professional. Note that in the event of a flood, occupants would be required to evacuate if ordered by Emergency Services personnel regardless of the availability of a shelter-in-place refuge.	(21) There is ample floor space provided on upper levels above the PMF. Refer to Section 3.5.2. (22) There is safe, interior access to the refuge areas for occupants on levels below the PMF. Details are to be provided at detail design stage. (23) Each dwelling should maintain an emergency kit including torch with spare batteries, portable radio, first aid kit, high visibility vest, non slip footwear, and clean water. Detailed are to be provided at detail design stage.
F. FENCING	
F1. Fencing, (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. At least 50% of the fence must be of an open design from the natural ground level up to the 1% AEP flood level. Less than 50% of the perimeter fence would be permitted to be solid. Openings should be a minimum of 75 mm x 75mm.	(24) No fences are proposed below the FPL of 11.65 mAHD.
G. STORAGE OF GOODS	
G1. Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.	(25) All storage areas are to be located above the FPL of 11.65 mAHD are to be adequately protected to the FPL.

Warringah Council DCP Requirement			Compliance
H. POOLS			
H1. Pools located within the 1% AEP flood extent are to be in-ground, with coping flush with natural ground level. Where it is not possible to have pool coping flush with natural ground level, it must be demonstrated that the development will result in no net loss of flood storage and no impact on flood conveyance on or from the site. All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level. All chemicals associated with the pool are to be stored at or above the Flood Planning Level.	(26)	NA	

5 Summary and Recommendations

A detailed hydraulic model has been developed for the site using a modified version of the previously accepted MA (2017) TUFLOW model with detailed site survey and proposed design elements incorporated to assess local flood characteristics. The model accurately replicates Council adopted flood characteristics.

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

1. The proposed development area of the site is flood free in the 1% AEP flood.

2. The proposed development would have acceptable offsite flood impacts.

3. Compliance with Council flood planning level requirements for building and car park levels are achieved.

The following recommendations are made:

1. All proposed residential and business uses are to maintain finished floor levels above the FPL of 11.65 mAHD.

2. Piers are to be designed by a suitably qualified engineer to withstand the forces of floodwater, debris and buoyancy.

3. Structures below the FPL of 11.65 mAHD are to be constructed using flood compatible materials in accordance with Council requirements.

4. The final ground surface beneath the building is to be adequately protected to prevent scour. Rock lining is likely to be used to achieve this scour protection.

5. A flood risk management plan should be prepared at DA stage to outline shelter-in-place and evacuation requirements to minimise flood risk to life and property associated with the use of land.

6 References

BMT WBM (August 2013), *Manly Lagoon Flood Study*.

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

Martens and Associates (August 2017), *Flood Assessment: 257-259 Condamine Street, Manly Vale, NSW (REF: P1605549JR03V03, August 2017)*.

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

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

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

Weeks, W and Rigby, T (2016), *Blockage of Hydraulic Structures*, Chapter 6 of Book 6 in *Australian Rainfall and Runoff – A Guide to Flood Estimation*.

7 Attachment A: Site Survey

NOTES:

1) CAUTION: SHOULD ANY DEVELOPMENT OR CONSTRUCTION BE PLANNED ON OR NEAR THE BOUNDARIES, THE BOUNDARIES SHOULD BE CLEARLY MARKED ON SITE.

2) AREA AND DIMENSIONS HAVE BEEN SURVEYED FROM PLANS MADE AVAILABLE AT LAND REGISTRY SERVICES.

3) ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM S.S.M. 25330 RL 10.354 A.H.D.

4) M.G.A. GDA 2020 COORDINATES ADOPTED FROM S.S.M. 25330 - E. 339476.475, N. 6259964.926 & S.S.M. 69583 - E. 339145.338, N. 62600214.957

4) TREE SPREADS ARE DIAGRAMMATIC ONLY AND ARE NOT SYMMETRICAL.

5) UNDERGROUND (NON VISIBLE) SERVICE LINES HAVE BEEN SHOWN FROM "DIAL BEFORE YOU DIG" SERVICE AUTHORITY RECORDS & ARE DIAGRAMMATIC ONLY IN REGARD TO THEIR POSITION & WIDTH UNLESS STATED OTHERWISE.

6) SPOT LEVELS ARE ACCURATE.

7) BEARINGS SHOWN ARE ON M.G.A.-(MAP GRID of AUSTRALIA).

8) CONTOUR INTERVAL 0.5 METRE.

9) CONTOURS ARE INDICATIVE OF GROUND FORM ONLY. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.

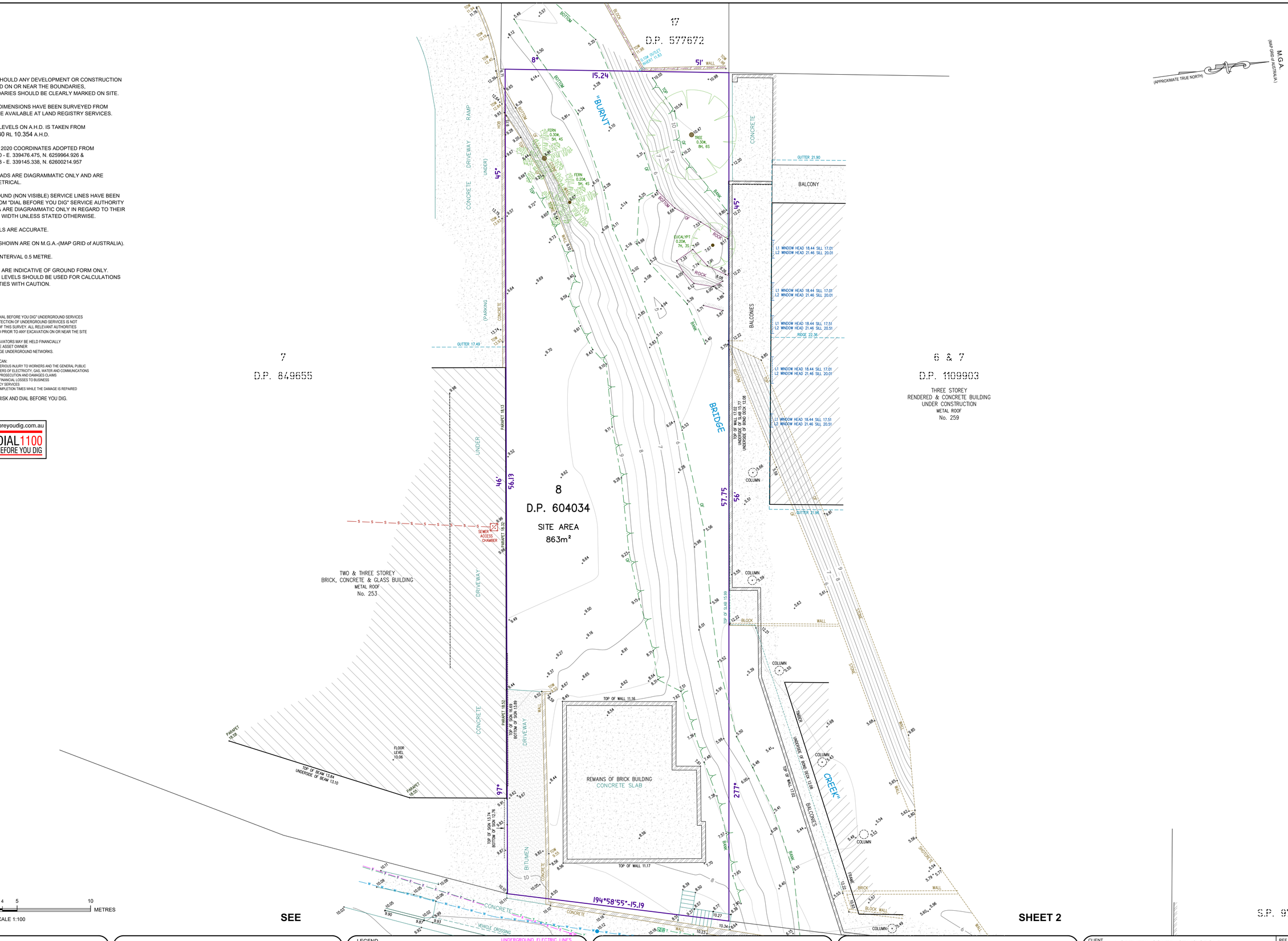
INVESTIGATION OF "DIAL BEFORE YOU DIG" UNDERGROUND SERVICES HAS BEEN MADE. DETECTION OF UNDERGROUND SERVICES IS NOT AN INTEGRAL PART OF THIS SURVEY. ALL RELEVANT AUTHORITIES SHOULD BE NOTIFIED PRIOR TO ANY EXCAVATION ON OR NEAR THE SITE

DEVELOPERS & EXCAVATORS MAY BE HELD FINANCIALLY RESPONSIBLE BY THE ASSET OWNER SHOULD THEY DAMAGE UNDERGROUND NETWORKS.

CARELESS DIGGING CAN:
- CAUSE DEATH OR SERIOUS INJURY TO WORKERS AND THE GENERAL PUBLIC
- INCONVENIENCE USERS OF ELECTRICITY, GAS, WATER AND COMMUNICATIONS
- LEAD TO CRIMINAL PROSECUTION AND DAMAGES CLAIMS
- CAUSE EXPENSIVE FINANCIAL LOSSES TO BUSINESS
- CUT OFF EMERGENCY SERVICES
- DELAY PROJECT COMPLETION TIMES WHILE THE DAMAGE IS REPAIRED

MINIMISE YOUR RISK AND DIAL BEFORE YOU DIG.
TEL. 1100

www.dialbeforeyoudig.com.au
DIAL1100 BEFORE YOU DIG



M.G.A. (MAP GRID of AUSTRALIA)
(APPROXIMATE TRUE NORTH)

Bee & Lethbridge
Quality Surveying & Development Solutions

Bee & Lethbridge Pty Ltd
Suite 2, 14 Starkey Street,
PO Box. 330, Forestville, NSW 2087
Phone: 9451 6757
Email: survey@beeleth.com.au
ABN: 13 003 194 447
www.beeleth.com.au

WARREN L. BEE
REGISTERED SURVEYOR N.S.W.
IDENTIFICATION No. SU000448

LEGEND

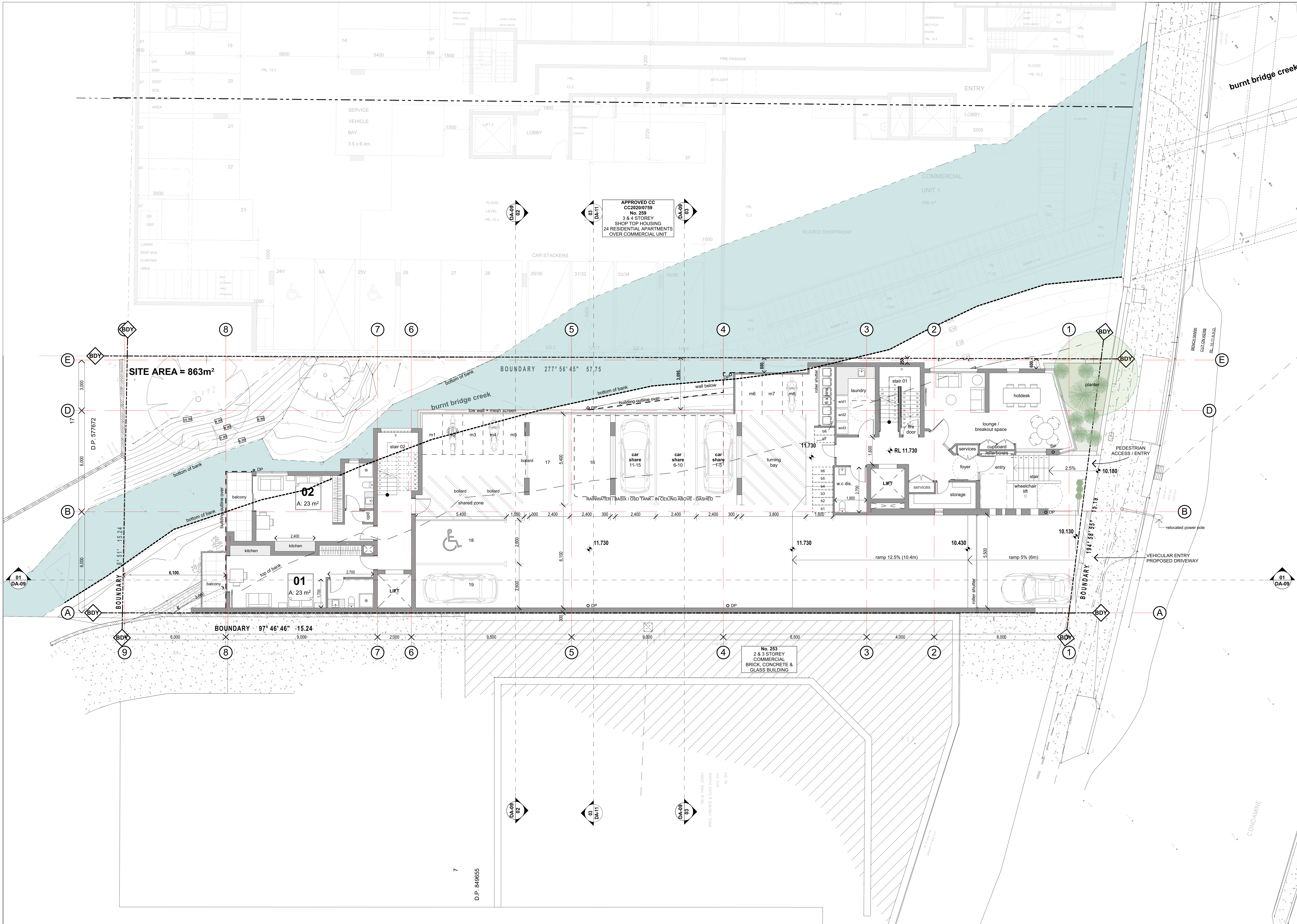
TREE 0.10ø, 5H, 4S — DENOTES APPROX. 0.1m DIAMETER OF TREE; DENOTES APPROX. 5m HEIGHT OF TREE; DENOTES APPROX. 4m SPREAD OF TREE
GUTTER — DENOTES TOP OF GUTTER
UOB — DENOTES UNDERSIDE OF BEAM
UOS — DENOTES UNDERSIDE OF SLAB
TOW — DENOTES TOP OF WALL

PLAN SHOWING BOUNDARIES, RELATIVE HEIGHTS & PHYSICAL FEATURES OVER LOT 8 IN D.P. 604034 KNOWN AS No. 255 CONDAMINE STREET, MANLY VALE.

L.G.A.: NORTHERN BEACHES

CLIENT	NORTHERN CONTRACTING GROUP			REF No.	21827
PROPERTY	No. 255 CONDAMINE STREET, MANLY VALE				
DATUM	A.H.D.	SCALE	1:100 @ B1	DATE	15/09/2020	SHEET No.	1 of 2
SURVEYED	W.B./M.R.	DRAWN	R.M.	DWG No.	21827	REV No.	00

8 Attachment B: Proposed Site Layout


burnt bridge creek (under)
CONDAMINE STREET
SITE AREA = 863m²
APPROVED CC
CC2020/0759
No. 259
3 & 4 STOREY
SHOP TOP HOUSING
24 RESIDENTIAL APARTMENTS
OVER COMMERCIAL UNIT
BOUNDARY 277° 56' 45" 57.75
BOUNDARY 97° 46' 46" 15.24
BOUNDARY 194° 58' 55" 15.19
burnt bridge creek
bottom of bank
top of bank
wall below
building outline over
low wall + mesh screen
laundry
stair 01
stair 02
hotdesk
planter
lounge / breakout space
services
cupboard letterboxes
foyer
entry
stair
wheelchair lift
LIFT
storage
w.c dis.
fire door
RL 11.730
car share 11-15
car share 6-10
car share 1-5
turning bay
shared zone
bollard
RAINWATER / BASIX / OSD TANK - IN CEILING ABOVE - DASHED
ramp 12.5% (10.4m)
ramp 5% (6m)
roller shutter
PEDESTRIAN ACCESS / ENTRY
VEHICULAR ENTRY PROPOSED DRIVEWAY
relocated power pole
02
A: 23 m²
01
A: 23 m²
balcony
kitchen
No. 253
2 & 3 STOREY
COMMERCIAL
BRICK, CONCRETE &
GLASS BUILDING
D.P. 577672
D.P. 849655

UNIT SCHEDULE

UNIT NUMBER	INTERNAL AREA (M2)
01	23
02	23
03	24
04	20
05	19
06	21
07	23
08	22
09	21
10	23
11	23
12	19
13	24
14	25
15	19
16	24
17	20
18	19
19	22
20	21
21	22
22	20
23	19
24	23
25	19
26	24
27	25
28	19
29	19
30	20
31	20
32	20
33	21
34	23
35	24
36	19
37	24
38	17
39	18
Common Room	23

PLOT DATE:2/17/2021

GARTNERTROVATO
ARCHITECTS
A PITTWATER PLACE L1/13 10 PARK STREET
PO BOX 1122
MONA VALE, NSW 2103
P +61 2 9979 4411
E gta@gta.com.au

Issue Date	Rev	Description	Drawn	Checked
15/02/21	A	ISSUE FOR DA	JR	SG

N

PROJECT
BOARDINGHOUSE
BOARDINGHOUSE
No. 255 CONDAMINE STREET,
MANLY VALE NSW
LOTS 8 DP DP 604034
FOR UPSTATE

DRAWING TITLE
GROUND FLOOR PLAN

SCALE	DRAWN BY	DATE
1:100 @ A1	JR	2/17/2021
PROJECT NO.	**DRAWING NO.**	**REVISION**
2040	DA-04	A

9 Attachment C: Northern Beaches Council Flood Information Report

FLOOD INFORMATION REQUEST – COMPREHENSIVE

Property: 255 Condamine Street MANLY VALE NSW 2093
Lot DP: Lot 8 DP 604034
Issue Date: 10/11/2020
Flood Study Reference: Manly 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]: 11.72 m AHD

1% AEP Flood – See Flood Map B

1% AEP Maximum Water Level [2, 3]: 11.23 mAHD

1% AEP Maximum Depth from natural ground level[3]: 5.72 m

1% AEP Maximum Velocity: 2.24 m/s

1% AEP Provisional Flood Hazard: High **See Flood Map D**

1% AEP Hydraulic Categorisation: Floodway **See Flood Map E**

Probable Maximum Flood (PMF) – See Flood Map C

PMF Maximum Water Level [4]: 12.47 m AHD

PMF Maximum Depth from natural ground level: 6.84 m

PMF Maximum Velocity: 2.28 m/s

PMF Flood Hazard: High **See Flood Map F**

PMF Hydraulic Categorisation: Floodway **See Flood Map G**

Flooding with Climate Change (See Flood Map H)

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]: 11.03 m AHD

1% AEP Maximum Depth with Climate Change[3]: 5.53 m

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

Flood Life Hazard Category – See Map I

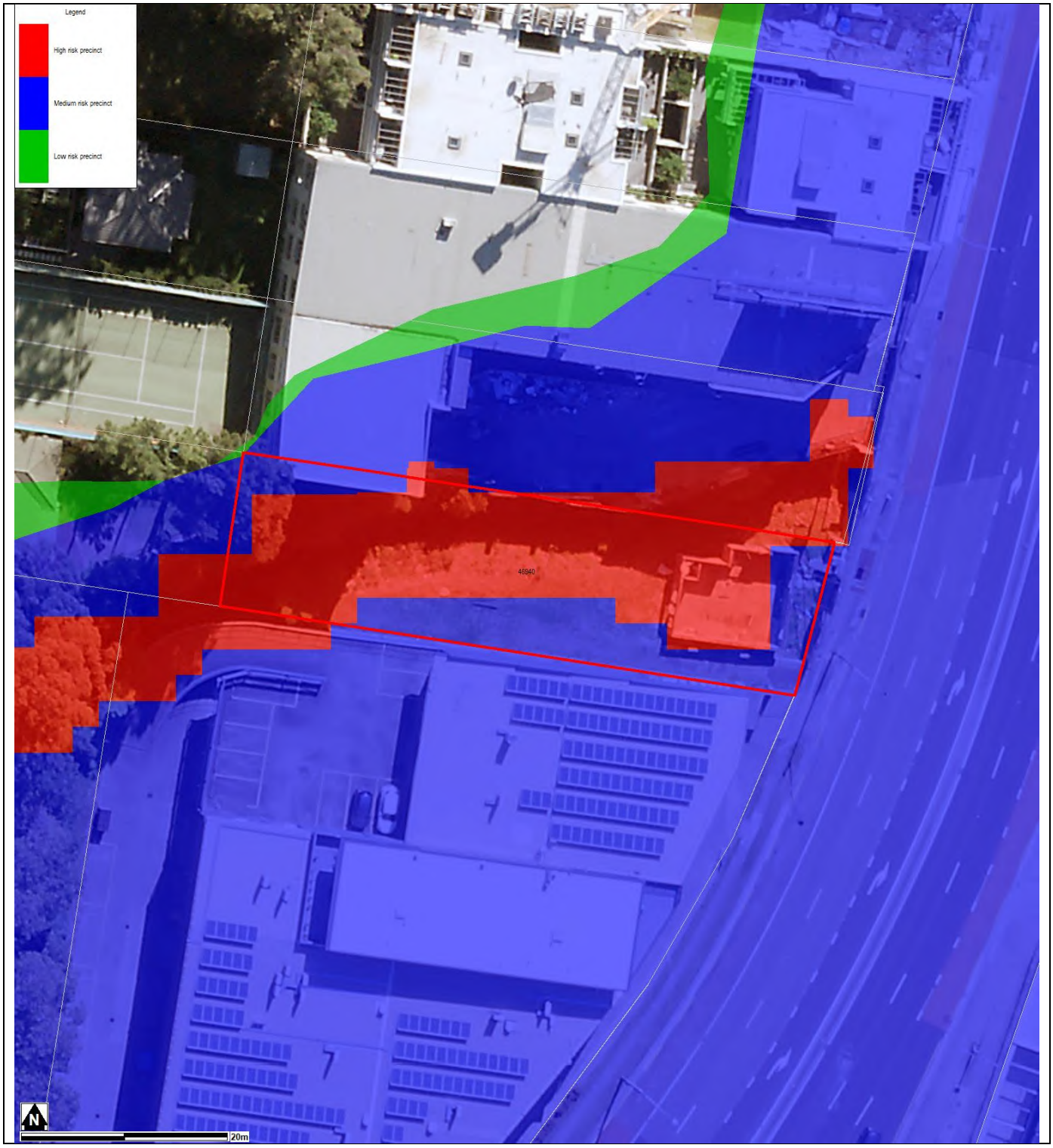
Indicative Ground Surface Spot Heights – See Map J

[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: Manly 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	10.70	3.89	11.16	4.35	1.78	11.65	12.56	5.74	2.62
2	10.71	1.15	11.16	1.59	1.06	11.66	12.24	2.67	1.45
3	10.72	0.75	11.16	1.19	0.74	11.65	12.20	2.24	1.26
4	10.71	4.37	11.17	4.83	1.35	11.66	12.34	6.01	1.57
5	10.71	2.27	11.17	2.72	1.01	11.66	12.31	3.86	1.14
6	10.72	1.22	11.17	1.67	0.70	11.66	12.24	2.74	0.79
7	10.72	5.22	11.18	5.68	1.54	11.67	12.29	6.79	1.71
8	10.72	3.48	11.17	3.93	1.18	11.67	12.25	5.02	1.57
9	N/A	N/A	11.17	0.88	0.55	11.66	12.24	1.95	0.95
10	10.75	2.76	11.20	3.21	1.24	11.69	12.29	4.31	1.44
11	10.75	5.25	11.20	5.70	1.92	11.70	12.31	6.81	1.96
12	10.76	0.62	11.21	1.07	0.51	11.70	12.30	2.16	0.86
13	N/A	N/A	N/A	N/A	N/A	N/A	12.33	0.58	0.36
14	10.77	3.46	11.23	3.92	1.29	11.72	12.35	5.04	1.48
15	10.77	3.65	11.22	4.10	2.56	11.72	12.34	5.23	2.15

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.

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	10.98	4.17
2	10.98	1.42
3	10.98	1.02
4	10.98	4.64
5	10.98	2.54
6	10.98	1.48
7	10.99	5.49
8	10.99	3.75
9	10.99	0.71
10	11.01	3.02
11	11.01	5.51
12	11.02	0.88
13	N/A	N/A
14	11.03	3.72
15	11.03	3.91

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

If the CC 1% AEP level is less than the 1% AEP level, this is possibly because the 1% AEP level used for planning includes a 5% AEP ocean surge. In this case, the 1% AEP value should be used.

FLOOD MAP B: FLOODING - 1% AEP EXTENT

Notes:

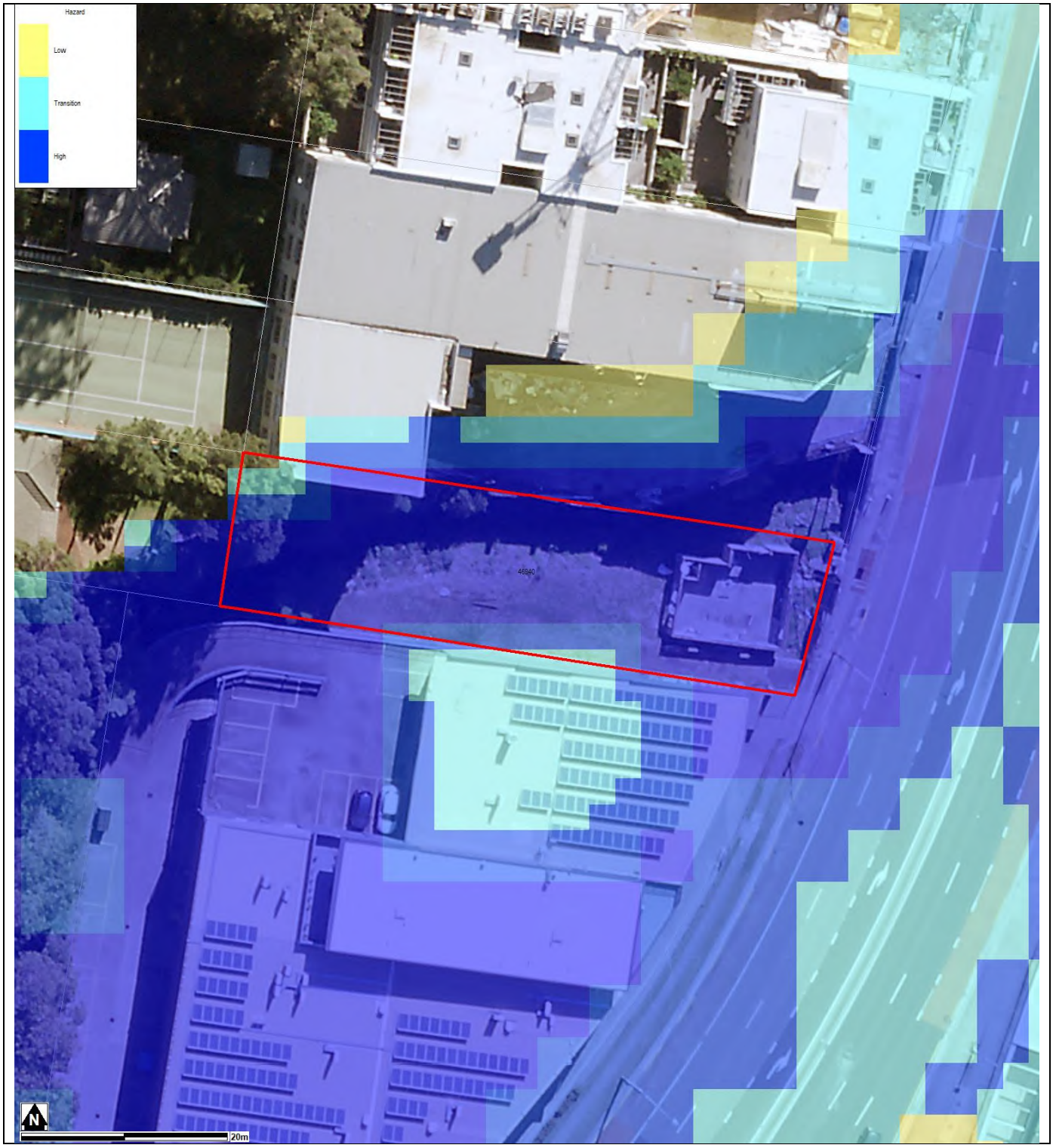
- Extent represents the 1% annual Exceedance Probability (AEP) flood event.
- Flood events exceeding the 1% AEP can occur on this site.
- Extent does not include climate change.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Manly Lagoon Flood Study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

FLOOD MAP D: 1% AEP FLOOD HAZARD EXTENT MAP



Notes:

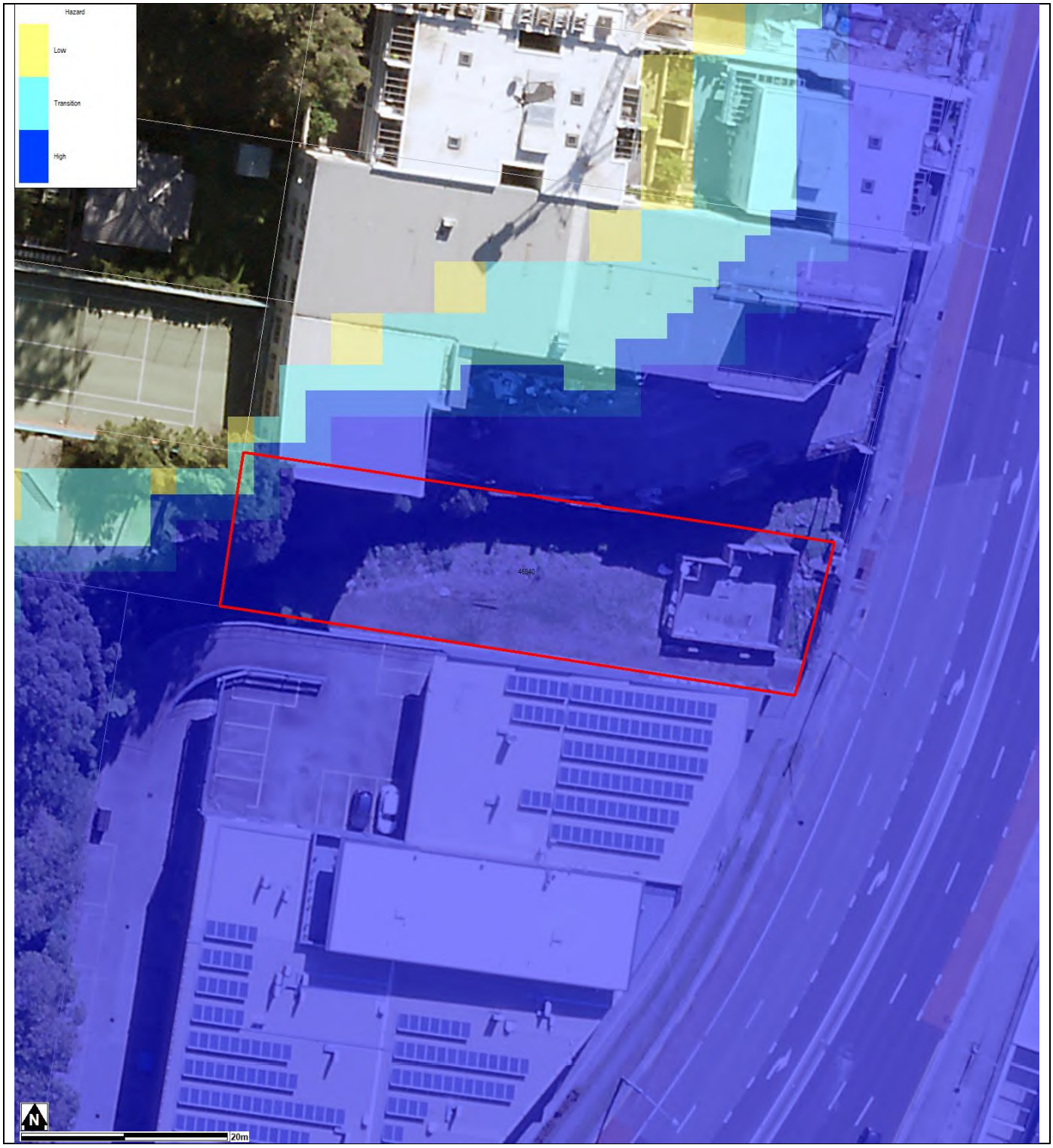
- Extent represents the 1% annual Exceedance Probability (AEP) flood event
- Extent does not include climate change
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Manly Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014)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

FLOOD MAP E: 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

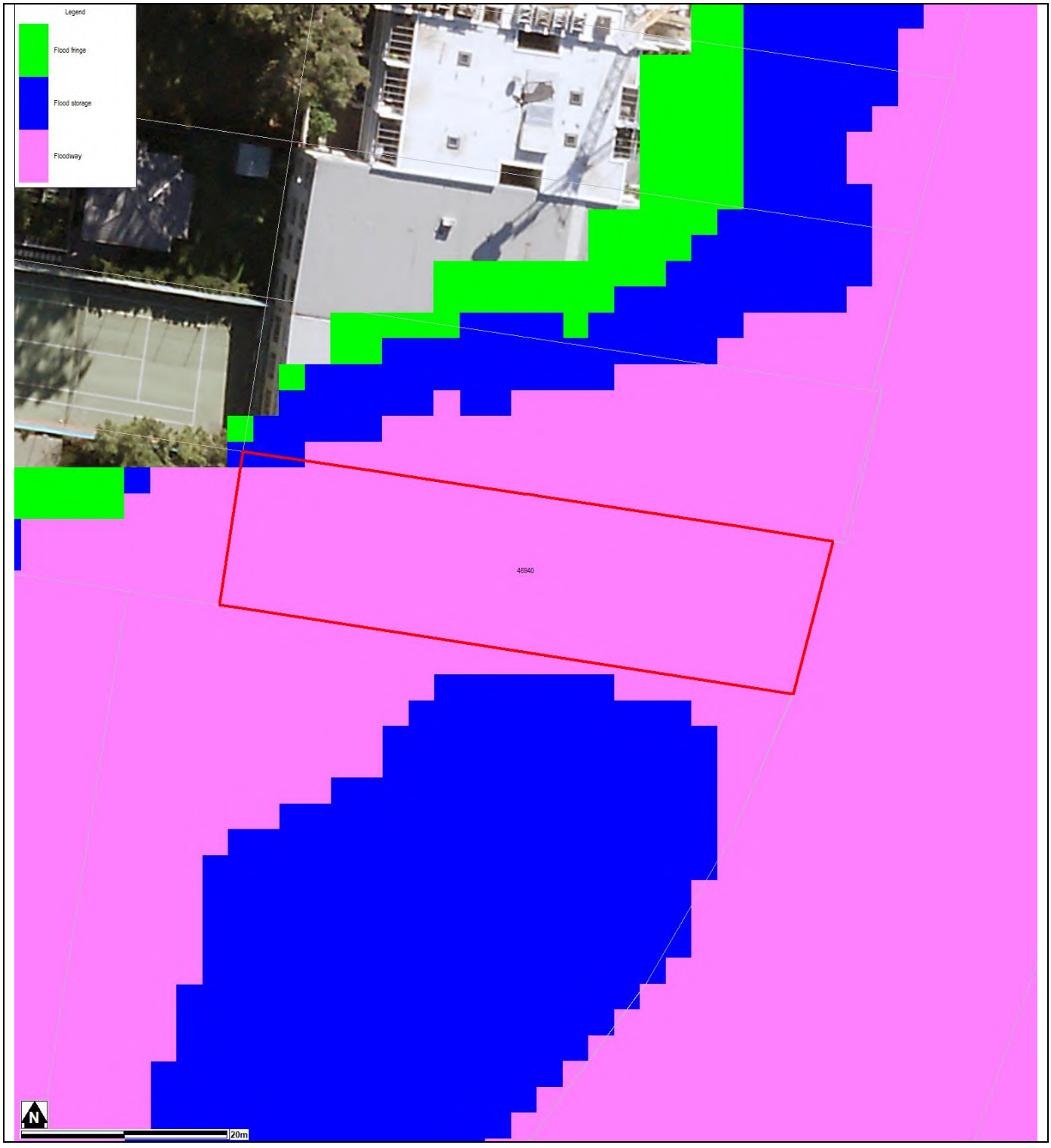
FLOOD MAP F: PMF FLOOD HAZARD EXTENT MAP



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

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

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

Note:

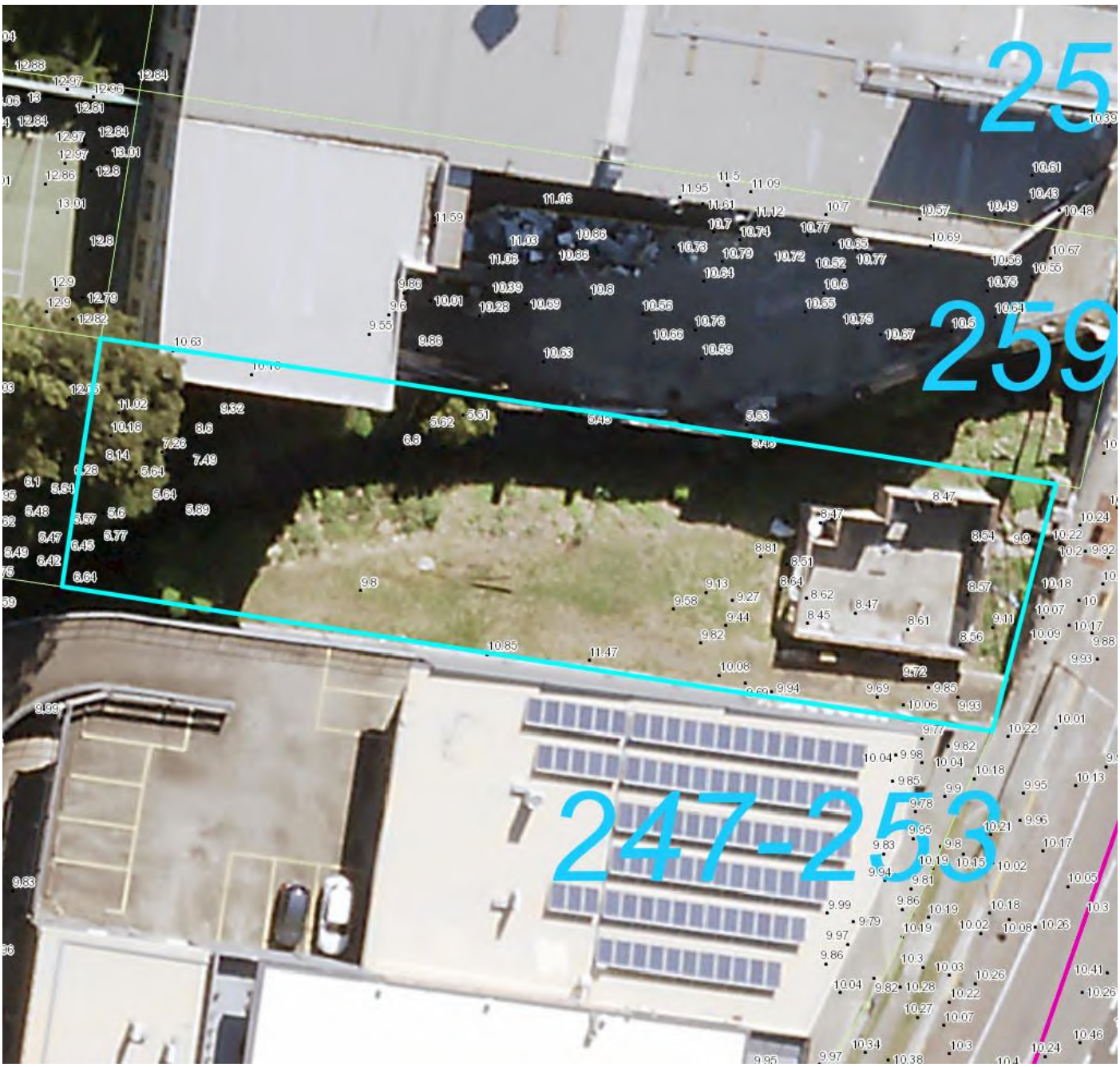
- Extent represents the 1% annual Exceedance Probability (AEP) flood event including 30% rainfall intensity and 0.9m Sea Level Rise climate change scenario
- Flood events exceeding the 1% AEP can occur on this site.
- Cadastre Lines (Source: NSW Government Land and Property Information), flood levels/extents (Source: Manly Lagoon Flood Study 2013, BMT WBM) and aerial photography (Source: NearMap 2014) are indicative only

FLOOD MAP I: FLOOD LIFE HAZARD CATEGORY

Notes:

- For additional information on Flood Life Hazard Categories, refer to the 'Flood Emergency Response Planning for Development in Pittwater Policy'.
- 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 J: 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.

GUIDELINES for Preparing a Flood Management Report

Introduction

These guidelines are intended to provide advice to applicants on preparing a Flood Management Report. The purpose of a Flood Management Report is to help applicants measure and manage the flood risk to life and property on their site.

When is a Flood Management Report required?

A Flood Management Report must be submitted with any Development Application on flood prone land, for Council to consider the potential flood impacts and 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.

Note that the flood extents shown on the mapping are indicative only. It is recommended that flood levels are compared to registered ground survey to more accurately determine the flood extent.

There are some circumstances where a 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 Flood Planning Level 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 in a Flood Management Report?

The aim of a Flood Management Report is to demonstrate how a proposed development will comply with the flood related 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.

Technical requirements of a Flood Management Report

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

1. ***Description of development***

   The description of development should identify:
   - 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, ie, critical, vulnerable, subdivision, residential, business, industrial, recreational, environmental or concessional

2. ***Flood analysis***

   The flood analysis should include:
   - Predicted 1 in 100 year flood level
   - Flood Planning Level (FPL)
   - Probable Maximum Flood (PMF) level
   - Flood Risk Precinct, ie High, Medium or Low
   - Flood Life Hazard Category (in former Pittwater Council area only)
   - Mapping of relevant extents
   - Flood characteristics for the site, eg depth, velocity, hazard and hydraulic category, and the impact these have on the proposed development

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

3. Assessment of impacts

The assessment of impacts should address the various elements of the relevant LEP and DCP. A simple compliance table should be provided, similar to the table one below.

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

Further details of what is required for each of these categories can be found in the *Development Control Plan for Flood Prone Land*.

For any of these categories which are applicable, the assessment should demonstrate how the development complies, or if it doesn't, provide an explanation of why the development should still be considered.

Reporting requirements for a Flood Management Report

The Flood Management Report should include:

a) Executive summary
b) Location plan, at an appropriate scale, that includes geographical features, street names and identifies all waterways and Council stormwater pipes, pits and easements
c) Plan of the proposed development site showing the extent of the predicted 100 year, any high hazard or floodway conditions and the PMF flood event
d) Development recommendations and construction methodologies
e) Calculation formulae (particularly for flood storage)
f) Clear referencing using an accepted academic referencing system (eg. Harvard)
g) Analysis of development against relevant State Environmental Planning Policies
h) Analysis of development against relevant Local Environment Plan and Policies
i) Conclusion detailing key points
j) Standard Hydraulic Certification (Form A/A1)
k) Qualifications of author
l) Any flood advice provided by Council
m) Any other details which may be relevant

NOTE: 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 Australian Institute of Engineers.

For further information please contact Stormwater and Floodplain Team on 1300 434 434 or via email at floodplain@northernbeaches.nsw.gov.au

Attachment A

NORTHERN BEACHES COUNCIL STANDARD HYDRAULIC CERTIFICATION FORM

FORM A/A1 – To be submitted with Development Application

Development Application for

Address of site: _____

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

I, _____ on behalf of _____
(Insert Name) (Trading or Business/ Company Name)

on this the _____ certify that I am engineer or a
(Date)

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

Flood Management Report **Details:**

Report Title: …….....

Report Date: …….....

Author: …….....

Author's Company/Organisation: …….

I: _____
(Insert Name)

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

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

☐ have followed Council's Guidelines for Preparing a Flood Management Report

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

Signature ……..

Name ……..……..

10 Attachment D: Structure Blockage Assessment

BLOCKAGE ASSESMENT FORM

STRUCTURE :

OPENING WIDTH:……6…m

DEBRIS TYPE/MATERIAL/L_{10}/SOURCE AREA - ***There may be more than one material type to consider!***

Debris Type/Material	L_{10}	Source Area	How Assessed
Branches and Detritus material	2 m	Underpass	Site Photos

DEBRIS AVAILABILITY (HML) – ***for the selected debris type/size and its source area***

Availability	Typical Source Area Characteristics	Notes
High	• *Dense forest, thick vegetation, extensive canopy, difficult to walk through with considerable fallen limbs, leaves and high levels of floor litter.* • *Streams with boulder/cobble beds and steep bed slopes and banks showing signs of substantial past bed/bank movements.* • *Arid areas, where loose vegetation and exposed loose soils occur and vegetation is sparse.* • *Urban areas that are not well maintained and/or old paling fences, sheds, cars and/or stored loose material etc., are present on the floodplain close to the water course.*	Dense forest and thick vegetation in upstream catchment.
Medium	• *State forest areas with clear understory, grazing land with stands of trees* • *Source areas generally falling between the High and Low categories.*	
Low	• *Well maintained rural lands and paddocks, with minimal outbuildings* • *Streams with moderate to flat slopes and stable beds and banks.* • *Arid areas where vegetation is deep rooted and soils resistant to scour* • *Urban areas that are well maintained with limited debris present in the source area.*	

DEBRIS MOBILITY (HML) - ***for the selected debris type/size and its source area***

Mobility	Typical Source Area Characteristics	Notes
High	• *Steep source area with fast response times and high annual rainfall and/or storm intensities and/or source areas subject to high rainfall intensities with sparse vegetation cover.* • *Receiving streams that frequently overtop their banks.* • *Main debris source areas close to streams*	
Medium	• *Source areas generally falling between the High and Low categories.*	Moderate riparian vegetation cover with moderate slopes
Low	• *Low rainfall intensities and large, flat source areas.* • *Receiving streams that Infrequently overtop their banks.* • *Main source areas well away from streams*	

DEBRIS TRANSPORTABILITY (HML) - ***for the selected debris type/size and stream characteristics***

Transportability	Typical Transporting Stream Characteristics	Notes
High	• *Steep bed slopes (> 3%).and/or high stream velocity (V>2.5m/sec)* • *Deep stream relative to vertical debris dimension (D>0.5L_{10})* • *Wide streams relative to horizontal debris dimension. (W>L_{10})* • *Streams relatively straight and free of constrictions/snag points.* • *High temporal variability in maximum stream flows*	
Medium	• *Streams generally falling between High and Low categories*	Velocities typically lie between 2.5 and 1 m/s
Low	• *Flat bed slopes (< 1%).and/or low stream velocity (V<1m/sec)* • *Shallow stream relative to vertical debris dimension (D<0.5L_{10})* • *Narrow streams relative to horizontal debris dimension.(W<L_{10})* • *Streams meander with frequent constrictions/snag points.* • *Low temporal variability in maximum stream flows*	

BLOCKAGE ASSESMENT FORM

SITE BASED DEBRIS POTENTIAL 1%AEP (HML) - ***for the selected debris type/size arriving at the site***

Debris Potential	Combinations of the Above (any order)	Notes
DP_{High}	HHH or HHM	
DP_{Medium}	MMM or HML or HMM or HLL	HMM
DP_{Low}	LLL or MML or MLL	

AEP ADJUSTED SITE DEBRIS POTENTIAL (HML) - ***for the selected debris type/size***

Event AEP	At Site 1% AEP Debris Potential			AEP Adjusted At Site Debris potential
	DP_{High}	DP_{Medium}	DP_{Low}	
AEP > 5% *(frequent)*	**M**edium	**L**ow	**L**ow	Low
AEP 5% - AEP 0.5%	**H**igh	**M**edium	**L**ow	Medium
AEP < 0.5% *(rare)*	**H**igh	**H**igh	**M**edium	High

Debris Blockage

MOST LIKELY DESIGN INLET BLOCKAGE LEVEL (B_{DES}%) ***for the selected debris type/size***

Control Dimension Inlet Width W (m)	At-Site Debris Potential (Generally)		
	High	**M**edium	**L**ow
$W < L_{10}$	100%	50%	25%
$W \geq L_{10} \leq 3*L_{10}$	20%	10%	0%
$W > 3*L_{10}$	10%	0%	0%

Event AEP	Bdes %
AEP > 5% ***(frequent)***	Low - 0%
AEP 5% - AEP 0.5%	Medium - 10%
AEP < 0.5% ***(rare)***	High - 20%

Refer Guideline if opening H<0.33W

11 Attachment E: Correspondence with Council

Paul Dinh

From: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Sent: Friday, 13 November 2020 1:25 PM
To: Paul Dinh
Cc: Daniel Dhiacou
Subject: RE: Flood Information Report for 255 Condamine St Manly Vale

Hi Paul,

Open carparks or carports cannot be located in the 1% AEP floodway as per control G1. With 255 Condamine almost completely being in a floodway, we will require them to be located above the 1% AEP level.

Regards,

Patrick Stuart
Senior Floodplain Management Officer

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

From: Paul Dinh <pdinh@martens.com.au>
Sent: Friday, 13 November 2020 11:38 AM
To: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Cc: Daniel Dhiacou <DDhiacou@martens.com.au>
Subject: RE: Flood Information Report for 255 Condamine St Manly Vale

Hi Patrick,

Thank you for your response, it has cleared up most of the queries we had but we have a few more questions if you could assist us.

We are doing detailed flood modelling of the site, and the level of the open carpark on the ground floor is a key part of the design. We understand the design requirements to show the design will have no offsite impacts as per the DCP requirements.

However, we can't find the clause in the DCP stating the open carpark level is to be above the 1% AEP. If the flood modelling shows no offsite flood impacts, with water depths in the carpark below 300 mm (or in the event of higher depths, with vehicle barriers and restraints), would this be acceptable?

If you could confirm or clarify the above via email at your earliest convenience it would be greatly appreciated.

Kind Regards,

Paul Dinh
Civil Engineer
BEng(Civil), BEng(Environmental)

Martens & Associates Pty Ltd
Suite 201, 20 George St
Hornsby, NSW 2077
P + 61 2 9476 9999
F + 61 2 9476 8767
www.martens.com.au

From: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Sent: Thursday, 12 November 2020 5:03 PM
To: Paul Dinh <pdinh@martens.com.au>
Cc: Daniel Dhiacou <DDhiacou@martens.com.au>
Subject: RE: Flood Information Report for 255 Condamine St Manly Vale

Hi Paul,

The only change to the PreDA advice is that "The underside of the slab of the ground floor must be at or above the FPL of 10.5m AHD" has been deleted because an FPL of 10.5 was an error and having the whole underside of ground floor above the actual FPL may not be achievable:

You will still need to demonstrate that the proposed development will not cause adverse flood impacts including appropriate blockage factors, so you may need the underside of the slab to be higher to achieve that. Based on that, you may still need to ramp the garage up to a level that the underside of the slab is above the FPL of 11.72m AHD. Also Prescriptive control F2 of Warringah DCP E11 will be considered when assessing the DA, which states all development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no [net] loss of flood storage in a 1% AEP Event.

See below for specific answers to questions.

Regards,
Patrick.

Patrick Stuart
Senior Floodplain Management Officer

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

northern beaches council

From: Paul Dinh <pdinh@martens.com.au>
Sent: Wednesday, 11 November 2020 4:35 PM
To: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Cc: Daniel Dhiacou <DDhiacou@martens.com.au>
Subject: RE: Flood Information Report for 255 Condamine St Manly Vale

Hi Patrick,

Thank you for your call earlier today, I just want to confirm a few things in relation to the flood levels and designs to forward on to our client.

I note that on the phone you mentioned the PREDA advice is likely to change in relation to flooding for the site, and wish to confirm the following;

- We note the certificate places the 1% AEP Maximum water level to be 11.23 mAHD, with the FPL being 11.72 mAHD. While minor, suggests a freeboard of 490 mm – I assume its due to a gradient of water level across the site, but can you confirm whether this FPL is correct? It should be a freeboard of 500mm. So yes, point 14 and the max FPL looks to have auto-generated incorrectly and should technically be 11.73, but if you are not building at the location of point 14, then its not relevant.
- The 1% AEP flood level for the site is approximately 11.23 mAHD based on the flood certificate – can you confirm that the it is the underside of the slab which needs to be above the 1% AEP (opposed to structural beams etc)? Any construction below the 1% AEP and FPL must be minimised due to the effect of conveyance of the floodway and potential for adverse impacts. As mention above, this includes the underside of the horizontal slab. Vertical structural beams must be sited to minimise the effect on the conveyance of floodwaters.
    - Furthermore, if the use of the ground floor is an open carparking space, is this still necessary? Yes, it is more to allow the unrestricted flow of floodwaters in a 1% AEP flood.
    - We note that in Warringah DCP E11 – G8; *Multi Dwelling Housing and Shop Top Housing residential carparking – consideration may be given to a minimum floor level for open or covered carparking being set at the 5% AEP Flood level, provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.* G8 does not apply in a high flood risk precinct and/or floodways.
    - Given this, is it applicable to our site to have the ground floor level at or below the 1% AEP? Formalised carparking areas must be at or above the 1% AEP flood level. Not only to reduce potential adverse flood impacts on neighbouring properties, but also to reduce potential damages to vehicles.
- Further to above, if we wish to use a portion of the ground floor as habitable land, we understand that the area would be subject to the FPL – however what requirements would be applied to the slab of the habitable area? (i.e. slab above the 1% AEP?). Same as above.

If you could confirm or clarify the above via email at your earliest convenience it would be greatly appreciated.

Kind Regards,

Paul Dinh
Civil Engineer
BEng(Civil), BEng(Environmental)

Martens & Associates Pty Ltd
Suite 201, 20 George St
Hornsby, NSW 2077
P + 61 2 9476 9999
F + 61 2 9476 8767
www.martens.com.au

From: Patrick Stuart <Patrick.Stuart@northernbeaches.nsw.gov.au>
Sent: Wednesday, 11 November 2020 11:26 AM
To: Paul Dinh <pdinh@martens.com.au>
Subject: Flood Information Report for 255 Condamine St Manly Vale

Hi Paul,

Please find attached the Flood Information Report for 255 Condamine St Manly Vale.

I'll give you a call now to discuss.

Regards,
Patrick.

Patrick Stuart
Senior Floodplain Management Officer

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

Northern Beaches Council

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Northern Beaches Council

12 Attachment F: Flood Assessment Planset

0 100 200 300 400 500 m

1:10000 @ A3

Map Title / Figure:
Catchment

Map 01	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

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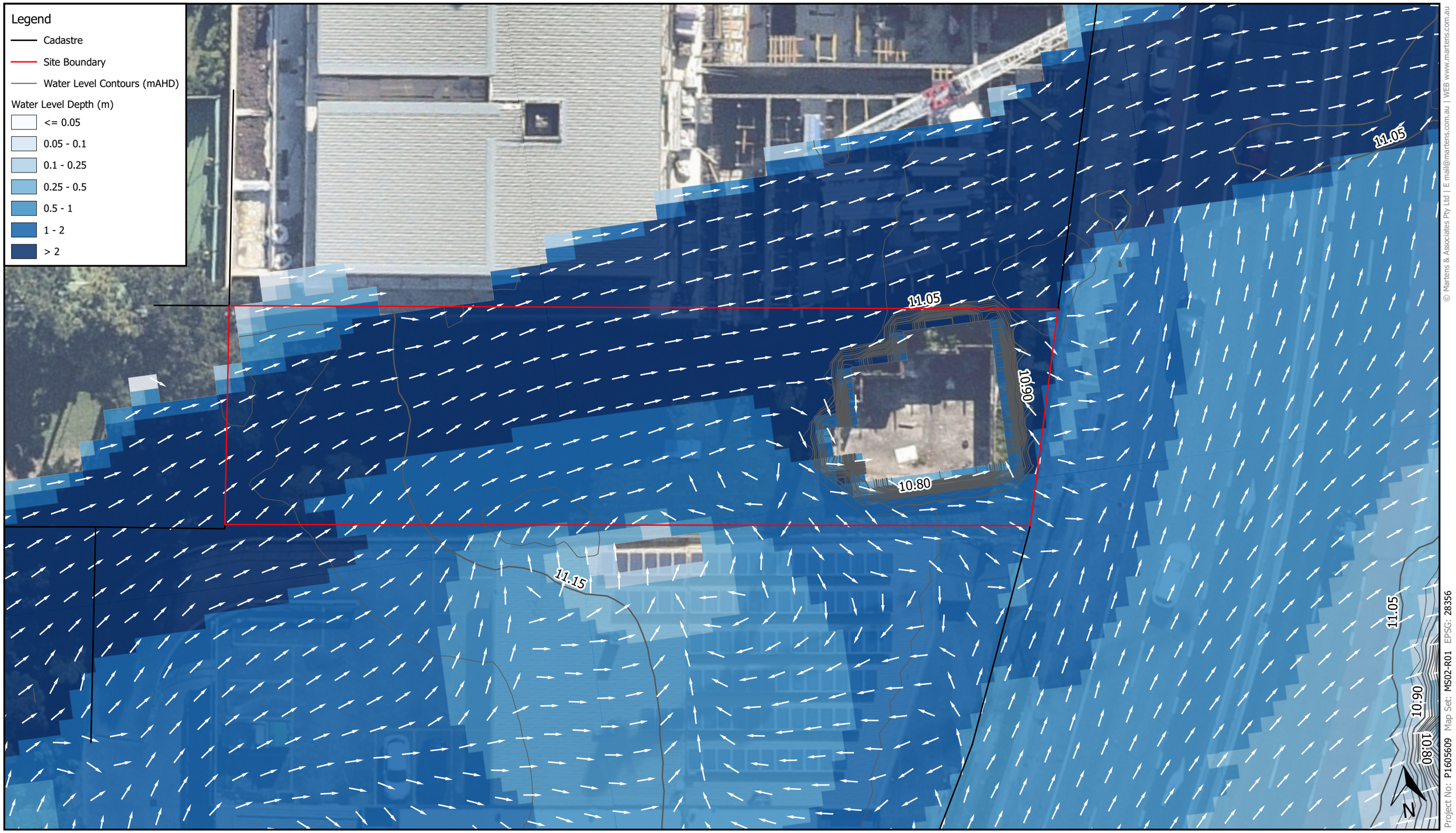
Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



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Project No: P1605609 Map Set: MS02-R01 EPSG: 28356

Map Title / Figure:

Existing Conditions 1% AEP event Water Level (mAHD) and Depth (m)

Map 02	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

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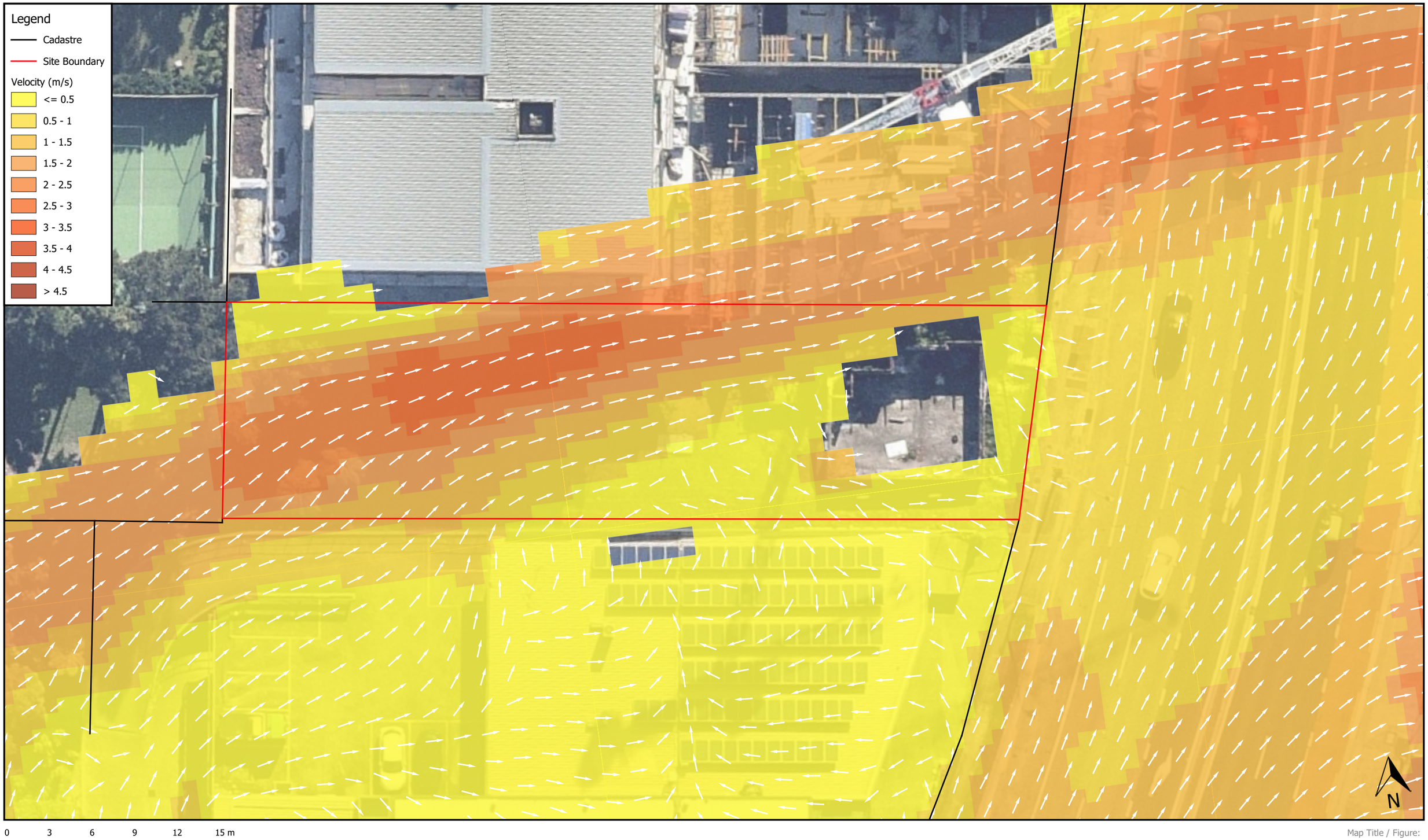

0 3 6 9 12 15 m

1:250 @ A3

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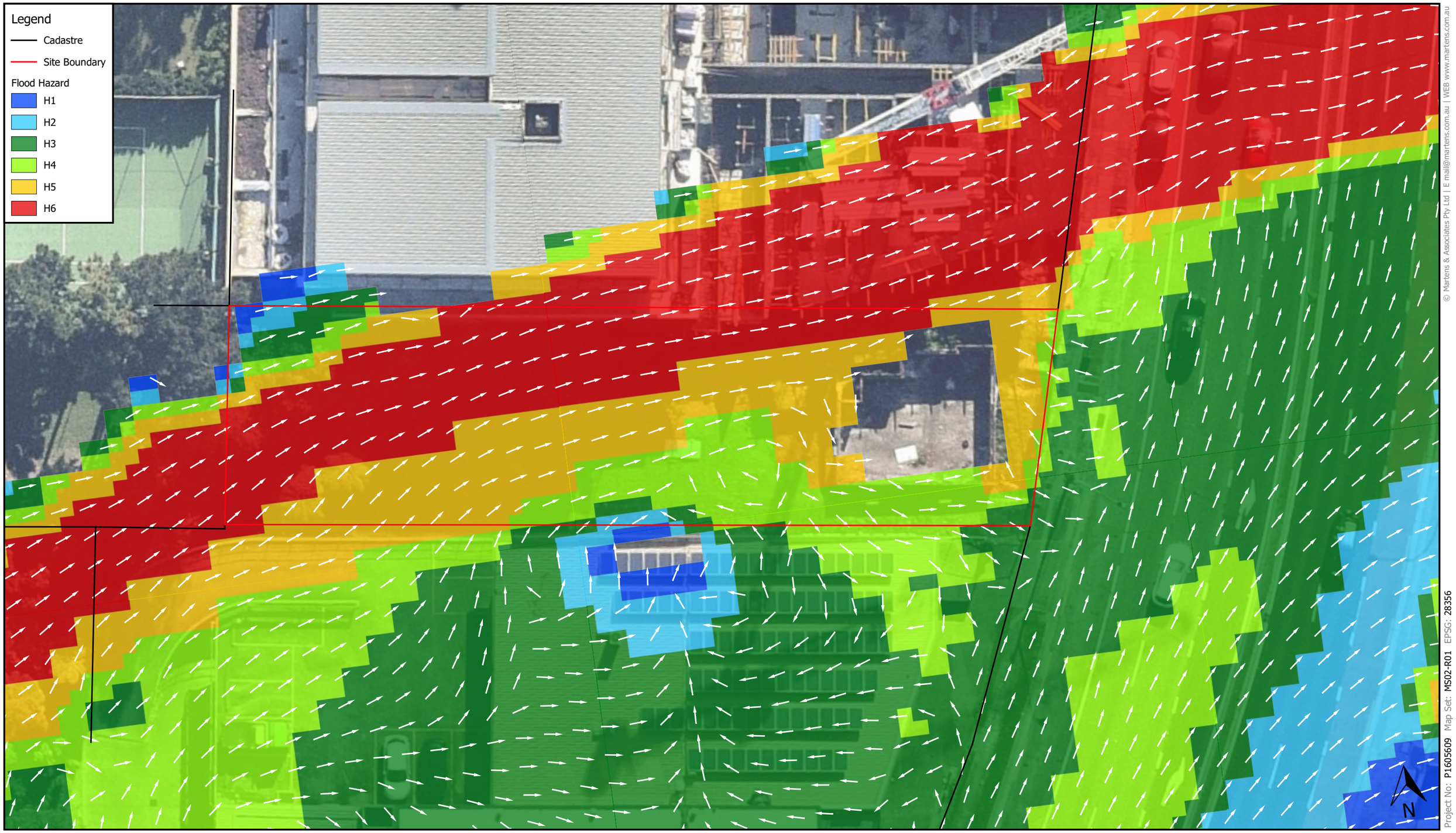
Map Title / Figure:

Existing Conditions 1% AEP event Velocity (m/s)

Map 03	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Note:
General flood hazard vulnerabilities are based on ARR (2019) definitions.
H1 - Relatively benign flow conditions. No vulnerability constraints.
H2 - Unsafe for small vehicles.
H3 - Unsafe for all vehicles, children and the elderly.
H4 - Unsafe for all people and all vehicles.
H5 - Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
H6 - Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

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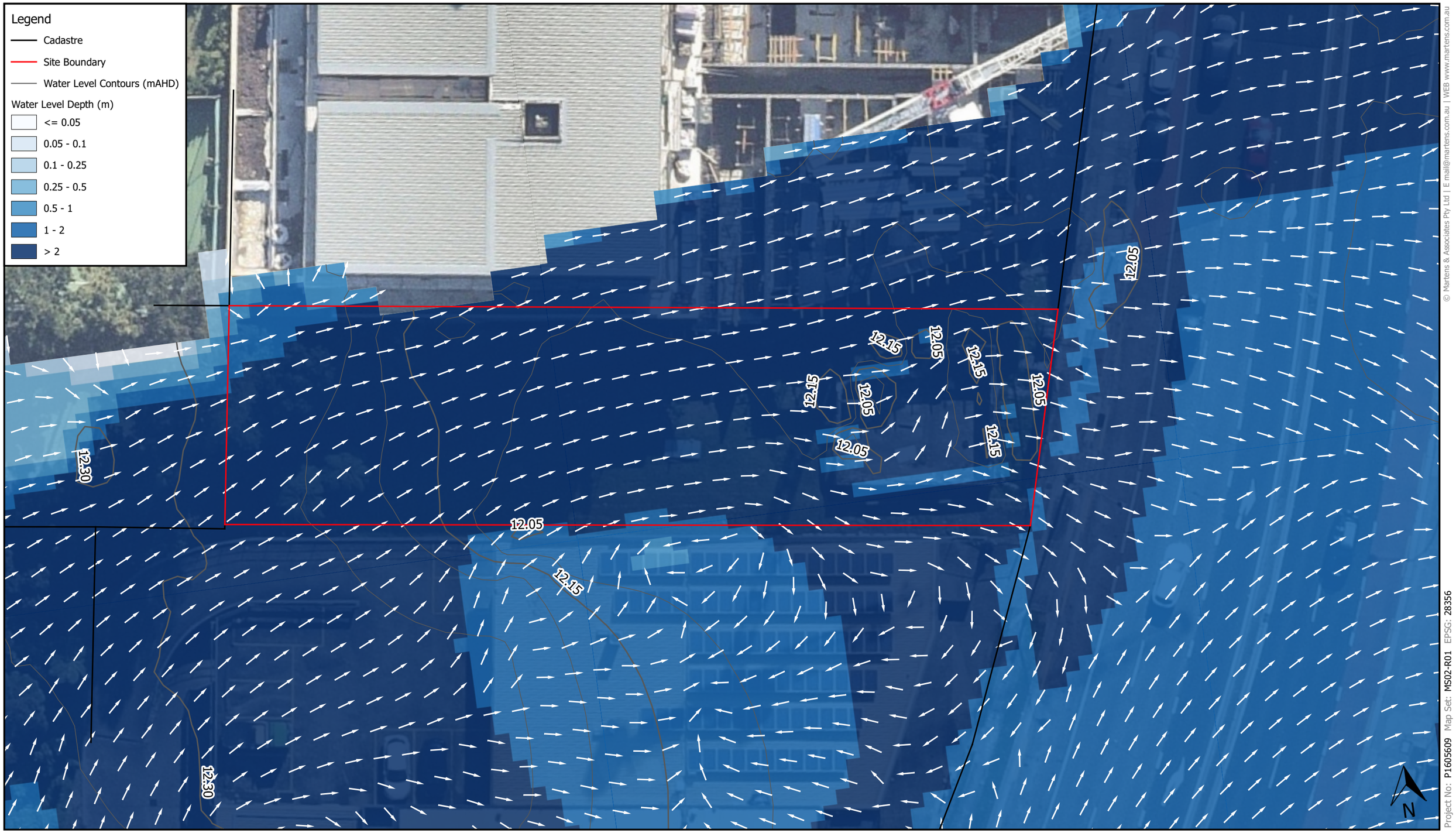
Map Title / Figure:

Existing Conditions 1% AEP event
Flood Hazard Vulnerability

Map 04	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356

Map Title / Figure:

Existing Conditions PMF event Water Level (mAHD) and Depth (m)

Map 05	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

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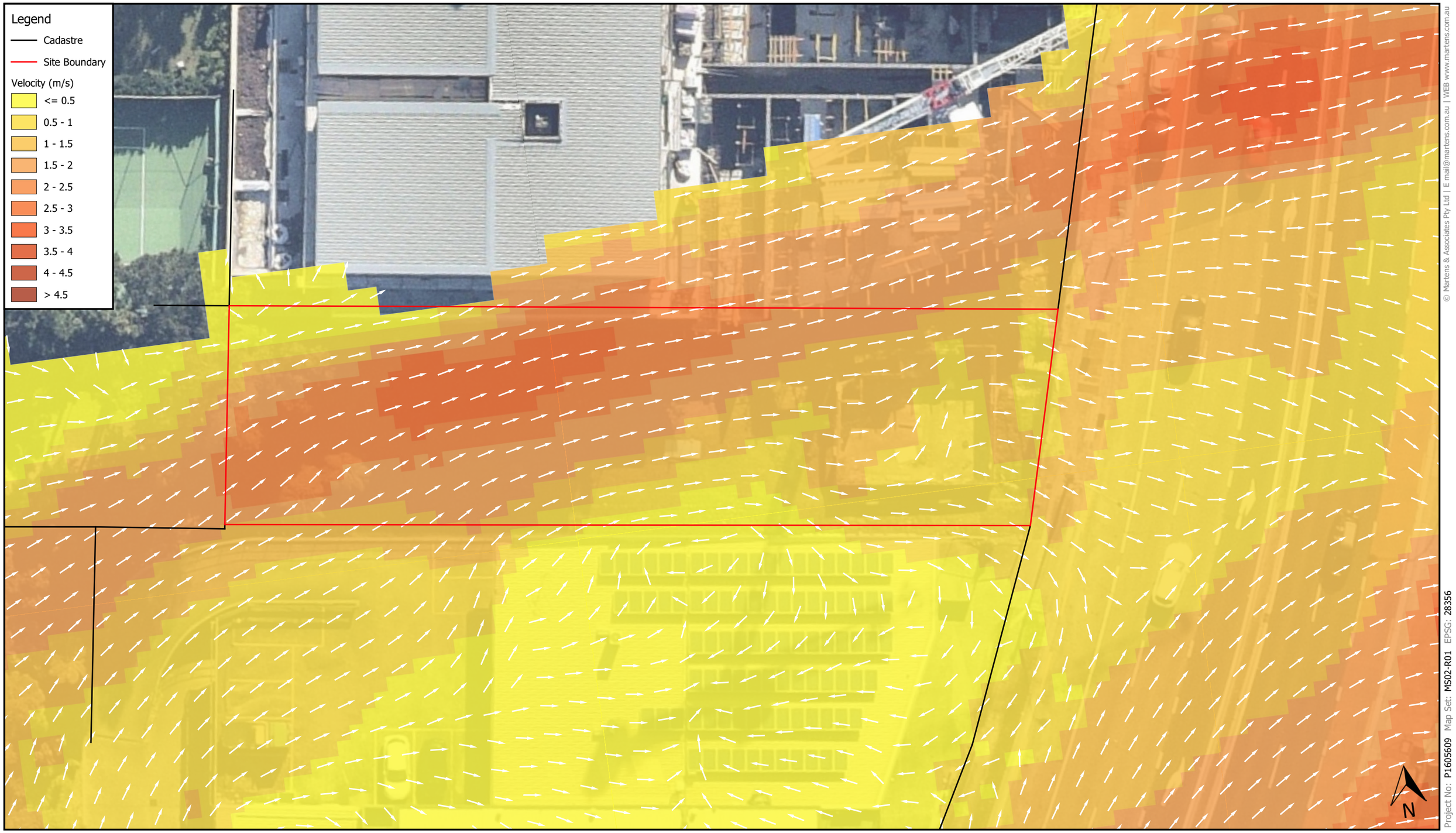

0 3 6 9 12 15 m

1:250 @ A3

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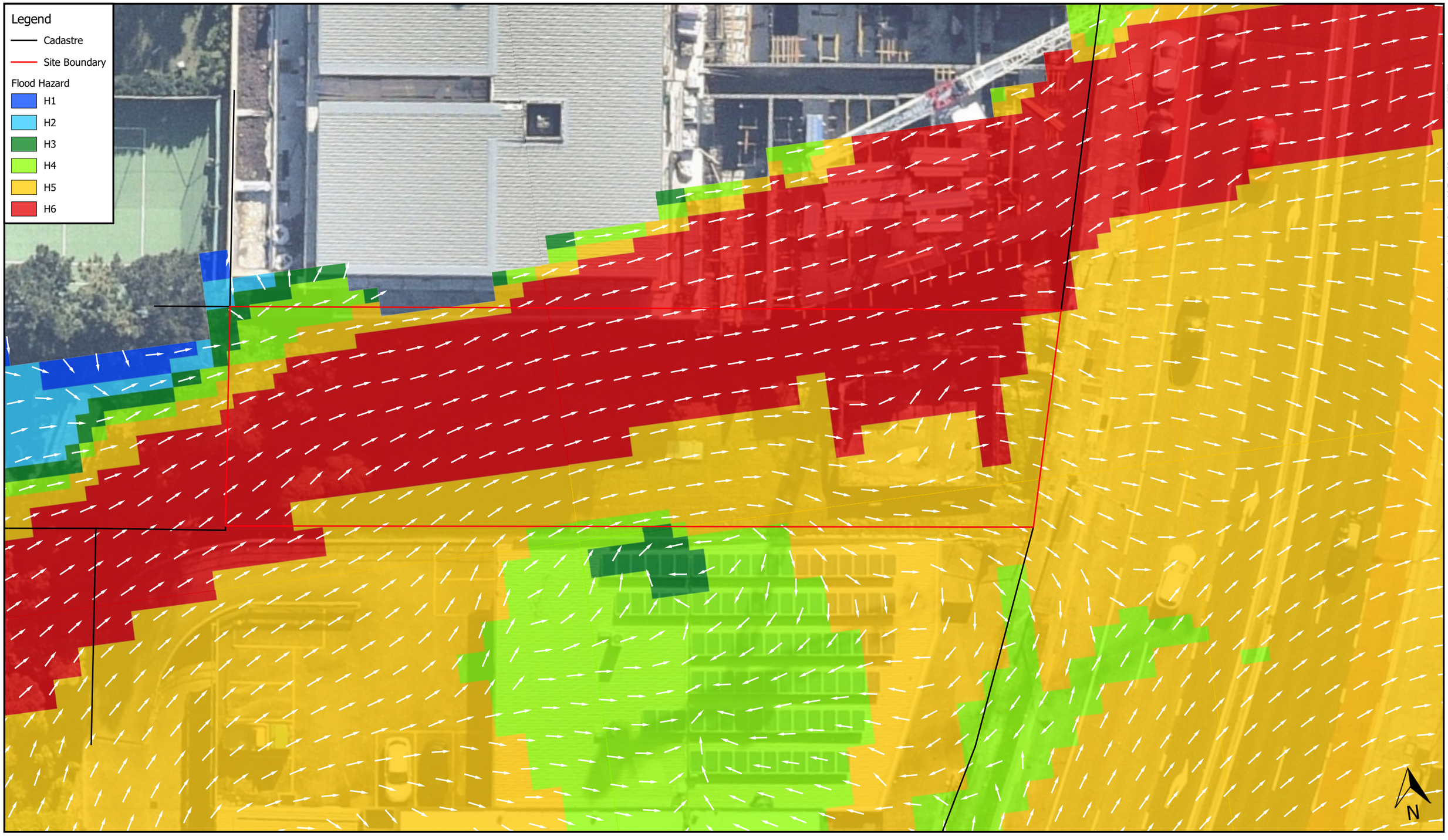
Map Title / Figure:

Existing Conditions PMF event Velocity (m/s)

Map 06	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Note:
General flood hazard vulnerabilities are based on ARR (2019) definitions.
H1 - Relatively benign flow conditions. No vulnerability constraints.
H2 - Unsafe for small vehicles.
H3 - Unsafe for all vehicles, children and the elderly.
H4 - Unsafe for all people and all vehicles.
H5 - Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
H6 - Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

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Map Title / Figure:

Existing Conditions PMF event Flood Hazard Vulnerability

Map 07	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356

Legend

- Lot Layout
- Cadastre
- Site Boundary
- Water Level Contours (mAHD)

Water Level Depth (m)

- <= 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- > 2

11.05
11.15
10.65
10.90
10.55
10.80
N

0 3 6 9 12 15 m

1:250 @ A3

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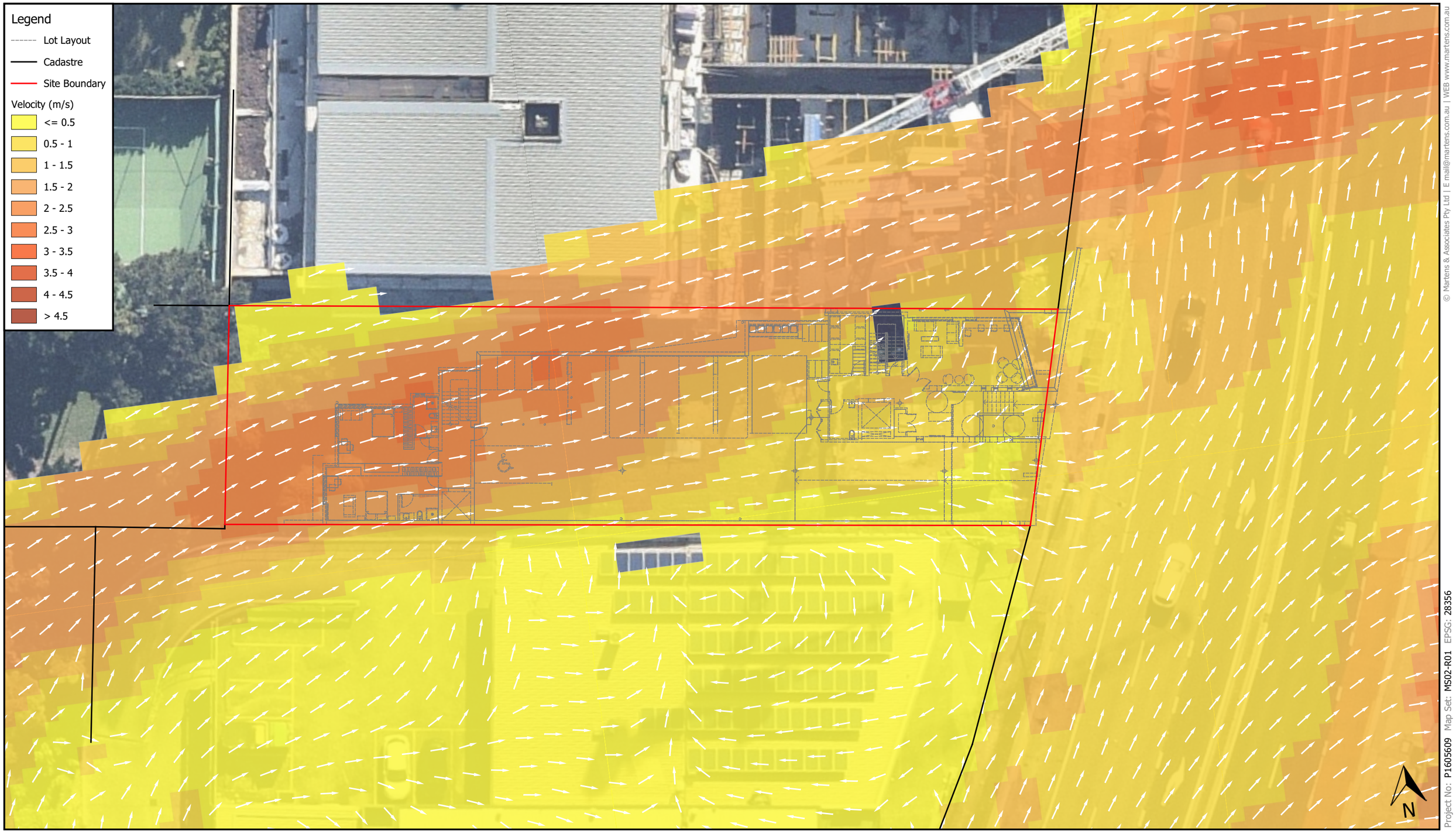
Map Title / Figure:

Proposed Conditions 1% AEP event Water Level (mAHD) and Depth (m)

Map 08	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



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1:250 @ A3

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356

Map Title / Figure:

Proposed Conditions 1% AEP event Velocity (m/s)

Map 09	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

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Legend

- Lot Layout
- Cadastre
- Site Boundary

Flood Hazard

- H1
- H2
- H3
- H4
- H5
- H6

0 3 6 9 12 15 m

1:250 @ A3

Note:
General flood hazard vulnerabilities are based on ARR (2019) definitions.
H1 - Relatively benign flow conditions. No vulnerability constraints.
H2 - Unsafe for small vehicles.
H3 - Unsafe for all vehicles, children and the elderly.
H4 - Unsafe for all people and all vehicles.
H5 - Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
H6 - Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

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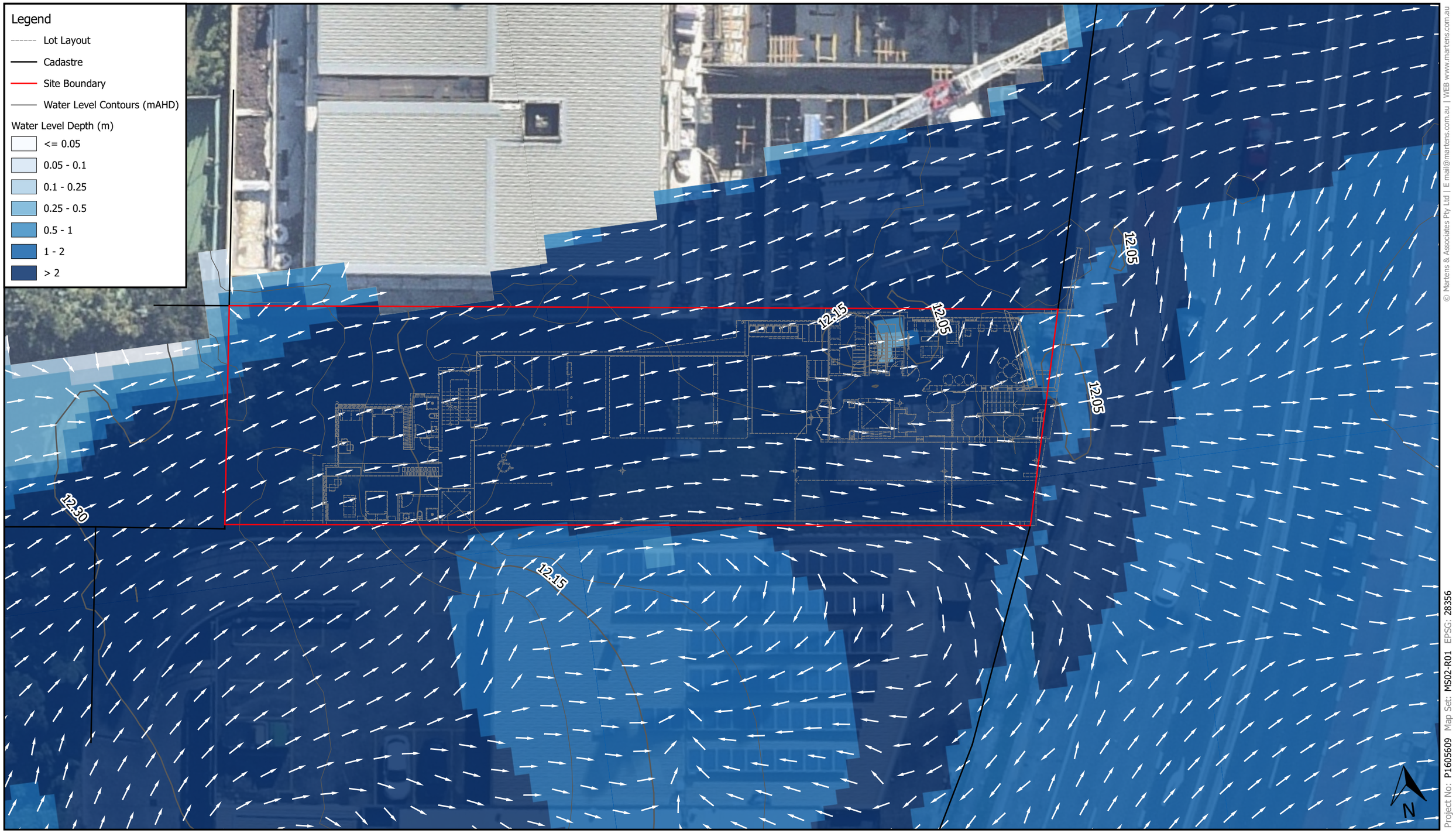
Map Title / Figure:

Proposed Conditions 1% AEP event Flood Hazard Vulnerability

Map 10	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Map Title / Figure:

Proposed Conditions PMF event Water Level (mAHD) and Depth (m)

Map 11	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

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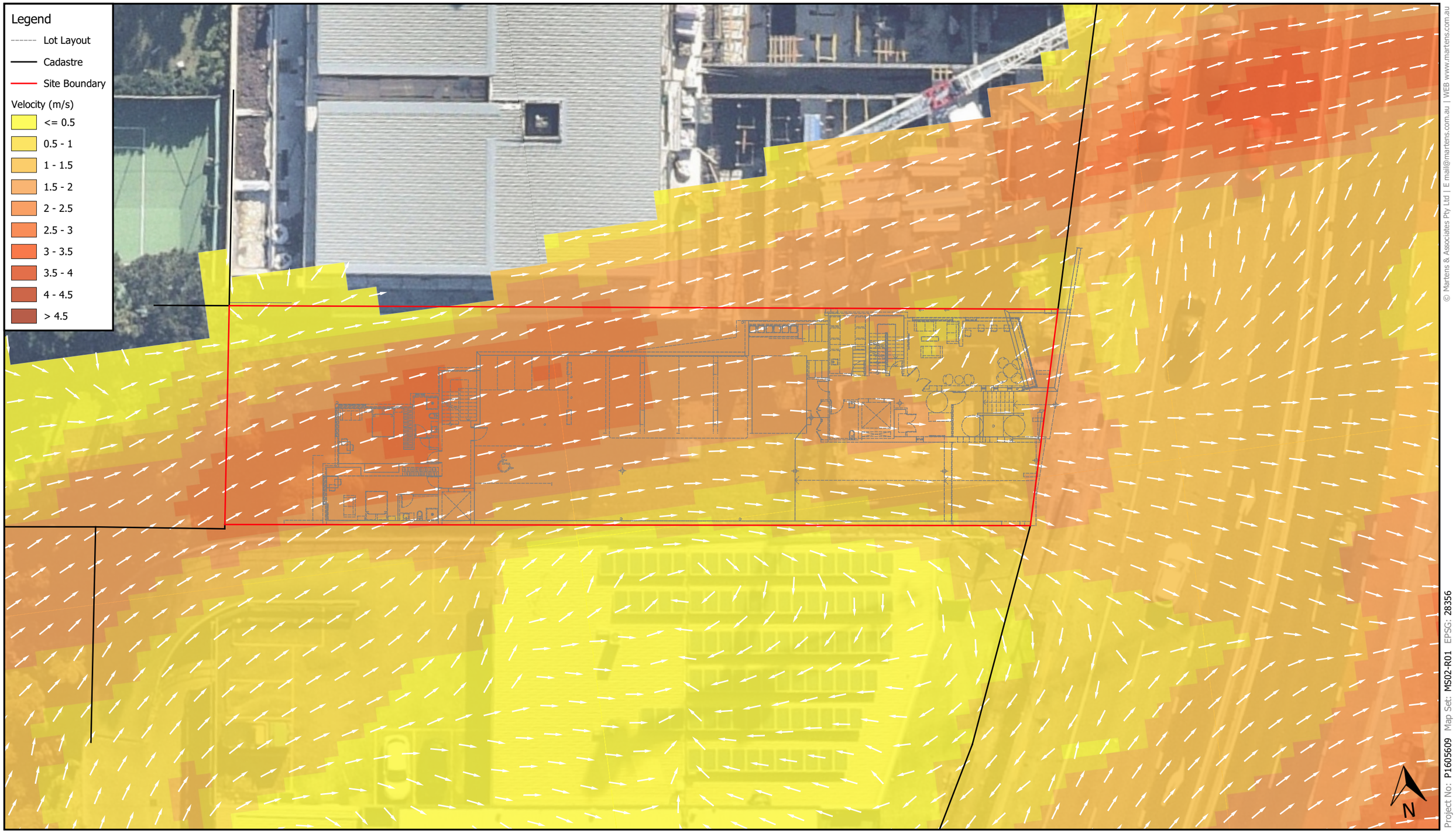
Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

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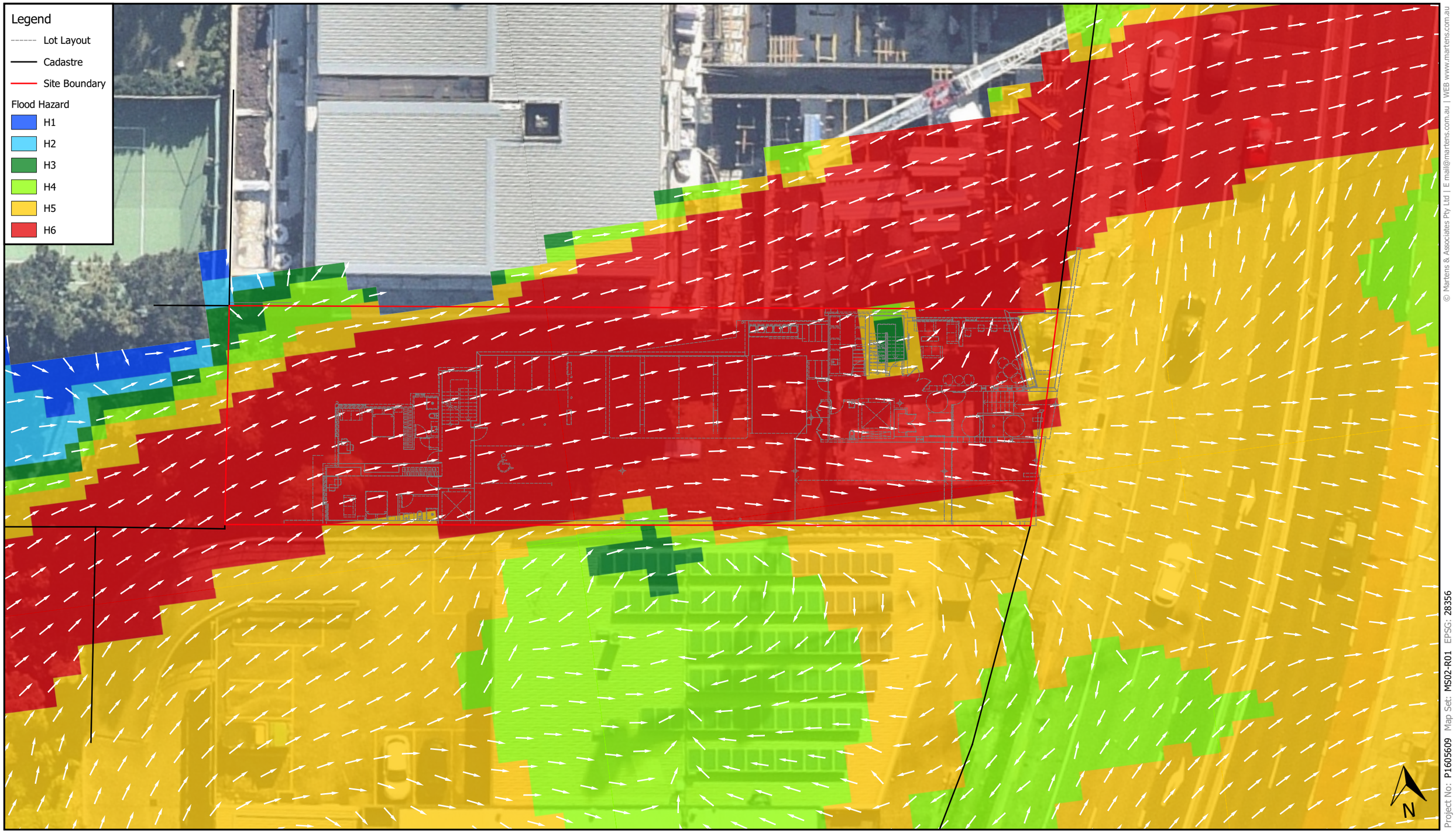
Map Title / Figure:

Proposed Conditions PMF event Velocity (m/s)

Map 12	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Note:
General flood hazard vulnerabilities are based on ARR (2019) definitions.
H1 - Relatively benign flow conditions. No vulnerability constraints.
H2 - Unsafe for small vehicles.
H3 - Unsafe for all vehicles, children and the elderly.
H4 - Unsafe for all people and all vehicles.
H5 - Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
H6 - Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building types considered vulnerable to failure.

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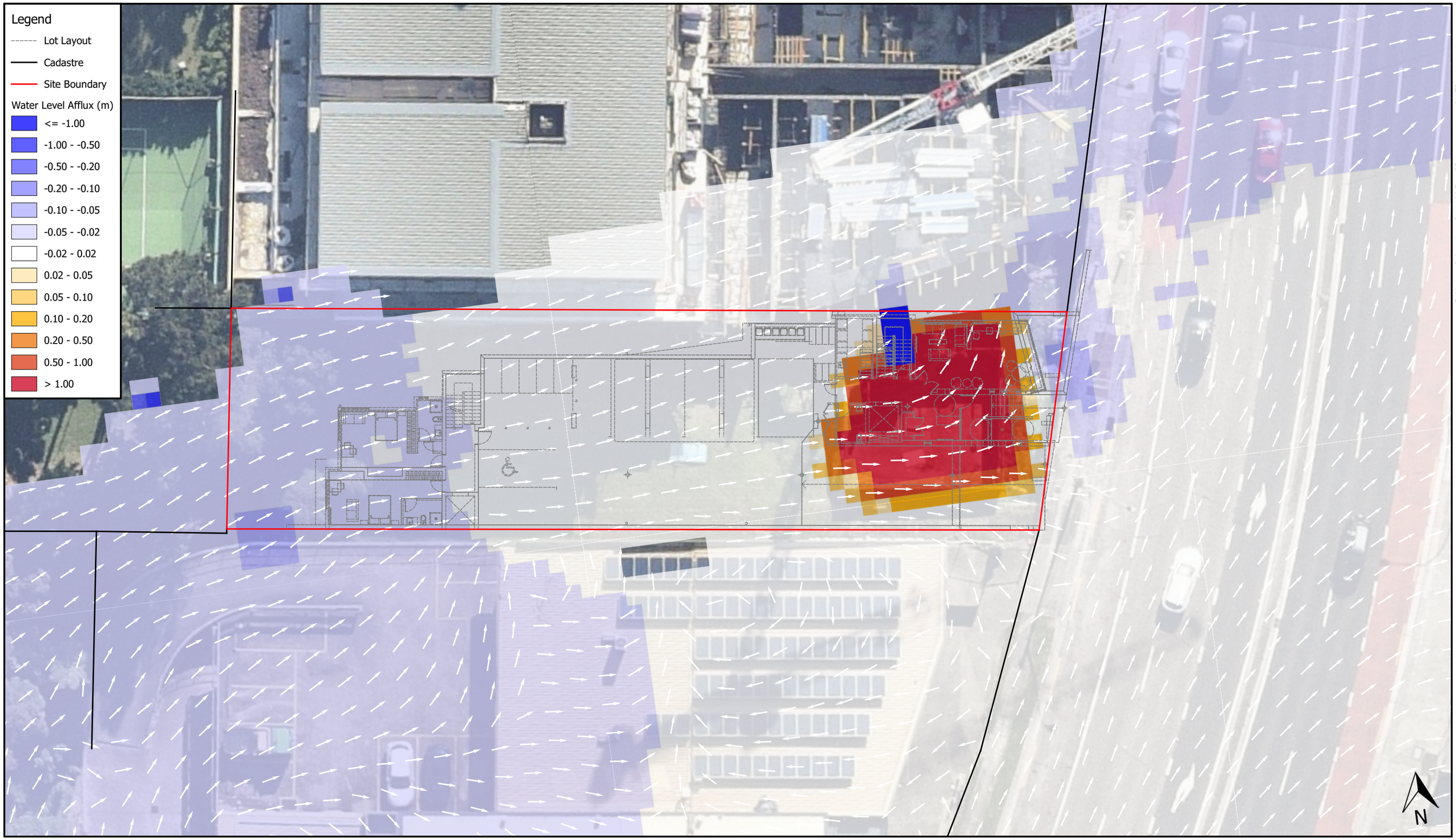
Map Title / Figure:
Proposed Conditions PMF event Flood Hazard Vulnerability

Map 13	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Notes:
Areas coloured white represent negligible change.
Areas coloured blue represent water level reduction.
Areas coloured yellow/red represent water level increase.

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Map Title / Figure:

Proposed Conditions 1% AEP event Water Level Afflux (m)

Map 14	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356

Legend

Lot Layout

Cadastre

Site Boundary

Water Level Afflux (m)

- <= -1
- -1 - -0.5
- -0.50 - -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- 0.20 - 0.50
- 0.50 - 1.00
- > 1.00

N

0 3 6 9 12 15 m

1:250 @ A3

Notes:
Areas coloured white represent negligible change.
Areas coloured blue represent water level reduction.
Areas coloured yellow/red represent water level increase.

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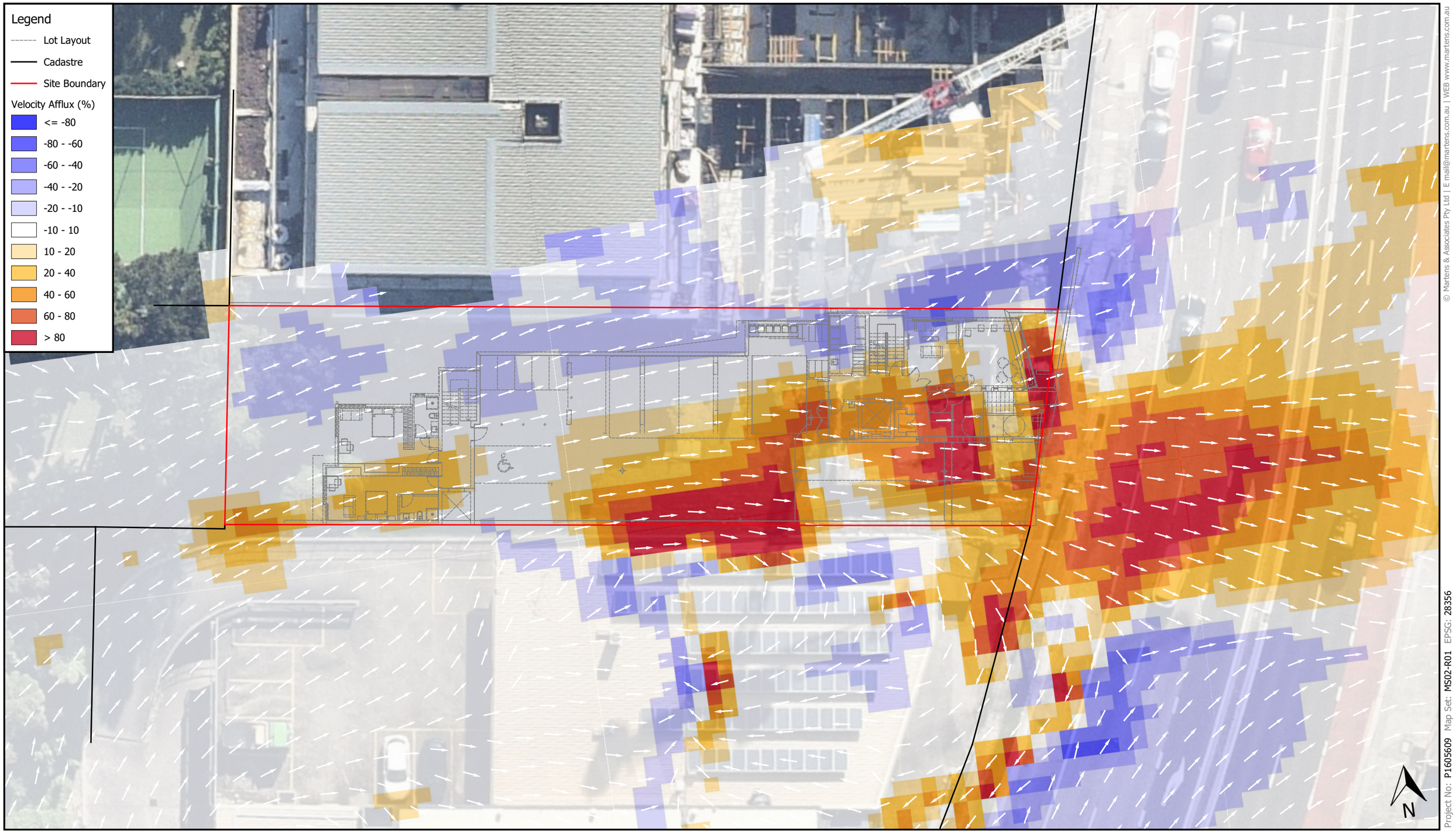
Map Title / Figure:

Proposed Conditions PMF event Water Level Afflux (m)

Map 15	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356



0 3 6 9 12 15 m

1:250 @ A3

Notes:
Areas coloured white represent negligible change.
Areas coloured blue represent velocity reduction.
Areas coloured yellow/red represent velocity increase.

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Map Title / Figure:

Proposed Conditions PMF event Velocity Impact (%)

Map 16	Map
255 Condamine Street, Manly Vale, NSW	Site
Proposed Boarding House Development	Project
Flood Impact Assessment	Sub-Project
MY Manly Vale Pty Ltd	Client
11/02/2021	Date

Project No: P1605609 Map Set: MS02-R01 EPSG: 28356