Planix Projects

C/ Waterbrook

Pre-Development Flood Assessment:

Waterbrook Bayview Seniors Living Facility:

Bayview Gold Course, Cabbage Tree Road, Bayview, NSW.

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1404179JR04V01
August 2014

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

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1 Introduction

1.1 Introduction

Martens & Associates Pty Ltd has prepared this pre development flood study to assist in the planning process for a proposed seniors living development at Bayview Golf Course; Cabbage Tree Road, Bayview, NSW. The study details existing flood conditions at the site and development requirements under Pittwater Council policy.

We understand a flood risk management report, considering the impacts of the proposed development, will be prepared at development application (DA) stage.

1.2 Project Scope

Project scope and objectives are as follows:

- Summarise flood conditions at the site in accordance with relevant Council flood studies (Section 1.3).
- Outline flood design and construction requirements and controls for the development.
- Provide preliminary recommendations for site evacuation response.

1.3 Relevant Guidelines

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

- Pittwater Council (2003) Pittwater 21 DCP
- Cardno (2013) *Pittwater Overland Flow Mapping and Flood Study*
- DHI Water and Environment (2002) *Mona Vale – Bayview Flood Study*

2 Site and Development Description

2.1 Overview

The proposed development ('development site') is located within Lot 1 DP 662920 of 52 Cabbage Tree Road, Bayview (the 'site') which forms part of the existing Bayview Golf Course (Figure 1, Attachment A).

Site description is provided in Table 1 and is based on review of site survey, site aerials and site inspection (May 16 and 21, 2014).

Table 1: Site description summary.

Element	Description/Detail
Site Area	8.95 ha
Development Site Area	2.0 ha
Site Address	Lot 1 DP 662920 of 52 Cabbage Tree Road, Bayview.
Existing Site Development	Bayview Golf Course.
Aspect	South.
Typical slopes	Slopes at 10 – 15 % to the south west. Site elevation varies from 4 mAHD in the south west to 38 mAHD in the site's north east.
Vegetation	Golf course consisting of grass, trees and shrubs.
Neighbouring Environment	Cabbage Tree Road to the south and residential properties and bushland to the north, east and west.
Local Government Area (LGA)	Pittwater Council
Drainage	The site and development site generally drain south into either: 1. A constructed drainage channel that runs along the western and south western boundary of the golfcourse and then parallel with and under Cabbage Tree Road; or 2. A culvert located in the south eastern corner directing flow under cabbage tree road. Both routes direct runoff into golfcourse irrigation dams located south of Cabbage Tree Road.

2.2 Proposed Development

We understand that the proposed development is the construction of a seniors living development which will occupy a portion of the existing Bayview Golf Course, north of Cabbage Tree Road. The development is envisaged to consist of the following elements:

1. 114 senior living units.
2. Internal access driveway with street access from Cabbage Tree Road.
3. Facilities including meeting and administration rooms, business centre, restaurant and catering, library, bar, fitness centre, indoor pool and cinema.
4. Basement car park.
5. Landscaping.

3 Existing Flood Conditions

3.1 Overview

The following sections outline existing flood conditions at the site and within the 'development site' based on available information in Council's various flood studies provided by Council's Floodplain Management team.

3.2 Mainstream 1% AEP Flooding Conditions

Based on DHI (2002) and flood mapping provided by Pittwater Council (Figure 2, Attachment A) the proposed 'development site' is not affected by mainstream flooding.

Areas of the site to the south of Cabbage Tree Road, the neighbouring south western lot (Lot 1 DP 19161 – also golf course) and parts of Cabbage Tree Road to the south west and south east of the development site are affected by mainstream flooding of the Cahill Creek catchment.

3.3 Overland Flow 1% AEP Flooding Conditions

Based on DHI (2002) and flood mapping provided by Pittwater Council (Figure 2, Attachment A) the proposed development site is not affected by 1% AEP flooding from overland flow.

A small portion of the north western corner of the site and the western neighbouring Lot 1 DP 19161 are impacted by the 'major overland flow extent' which is defined in Appendix 8 of Pittwater 21 DCP (2003) as land that has a 1% AEP peak flood depth of greater than 0.3m.

3.4 PMF Flooding Conditions

As shown in Figure 3 the south eastern portion of the 'development site' is impacted by the PMF. From review of Council's stormwater drainage map, it appears that this flooding is localised and likely being caused by a backup from the single culvert in the site's south eastern corner that directs flow under Cabbage Tree Road and overland flow from the residential properties adjacent and upslope of the north eastern boundary (Figure 3). Based on the concept development layout (Figure 1), buildings in the south eastern portion of the site and a portion of the access driveway are within mapped PMF extents.

Council have indicated (M Schwecke, June 4, 2014) that the PMF level on the site, north of Cabbage Tree Road (and hence the development site) is 12.4 mAHD.

3.5 Flood Category

Council have indicated (M Schwecke, June 4, 2014) that the areas of the site north of Cabbage Tree Road, including the development site, is categorised as Flood Category 3 being that located outside or adjacent to the primary floodplain area that is affected by flooding hazards associated with major stormwater drainage systems, local overland flow paths or drainage easements. Flood Category 3 sites are further separated by Council into 2 subcategories based on overland flow flooding conditions (Section 3.3). The site is classed as *Category 3 – Overland Flow Path Major*.

Section 4 outlines Council requirements based on this flood category.

3.6 Flood Hazard

According to Council's mapping (Figure 4, Attachment A) the site is classified as having a high flood hazard – affected by FPL (Section 3.7) and PMF (Section 3.4).

Appendix 8 of DCP 21 defines high hazard sites as those where *some part of the site* is subject to high flood hazard (based on flood depth and velocity) in a 1% AEP flood. Council also note that there is a possible danger to personal safety, able-bodied adults would have difficulty wading and there is potential for significant structural damage.

Based on mapped 1% AEP flood extents (Figure 2) it is likely that high hazard areas are restricted to areas of the site south of Cabbage Tree Road which are impacted by 1% AEP flooding. As these areas are defined by the same lot descriptors, the hazard category applies to the whole site area (which includes the development site).

3.7 Flood Planning Level (FPL)

As shown in Figure 4, the high hazard classification of the site indicates the site is affected by an FPL. Appendix 8 of DCP 21 notes that Flood Category 3 – Overland Major sites require a 5m horizontal buffer (to the 1% AEP flood extent) and a minimum floor level to be no less than 500mm above the 1% AEP plus the 5m horizontal buffer.

Council have indicated (M Schwecke, June 4, 2014) that the FPL for the site north of Cabbage Tree Road is 10.9 mAHD, however given the

nature of the development (seniors living) the minimum floor level is to be no less than the PMF (Section 4.1).

It is noted that FPL requirements are based on flooding conditions for the entire site. The development site is currently flood free in the 1% AEP and only partially inundated in the south eastern corner in the PMF (Attachment B). It is likely PMF extents can be reduced at DA stage with provision of specific site flood modelling and implementation of engineered solutions (culvert design, flow diversion, etc.) if this is required. Outcomes of this are likely to result in the site being flood free and change FPL requirements.

3.8 Climate Change Impacts

Cardno (2013) investigated the impacts of climate change on flooding within the Pittwater LGA.

Based on a modelling scenario of 0.9m sea level rise and a 30% increase in rainfall intensity, Cardno mapping (Figure 5) suggests 1% AEP peak flood levels in the vicinity of the site will generally increase by 0.05 – 0.20m. The development area remains flood free.

3.9 Summary

Table 2 provides a summary of Council advice on site flood conditions and observed development site conditions based on Council flood mapping.

Table 2: Development site flood conditions summary.

Flood Element	Site Conditions[1]	Development Area Conditions[2]
1% AEP level (mAHD)	Not affected.	Not affected.
PMF level (mAHD)	12.4	Localised impacts in south east, likely to be resolved through additional flood modelling and engineered solutions.
FPL (mAHD)	10.9	For a Seniors Living development FPL = PMF level.
Flood Category	Category 3 – Overland Flow Path Major.	Category 3 – Overland Flow Path Major [3]
Flood Hazard	High hazard.	High hazard.[3]
1% AEP Climate Change Impacts	Not affected.	Not affected.

Note:

[1] Site conditions based on Council advice.

[2] Development site conditions inferred from flood mapping and site survey (Attachment B).

[3] These conditions are likely to change at DA stage through specific site modelling.

4 Preliminary Flooding Requirements

4.1 Flood Development Controls

As the development site is categorised as Flood Category 3 – Overland Major, the proposed developed must comply with Section B3.22 of DCP 21 (2003).

Under this section, the relevant design and construction requirement are:

- Development shall ensure no additional adverse impacts on surrounding properties.
- A Flood Risk Management Report be provided to Council at DA stage.
- Special Flood Protection developments (including seniors living development) must have minimum floor levels no less than the PMF level.
- Enclosed garage and carpark floor levels shall not be less than the FPL.
- Covered basement carparking shall have all entry points at the FPL.
- Open carparking areas shall be at or above the FPL.
- All foundation structures within the area affected by the FPL are to incorporate a suspended floor system on open pier/pile footings with openings in perimeter walls to allow for the flow of surface water and flood storage up to the 1 % AEP flood.
- All structural elements below the FPL must be constructed from flood compatible material.
- Any structures relied on for 'shelter-in-place' refuge shall ensure structural integrity to the PMF level.
- All electrical equipment, wiring, fuel lines and service pipes and connections must be waterproofed to no less than the FPL.
- Storage of toxic or potentially polluting goods, materials or other products is not permitted below the FPL.

4.2 Flood Risk Management Report

Given the site is identified on Council's flood hazard maps (Figure 3), a Flood Risk Management Report (FRMR) is required to support the development application. It shall be prepared in accordance with Appendix 8 of DCP 21 *Flood Risk Management Policy for Development in Pittwater* and include:

- Adequate qualitative and quantitative detail addressing site flood information.
- Suitable engineering design to render the site free from flooding impacts while not impacting on adjoining properties.
- Management of flood risk.
- Emergency Response.

4.3 Climate Change Requirements

An assessment of climate change is required as part of the FRMR in accordance with Section B3.23 of DCP 21. This assessment is required to consider both the impacts of sea level rise, and the impacts of sea level rise combined with increased rainfall volume.

5 Preliminary Site Flood Evacuation Plan

5.1 Preliminary Flood Evacuation Plan

According to Council mapping (Figure 2 and Figure 3), there is no flood free access to or from the site via Cabbage Tree Road (to the east or west) in the 1% AEP or PMF flood event. Given the nature of the proposed development and the high hazard classification, we see options for flood response and evacuation includes: shelter-in-place refuge and evacuation north.

5.1.1 Shelter in Place Refuge

In the event of a 1% AEP or greater flood, people onsite shall shelter in place until such time where it is deemed safe to evacuate (i.e. as instructed by local SES, police, other authority). This is considered the most appropriate flood evacuation option as:

- The site is not inundated by the 1% AEP flood.
- Only a small portion of the site's south eastern corner is inundated by the PMF.
- DCP 21 development controls require:
  - Habitable floor levels to be at the PMF level for seniors living development.
  - Structures to be built with flood compatible materials to a level no less than the FPL.
  - Shelter in place building(s) to have structural integrity to the PMF level.
- The high flood hazard category suggests able-bodied adults would have difficulty wading in flood waters. Areas impacted by flooding should therefore be avoided.
- Typically a seniors living development would have provisions onsite (food, water, medical supplies *etc.*) to sustain residents onsite until flood waters recede.

5.1.2 Evacuation North

Should people remain onsite when flood waters reach the 1% AEP level and access via Cabbage Tree Road is no longer available, site

evacuation could (if required) be undertaken to the north where golf course elevations exceed 35 mAHD. Figure 2 and Figure 3 indicate this area and adjoining Nangana Road (Figure 3) are flood free up to and including the PMF. Evacuation via this option has the benefit of enabling people to leave the site and access transport via Nangana Road.

6 References

Cardno (2013) *Pittwater Overland Flow Mapping and Flood Study*

DHI Water and Environment (2002) *Mona Vale – Bayview Flood Study*

Pittwater Council (2003) Pittwater 21 DCP

7 Attachment A – Figures

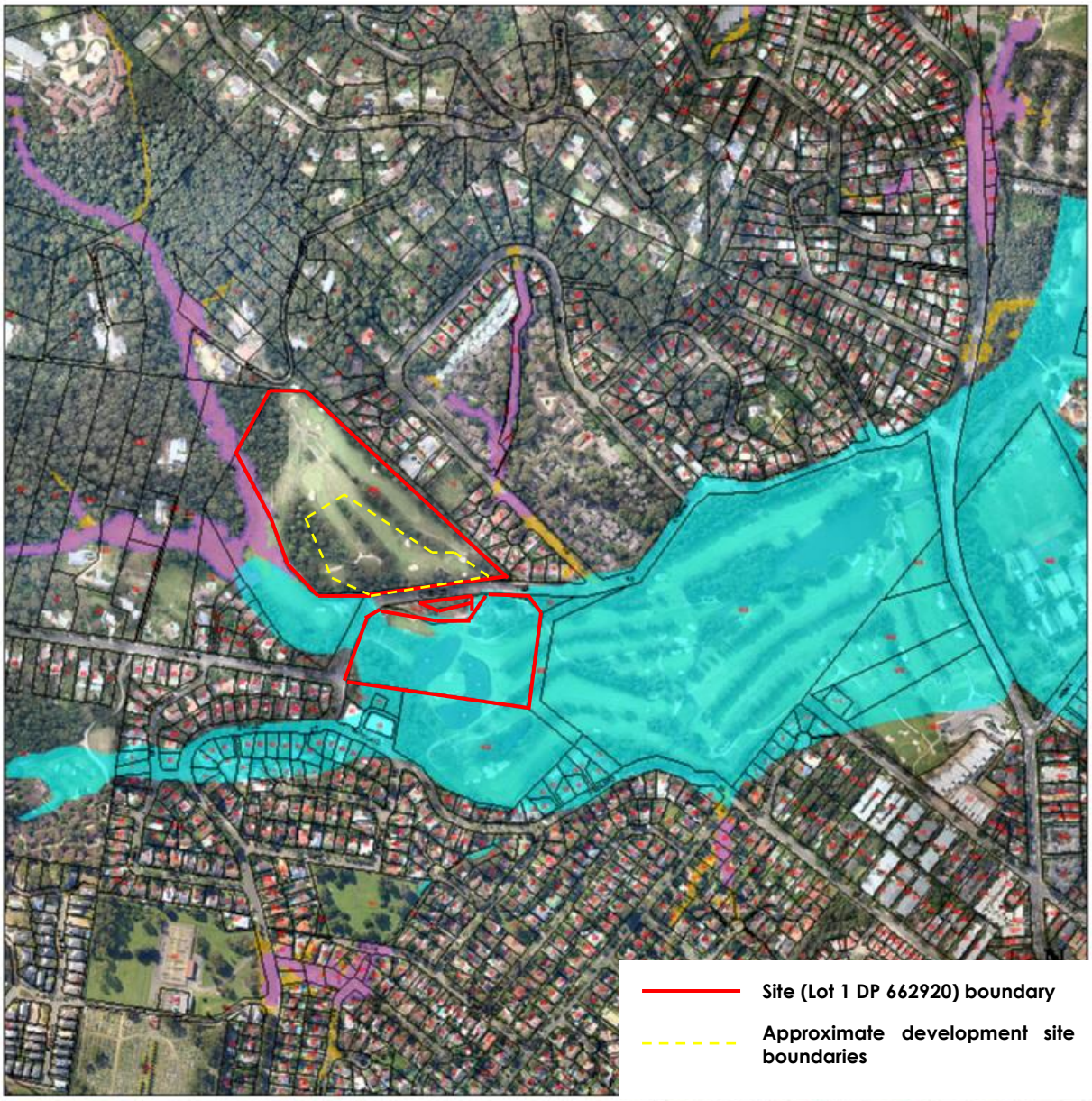
N

Site Boundary — Development Site

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Site Location and Preliminary Development Site Layout** Source: Nearmaps (above), Marchese Partners (below)	Figure 1
Approved:	GT		
Date:	24.06.2014		
Scale:	NA		Job No: P1404179

Pittwater Flood Extent Map

Bayview Golf Course



Major Overland Flow Path extent

Minor Overland Flow Path extent*

Mainstream Flood Planning Level extent

Notes:
1. Overland Flow Mapping adopted November 2013
2. * extent represents the 1% annual Exceedance Probability (AEP) flood event
3. Overland Flow Path Major includes a fixed 5m horizontal planning buffer on the 1% AEP extent for planning purposes
4. Mainstream FPL – Mainstream Flood Planning Level includes the 0.5m freeboard on the 1% AEP extent for planning purposes
5. Cadastre Lines, flood extents, aerials and pit and pipes locations are indicative only

Not to Scale
Printed 2014

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Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Flood Extents Mapping – 1% AEP** Source: Pittwater Council	Figure 2
Approved:	GT		
Date:	04.06.2014		
Scale:	NA		Job No: P1404179

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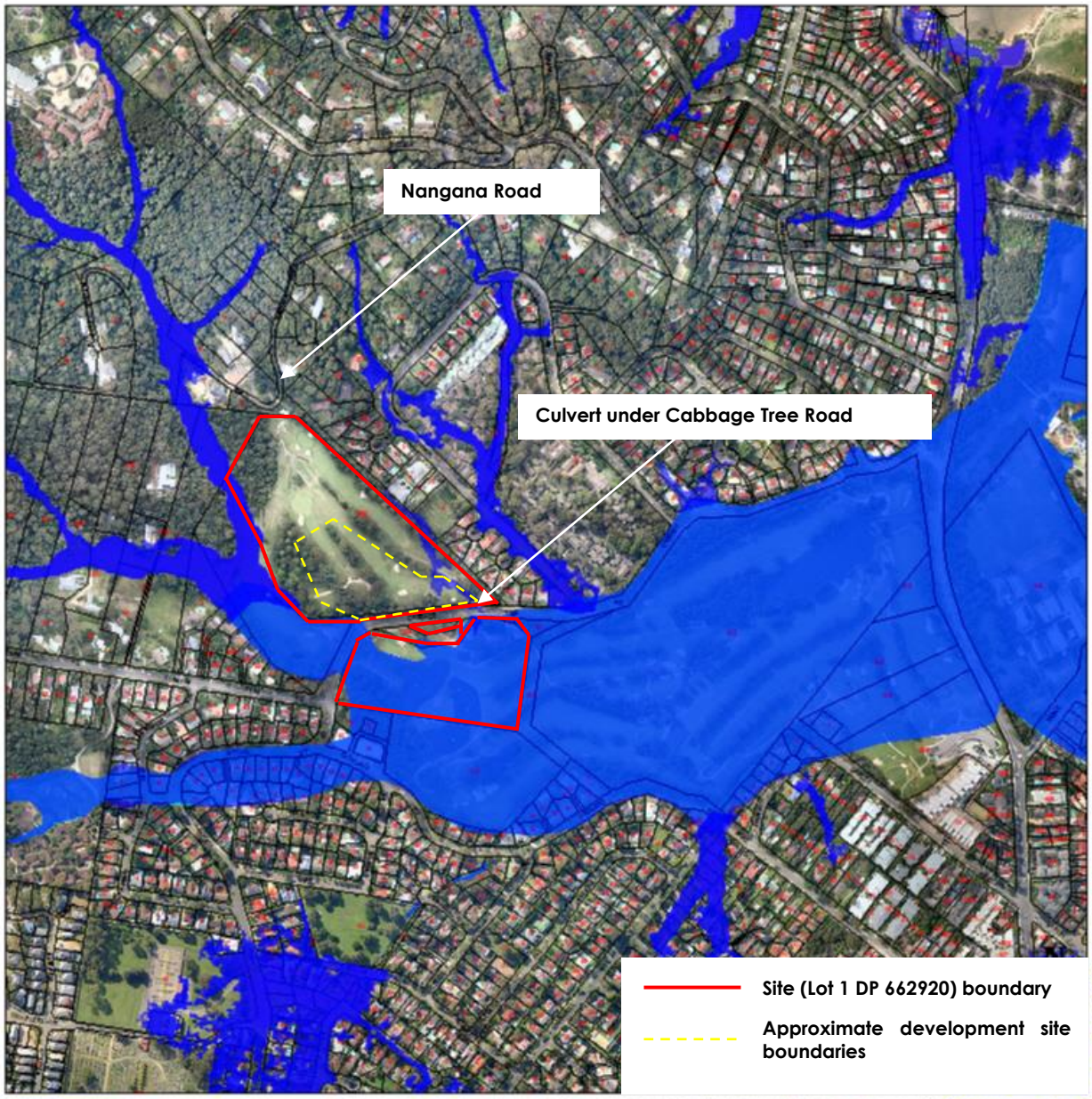
Pittwater Flood Extent Map

Bayview Golf Course



Major Overland Flow Path extent

Minor Overland Flow Path extent*

Mainstream Flood Planning Level extent

Probable Maximum Flood extent

Notes:
1. Overland Flow Mapping adopted November 2013
2. * extent represents the 1% annual Exceedance Probability (AEP) flood event
3. Overland Flow Path Major includes a fixed 5m horizontal planning buffer on the 1% AEP extent for planning purposes
4. Mainstream FPL – Mainstream Flood Planning Level includes the 0.5m freeboard on the 1% AEP extent for planning purposes
5. Cadastre Lines, flood extents, aerials and pit and pipes locations are indicative only

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Drawn:	MLK	**Flood Extents Mapping - PMF** Source: Pittwater Council	Figure 3
Approved:	GT		
Date:	04.06.2014		
Scale:	NA		Job No: P1404179

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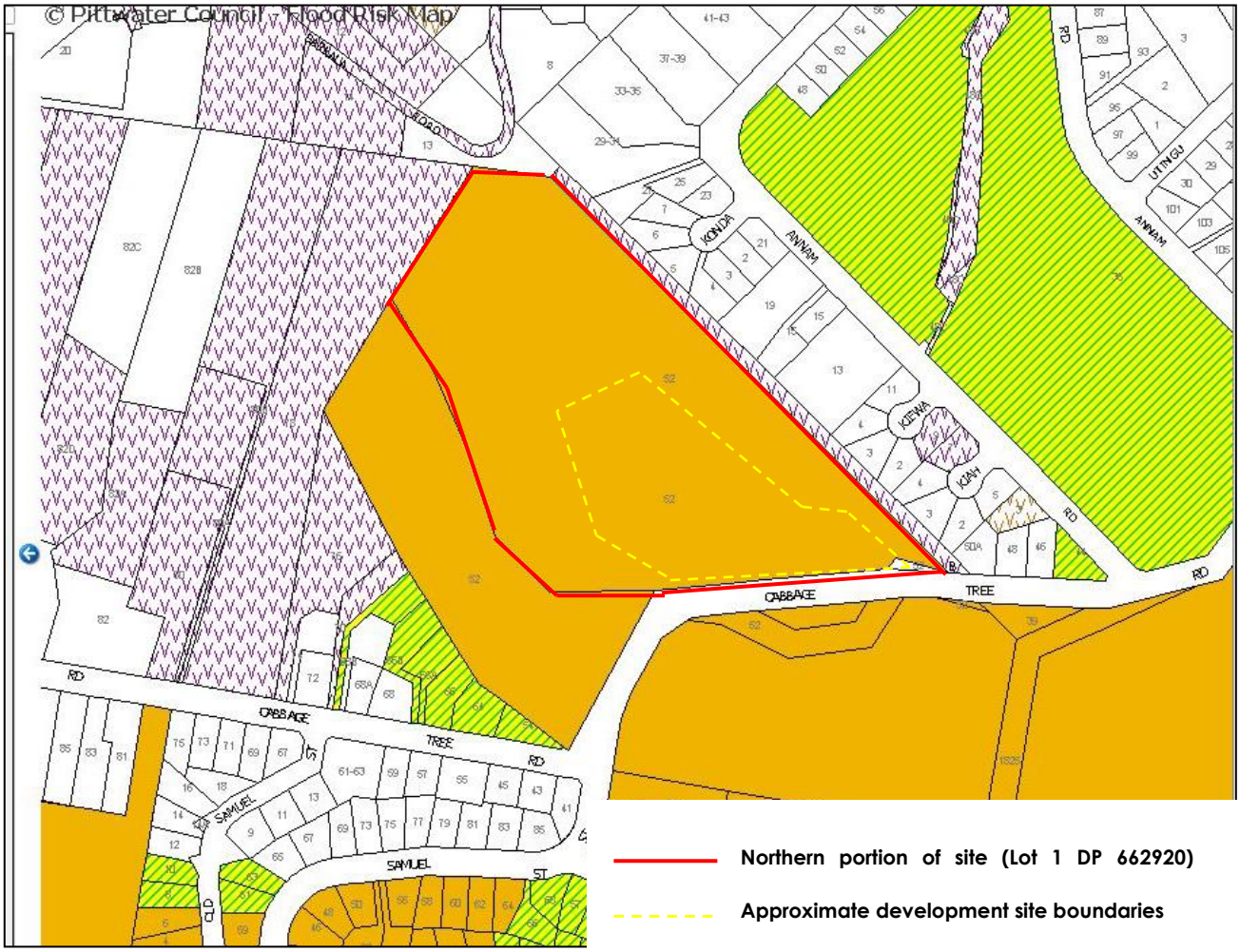
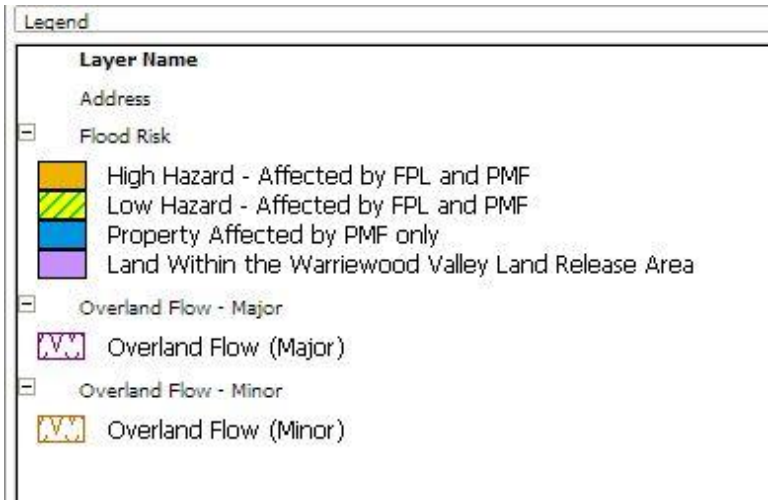
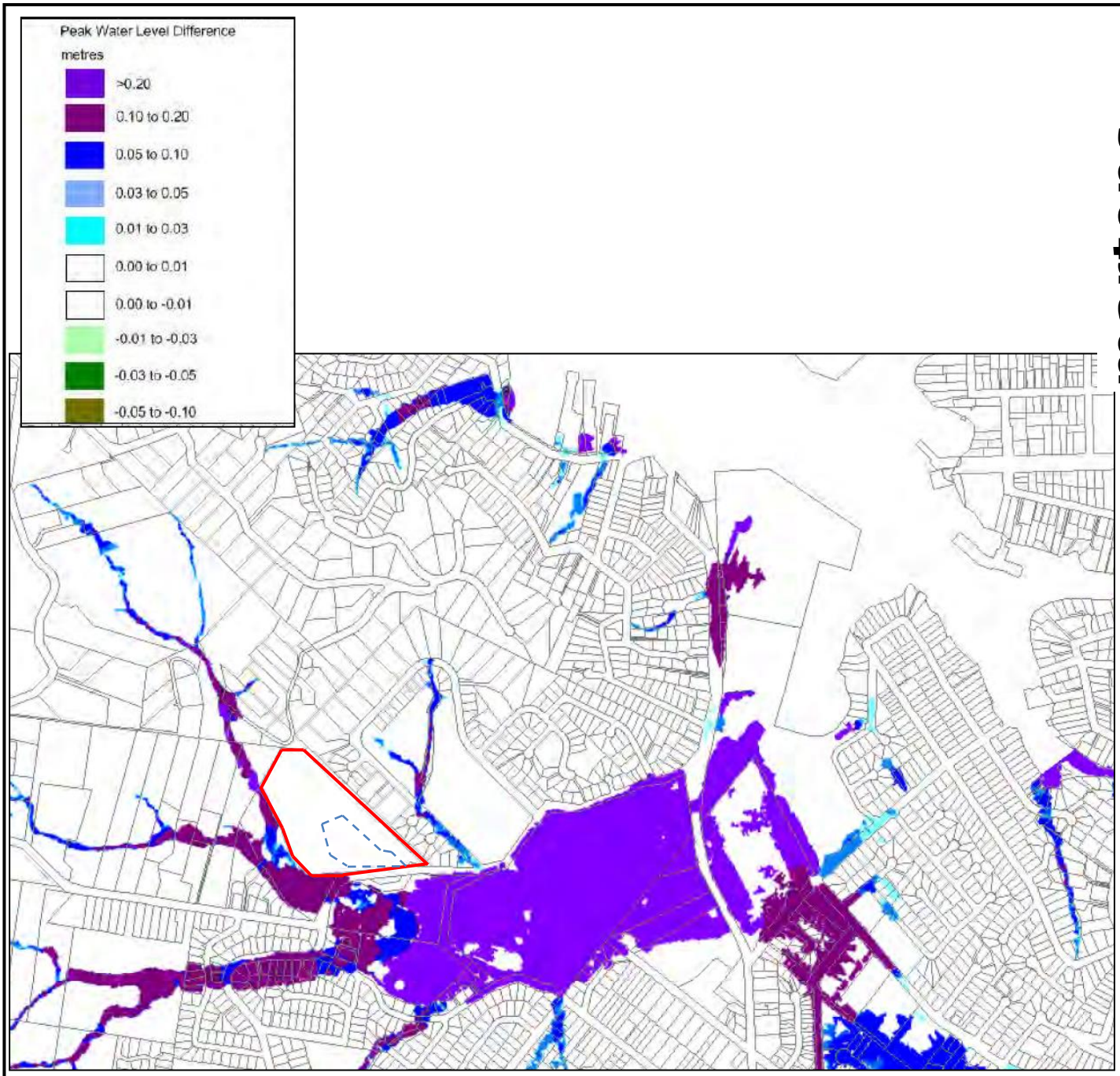




Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Flood Prone Land Mapping** Source: Pittwater Council	Figure 4
Approved:	GT		
Date:	04.06.2014		
Scale:	NA		Job No: P1404179



Northern portion of site (Lot 1 DP 662920)

Approximate development site boundaries

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Mona Vale 1% AEP Water Level Impact – Climate Change** Source: Cardno (2013)	Figure 5
Approved:	GT		
Date:	04.06.2014		
Scale:	NA		Job No: P1404179

8 Attachment B – Flood Extents Mapping

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EXISTING CULVERT UNDER CABBAGE TREE ROAD LIKELY CAUSING PMF IMPACTS ON DEVELOPMENT SITE

CABBAGE TREE RD

MAINT. TRACK

KEY

- SITE BOUNDARY
- WATERCOURSE (BASED ON SITE INSPECTION)
- CONSTRUCTED CHANNEL (BASED ON SITE INSPECTION)
- DEVELOPMENT AREA
- 1% AEP FLOOD EXTENTS (BASED ON PITTWATER COUNCIL MAPPING 2013)
- PMF EXTENTS (BASED ON PITTWATER COUNCIL MAPPING 2013)

N W E S

0 20 40 60 80 100

UNITS - METRES

Martens & Associates Pty Ltd ABN 85 070 240 890		Environment | Water | Wastewater | Geotechnical | Civil | Management		
Drawn:	MLK	DEVELOPMENT SITE FLOOD CONDITIONS	Drawing No./ID: SK002	
Approved:	GT			
Date:	24.06.2014			
Scale @A3:	1:2000	6/37 Leighton Place, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767 Email: mail@martens.com.au Internet: http://www.martens.com.au	Project: P1404179	File: JD02V02 Revision: A

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