FLOOD STUDY REPORT

FOR

A PROPOSED DEVELOPMENT

18 Alexander Street, Collaroy

February 2020

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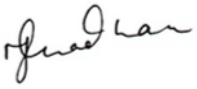
Report Description

Report Name	**Flood Study Report for a Proposed Development**	
Address	**18 Alexander Street, Collaroy**	
Client	**Brendan Waights**	
Our Reference	**FSR1797-1**	
Prepared By	**Muna Pradhan** **Flood and Drainage Engineer** **MIE Aust, CPEng, NER**	

Revision History

Date	Version	Author	Comments
25.02.2019	V_0	MP	First Edition

Contents

List of Figures

1 Introduction

BMB Engineers was commissioned to prepare a flood study report in regard to the proposed development at 18 Alexander Street, Collaroy. In this study, the impacts on the existing flooding behaviour due to the proposed development have been assessed. The flood study report covers the followings analysis and assessments:

- Catchment hydrology analysis for 1% AEP storm event using DRAINS software;
- Analysis of overland flow for 1% AEP storm event using HEC RAS software;
- Analysis of overland flow for the pre and post development scenarios;
- Assessment of the flooding impacts due to the proposed development at the development site and vicinity;
- Estimation of depth, velocity and flood water level for 1% AEP storm events;
- Analysis of hydraulic hazard for 1% AEP storm event and carry out risk assessment;
- Preparation of flood extent map for pre and post development conditions;
- Recommendation of minimum finished floor level.

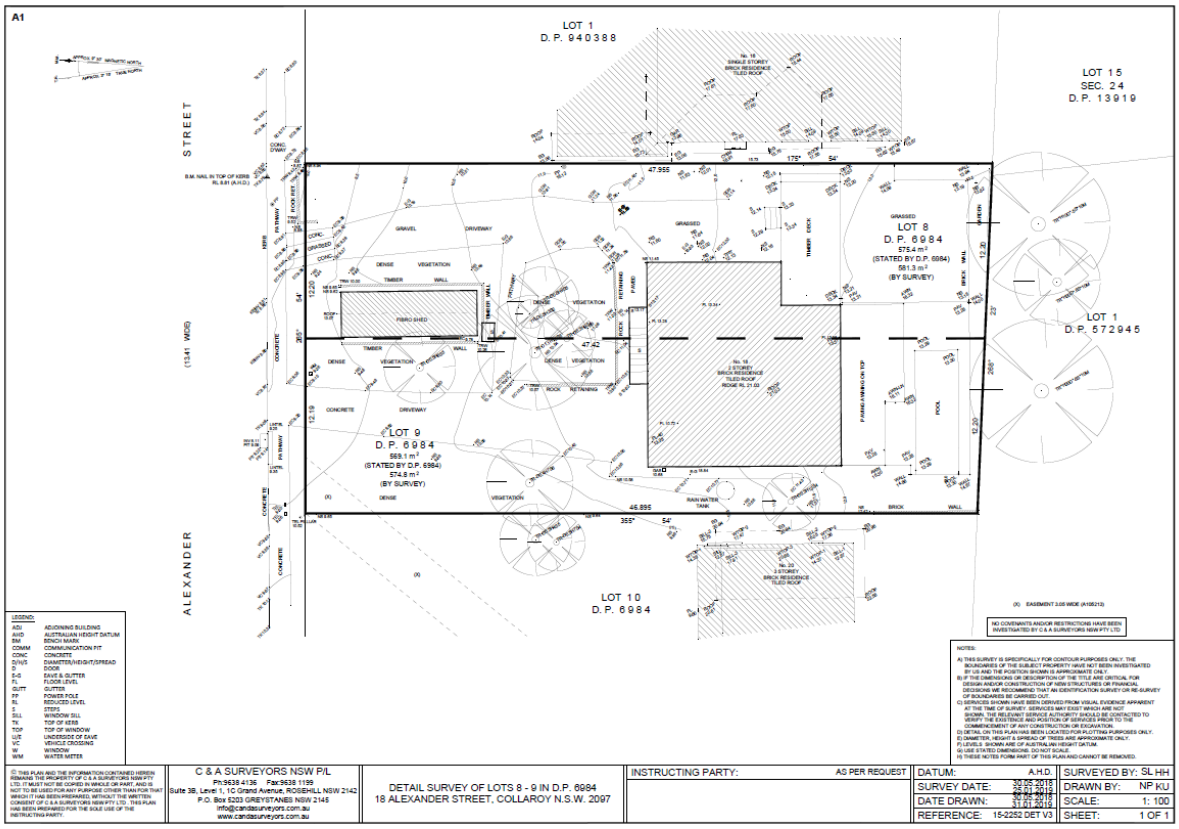
This report has been prepared to accompany a Development Application for the proposed development that will address Northern Beaches Council's requirements for a flood control lot. This report describes the existing characteristics of the area, proposed development and quantifies the impact of flooding due to the proposed development.

2 Site Description

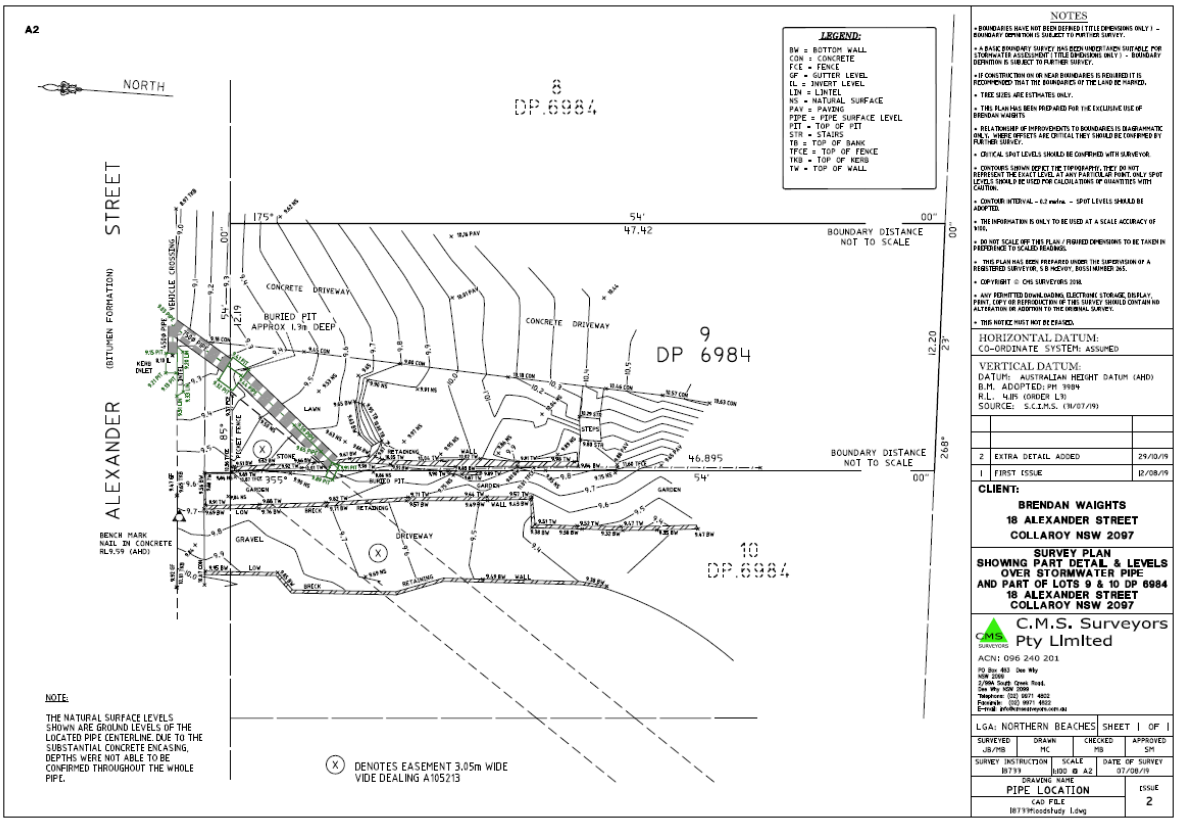
The site is located to the southern side of Alexander Street, near the junction of Pittwater Road and Alexander Street. A locality plan of the site is as shown in Figure 1 below.

Figure 1 Location of Site (Source: SIX Maps)

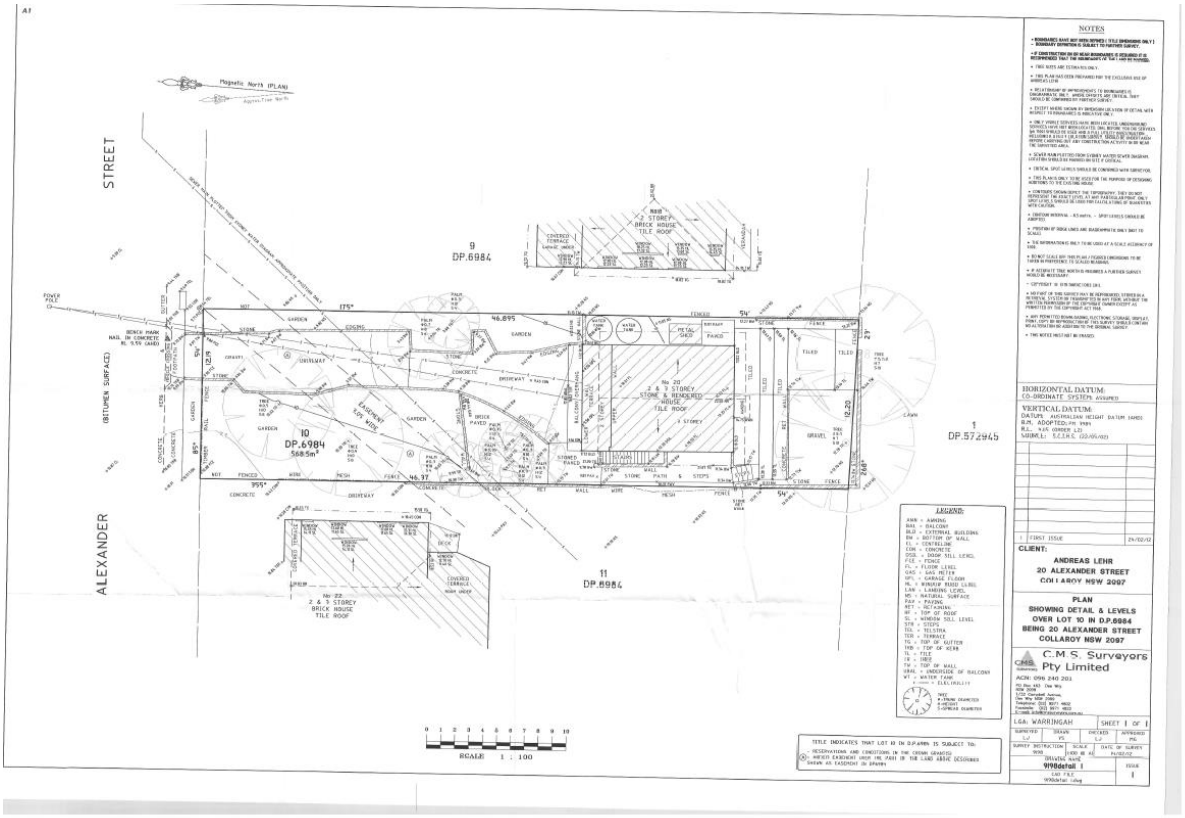
The site is currently developed with a double storey brick residence with tile roof, a shed, a swimming pool and a concrete driveway. The survey plan of the development site and its surroundings is as given in Figure 2. An easement to drain stormwater runs through the site around the north-west corner of the lot. The site slopes towards the front boundary. Few trees also exist around the site.



a) Development Site



b) Part of Development Site and 20 Alexander Street



c) 20 Alexander Street

Figure 2 Survey Plan at and around Development Site

3 Proposed Development

The proposed development comprises partial demolition of the existing structures, addition and alterations to the existing structures, construction of a new dwelling. The site plan of the proposed development is shown in Figure 3.

Figure 3 Proposed Development

4 Hydrological Analysis

4.1 Catchment Area

The most probable extent of the catchment area (Figure 4) contributing to the overland flow near the proposed development site has been estimated from the available LiDAR data. The area of catchment has been estimated to be approximately 7.55 ha.

Figure 4 Catchment Area of the Development Site (Image: Google Earth)

4.2 Rainfall Data and Design Flow

The rainfall data have been obtained from Intensity Frequency Duration Chart of the proposed development site provided by the Bureau of Meteorology. ILSAX model was used for hydrological modelling with multiple ARR2016 storm events for a range of storm duration ranging from 5 minutes to 3 hours. The impervious area for the catchment was estimated around 60%. DRAINS software was used to run the model and the most critical overland flow through the proposed development site for 1% AEP storm event was determined.

The results of the model show that the most severe storm duration the catchment is 15 minutes for 1% AEP storm event. The relevant hydrograph is shown in Figure 5.

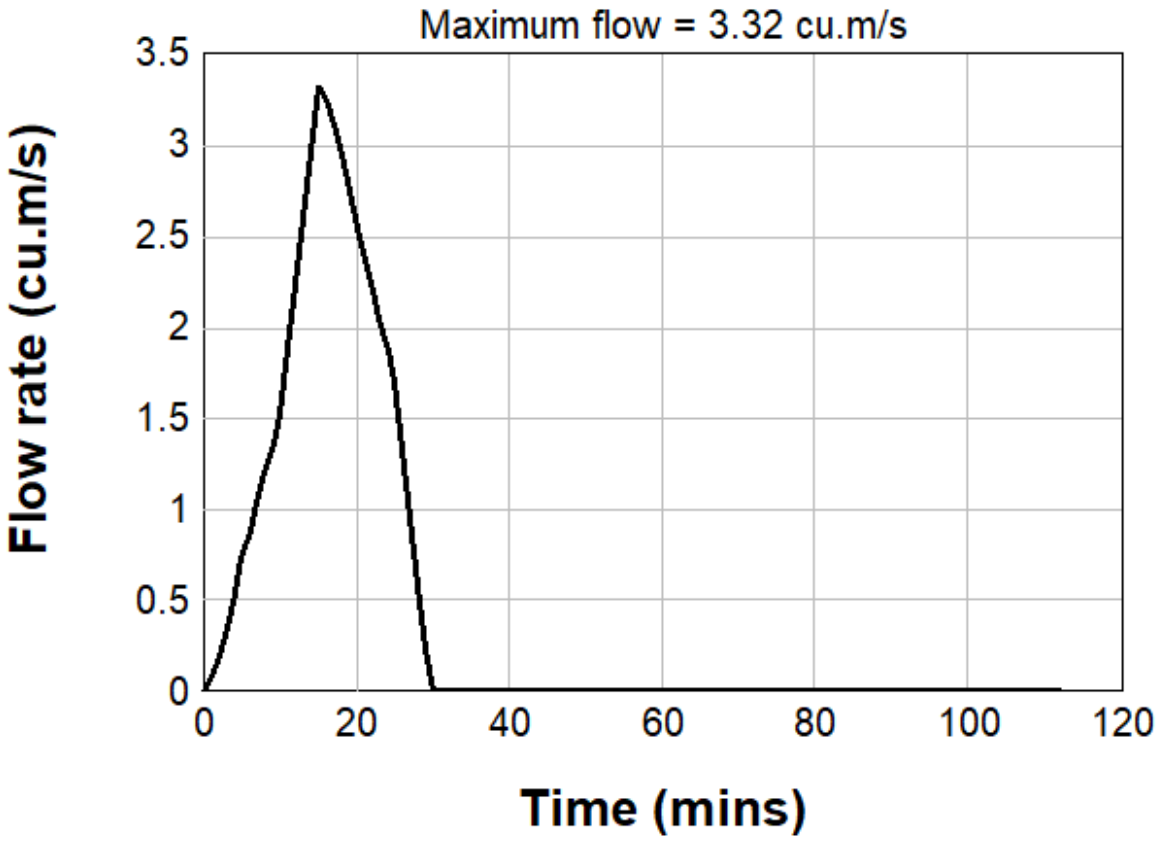


Figure 5 Hydrograph (1%AEP)

5 Hydraulic Modelling and Analysis

5.1 Pipe Capacity and Overland Flow

A stormwater pipe of diameter 750 mm is running through the development site. The Invert level of the pipe is not available. It has been assumed that the slope of the pipe is same as the existing ground which is about 5%. The full pipe capacity has been estimated as 2.48 m^3/s. To be on safe side, only 50% of the pipe capacity has been considered in this study. The hydrograph was adjusted accordingly.

5.2 Overland Flow Model

A 1.0 m Digital Elevation Model has been used to develop a terrain model of the study area. The terrain model within the development site and surroundings has been updated (Figure 6) using the survey plan of the site and surroundings.

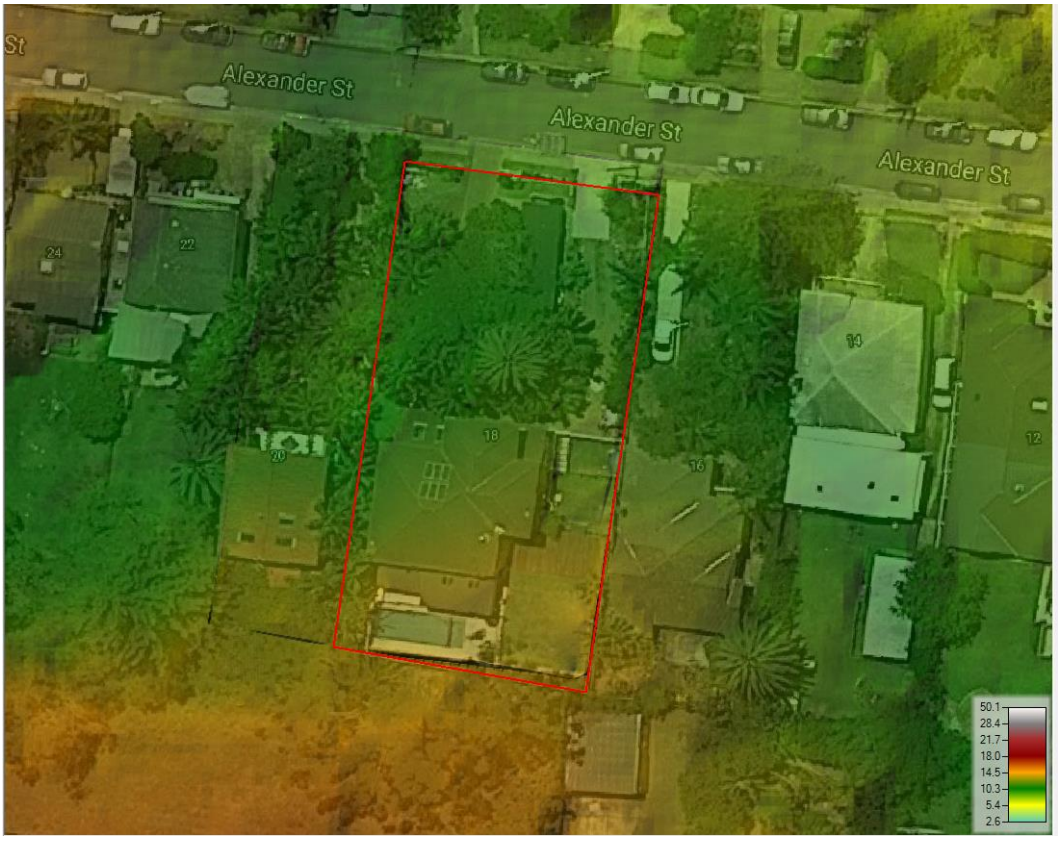


Figure 6 Existing Terrain Model around the Study Area

The area defined as a 2D flow area in the HEC RAS model has been generated into 2m grids. The downstream boundary of the 2D flow area has been assigned as a normal depth. The flood hydrograph from the upstream catchments have been assigned as inflow along the upstream boundary of the 2D flow area in the hydraulic model. Manning's roughness coefficient has been chosen as 0.05 for the general urban environment, 0.015 for road, and 0.025 for other hard surfaces. The obstructions caused by the existing buildings within the flow area have been taken into account on the model. As per council's advice, existing retaining walls at the site and neighbouring property has also been taken into account.

5.3 Model Results for Existing Condition

Figure 7 to 9 present the flood extent map, depth and velocity of the overland flow for the existing condition in 1% AEP storm event. This result shows that the development site is affected by the overland flooding in 1% AEP storm around the north-west corner. The estimated 1% AEP flood level within the development site varies from 9.25 m to 10.07 m AHD.

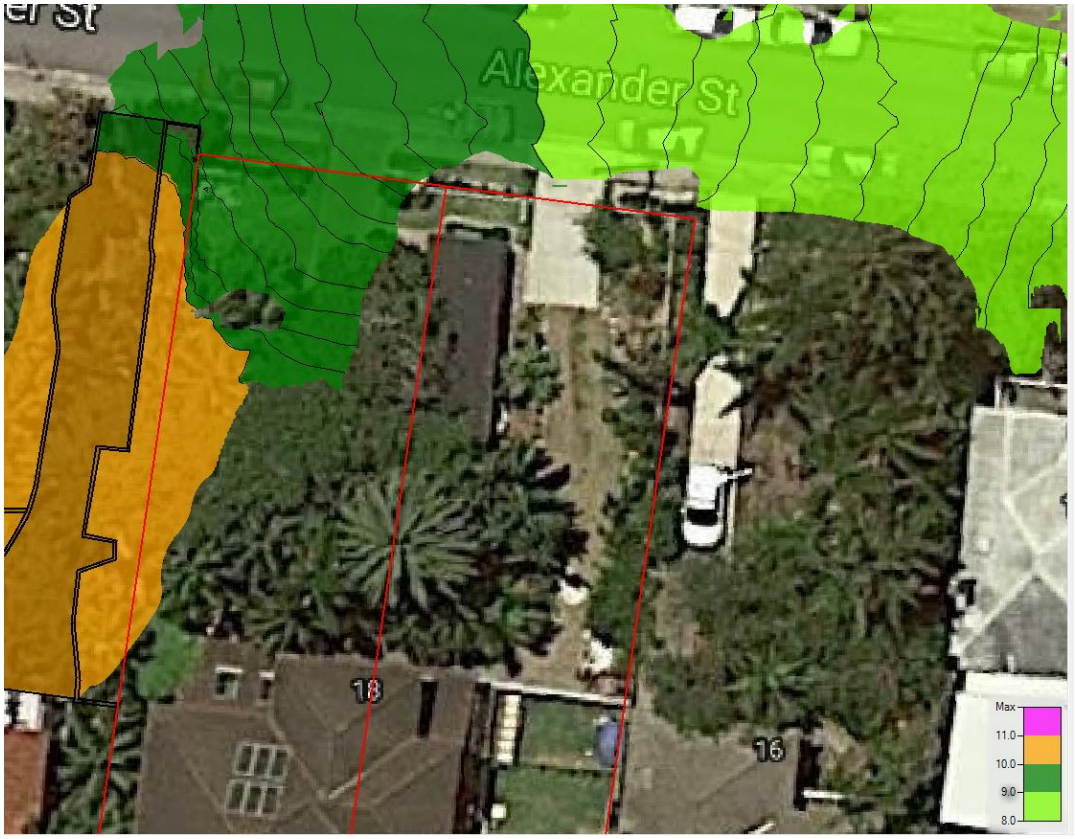


Figure 7 Flood Extent Map for Existing Condition in 1% AEP Storm

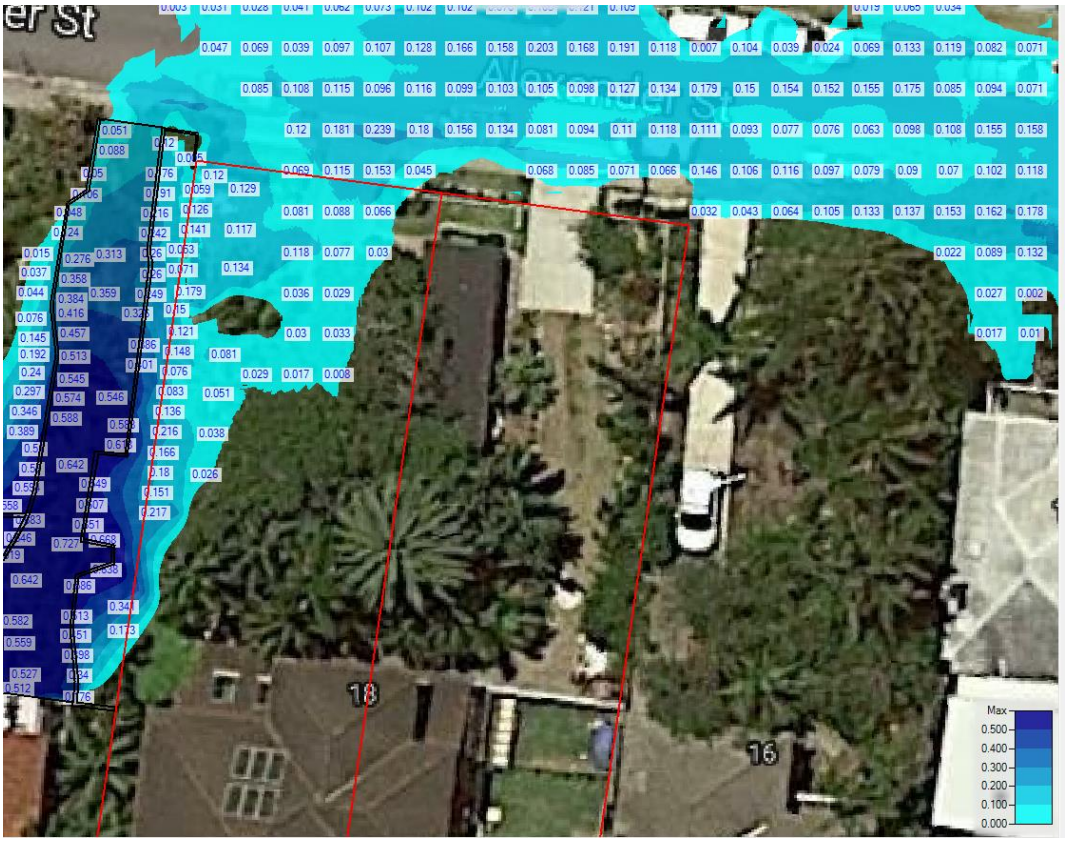


Figure 8 Flood Depth for Existing Condition in 1% AEP Storm

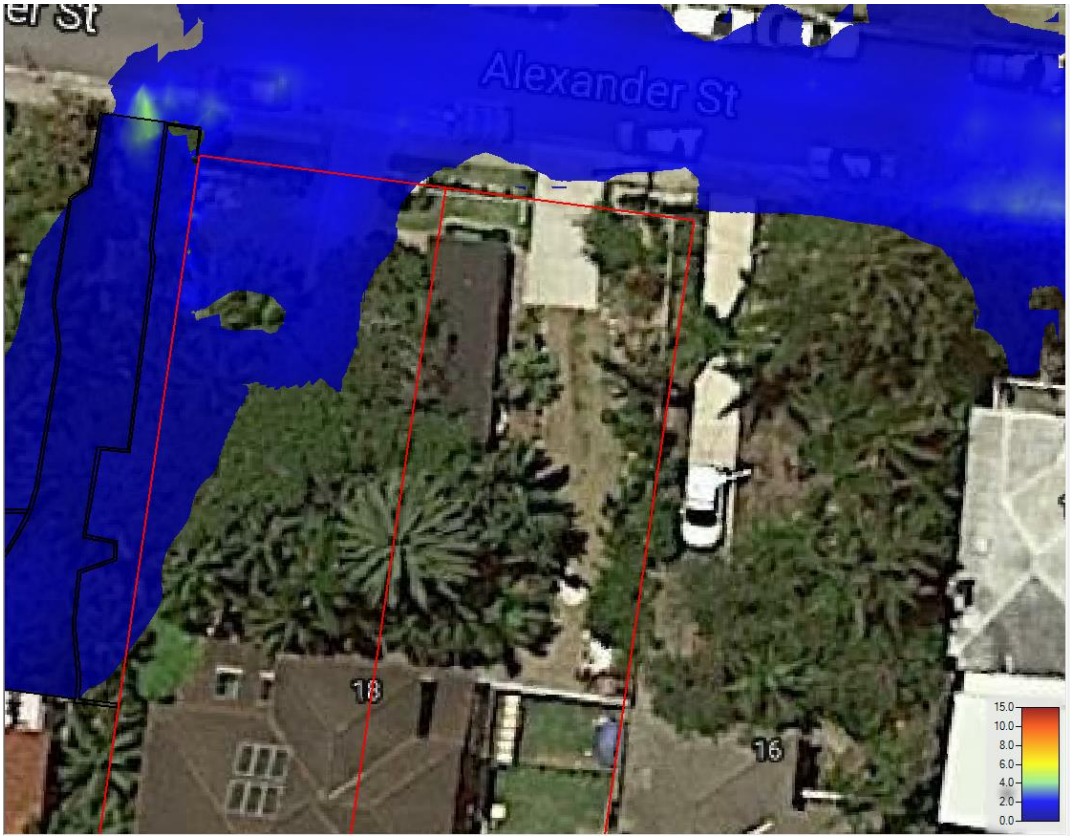


Figure 9 Flood Velocity for Existing Condition in 1% AEP Storm

5.4 Model Results for Developed Condition

In order to assess the impact of flooding in the development site, a model for the developed condition was created. The obstructions caused by the existing structures (to be demolished) were removed and obstructions due to the new development were introduced.

Figure 10 to 12 present the flood extent map, depth and velocity of the overland flow for the developed condition in 1% AEP storm event. The maximum depth of the 1% AEP flood and velocity around the proposed under-croft carport is mostly around 0.1 m and 0.9 m/s respectively.

This model result shows that there will not be significant impact on the existing flood level around the proposed development in post development scenario.

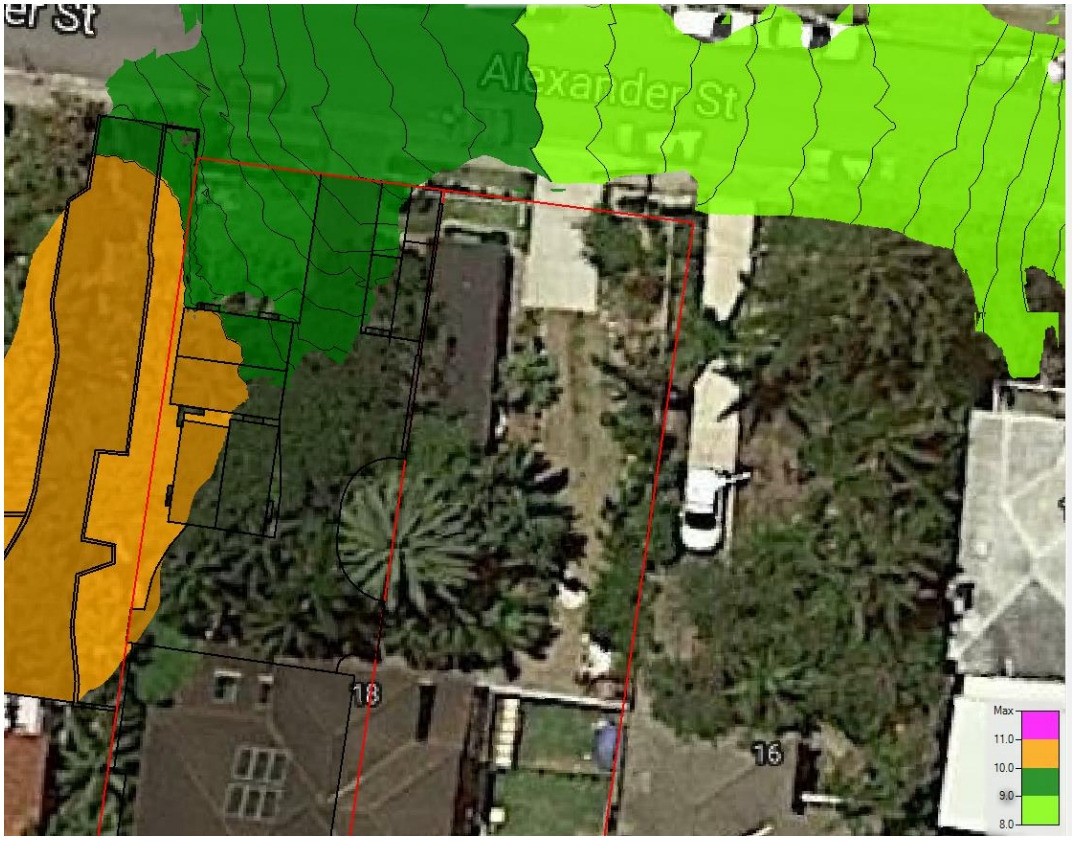


Figure 10 Flood Extent Map for Developed Condition in 1% AEP Storm

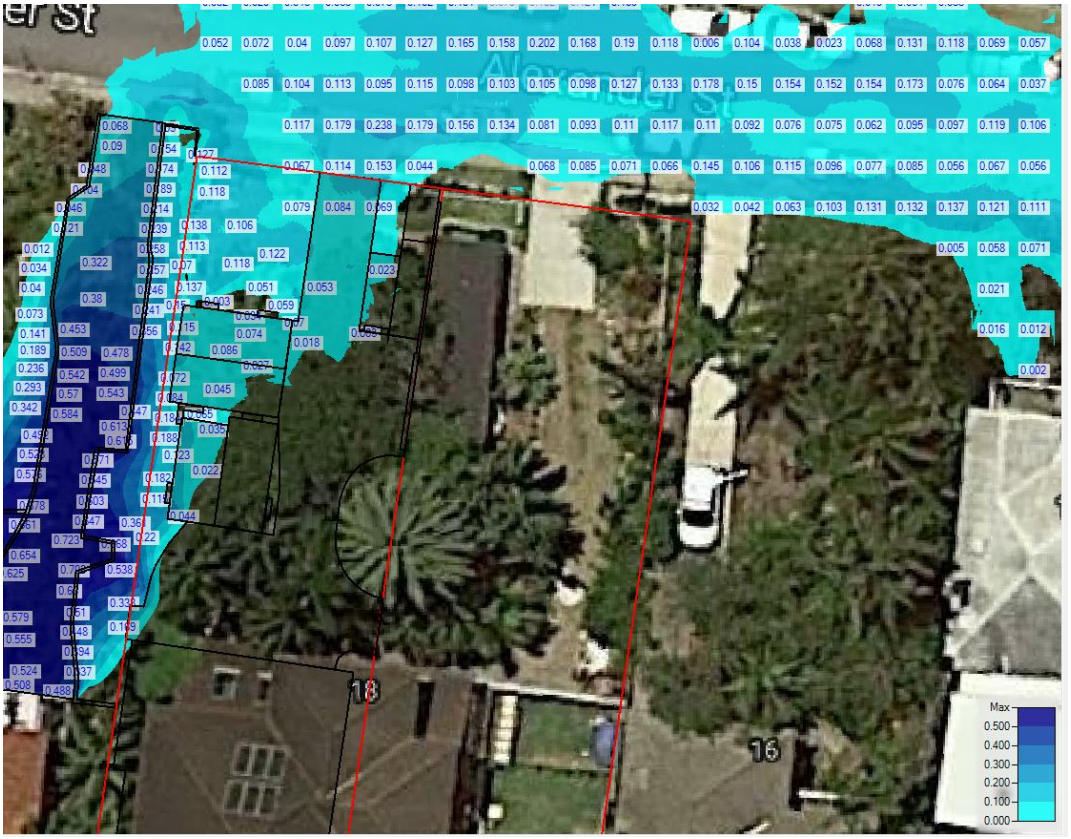


Figure 11 Flood Depth for Developed Condition in 1% AEP Storm

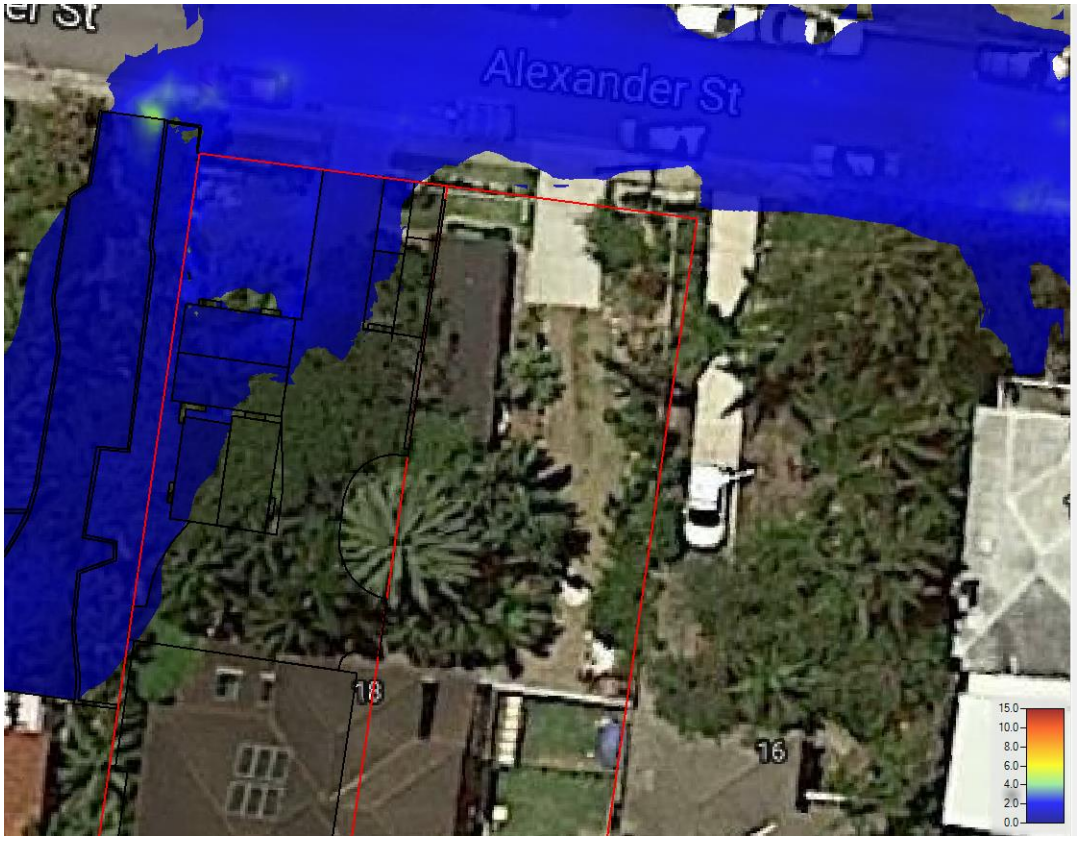


Figure 12 Flood Velocity for Developed Condition in 1% AEP Storm

5.5 Comparison of Results for Pre and Post-Development Condition

Comparison of results in pre and post development condition is shown in Figure 13. This figure shows that there is not a significant impact in the flood extent in the post development scenario around the proposed development.

Figure 13 Comparison of Flood Extent in Pre and Post-Development Condition

5.6 Flood Hazard Category

Flood hazard category is a function of flood depth and flow velocity. A method specified in NSW Government Floodplain Development Manual 2005 has been used to determine the hydraulic hazard category of the development site. According to this manual, relationship between the depth of flood and velocity for the provisional hydraulic hazard category is as shown in Figure 14.

The velocity depth product map is shown in Figure 15. This result shows that the site is located in low hydraulic hazard.

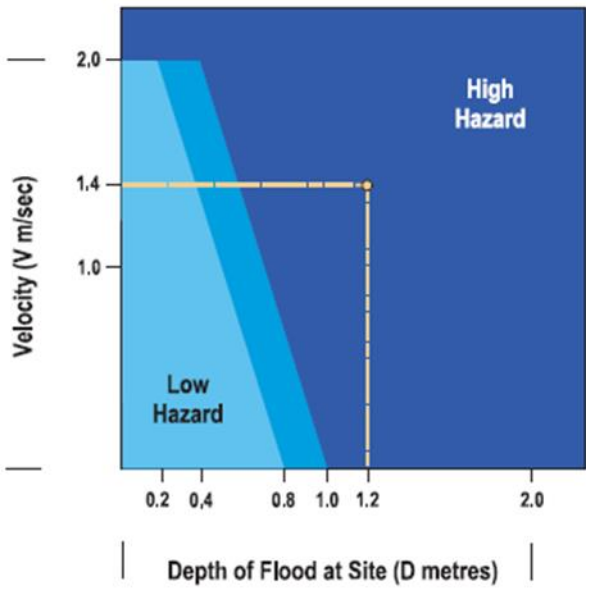


Figure 14 Provisional Hazard Category

Figure 15 Velocity Depth Product Map

6 Development Control

The proposed redevelopment has been assessed against the requirements of Warringah Development Control Plan 2011 for flood control lot. The assessments for flood controls are presented below.

6.1 Flood Effects caused by Development

The part of the proposed development subjected to the 1% AEP flood extent is only the under-croft area in the western lot. The front part of the proposed dwelling (within 1% AEP flood extent area) shall be supported on piers/columns. The flood storage replaced by the columns can be considered negligible. Model result has shown that there will not be any significant flooding impact due to the proposed development.

6.2 Building Components and Structural Soundness

All structures will be constructed with flood compatible building materials up to 10.55 m AHD (0.5m + 1% AEP flood level) for the front dwelling of western lot (within 1% AEP flood extent area). Structures shall be designed and constructed in order to ensure structural integrity up 10.55 m AHD. Structural certification shall be provided confirming that the structure can withstand the forces of floodwater debris, wave action, buoyancy and immersion up to 10.55 m AHD.

6.3 Storage of Goods

No hazardous or potentially polluting materials are likely being stored below the Flood Planning Level. Highly water susceptible goods, materials and other products will be located above the Flood Planning Level.

6.4 Flood Emergency Response

Evacuation will not be required for the proposed development up to 1% AEP storm. In larger storms, staying inside the home seems relatively a safer option for wide ranges of flooding events.

6.5 Floor Levels

The maximum flood level around front part of the dwelling in the western lot is 10.05 m AHD. The minimum habitable floor level is to be 10.55 m AHD or higher. The proposed habitable floor level is compliance with this requirement.

7 Conclusions& Recommendations

The impact of proposed development at the subject site on the existing flooding characteristics has been considered in this study.

This study has shown that some part of the overland flooding from upstream catchment enters the site via western boundary around the north-west corner, and leaves the site via northern/front boundary. The existing driveway on the western lot is located within 1% AEP overland flooding.

Only some front part of the proposed dwelling on the western lot is affected by the overland flooding, which is located within low hydraulic hazard and in medium flood risk precinct.

The maximum depth of the 1% AEP floodwater within the proposed under-croft carport is mostly within 0.20 m and the maximum velocity is 0.9 m/s. Therefore, there is not any significant risk of floating the car within the proposed under-croft carport.

Model results have shown that the proposed development does not have any significant impacts on the existing flooding behaviours at the site and surrounding.

The following are the recommendations from this study:

- Minimum habitable floor level of the proposed dwelling (at front part) in lot 2 complies the requirements for a flood control lot;
- All structural components below the minimum habitable floor level of the proposed dwelling in western lot (within 1% AEP flood extent area) are to be constructed with flood compatible materials and should withstand the forces of floodwater debris and buoyancy;
- All external power points, air conditioning units, hot water system are to be set above the habitable floor level;
- All electrical wiring should be waterproofed or installed above the minimum habitable floor level;
- Fencing up to 1% AEP flood depth within the flood extent are to be pervious type;
- All the development controls mentioned in section 6 are to be implemented.