



Our Ref: 82017208-01:NGP
Contact: Nathan Pomfret

17 October 2017

University of Wollongong
via email: egarbayo@uow.edu.au

Attention: Erika Garbayo

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Dear Erika,

UOW ASSB FLOODING APPROACH

It is understood that the University of Wollongong (UOW) are proposing to submit a State Significant Development Application for the Arts and Social Sciences Building (ASSB). In order to address flooding requirements UOW proposed to construct "Option 3" which includes a flood wall and localised grading or a swale immediately adjacent to the flood wall as detailed in the enclosed UOW ASSB Preliminary Flood Assessment Letter (Cardno, 15 June 2017). It is noted that this option involves works immediately to the west of the proposed building and does not include any works adjacent Robsons Road.

In addition to the measures detailed in the preliminary flood assessment letter, the proposed flood mitigation approach will be in accordance with both the NSW Floodplain Development Manual and Wollongong City Council Development Control Plan requirements.

Yours sincerely,

Nathan Pomfret
Water Engineer
for Cardno
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Email: nathan.pomfret@cardno.com.au

Enc: UOW ASSB Preliminary Flood Assessment Letter

Our Ref: 8201720801
Contact: Nathan Pomfret

15 June 2017

University of Wollongong
Via Email: egarbayo@uow.edu.au

Attention: Ms Erika Garbayo

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RE: UOW ARTS AND SOCIAL SCIENCES BUILDING – PRELIMINARY FLOOD ASSESSMENT

1. Introduction

The University of Wollongong (UOW) has engaged Cardno (NSW/ACT) Pty Ltd to provide preliminary advice for the proposed Arts and Social Sciences Building (ASSB) to be located at UOW's Wollongong campus. This letter presents the outcome of the preliminary assessment to inform the SEAR's application as well as to highlight potential requirements of the proposed building defined in Chapter E13 – Floodplain Management of Wollongong City Council's (WCC's) Development Control Plan (DCP).

1.1 Site Description

The site is situated in the north west of the UOW main campus on Northfields Avenue in Keiraville. The site fronts a car parking area and has direct access to the Ring Road and backs onto the riparian corridor of an upper tributary of Fairy Creek. The proposed building is to replace a group of existing demountable buildings and some ground level carpark area.

2. Hydraulic Modelling

2.1 Existing Scenario

A 2D TUFLOW model was established over a 2 m grid with elevations extracted from detailed survey and ALS data. The model grid extent covers the entire UOW Campus and the adjacent sub-catchments.

Culverts and pipes inspected within the study area were modelled in accordance with WCC's new blockage policy as detailed in the Review of Conduit Blockage Policy Summary Report (WMA, May 2016).

2.2 Proposed Scenario

A maximum possible footprint was created by combining the extents of all options to identify the largest possible shape the ASSB would occupy. This was overlaid on flood modelling results to identify flood constraints for the proposed development. Based on this assessment any of the provided options will result in similar flood requirements which are discussed in Section 3.

2.3 Simulation Results

The hydraulic model was simulated for the existing 100 year ARI and PMF storm events. The results show that flooding occurs through the group of existing demountable buildings as overland flow. This overland flow originates from Northfields Ave, which is overtopped when flows exceed the capacity of the existing 1.8m diameter pipe under the road. The overland flow does not return to the creek but flows east towards the buildings to the Ring Road. It is noted that the watercourse south of the site is not overflowing (Refer to **Figure 2-2** below) and if the overland flow from Northfields Ave could be returned to the creek via a swale, then flooding on the site would reduce significantly.

Overland flows will occur in the western carpark and adjacent to the demountable buildings in both the 100 year ARI and PMF events. Flood results are shown in **Figures 2-1** and **2-2** below.

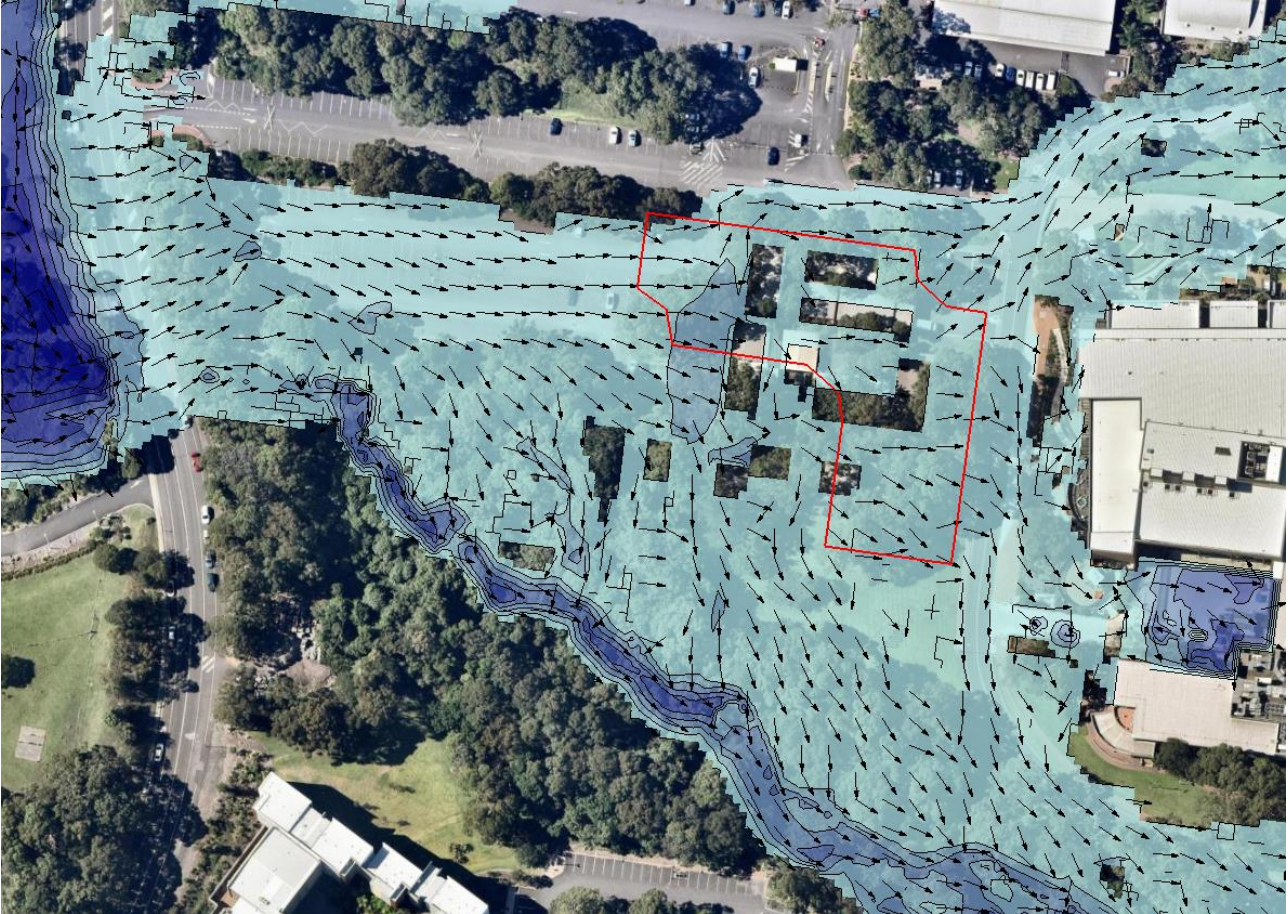
The depth of flow adjacent to the demountable buildings is below 100 mm during the 100 year ARI event and generally less than 200 mm during the PMF. The exception to this is one small area that has a maximum depth of 200 mm in the 100 year ARI event and 700 mm in the PMF. This deeper section appears to be due to the effect of the current demountable buildings obstructing the overland flow.

Flood velocities in the area adjacent to the demountable buildings are less than 0.3 m/s during the 100 year ARI event and as much as 3 m/s during the PMF event. The areas of high flow rate during the PMF event are a result of flow constriction between the demountable buildings, in areas where flow is unconstricted, flood velocities are much lower.

Figure 2-1 Existing 100 year ARI Flood Depth and Extent



Figure 2-2 Existing PMF Flood Direction, Depth and Extents



3. Discussion

3.1 Proposed Development

The proposed ASSB will interrupt the existing overland flow path that passes over the western carpark and through the demountable buildings in the existing scenario. This does not preclude the site from development, but will likely require the proposed design to accommodate and control flood flows. Options to improve the flood immunity and design of the proposed building are discussed in **Section 3.4.1.1**.

3.2 Hydraulic Hazard Categorisation

Flood model results were assessed to identify hazardous areas. The area proposed for the ASSB is currently predominantly low hydraulic hazard, with some small areas being flood free.

3.3 Flood Risk Precincts

WCC's DCP 2009 states that flood prone land should be divided into three flood risk areas (**Figure 1-1Table 3-1**).

Table 3-1 Council DCP 2009 Risk Precinct Definitions

High	The area within the envelope of land subject to a high provisional hydraulic hazard (in accordance with FPDM, 2005) in a 100 year flood event plus all land within 10m from the top of the creek bank.
Medium	Land below the 100 year flood level (plus 500mm freeboard) that is not within the High Flood Risk precinct.
Low	All other land within the floodplain (i.e. the extent of the PMF) but not defined within either the High or Medium Flood Risk precincts.

The site is primarily classed as being within the medium Flood Risk Precinct (FRP). The proposed development is considered to be suitable for medium FRP, with the following prescriptive controls expected to apply in order to comply with the WCC DCP (2009).

3.4 Floodplain Management

3.4.1 Flood Planning Level (FPL)

The proposed ASSB is inside the 100 year average recurrence interval (ARI) flood extents. As such, the FPL for the ASSB is to be equal to or greater than the 100 year ARI flood level (including the effects of climate change) adjacent to the site plus 500 mm freeboard.

As the design and climate change scenarios have not yet been modelled the exact FPL for the proposed building cannot be confirmed at this point. However, hydraulic modelling results show that the 100 year ARI water level adjacent to the proposed building site (upstream extent) in the 100 year event is approximately 39.9 m AHD. Assuming a climate change impact of 0.1 m (to be confirmed at design) the estimated FPL for the proposed building is 40.5 m AHD. This is the highest FPL applicable to the proposed building, assuming a single floor level and could be modified through a split level design, flood mitigations and/or surface works at the design stage.

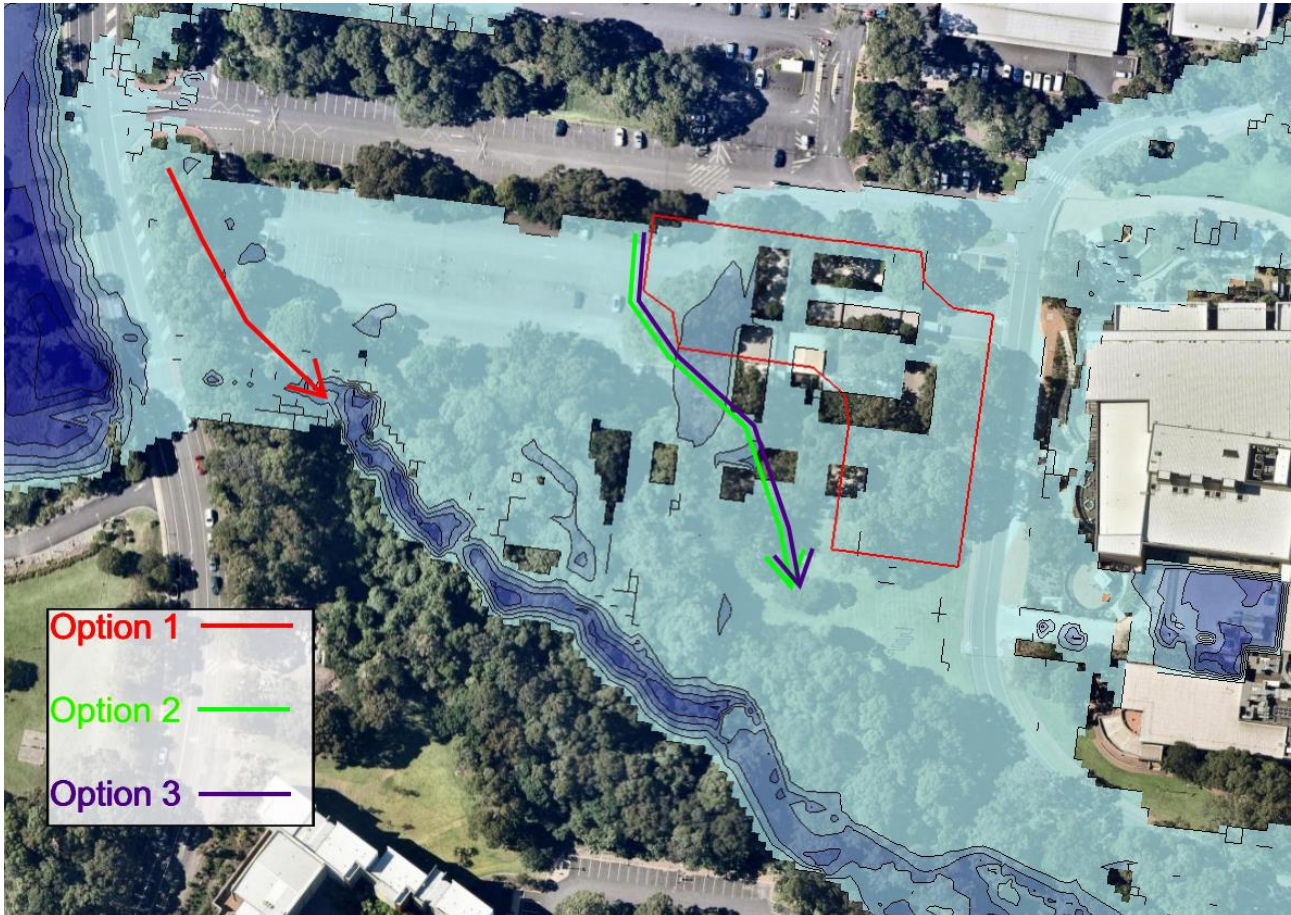
3.4.1.1 Flood Mitigation Works to Reduce FPL Requirements

It is understood that a split level North and East wing building design is being considered as a design option. This approach based on the methodology above would result in FPL's of 40.5 m AHD for the north wing and 38.9 m AHD for the east wing.

It is also understood, that the desired floor level for a split level building is circa 39.5 m AHD for the north wing and 38 m AHD for the east wing. Three options to further reduce the FPL for each wing are detailed below. Indicative locations of these options are shown in **Figure 3-1**. It is noted that the effectiveness of these options are only an estimation at this stage and are pending detailed flood assessment and will need to comply with all conditions specified in **Section 3.4** of this letter.

- **Option 1** involves designing a flow diversion (such as a swale) at the western end of the western carpark (adjacent to Robsons Road) to divert flow back into the watercourse. This option would aim to eliminate sheet flow from the carpark and building and could eliminate the requirement for a FPL or reduce it to 38.7 m AHD and 37.3 m AHD for the north and east wings respectively.
- **Option 2** involves designing a diversion closer to the western boundary of the proposed ASSB to divert flow back into the watercourse. This option would aim to eliminate sheet flow from the proposed building and could reduce the FPL's to between 40.0 – 40.5 m AHD and 38.4 – 38.9 m AHD for the north and east wings respectively.
- **Option 3** would incorporate a swale in a similar fashion to **Option 2**, but would also incorporate a flood training wall or bund to provide the freeboard requirements (approximately 600 mm). This option would aim to have the proposed building be considered flood free and could eliminate the need for a FPL altogether.

Figure 3-1 Indicative Locations of Flood Mitigation Measures for the Proposed ASSB



3.4.2 Flood Compatible Buildings Materials and Structural Soundness

Flood compatible building components would be required for any portion of the building which is below the flood planning level. This includes masonry foundations and other such features. An extensive list of approved materials is available in WCC's DCP (2009) and should be referenced during detailed design.

A structural soundness certificate will be required as part of the Construction Certificate to demonstrate that the proposed works can withstand the force of floodwater, debris and buoyancy up to and including the PMF.

3.4.3 Evacuation and Safe Access

Evacuation and safe access will need to be assessed at the design stage.

3.4.4 Flood Affectionation

Changes in flood elevations in the 100 year ARI and PMF storm events as a result of the proposed works will need to be assessed at the design stage.

3.4.5 Floodplain Storage

Floodplain storage will need to be assessed at the design stage. WCC generally requires no net floodplain storage loss during development.

3.4.6 Trafficability

The effect of this development on trafficability of adjacent roads, particularly the University Ring Road that passes to the east of the proposed ASSB will need to be assessed at the design stage.

4. Conclusions

It can be concluded that:

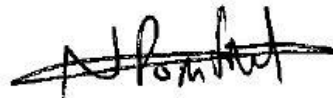
- > Flood constraints do not prohibit any of the proposed design options. All of the options will result in similar flood prescriptive controls.
- > Flooding occurs as overland flows over the area of the proposed ASSB and adjacent carpark.
- > The depth of inundation adjacent to the existing demountable buildings is generally below 100 mm in the 100 year ARI and 200 mm in the PMF event in the existing and scenarios with some small areas during the PMF event reaching a maximum of 700 mm.
- > Velocities are generally less than 0.3 m/s in the 100 year ARI event. Higher velocities during the PMF event are small and localised and can be attributed to the constricting of flow caused by the demountable buildings.
- > The proposed ASSB building area is within the medium risk flood precinct, and is subject to low hydraulic hazard.
- > The flood planning level for the proposed building is dependent on the design and flood mitigation measures implemented.
- > A climate change assessment will need to be undertaken and considered when setting the proposed FPL.
- > Flood affectation, floodplain storage and trafficability will need to be assessed at the design stage.

Prepared by
for and on behalf of
CARDNO (NSW/ACT) PTY LTD



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Reviewed by



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