Attachment A11

Site Specific Flood Study

FLOOD ASSESSMENT FOR PLANNING PROPOSAL FOR 242-258 YOUNG STREET WATERLOO

FINAL REPORT

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JANUARY 2024

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Project Flood Assessment for Planning Proposal for 242-258 Young Street Waterloo	**Project Number** 123020
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FLOOD ASSESSMENT FOR PLANNING PROPOSAL FOR 242-258 YOUNG STREET WATERLOO FINAL REPORT

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1. INTRODUCTION

1.1 Background

This flood assessment report is submitted to the Council of the City of Sydney (Council) to support a request for a Planning Proposal relating to land at 242-258 Young Street, Waterloo. The Planning Justification Report prepared by Ethos Urban outlines the proposed amendments to the Sydney Local Environmental Plan (Sydney LEP) 2012.

The proposed amendments are seeking principally to facilitate the delivery of a new independent K-12 vertical school, catering for approximately 800 students. The amendments sought to the Sydney LEP 2012 will encourage and facilitate the redevelopment of the site by allowing for:

- an increased maximum Floor Space Ratio (FSR)
- an increased maximum Building Height.

Supporting the amendments to the Sydney LEP 2012 is an amendment to the Sydney DCP 2012 which includes site-specific controls. For assessment purposes, the Planning Proposal is supported by a concept scheme prepared by Plus Architecture that facilitates the following:

- A new 6 storey vertical school consisting of:
    - 45 GLS, 13 specialist / classrooms
    - A multi-purpose hall / auditorium
    - A library
    - A canteen
    - Administration, lobby and circulation spaces
    - An active green roof
    - A basement including 60 car parking spaces and end-of-trip facilities
- The incorporation of the existing film school within the new vertical school building
- A total of approximately 13,543 m^2 of gross floor area which equates to a floor space ratio of 2.94:1. The gross floor area comprises approximately:
    - 10,608 m^2 education floor area
    - 2,935 m^2 commercial (film school) floor area
- Outdoor spaces totalling approximately 4,978 m^2.

1.2 Site Location and Context

The site is situated on the traditional land of the Gadigal people of the Eora nation, located at 242-258 Young Street, Waterloo within the City of Sydney Local Government Area (LGA). The site is prominently positioned at the junction of Hunter Street, Young Street and Powell Street. It is located 4 km south of the Sydney CBD within the Green Square Urban Renewal Area.

The site comprises three lots which are legally described as Lot 1 in DP84655 and Lots A and B in DP 161650. The site's area is 4,611 m^2 and is triangular in shape and is bounded by Hunter Street to the west, Young Street to the east and Powell Street to the south. The site has street frontage dimensions of 118 m along Hunter Street, 137 m along Young Street and 4.3 m along Powell Street. The topography of the site generally falls in an east to west direction.

The site and is currently occupied by 2 storey office building and film school. The southern tip of the site is a grass lawn area.

An aerial photo of the site is shown in Diagram 1.

Diagram 1: Site location (*Source: Nearmap + Ethos Urban*)

1.3 Catchment Description

The site is within the Alexandra Canal catchment, for which WMAwater completed the *Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology* for City of Sydney (Reference 1). This report documents a site-specific flood assessment using information from the catchment-wide study, for the purposes of this planning proposal.

There is a catchment area of approximately 200 ha that drains to the streets surrounding the site (noting that not all of the catchment directly drains to the site due to a number of sag points that store water, the complex underground stormwater network and diversion of flow paths along different streets in different events). There are two trunk drains that run under Hunter Street and Young Street past the site. The main drain is under Young Street and consists of a 3000 mm (W) x 1800 mm (H) box culvert. At Powell Street (the apex of the site), the trunk drain continues west along Powell Street. There are also twin 600 mm diameter pipes under Hunter Street. A single 600 mm diameter pipe continues west from Hunter Street and joins the main box culvert on Powell Street. The trunk drain discharges into an open channel on the downstream side of Wyndham Street. This open channel combines with the Sheas Creek open channel which then discharges into the upstream end of Alexandra Canal.

In general, overland flow from Euston Road (to the north of the site) flows along Hunter Street and Young Street in a southerly direction. Water can also pond on Euston Road at a sag point between Hunter Street and Young Street. There is a substantial sag point on Hunter Street adjacent to the site. This receives flow from Hunter Street and also Young Street as it rounds the apex of the site via Powell Street. The sag point can only drain via the 600 mm diameter pipe, or when the flood

depth is large enough to overtop the crest level at the western end of Powell Street. Overflow can then continue down Elizabeth Street as it flows toward Alexandra Canal. The depth of ponding on Hunter Street would need to be approximately 1.5 m in order to activate the overflow to Elizabeth Street.

The study area topography and stormwater network can be seen in Figure 1. Photos around the site can be seen in Photo 1, Photo 2 and Photo 3.

Photo 1: Hunter Street looking south, with the site on the left and the sag point toward the end of the street. *Source: Google Street View, dated March 2021.*

Photo 2: Young Street looking south, with the site on the right. *Source: Google Street View, dated March 2021.*

Photo 3: Powell Street looking west, with the apex of the site on the right, and sag point overflow point located at the end of the road. *Source: Google Street View, dated March 2021.*

The site is considered to be flood prone and hence flood-related development controls apply to the site.

2. AVAILABLE FLOOD INFORMATION

2.1 Source of Flood Information

Flood information used in this assessment is based on the Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology (Reference 1). This is the most up-to-date flood modelling available for the Alexandra Canal catchment which covers the site. Further details regarding the flood modelling can be found in Reference 1.

2.2 Existing Flood Behaviour

The site is subject to overland flooding from both Hunter Street and Young Street. The overland flows are typically shallow (less than 0.2 m deep) up to and including the 1% AEP event. These flows, however, are deep enough to overtop the gutter and affect the site. The main flood risk for the site, however, is due to ponding at the sag point on Hunter Street adjacent to the site. When this ponding is deep enough, it affects a large portion of the site fronting Hunter Street and even extends across Powell Street and up Young Street. In the PMF event, flood water 1 m to 4 m deep surrounds the site, due to both ponding at the sag point but also significant catchment flows from McEvoy Street. A summary of the peak flood depths and levels at the Hunter Street sag point from the Reference 1 flood model can be found in Table 1, along with flows crossing McEvoy Street toward the site.

Table 1: Peak flood levels and depths at the Hunter Street sag point and peak flows crossing McEvoy Street towards the site

Event	Peak Flood Level[1] (mAHD)	Peak Flood Depth[2] (m)	Peak Flow[3] (m^3/s)
50% AEP	19.88	0.53	0.48
20% AEP	20.15	0.8	0.84
10% AEP	20.32	0.97	1.35
5% AEP	20.51	1.16	1.79
2% AEP	20.68	1.33	2.01
1% AEP	21.05	1.7	3.16
0.5% AEP	21.36	2.01	5.11
0.2% AEP	21.63	2.28	8.58
PMF	23.36	4.01	81.3

1. Sourced from Reference 1 modelling at the Hunter Street sag point
2. Calculated flood depth based on the surveyed surface level of the Hunter Street sag pit
3. Peak overland flows crossing McEvoy Street towards the site

3. PROPOSED DEVELOPMENT

The proposed development consists of multi-storey school building. The proposed building contains basement carparking accessed via Young Street and a loading dock. The ground level of the building can be accessed via both Hunter Street and Young Street and contains administration offices and a large auditorium. There are outdoor play spaces at the apex of the site. The facilities such as the auditorium will have a dual function and be used by community groups on the weekend. At the north-east corner of the building there is a film school and café. The proposed building comprises most of the site, although this is consistent with the existing use

of the site, where the industrial and commercial buildings comprise the majority of the site. The proposed ground floor plan is shown in the attachment.

4. FLOOD-RELATED DEVELOPMENT CONTROLS

The site is identified as being flood prone under Clause 7A(1) and Clause 7A(2) of Schedule 4 of the *Environmental Planning and Assessment Regulation 2000*, and is subject to flood-related development controls. Relevant flood considerations include:

a) Flood planning levels for the site are to be determined in accordance with the *Sydney Local Environment Plan* (Reference 2) and *Sydney Development Control Plan 2012* (Reference 3), and based on flood modelling results from previous catchment-wide flood investigations (discussed above); and
b) The development will also need to comply flood-related development controls specified in the *City of Sydney Interim Floodplain Management Policy* (Reference 4).

City of Sydney's *Interim Floodplain Management Policy* (Reference 4) documents the requirements for the management of flood risk for all new developments within the local government area (LGA). City of Sydney has a responsibility to manage floodplains and ensure that any:

- New development will not experience undue flood risk; and
- Existing development will not be adversely affected through increased damage or hazard as a result of any new development.

The Flood Planning Level (FPL) requirements specify the minimum floor levels required for buildings and depends on the type of flooding experienced on the site and type of development. The site is subject to 'mainstream' flooding and can be classified as a 'school'. The FPLs applicable to the site are specified in Table 2.

Table 2: Flood Planning Levels (from City of Sydney Interim Floodplain Management Policy)

Development	Type of Flooding	Requirement	Comment
Schools	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level + 0.5m	This is considered applicable to all school facilities within the building.
Business	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level	Applies to the café within the building. Also considered applicable to any general 'lobby' type areas outside of the school facilities.
Below-ground car park	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m or the PMF (whichever is the higher)	This applies to all possible ingress points to the car park such as vehicle entrances and exits, ventilation ducts, windows, light wells, lift shaft openings, risers and stairwells. It is noted that the PMF level dictates the FPL at the site for below-ground

Development	Type of Flooding	Requirement	Comment
			car parks as it is higher than the 1% AEP + 0.5 m.
Above ground enclosed car park	Mainstream or local drainage flooding	1% AEP flood level	Considered applicable for the loading dock.

As outlined in Table 2, there a number of FPLs applicable to the site and a different FPL may apply for each entry depending on the adjacent flood behaviour and use. An assessment of the proposed development is provided in the following sections.

5. FLOOD IMPACT ASSESSMENT

5.1 Existing Flood Model

Flood modelling used for this assessment was taken from the 'Alexandra Canal Catchment – Flood Study Model Update ARR2019 Hydrology' (Reference 1). The 'Ultimate Development' scenario simulated the current day conditions at the time of model development (2019) in addition to approved major developments (precincts and stormwater upgrades) within the catchment. Further details about the flood model can be found in Reference 1.

WMAwater has undertaken some additional modelling within the Alexandra Canal catchment for City of Sydney since this study was finalised. The modelling undertaken for major stormwater upgrades does not affect flood levels at the site and hence the '2019 Ultimate Development' scenario is considered applicable for the site. The study also utilised the latest guidelines – Australian Rainfall and Runoff (ARR) 2019 (Reference 5).

The flood study (Reference 1) undertook a critical duration analysis across the entire catchment and found the 30 minute and 60 minute storms represented flood behaviour across the catchment. The same storms were adopted for this assessment and no changes were made to the hydrologic (DRAINS) modelling. Updates were made to the hydraulic model (TUFLOW), which are described in the following sections.

5.2 Updated Flood Model

The existing flood model was updated with the following features to represent current conditions:

- Inclusion of the latest LiDAR topography from NSW Spatial Services. The LiDAR was captured in May 2020 and better represents the terrain on the roads surrounding the site. Several large trees line McEvoy Street, Hunter Street and Young Street, such that the LiDAR data does not represent the road, gutter and nature strip accurately in several areas. The most recent LiDAR better represents key features such as the gutters, as shown in Diagram 2. The extent of the terrain update is limited to the crest s of McEvoy Street, Hunter Street, Young Street and Powell Street, where the two LiDAR datasets are in good agreement. The gutters were also enforced in the model with breaklines based on

the 2020 LiDAR data, or detailed topographic survey (where available).

Photo 4: At the corner of McEvoy Street and Young Street, looking south-west. *Source: Google Street View, dated May 2022.*

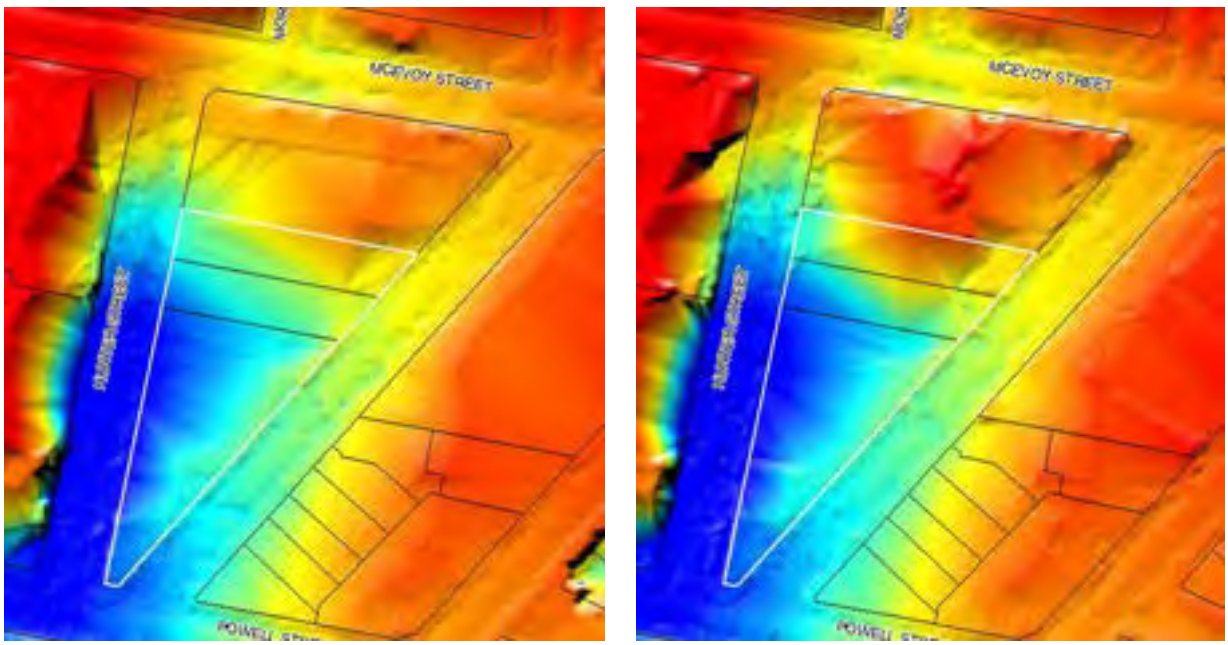


Diagram 2: Comparison of Flood Study LiDAR data (left) and latest 2020 LiDAR data (right)

- Adjustment of the building footprint on the site and inclusion of an undercroft parking area that would be subject to flooding (Photo 5). The parking area terrain was included based on detailed survey of the site.

Photo 5: Undercroft area existing on the site that would be subject to inundation in flood events. *Source: Google Street View, dated March 2021.*

- Minor modification to buildings on McEvoy Street. A small gap exists in the model between the buildings that allows water to enter (Diagram 3). This gap does not exist in reality and was removed from the modelling.

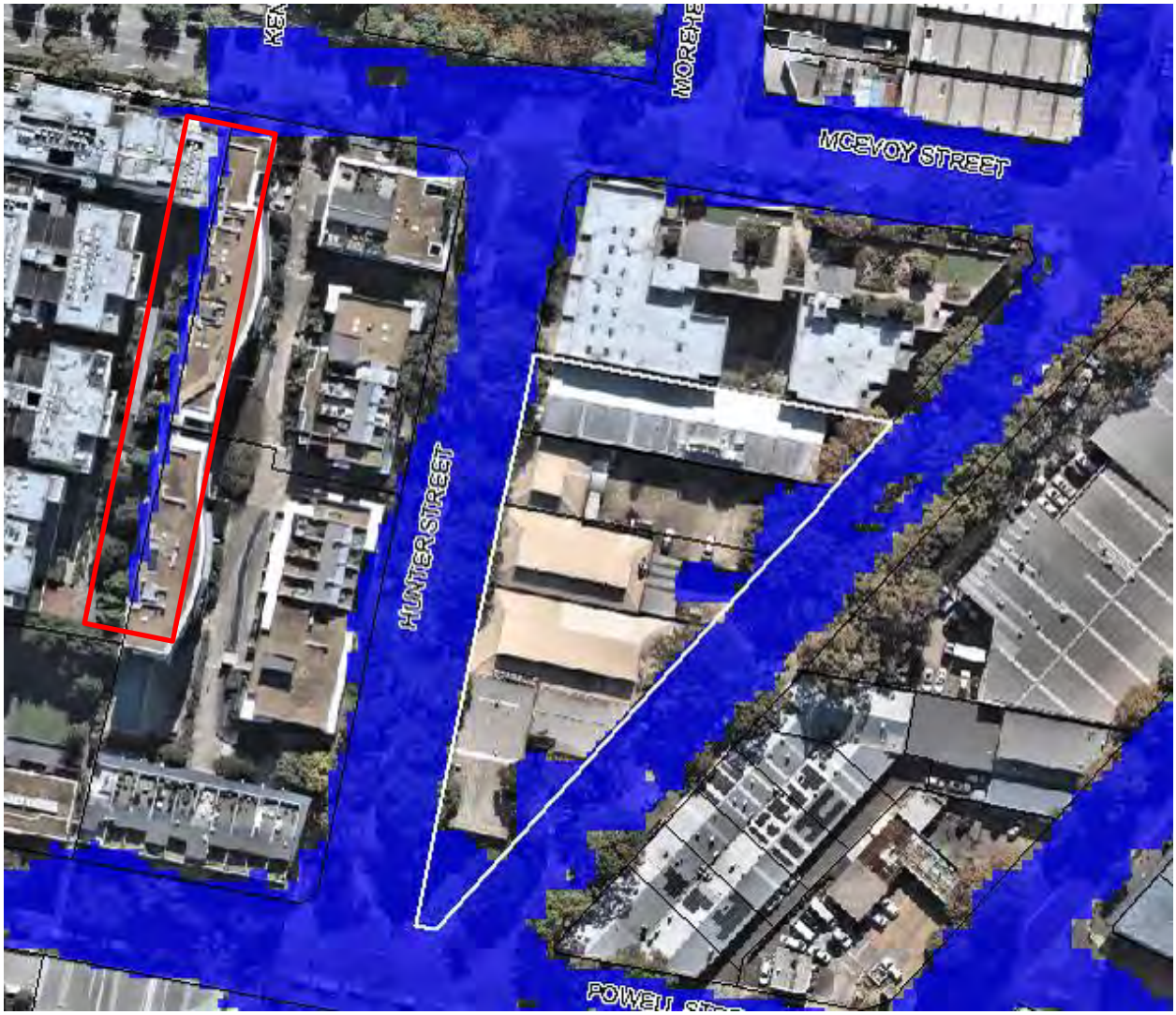


Diagram 3: Flood Study model results showing inundation between buildings on McEvoy Street

The updated model was run for the '2019 Ultimate Development' scenario for the 20% AEP, 5% AEP, 1% AEP and PMF events.

These updates resulted in a change in 1% AEP peak flood levels as follows:

- Increase of 0.03 m on McEvoy Street
- Increase of 0.01 m at the Hunter Street sag point
- Generally reductions in overland flow depths on Young Street, in the range of 0.03 m to 0.08 m

These changes are typically within the accuracy of the flood levels quoted for the purpose of setting floor levels. The overall flood behaviour, as described in Section 2.2, is consistent with the updated model.

The existing conditions flood behaviour with the updated model is shown in the following maps in Appendix A:

- Peak flood depth and level contours in Figure A1 to Figure A4 for the 20% AEP, 5% AEP, 1% AEP and PMF events, respectively;
- Peak velocity in Figure A5 to Figure A8 for the 20% AEP, 5% AEP, 1% AEP and PMF

events, respectively; and

- Hydraulic hazard in Figure A9 to Figure A12 for the 20% AEP, 5% AEP, 1% AEP and PMF events, respectively.

Peak flood depths on Hunter Street and Powell Street remain shallow (less than 0.2 m deep) where overland flow is present adjacent to the site up to and including the 1% AEP event. Ponding occurs at the Hunter Street sag point, however, where ponding in the 1% AEP event affects a portion of Hunter Street adjacent to the site as well as Powell Street. In the PMF event, the Hunter Street sag point causes deep water adjacent to much of the site (in the range of 1.5 m to 4 m deep) in addition to significant overland flows from McEvoy Street.

Peak velocities in the 1% AEP event can exceed 2 m/s on Hunter Street towards the sag point and are typically between 1 m/s and 1.5 m/s along Young Street. Lower peak velocities in the order of 0.5 m/s are evident at the Hunter Street sag point. In the PMF event, velocities are approximately 3 m/s to 4 m/s on Young Street and up to 3.5 m/s on Hunter Street, again with lower peak velocities at the sag point (less than 0.5 m/s).

Australian Rainfall and Runoff (ARR) 2019 (Reference 5) provides information relating to categorisation of flood hazard. A summary of this categorisation is provided in Diagram 4.

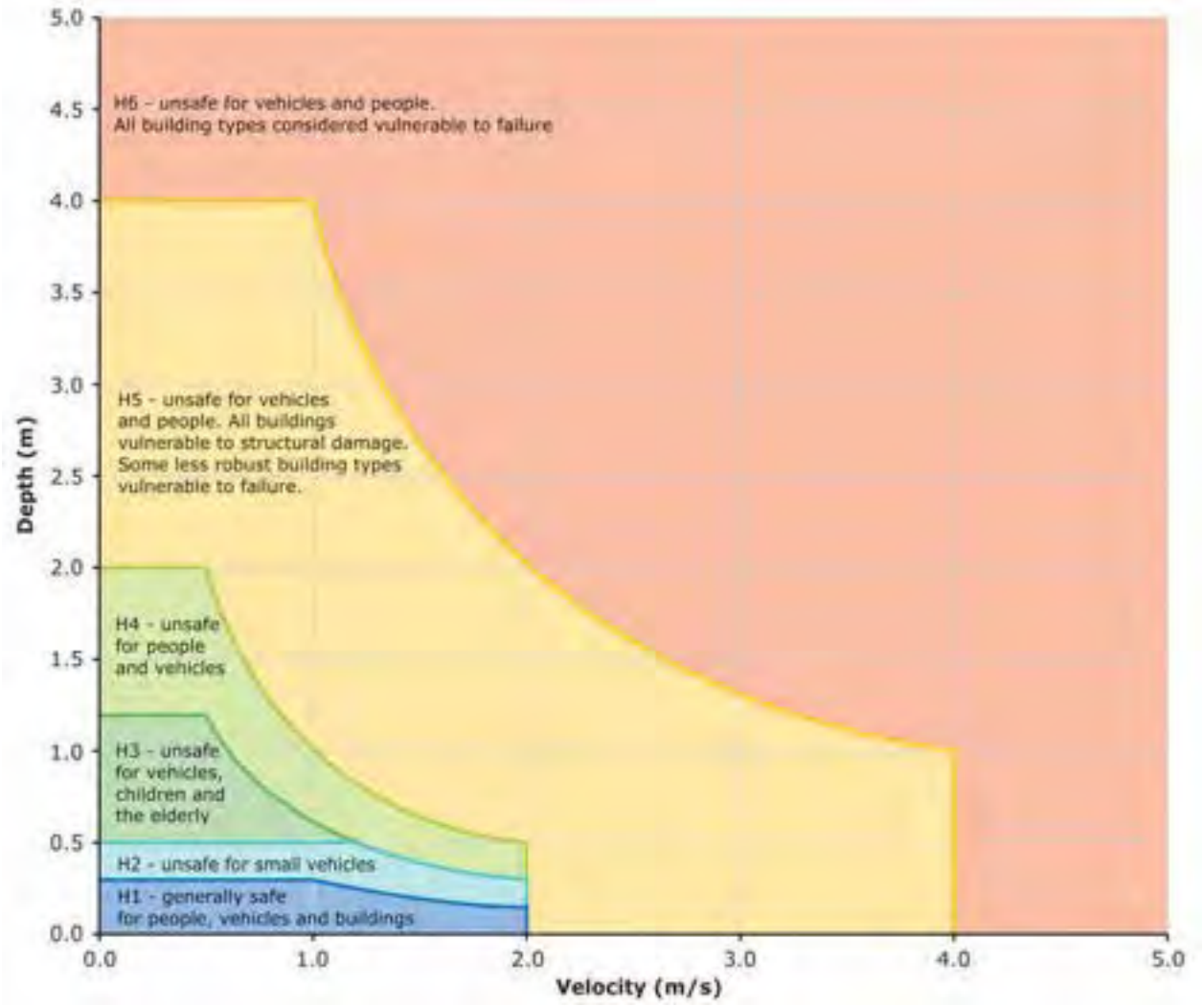


Diagram 4: General flood hazard vulnerability curves (Source: Reference 5)

The flood hazard at the Hunter Street sag point and McEvoy Street sag point is H3 in the 20% AEP and 5% AEP flood events. The remaining areas are subject to H1 hazard. In the 1% AEP event, the McEvoy Street sag point remains H3, but the Hunter Street sag point reaches H4. High velocities in the gutter along Hunter Street upstream of the sag point also trigger H5 hazard. Young Street is still subject to only H1 hazard. In the PMF event, there is H6 hazard along the centre of Young Street and continuing onto Powell Street to the west. The site itself is subject to H5 hazard along each of its open boundaries.

5.3 Flood Impact with Proposed Development

The proposed development was included in the flood model with the following elements:

- Inclusion of the proposed building footprint for the ground level as a solid obstruction, maintaining a consistent representation with buildings in the Flood Study model.
- Inclusion of the proposed outdoor space at the apex of the site, at an elevation of 20.2 mAHD.

Currently, it has been assumed that ground levels within the small area between the building/outdoor space and the boundary will remain as per existing conditions. Although there may be some landscaping in this small area, it will still need to interface with the road reserve and hence levels should remain fairly similar.

The model was run for the same events as outlined in Section 5.2. The proposed conditions flood behaviour is shown in the following maps in Appendix B:

- Peak flood depth and level contours in Figure B1 to Figure B4 for the 20% AEP, 5% AEP, 1% AEP and PMF events, respectively;
- Peak velocity in Figure B5 to Figure B8 for the 20% AEP, 5% AEP, 1% AEP and PMF events, respectively; and
- Hydraulic hazard in Figure B9 to Figure B12 for the 20% AEP, 5% AEP, 1% AEP and PMF events, respectively.

The proposed conditions flood behaviour remains very similar to the existing conditions. Most notably, the proposed driveway is not inundated in events up to the 1% AEP event, with the proposed culvert conveying the 1% AEP flow under the driveway. The carpark also remains flood free in the 1% AEP event.

The results for the proposed conditions were compared with the existing conditions to understand any changes to the flood behaviour that may arise as a result of the development. The change in peak flood level is shown in Appendix C in Figure C1 to Figure C3 for the 20% AEP, 5% AEP and 1% AEP events, respectively.

Changes in flood level of more than 0.01 m have been mapped, as changes less than this are considered to be within the precision of the numerical model and data (Reference 6). The results indicate that for the 20% AEP event, there are negligible changes in peak flood level outside of the site. In the 5% AEP event, there is a reduction in flood level at the Hunter Street sag point of

0.05 m and negligible changes elsewhere. In the 1% AEP event, there is a reduction of approximately 0.02 m at the Hunter Street sag point. On Young Street, there is a change in the flood level profile down the street, due to the change in the building footprint. The areas of flow path widening and narrowing change with the proposed building footprint that result in a localised area where the flood level increases by up to 0.02 m. A flood level profile along Young Street is shown in Diagram 5 that demonstrates this small localised increase (around chainage 110 m). This impact due to a slight change in the flow regime is considered to be acceptable.

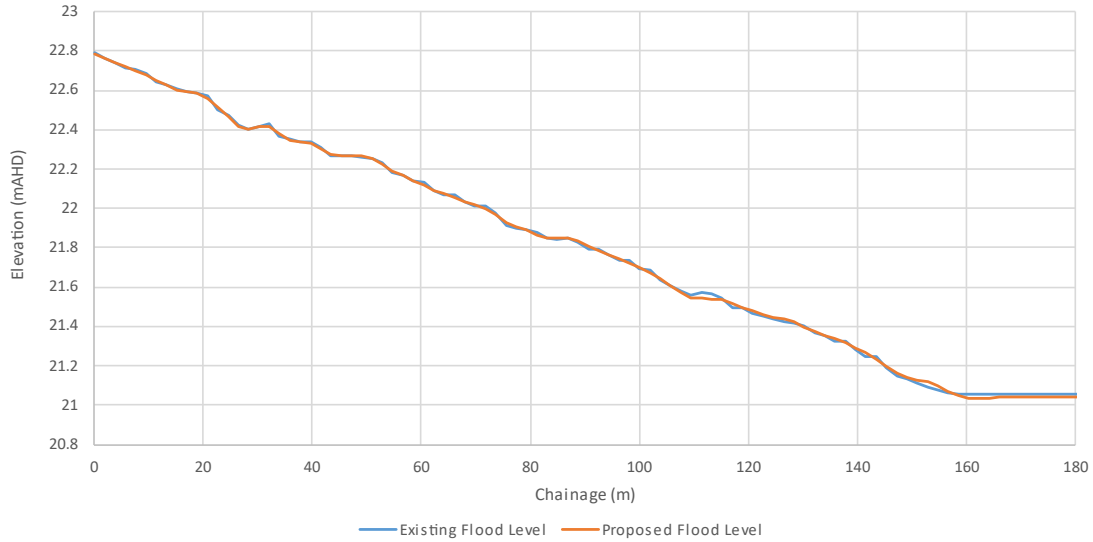


Diagram 5: Flood level profile for the 1% AEP existing and proposed conditions along Young Street

6. PROPOSED FLOOR LEVELS

The proposed floor levels have been designed to accommodate the flooding around the site. A summary of the proposed finished floor level (FFL) and FPL for all entry points around the site is provided in Table 3. The location of each entry point is shown in Figure 4.

It is noted that there are lifts in the main lobby of the school. Only two of these are accessible from the ground floor, and these lifts only go to upper levels. The third lift, which goes to the basement, is only accessible from upper levels. Hence these lifts protect the basement from inundation up to and including the PMF. All entry points comply with the required FPL.

Table 3: Floor level compliance with flood planning levels

ID[1]	Entry	Requirement	Applicable Flood Level[2]	FPL[2]	FFL[2]	Comment
1	Fire Stairs	N/A	N/A	N/A	N/A	No requirement. Fire stairs only to upper levels and need to interface with surrounding ground levels.
2	Auditorium	1% AEP + 0.5 m	21.15	21.65	21.80	Complies. Entry is at 21.25, but rises to 21.8. Also provides access to storage areas.
3	Main School Entrance (Hunter St)	1% AEP + 0.5 m	21.05	21.55	22.10	Complies. Elevated entry to main school foyer and administration offices.
4	Entry from outdoor space	1% AEP + 0.5 m	21.20	21.70	22.10	Complies. Based on nearest flood level on Young Street. Upper level of outdoor space also at 22.1.
5	Outdoor space (lower level)	N/A	N/A	N/A	20.20	No requirement for outdoor space. At a lower level to provide activation with street. Protected from inundation from Hunter Street sag point up to and including the 20% AEP event if shallow overland flows from Young Street are prevented from entering the space.
6	Main School Entrance (Young St)	1% AEP + 0.5 m	21.60	22.10	22.10	Complies. Elevated entry to main school foyer and administration offices.
7	Café	1% AEP	21.95	21.95	21.95	Complies. Based on commercial floor level requirement.
8	Film School Entry	N/A	N/A	N/A	21.80	Complies. This is only proposed to be an entry point to the film school that interfaces with the surrounding ground, with no proposed functional use. Once inside the building, the floor rises to 22.65 for the main lobby area (point 10 below).
9	Basement stairs	PMF	23.58	23.58	23.58	Complies. Basement entry protected to the maximum PMF level on Young Street.

ID[1]	Entry	Requirement	Applicable Flood Level[2]	FPL[2]	FFL[2]	Comment
10	Film School Lobby	1% AEP	21.95	21.95	22.65	Complies. Based on commercial/non-habitable floor level requirement.
11	Basement lift	PMF	23.58	23.58	23.58	Complies. Basement entry protected to the maximum PMF level on Young Street.
12	Loading dock	1% AEP	21.80	21.80	21.80	Complies. Loading dock at the 1% AEP flood level on Young Street.
13	Basement vehicle entrance	PMF	23.58	23.58	23.58	Complies. Crest level of the basement entry is protected to the maximum PMF level on Young Street.
14	Basement service lift	PMF	23.58	23.58	23.58	Complies. Basement entry protected to the maximum PMF level on Young Street.

1. Locations shown in Figure 4
2. Elevation in mAHD

7. FLOOD EMERGENCY MANAGEMENT AND EVACUATION

The City of Sydney *Interim Floodplain Management Policy* does not contain explicit flood-related development controls for evacuation or active flood emergency management plans for individual sites. There is a requirement under the performance criteria that proposed development should not increase risk to human life, and there should be adequate consideration of flood access, evacuation and flood readiness.

The flood risk at the site is from urban overland flow along roadways, when rainfall exceeds the capacity of the local stormwater network. Flooding will generally occur quite quickly in response to very heavy rain. Generally, the most effective way to mitigate flood risk to human life in this environment is to ensure that buildings are built to withstand flood forces to enable people to remain indoors during the intense storm events, and to discourage people from attempting to drive or walk through floodwaters. This is best achieved by effective design of the building to ensure it remains flood free without requiring active measures such as the deployment of barriers or flood gates, so that people can remain on site until flooding has subsided. Since flooding around the site will be of short duration, the risks arising from isolation during flooding are low.

Discussion is provided below about emergency management and evacuation considerations for the site.

7.1 Existing Flood Warnings and Response

7.1.1 Bureau of Meteorology flood warning

The Bureau of Meteorology issues quantitative flood warnings for specified forecast locations including expected flood class (major, moderate, minor) and timing of flooding. The Bureau does not cover quantitative flash-flood warnings, defined as rain-to-flood times of less than six hours. The area around the site is subject to flash-flooding and, as such, The Bureau does not issue quantitative warnings for this catchment.

7.1.2 Bureau of Meteorology severe weather warnings

The Bureau of Meteorology issues severe weather warnings whenever severe weather is occurring in an area or expected to develop or move into an area. This includes very heavy rain that may lead to flash flooding. The warnings describe the area under threat and the expected hazards. Warnings are issued with varying lead-times, depending on the weather situation, and can be from one hour to 24 hours or more. The Bureau also issues severe thunderstorm warnings that include thunderstorms producing heavy rainfall which may cause flash flooding.

These warnings are provided for a broad region (for example, the Sydney Metropolitan Area) and do not contain advice at the suburb level.

7.1.3 SES warnings and response

The SES is the legislated Combat Agency for floods and is responsible for the control of flood operations. This includes the coordination of other agencies and organisations for flood management tasks. The SES Local Controller is responsible for dealing with floods as detailed in the State Flood Plan.

Given the flash flood nature of the catchment and the lack of warning time for flooding, the SES is unlikely to mobilise volunteers in the vicinity of the site in anticipation of flooding. The SES will generally only respond to specific calls for assistance in flash flood areas.

7.2 Assessment of Emergency Management Requirements for the Site

It will not be possible in real time during a flood to understand what the peak of the flood will be for this site. This is because:

- the time between the rainfall occurring and flooding occurring is short (generally less than an hour, and possibly as short as 15 minutes for local flash flooding in the road reserves);
- the location of the most intense rainfall bursts for flood-producing storms in small catchments such as this cannot be predicted accurately ahead of time; and
- as a result of the above, there are no formal flood warning systems in place for the catchment (discussed in above Sections).

There will likely be very little warning of flooding, apart from very heavy local rainfall. General warnings about severe storms will be available for the Sydney Metropolitan region provided by the Bureau of Meteorology (BoM) but these will not provide specific information for this site. The operators of the site will not have statutory authority to detain people on-site in the event of flooding. However, by designing the buildings in such a way that they remain safe during flash flooding, people will be encouraged to remain inside until the flood risk in the streets subsides.

7.2.1 Flood Hazard on Site

The peak flood depths on the site are provided in Table 4.

Table 4: Summary of peak flood depths on site

Event	Peak Flood Depth (m)				
	Open space (lower level)	**Ground Floor of School**	**Auditorium**	**Café / Loading Dock**	**Level 1**
Floor level (mAHD)	*20.2*	*22.1*	*21.8*	*21.8 – 21.95*	*26.5*
50% AEP	0.0	0.0	0.0	0.0	0.0
20% AEP	0.0	0.0	0.0	0.0	0.0
10% AEP	0.1	0.0	0.0	0.0	0.0
5% AEP	0.3	0.0	0.0	0.0	0.0
2% AEP	0.5	0.0	0.0	0.0	0.0

Event	Peak Flood Depth (m)				
	Open space (lower level)	Ground Floor of School	Auditorium	Café / Loading Dock	Level 1
1% AEP	0.9	0.0	0.0	0.0	0.0
0.5% AEP	1.2	0.0	0.0	<0.1	0.0
0.2% AEP	1.4	0.0	0.0	<0.1	0.0
PMF	3.2	1.5	1.8	1.8	0.0

The lower level open space at the apex of the site is subject to inundation from the Hunter Street sag point in the 10% AEP event to a depth of 0.1 m. This increases to 0.9 m in the 1% AEP event and 3.2 m in the PMF event. This is the most hazardous area within the site, being only slightly better than the Hunter Street sag point itself. This is, however, open space with access to the ground floor. The ground floor and auditorium will remain flood free in events up to and including the 0.2% AEP event. In the PMF event, however, the ground floor will be inundated by approximately 1.5 m of water and the auditorium by 1.8 m of water. The café and loading dock area fronting Young Street are protected up to the 1% AEP event. In the 0.5% and 0.2% AEP events, shallow overland flows from Young Street can be expected to enter these areas, with depths less than 0.1 m. Again, in the PMF event, flood depths at these areas could reach 1.8 m. The first level (and higher levels) of the proposed building will remain flood free in all events up to and including the PMF event. The basement will also remain flood free up to and including the PMF event.

While the building will remain safe up to and including the 0.2% AEP event, the ground floor will experience hazardous inundation in the PMF event.

7.2.2 Site Access

Due to the location of the site, there are floodwaters on both Hunter Street and Young Street in all events simulated. In the 20% AEP event, the floodwaters at each of the entrances remains H1 and is considered safe for all vehicles and people. The Hunter Street sag point and McEvoy Street sag points reach H3 hazard, which would restrict access routes to and from the site, however, alternative routes are available.

In the 5% and 1% AEP events, the main school entrance on Hunter Street would be subject to H3 hazard due to ponding at the sag point, and unlikely to be accessible as it is unsafe for vehicles, children and the elderly. However, the hazard on Young Street remains H1 and would be accessible, as too would be the northern entrances on Hunter Street (from the auditorium and fire stairs) that are located away from the sag point. In the 1% AEP event the hazard at the Hunter Street sag point reaches H4.

In the PMF event, access to the site would be completely cut off, with the hazard on Young Street and Hunter Street being H5.

7.2.3 Rate of Rise

The site is subject to flash flooding, and as such there will be very little warning of flooding, apart from very heavy local rainfall. Not only will there be effectively no warning time, but there will be no way of accurately predicting the duration of flooding or the extent of flooding. For example, it will not be known how high the ponding at the Hunter Street sag will get to in an intense storm event.

The rate of rise of floodwater at the site can be extremely quick. From the adopted 30 minute and 60 minute critical duration storms, the rate of rise of floodwater at the Hunter Street sag point was analysed, with the results shown in Diagram 6. The rate of rise of the 1% AEP 30 minute storm event may be as quick as 7 cm per minute, with the peak flood level being reached in just 37 minutes. It can be seen that the 1% AEP 60 minute storm actually produces a higher flood level, but with a longer response time. The rate of rise for the 60 minute storm can be up to 4 cm per minute, with the peak flood level being reached in 85 minutes. This demonstrates the variable nature of storm events and the response of flash flooding. At the time of the storm, there would be no way of predicting what the water level hydrograph at the Hunter Street sag point would look like. For storms up to the 0.2% AEP, however, the building ground floor will remain flood free.

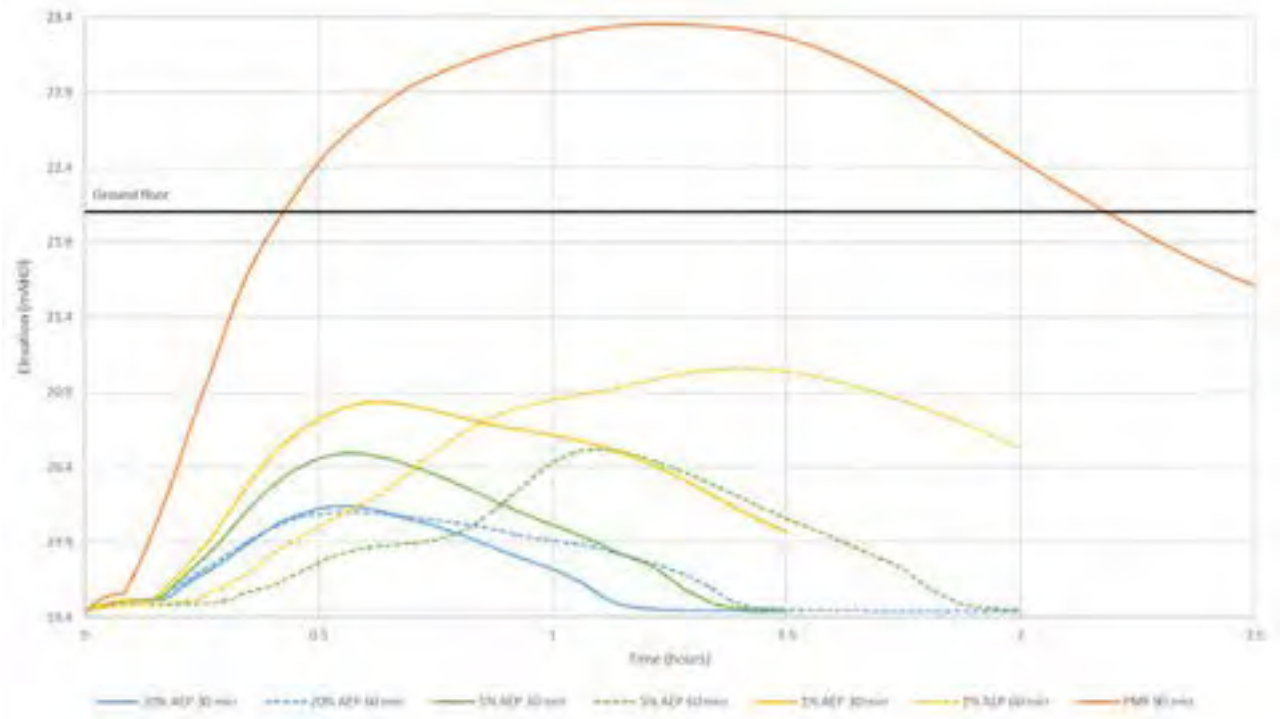


Diagram 6: Rate of rise of floodwater at the Hunter Street sag point

It is in an extreme storm event that the ground floor (of the main school building) would be inundated and this is the primary concern for the site. In the 90 minute probable maximum precipitation (PMP) storm event that produces the critical PMF at the site. This storm event can cause a rate of rise at the Hunter Street sag point of up to 15 cm per minute. The ground floor of the building would be reached in just 25 minutes from the onset of the storm. It would only take a further 8 minutes to reach 0.5 m deep above the ground floor, or 23 minutes to reach 1 m deep above the ground floor. This is a rapid rate of rise that requires a fast response. It is recognised

that the storm could be of a shorter duration (for example 30 minutes or 60 minutes), which could result in a faster rate of rise but lower peak flood level.

7.2.4 Flood Response Options

There are two flood response options available for the site:

1. Evacuation of the building to an off-site location
2. 'Shelter in place' within the building by undertaking 'vertical evacuation'

Evacuation of the building to an off-site location requires consideration of the following:

- A trigger level to initiate evacuation. This may consider factors such as rainfall depths, rainfall rates, rate of rise of floodwater or level of floodwaters.
- Evacuation location. It is understood that the muster point for the evacuation of the building in the event of an emergency is Waterloo Oval, located approximately 250 m from the site (see Figure 1). The oval is flood-free in all events.
- Evacuation route. The route to Waterloo Oval should be from the Hunter Street entry point north along the footpath to McEvoy Street, and then west to the corner of McEvoy Street and Elizabeth Street where the oval is located. The sag points on Hunter Street and McEvoy Street should be avoided. It is recognised that this route may be subject to shallow overland flows that will need to be traversed to reach the oval, depending on the magnitude of the event and the progression of flooding at the time of evacuation.
- Time to evacuate. Evacuation of a building requires a coordinated effort that takes time to action. Consideration would also need to be given to the nature of the building use as a school facility, where evacuation may take longer with the coordination of students. The trigger level should be selected to provide enough time to evacuate the entire site before flooding becomes hazardous. Evacuation of the building should be completed before the ground level of the building is inundated, and before the route becomes hazardous.
- Given the flash-flooding nature of the site, evacuation would likely take place while there is heavy rainfall and low visibility. This adds further hazards to the evacuation process.

'Shelter-in-place' within the building through 'vertical evacuation' requires consideration of the following:

- A trigger level to initiate evacuation. This may consider factors such as rainfall depths, rainfall rates, rate of rise of floodwater or level of floodwaters.
- Refuge space required for evacuation to upper levels. The upper levels of the building should contain the space and resources required to support all occupants of the building for the duration of the flood (potentially several hours).
- Evacuation route. Evacuation of the ground floor via stairs is the most reliable route, given the potential for power outages during extreme flood events or the inundation of lift shafts. The evacuation route should also consider people with accessibility issues.
- Safety of the building. The building should be designed such that it will withstand the forces of floodwater and buoyancy so that the building will remain safe during the event of a flood if it is to be used as a flood refuge.

7.3 Flood Management Plan

It is recommended that a Flood Management Plan be prepared for the site. The plan should include the following:

- Site information
- Flood behaviour
- Actions prior to a flood (preparation)
- Actions during a flood (response)
- Actions following a flood (recovery)

The plan in particular should be clear about the response for the site, since it is subject to flash flooding and inundation can occur with very little warning. Allocation of responsibilities should also be clear so that a response can be actioned as soon as it is required. The Flood Management Plan can be developed as part of a wider Emergency Management Plan, which is a legal requirement under the Education and Care Services National Regulations.

8. CONCLUSION

The flood modelling developed for the Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology (Reference 1) was utilised to inform the flood assessment of the proposed development at 242-258 Young Street, Waterloo. For the purpose of the planning proposal for the site, this flood assessment found that:

- The proposed floor levels meet the City of Sydney's Interim Floodplain Management Policy (Reference 4). This includes school floor levels being 0.5 m above the 1% AEP flood level and basement car parking being protected to the PMF level.
- The proposed building would not have an adverse impact on flood levels for surrounding properties and would not change the flood hazard on the surrounding roads up to and including the 1% AEP event.
- Flood emergency management and evacuation is a key consideration for the site. The upper levels of the building can serve as a flood refuge, providing protection for occupants during the PMF event. Evacuation to Waterloo Oval is also possible if triggered early to avoid potential flood hazards during evacuation. Either response would require a detailed investigation and flood management plan to be put in place given the flash-flooding nature of the site.

9. REFERENCES

1. WMAwater
Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology
Prepared for City of Sydney, September 2020

2. City of Sydney
Local Environment Plan
2012

3. City of Sydney
Development Control Plan
2012

4. City of Sydney
Interim Floodplain Management Policy
May 2014

5. Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors)
Australian Rainfall and Runoff – A Guide to Flood Estimation
Commonwealth of Australia (Geoscience Australia), 2019

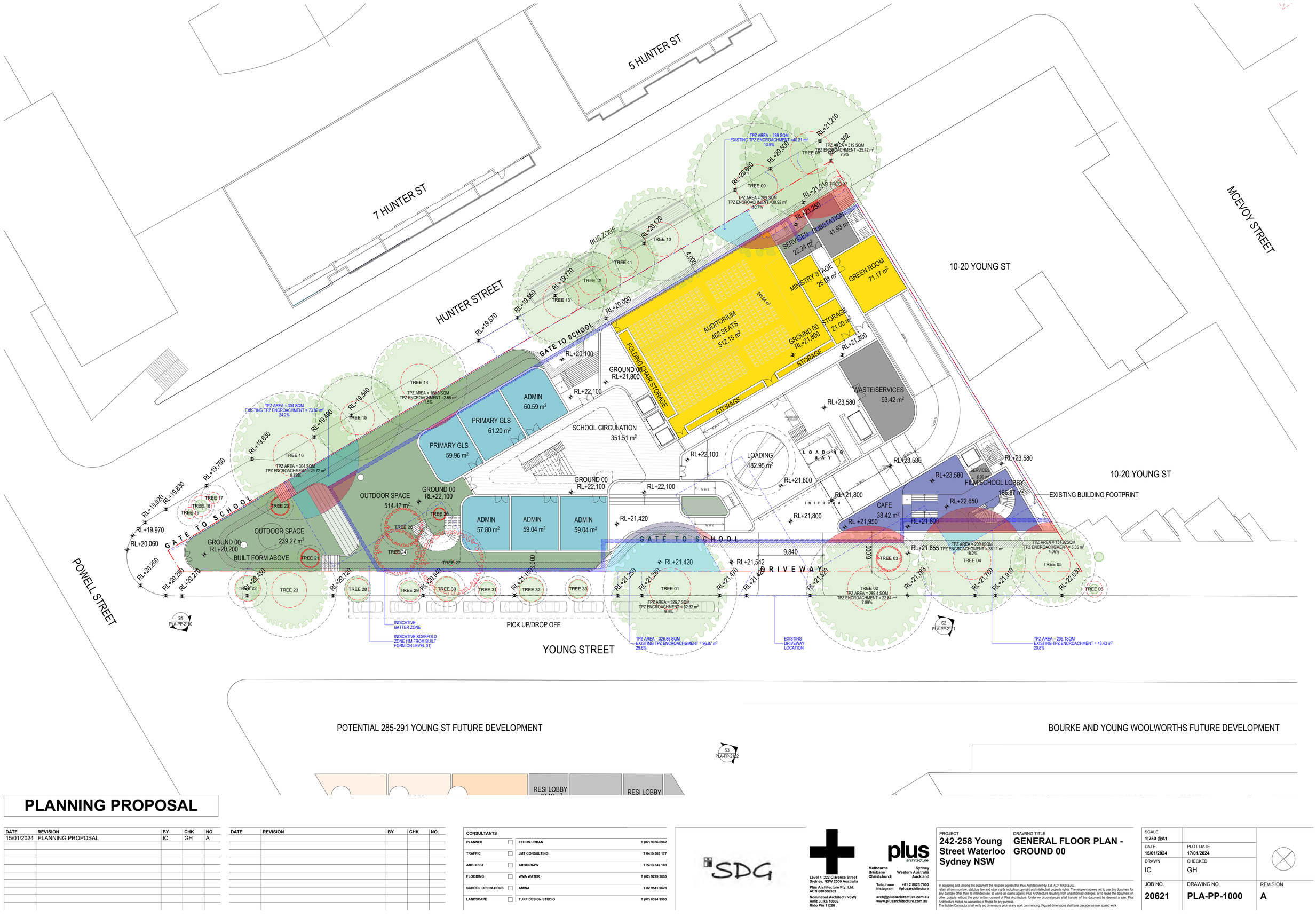
6. Engineers Australia
Australian Rainfall and Runoff Revision Project 15:
Two Dimensional Modelling Urban and Rural Floodplains
Department of Climate Change and Energy Efficiency, 2012

ATTACHMENTS

Attachment: Proposed ground floor plan (Plus Architecture, 15/1/2024)

FIGURES

Attachment



PLANNING PROPOSAL

DATE	REVISION	BY	CHK	NO.
15/01/2024	PLANNING PROPOSAL	IC	GH	A

DATE	REVISION	BY	CHK	NO.

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PROJECT	DRAWING TITLE
242-258 Young Street Waterloo Sydney NSW	GENERAL FLOOR PLAN - GROUND 00

SCALE		
1:250 @A1		
DATE	PLOT DATE	
15/01/2024	17/01/2024	
DRAWN	CHECKED	
IC	GH	
JOB NO.	DRAWING NO.	REVISION
20621	PLA-PP-1000	A

Figures

FIGURE 1
242 - 258 YOUNG STREET WATERLOO
STUDY AREA

WEST STREET
REEVE STREET
KELLICK STREET
GIBSON STREET
WELLINGTON STREET
BRISBANE LANE
KELLICK STREET
MOREHEAD STREET
CRYSTAL ST
POTTER STREET
PITT STREET
JOHN STREET
MEAD STREET
KENSINGTON LANE
KENSINGTON STREET
KENSINGTON MEWS
LACHLAN STREET
MCEVOY STREET
THREAD LANE
Waterloo Oval
HUNTER STREET
YOUNG STREET
GADIGAL AVENUE
TUNG HOP STREET
BRUCE STREET
SAM SING STREET
THE ROPE WALK
ARCHIBALD AVENUE
REED STREET
POWELL STREET
DUNKERLEY PLACE
HATBOX PLACE
HATTER LANE
ALLEN STREET
SHORT STREET
GEORGE STREET
HAWKSLEY STREET
BOURKE STREET
O'DEA AVENUE
ELIZABETH STREET
KINGSBOROUGH WAY
JOYNTON AVENUE
WOLSELEY GROVE
N
Site
Cadastre
0
100
200
m

Note:

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FIGURE 2
242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
TUFLOW MODEL UPDATES

YOUNG STREET
MCEVOY STREET
HUNTER STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Updated gutter breakline
Updated undercover parking
Updated building outline
Updated LiDAR Elevation (mAHD)
High : 24
Low : 19

0 50 100 m

Note:

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FIGURE 3

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
TUFLOW MODEL UPDATES

Note:

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FIGURE 4
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
ENTRY POINTS / FLOORS

1
2
3
4
5
6
7
8
9
10
11
12
13
14

MOREHEAD STREET
MCEVOY STREET
HUNTER STREET
YOUNG STREET
POWELL STREET
BOURKE STREET
ARCHIBALD AVENUE
DUNKERLEY PLACE

N

Site
Cadastre
Proposed Entry Points / Floors

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\Figure04_Entry_Points.mxd

Appendix A Existing Conditions Flood Maps

FIGURE A1

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
20% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA01_Depth_20pcAEP.mxd

FIGURE A2

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA02_Depth_5pcAEP.mxd

FIGURE A3

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA03_Depth_1pcAEP.mxd

FIGURE A4

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
PMF EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

26
25.5
25
24.5
24
23.5
24.5
24
24.5
24
23
23.5
24
24
23.5
23.5
24
23.5

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA04_Depth_PMF.mxd

FIGURE A5

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK VELOCITY
20% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\Appendix A\FigureA05_Velocity_20pcAEP.mxd

FIGURE A6

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK VELOCITY
5% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

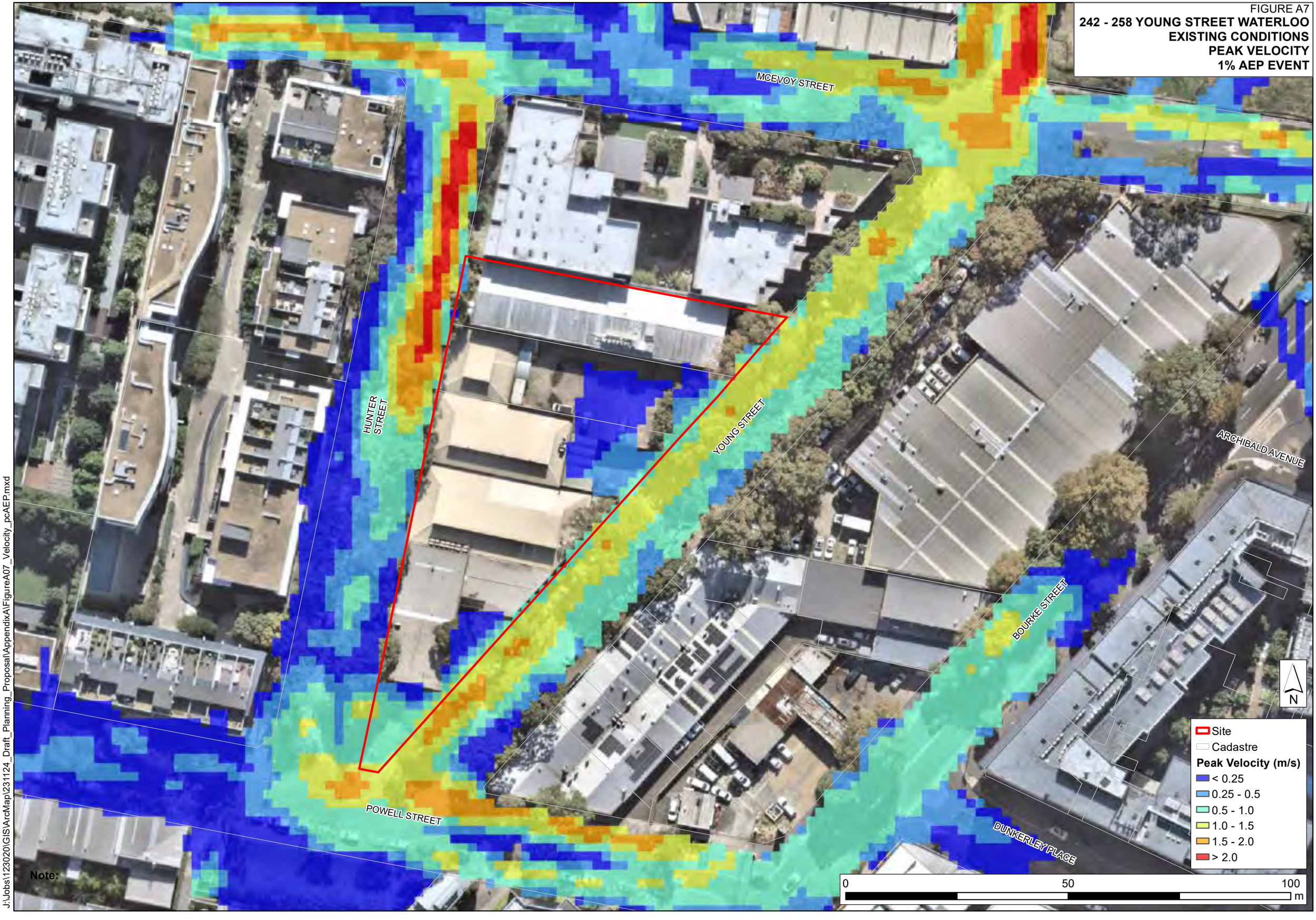
0 50 100
m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA06_Velocity_5pcAEP.mxd

FIGURE A7

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK VELOCITY
1% AEP EVENT



Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA07_Velocity_pcAEP.mxd

FIGURE A8

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
PEAK VELOCITY
PMF EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA08_Velocity_PMF.mxd

FIGURE A9

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
HYDRAULIC HAZARD
20% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site

Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA09_Hazard_20pcAEP.mxd

FIGURE A10
242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
HYDRAULIC HAZARD
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA10_Hazard_5pcAEP.mxd

FIGURE A11
242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
HYDRAULIC HAZARD
1% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA11_Hazard_1pcAEP.mxd

FIGURE A12

242 - 258 YOUNG STREET WATERLOO
EXISTING CONDITIONS
HYDRAULIC HAZARD
PMF EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site

Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixA\FigureA12_Hazard_PMF.mxd

Appendix B Proposed Conditions Flood Maps

FIGURE B1

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
20% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB01_Depth_20pcAEP.mxd

FIGURE B2

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)
Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB02_Depth_5pcAEP.mxd

FIGURE B3

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
1% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB03_Depth_1pcAEP.mxd

FIGURE B4

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK FLOOD DEPTHS AND LEVELS
PMF EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
POWELL STREET
BOURKE STREET
ARCHIBALD AVENUE
DUNKERLEY PLACE

Site
Cadastre
Major Contour (0.5m interval)
Minor Contour (0.1m interval)

Depth (m)
0 to 0.15
0.15 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

0 50 100 m

N

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB04_Depth_PMF.mxd

FIGURE B5
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK VELOCITY
20% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB05_Velocity_20pcAEP.mxd

FIGURE B6
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK VELOCITY
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB06_Velocity_5pcAEP.mxd

FIGURE B7

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK VELOCITY
1% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB07_Velocity_1pcAEP.mxd

FIGURE B8

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
PEAK VELOCITY
PMF EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre

Peak Velocity (m/s)
< 0.25
0.25 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
> 2.0

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB08_Velocity_PMF.mxd

FIGURE A9

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
HYDRAULIC HAZARD
20% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site

Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB09_Hazard_20pcAEP.mxd

FIGURE B10
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
HYDRAULIC HAZARD
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB10_Hazard_5pcAEP.mxd

FIGURE B11
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
HYDRAULIC HAZARD
1% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB11_Hazard_1pcAEP.mxd

FIGURE B12
242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
HYDRAULIC HAZARD
PMF EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre

Hydraulic Hazard

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

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\AppendixB\FigureB12_Hazard_PMF.mxd

Appendix C Flood Impact Maps

FIGURE C1

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
CHANGE IN PEAK FLOOD LEVEL
20% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre

Change in Peak Flood Level (m)

- < -0.2
- -0.2 to -0.1
- -0.1 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.1
- 0.1 to 0.2
- > 0.2
- No Longer Flooded
- Newly Flooded

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\Appendix C\FigureC01_Impact_20pcAEP.mxd

FIGURE C2

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
CHANGE IN PEAK FLOOD LEVEL
5% AEP EVENT

MCEVOY STREET
HUNTER STREET
YOUNG STREET
ARCHIBALD AVENUE
BOURKE STREET
POWELL STREET
DUNKERLEY PLACE

N

Site
Cadastre
Change in Peak Flood Level (m)
< -0.2
-0.2 to -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
0.1 to 0.2
> 0.2
No Longer Flooded
Newly Flooded

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_ProposalAppendixC\FigureC02_Impact_5pcAEP.mxd

FIGURE C3

242 - 258 YOUNG STREET WATERLOO
PROPOSED CONDITIONS
CHANGE IN PEAK FLOOD LEVEL
1% AEP EVENT

MCEVOY STREET

HUNTER STREET

YOUNG STREET

ARCHIBALD AVENUE

BOURKE STREET

POWELL STREET

DUNKERLEY PLACE

N

Site
Cadastre

Change in Peak Flood Level (m)

< -0.2
-0.2 to -0.1
-0.1 to -0.05
-0.05 to -0.01
-0.01 to 0.01
0.01 to 0.05
0.05 to 0.1
0.1 to 0.2
> 0.2
No Longer Flooded
Newly Flooded

0 50 100 m

Note:

J:\Jobs\123020\GIS\ArcMap\231124_Draft_Planning_Proposal\Appendix C\FigureC03_Impact_1pcAEP.mxd