

To: [Department of Planning, Industry and Environment](#)

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Approved: Rob Leslie (Section Executive – Water Resources - WSP)

Subject: **Waterloo Metro Quarter OSD**
SSD-10440 Northern Precinct – Response to submission comments

Date: 22 June 2021

Introduction

This note has been prepared to respond to the comments dated 22 April 2021 raised by the Environment, Energy and Science Group (EES) to the Department of Planning, Industry and Environment (DPIE) public exhibition period for Waterloo Metro Quarter Over Station Development (OSD).

Specifically, this note responds to the comments for the Northern Precinct detailed SSD DA (SSD-10440).

Figure 1 below represents a schematisation of Waterloo Metro Quarter OSD - areas in purple identify the proposed Northern Precinct (SSD-10440).

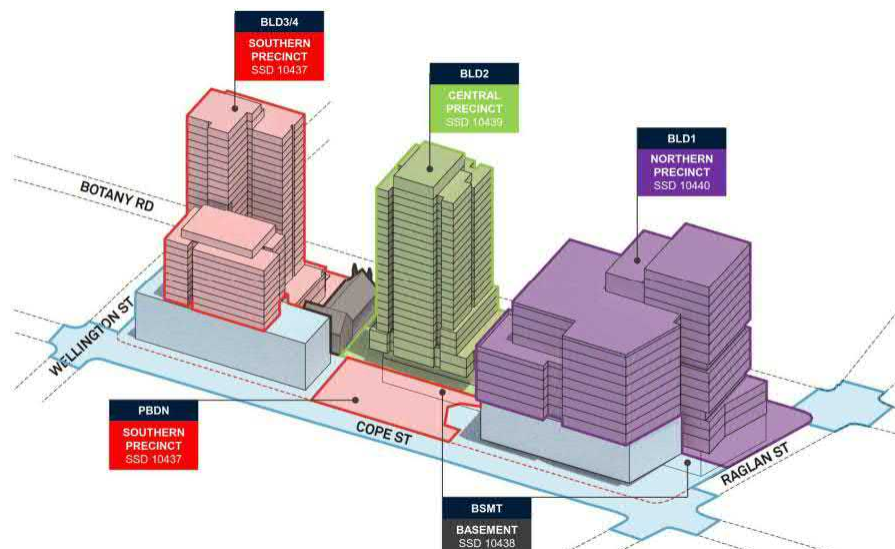


Figure 1. Waterloo Metro Quarter site, with sub-precincts identified

Comment 1

EES COMMENT

EES originally recommended that the proponent engage a suitably qualified and experienced professional to develop an appropriate strategy for flood emergency management. Neither a flood emergency management plan nor detailed emergency management procedures is required for this stage. However, a strategy is required to demonstrate that the current design allows risk to life to be managed. This includes calculation of persons and risk and consideration of suitable shelter in place. If the proponent does not investigate emergency management at this stage, the continuous flood risk may not be able to be properly managed later.

WSP RESPONSE

As noted by the EES reviewer a flood emergency management plan and a flood emergency strategy are not required at this stage. A preliminary flood emergency strategy is provided below. A flood emergency management plan will be prepared in accordance with any planning conditions or relevant legislation at a later stage prior the occupancy of the building.

The flood study (i.e. *Stormwater Management Strategy and Flood Impact Assessment - SSD -10440 Northern Precinct, September 2020*) and flood response (i.e. *Waterloo Metro Quarter OSD – SSD 10440 Northern Precinct – Response to submission comments, February 2021*) previously submitted to the Department of Planning, Industry and Environment demonstrated that all occupants of the northern precinct can remain safe by sheltering in place in a flood emergency. Flood protection has been achieved by adopting FFLs above FPLs and shelter areas above the PMF flood levels.

As requested by the EES reviewer further details that include the number of occupants of the building (at ground floor) and locations of the designated shelter areas are provided in this technical response

Table 1 below shows the number of persons expected within the building at ground floor and areas that can be used as refugee (i.e. shelter area) in a flood emergency. The number of persons is based on anticipated use of each retail tenancy, an average split between front of house and back of house areas within the tenancy, and the expected occupancy of both retail staff and patrons.

An evacuation plan that shows the evacuation route to the shelter areas is included in Figure 2 and Appendix A.

The evacuation strategy is provided for occupants of the ground floor only; any occupants located above the ground floor of the building can remain safe by sheltering in place until the end of the flood emergency.

The flood emergency response provided at this stage needs to be considered as a preliminary strategy that aims to demonstrate in principle that occupants of the building can be safe and protected in a flood emergency. Both the evacuation strategy and the emergency response will be further investigated at a later stage in consultation with the State Emergency Service (SES).

Table 1: Emergency response – occupants of the building (refer to Figure 2 and Appendix A for emergency plan)

Area	Classification	Number of occupants	FFL	Shelter
1	Retail area	75 to 125 persons	FFL is proposed at 16.750 m AHD. FFLs is above the 1% AEP flood level.	Occupants of area 1 can evacuate to shelter area (i.e. area 2). Area 2 can accommodate all occupants of area 1.

Area	Classification	Number of occupants	FFL	Shelter
			PMF flood level is 16.81 m AHD	
1b	Commercial lobby	40 to 60 persons	FFL is proposed at 16.750 m AHD. FFL is above the 1% AEP flood level. PMF flood level is 16.85 m AHD	Occupants of area 1 can evacuate to shelter area (i.e. area 2). Area 2 can accommodate all occupants of area 1b.
2	Entry lobby	Number of persons in area 2 are considered in the calculation for area 1b. Area 2 is designated to be a shelter area.	FFL: 17.130 m AHD FFL is above the PMF flood level PMF flood level is 16.820 m AHD	Designated shelter area.
3	Loading Dock/Shuttle lifts/ Access to below ground car park	2 to 4 persons. Area 3 has restricted access. Only authorised persons can access area 3.	FFL: 16.7 m AHD FFL is above the PMF flood level PMF flood level is 16.453 m AHD	Occupants of area 3 can remain safe in a flood emergency as FFL is above the PMF flood level. In a flood emergency, occupants of area 3 can evacuate to both the shelter area 2 and the evacuation area in Raglan Walk. Emergency strategy will be further investigated at a later stage.
4	Substation	Nil - not expected to be populated. Only authorised persons can access area 4.	FFL: 16.5 m AHD FFL is above the PMF flood level. PMF flood level is 16.45 m AHD	Occupants of area 4 can remain safe within area 4 in a flood emergency as FFL is above the PMF flood level. Evacuation to area 3 is also possible.
5	Community area	40 to 60 persons	FFL: 15.870 m AHD FFL is above 1%AEP flood level. PMF flood level is 16.46 m AHD	Occupants of area 5 can access area 5b. Area 5b has FFL above the PMF flood level.
5b	Shelter area for area 5	Number of persons in area 5b are considered in the calculation for area 5. Area 5 is designated to be a shelter area.	FFL: 16.5 m AHD FFL is above PMF flood level. PMF flood level is 16.45 m AHD	Shelter area – capacity to accommodate 90 persons in case of a flood emergency.

Area	Classification	Number of occupants	FFL	Shelter
6	Retail area	Area 6 is not affected by flooding up to and including the PMF flood event. All occupants of area 6 can remain safe in case of a flood emergency.		
7	Retail	Area 7 is not affected by flooding up to and including the PMF flood level. All occupants of area 6 can remain safe in case of a flood emergency.		
	Access to underground car park. (fire Stair)	Stair access – no occupants expected. Occupants of the underground car park remain within the car park in case of a flood emergency or evacuate through area 10.		
10	Access to underground car park. (fire Stair)	Stair access – no occupants expected.		

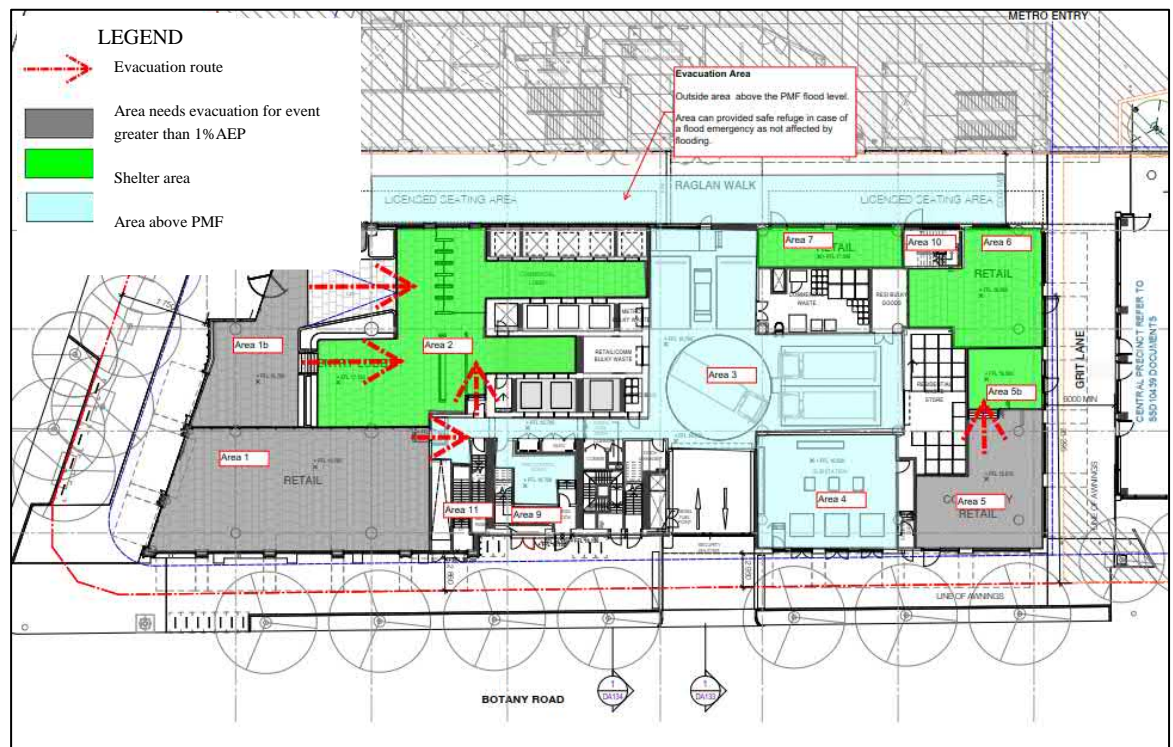


Figure 2. Shelter areas and evacuation route - Northern precinct (ground level)

Occupants of the northern precinct can remain safe in a flood emergency for the following reasons:

- 1) Shelter areas that can be use as safe refuge are provided at ground floor (i.e. green areas in Figure 2 and Appendix A);
- 2) Shelter areas have FFLs above the PMF flood level;
- 3) Safe evacuation routes (i.e. red arrows in Figure 2) have been provided from areas that have FFLs below the PMF flood level to the evacuation area (i.e. FFLs above PMF flood level); and,

Comment 2

EES COMMENT

EES concurs with the consultant's assertion that the industry standard approach is to set finished floor levels using the critical storm duration for each flood event. However, in flood emergency response management, the industry standard approach is to consider also other storm durations. For example, shorter duration storm events may be needed to calculate effective warning time and longer durations to understand the duration of isolation. EES repeats its original comment that the discussion regarding timing of flooding in relation to evacuation has not demonstrated an understanding of the principals involved in flood emergency response management. Further, the RtS now also claims that only short duration storms are relevant, because the site is at the top of the catchment.

WSP RESPONSE

As noted by the EES reviewer the industry standard approach is to set finished floor levels (FFLs) using the critical storm duration for the relevant flood events (i.e. 1% AEP and PMF flood event); the reason for this approach is that only critical storm durations generate maximum flood levels. Thus, testing different storm durations is irrelevant for assessing maximum flood levels.

Northern precinct FFLs have been designed to provide adequate protection for all occupants of the building. Building FFLs are above the 1% AEP flood level. Thus, no evacuation is necessary up to and including a 1% AEP flood event.

Only area 1 and 5 would need evacuation for flood event greater than 1% AEP. Evacuation to shelter areas is provided inside the building.

Discussion regarding time of inundation/flooding and duration of isolation have been presented below. As previously anticipated time of inundation/flooding and duration of isolation will be discussed in detail in the flood emergency management plan and flood emergency strategy as per planning requirements.

Flood hydrographs and time to peak flood level.

Flood hydrographs have been assessed in three key locations (i.e. A, B and C in Figure 3 below) for the 1% AEP and PMF flood events (with different storm durations).



Figure 3. Flood hydrographs location assessment

1% AEP flood event

1% AEP flood hydrographs for the 25, 60, 90 and 120-minutes storm events have been considered for point A, B and C.

Figure 4 shows flood hydrographs for different storms duration at Point A. As demonstrated in Figure 4 the building is not affected by flooding up to and including the 1% AEP flood event.

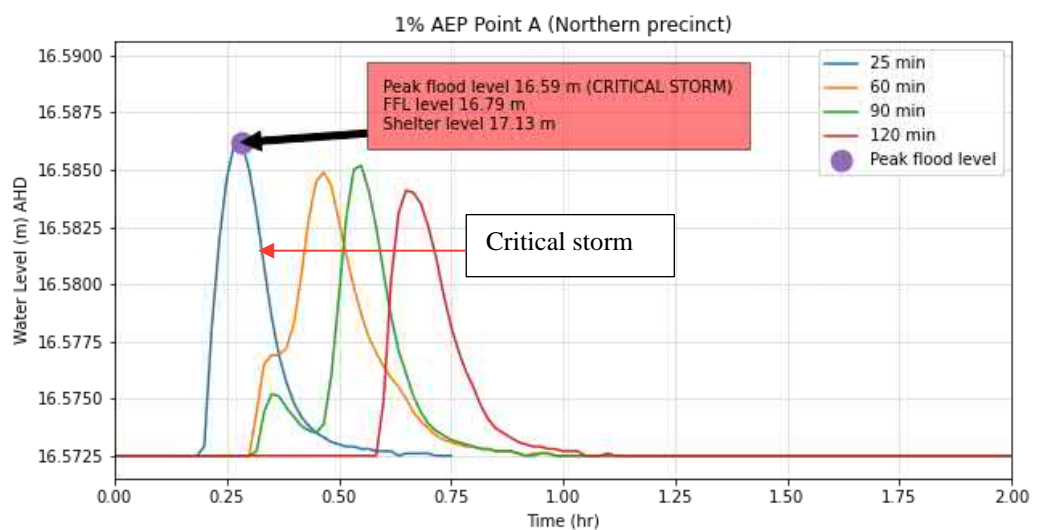


Figure 4. Flood hydrograph at point A: 1% AEP - 25 min, 60 min, 90 min and 120 min.

Figure 5 shows flood hydrographs for different storms duration at Point B. As demonstrated in Figure 5 the building is not affected by flooding up to and including the 1% AEP flood event.

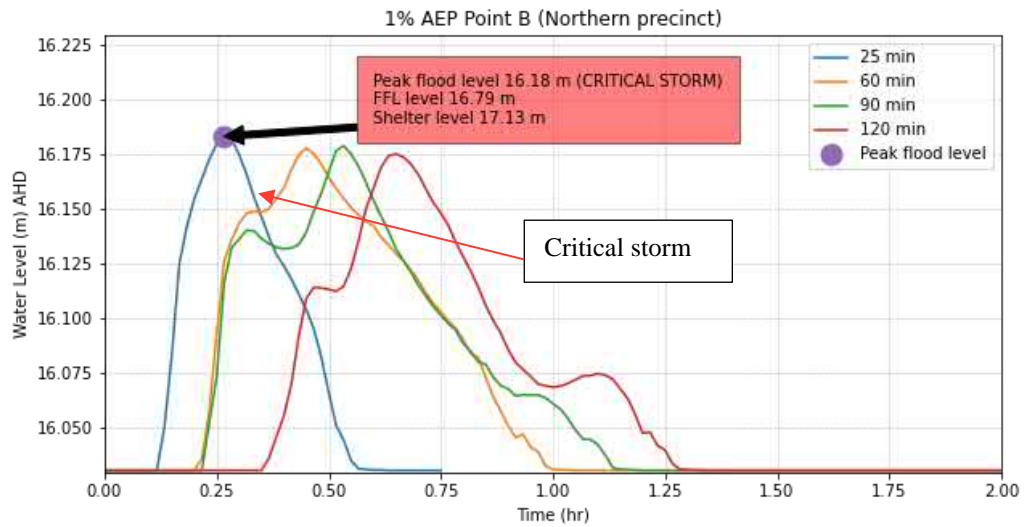


Figure 5. Flood hydrograph at point B: 1% AEP - 25 min, 60 min, 90 min and 120 min.

Figure 6 shows flood hydrographs for different storms duration at Point C. As demonstrated in Figure 5 the building is not affected by flooding up to and including the 1% AEP flood event.

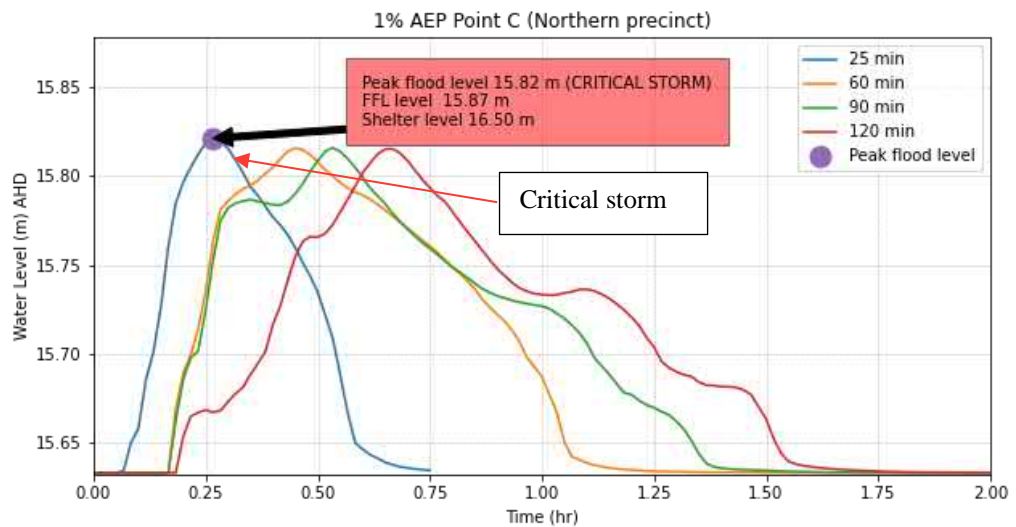


Figure 6. Flood hydrograph at point C: 1% AEP - 25 min, 60 min, 90 min and 120 min.

PMF flood event

PMF flood hydrographs for the 30, 45- and 90-minutes storm events have been considered for point A, B and C.

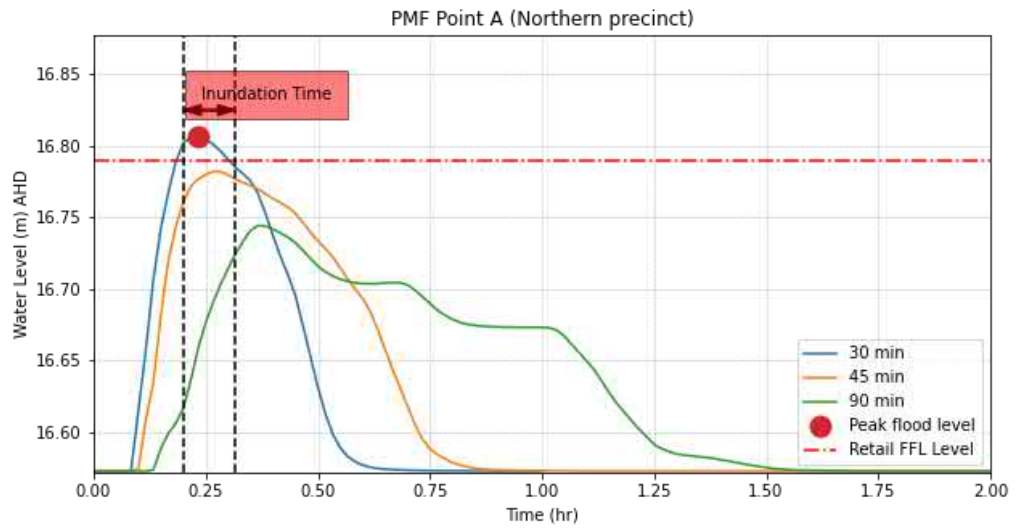


Figure 7. Flood hydrograph at point A: PMF- 30 min, 45 min, 90 min.

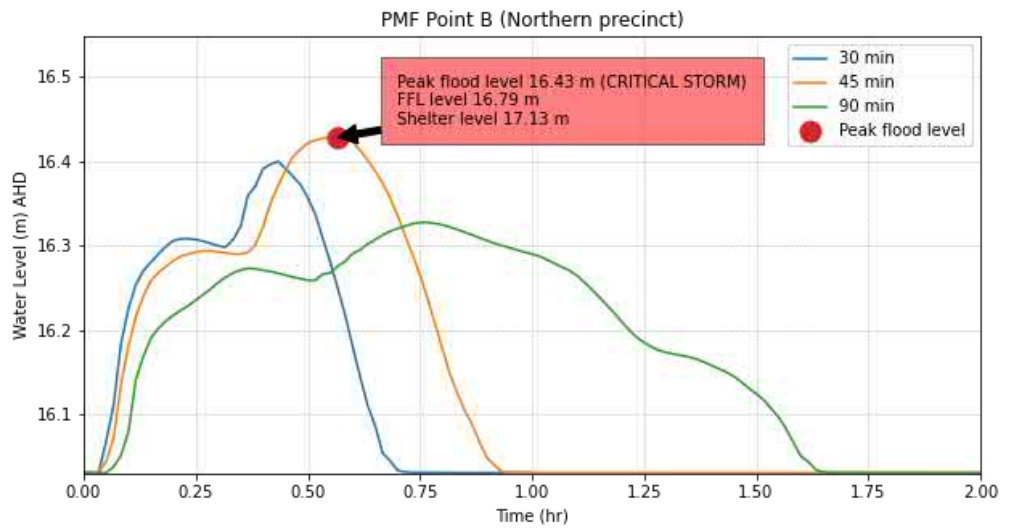


Figure 8. Flood hydrograph at point B: PMF- 30 min, 45 min, 90 min.

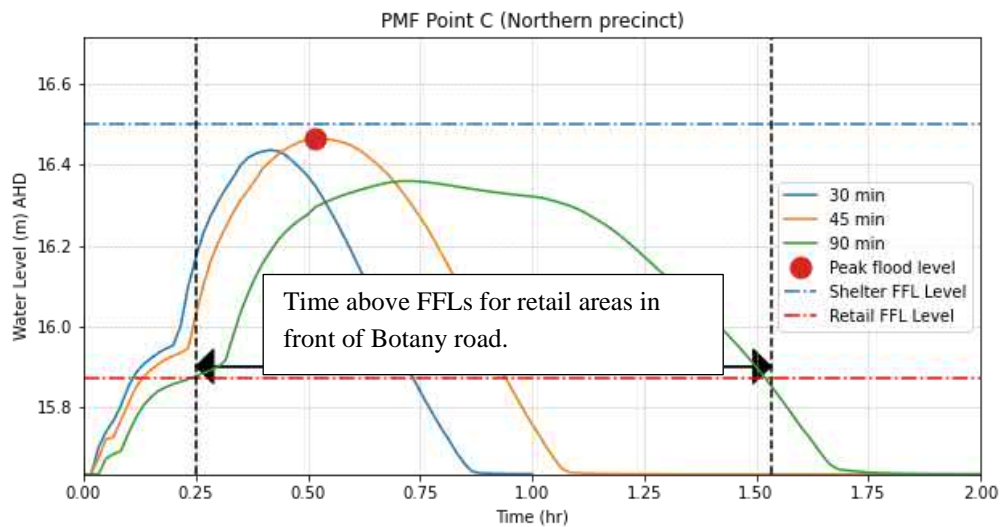


Figure 9. Flood hydrograph at point C: PMF- 30 min, 45 min, 90 min.

Table 2 below summarises the timing to reach critical consequence height at the building.

Table 2: Time to reach critical consequence height

Flood Event	Peak Flood Level (m AHD)	Time to Peak (hrs)	Time to reach FFL (after the storm)	Time above FFL (after the storm)
1% AEP – 25 minutes (point A)	16.58	0.28	NA – FFL above 1% AEP flood level	Nil
1% AEP – 60 minutes (point A)	16.57	0.47	NA – FFL above 1% AEP flood level	Nil
1% AEP – 90 minutes (point A)	16.58	0.55	NA – FFL above 1% AEP flood level	Nil
1% AEP – 120 minutes (point A)	16.58	0.65	NA – FFL above 1% AEP flood level	Nil
1% AEP – 25 minutes (point C)	15.82	0.27	NA – FFL above 1% AEP flood level	Nil
1% AEP – 60 minutes (point C)	15.81	0.45	NA – FFL above 1% AEP flood level	Nil
1% AEP – 90 minutes (point C)	15.81	0.53	NA – FFL above 1% AEP flood level	Nil

Flood Event	Peak Flood Level (m AHD)	Time to Peak (hrs)	Time to reach FFL (after the storm)	Time above FFL (after the storm)
1% AEP – 120 minutes (point C)	15.81	0.65	NA – FFL above 1% AEP flood level	Nil
PMF (point A) 30 minutes	16.8	0.27	0.27	0.08 (~ 5 minutes)
PMF (point A) 45 minutes	16.78	0.33	NA – FFL above 1% AEP flood level	Nil
PMF (point A) 90 minutes	16.74	0.36	NA – FFL above 1% AEP flood level	Nil
PMF (point C) 30 minutes	16.43	0.42	0.13	0.62 (~ 37 minutes)
PMF (point C) 45 minutes	16.46	0.51	0.13	0.76 (~ 45 minutes)
PMF (point C) 90 minutes	16.35	0.73	0.25	1.2 (1h and 12 minutes)

Time of inundation / time of isolation

As requested by the EES reviewer time of isolation map have been prepared for the 1% AEP and PMF flood events for the areas surrounding the site. Time of isolation maps have been prepared assuming a cut-off depth of 10 cm.

1% AEP flood event

Figure 10 shows time of isolation map for the 1% AEP flood event; refer to Appendix B for high resolution map.



Figure 10: Time of inundation for the 1% AEP (25,60, 90- and 120-minutes storms) flood event

Inundation map for the 1% AEP flood event shows that:

- The area at the north of the site is affected by flooding for 15 minutes; after 15 minutes flood depths decrease below 10 cm;
- Flooding affects the area at the south of the site (Wellington street, Botany Road and Cope Street) for 1.5 hours. After 1.5 hours flood depths decrease below 10 cm.
- Maximum time of isolation for the site area is considered 15 minutes for the 1% AEP flood event.
- Storm duration longer than 120 minutes are not expected to generate significant flood depths and flood hazard at each location.

PMF flood event

Figure 11 shows time of isolation map for the PMF flood event; refer to Appendix B for high resolution map.

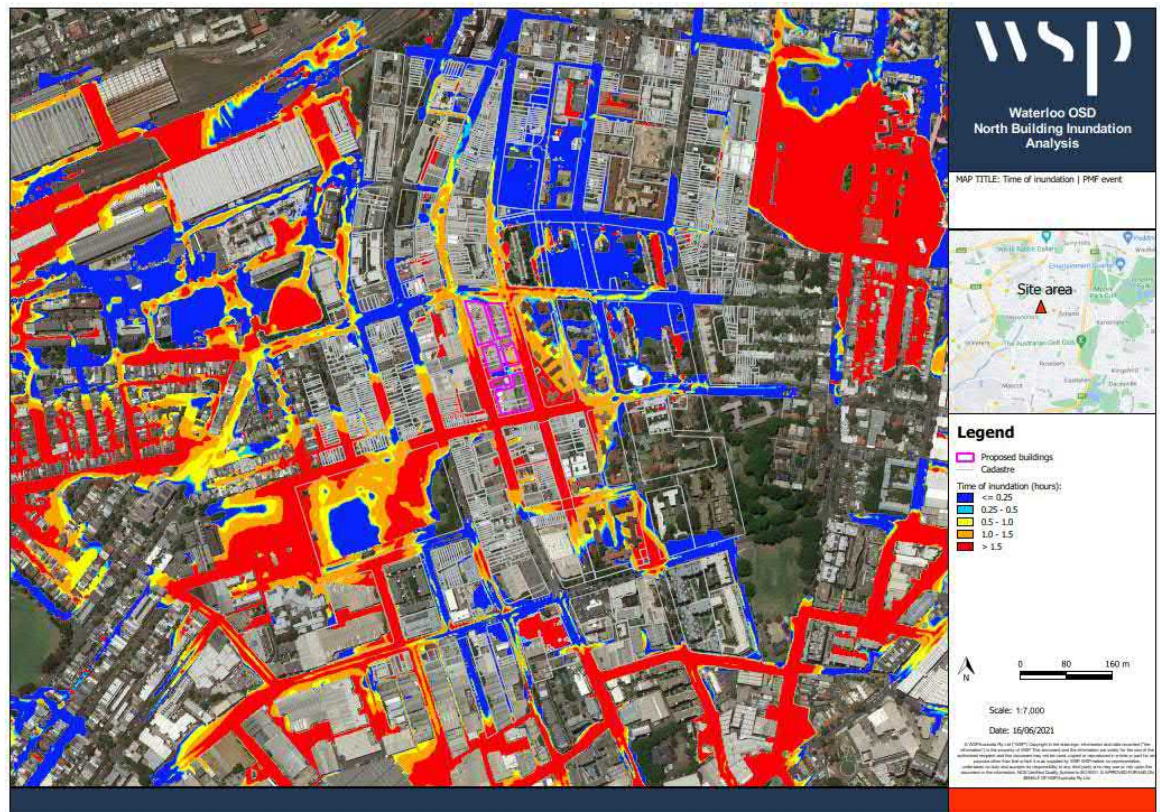


Figure 11: Time of inundation for the PMF (30,45- and 90-minutes storms) flood event

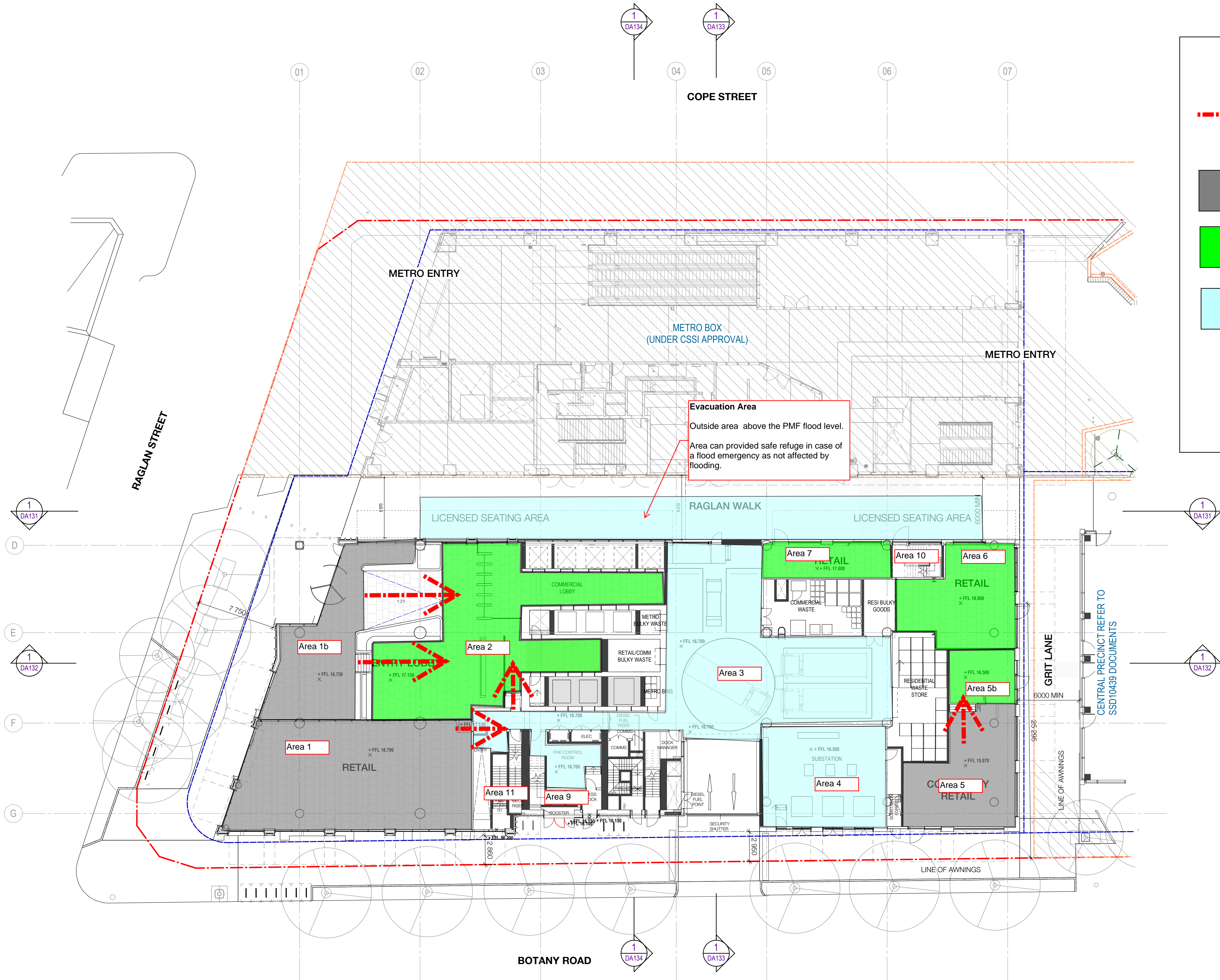
Inundation map for the PMF flood event shows that:

- The area at the north of the site is affected by flooding for 1.5 hours; after 1.5 hours flood depths decrease below 10 cm and the street access can be reactivated;
- Flooding affects the area at the south of the site (Wellington street, Botany Road and Cope Street) for more than 1.5 hours. Most of the streets at the south of the site are expected to be flooded for longer than 1.5 hours in a PMF flood event.
- The streets at the north of site (top of the catchment) are expected to be reactivated after 1.5 hours in a PMF flood event; thus, maximum time of isolation for the site area is considered 1.5 hours for the PMF flood event.

As already demonstrated in a PMF flood event occupants of the building can remain safe within the precinct by sheltering in place until the end of the flood emergency.



APPENDIX A – **EVACUATION** ROUTE PLAN



LEGEND

Evacuation route

Area requires evacuation for event greater than 1% AEP

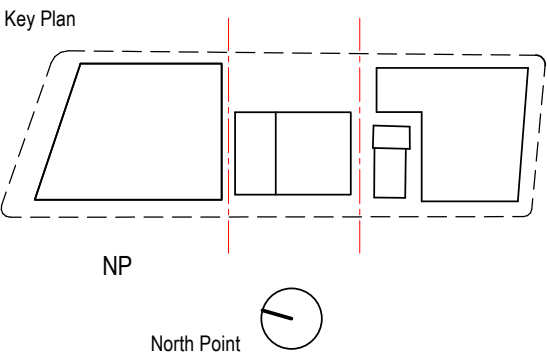
Shelter area

area above PMF No evacuation needed/ area can be used as additional shelter in a flood emergency

Recent revision history		
#	Status	Description
A	FOR INFORMATION (DA)	15.07.20
B	FOR APPROVAL	31.07.20
C	FOR APPROVAL	28.08.20
D	FOR APPROVAL	25.09.20
E	FOR INFORMATION	28.01.21
F	FOR APPROVAL	15.03.21

Current Revision Amendments		
#	Mark	Comments
F 1		LAYOUT UPDATED
F 2		LIFT UPDATED TO GROUND
F 3		FIRE STAIR RELOCATED

Notes
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Do not scale drawings.



Consultant
W-B
WOODS BAGOT

Project
WATERLOO METRO QUARTER DEVELOPMENT

Project number 121234	Size check 25mm
Checked SJ	Approved PM
Sheet size A1	Scale 1 : 200

Sheet title
SSD10440
BUILDING 1 - FLOOR PLAN - LEVEL
GROUND

Status
FOR APPROVAL

Sheet number
WMQ-BLD1-WBG-AR-DRG-DA100

Revision
F

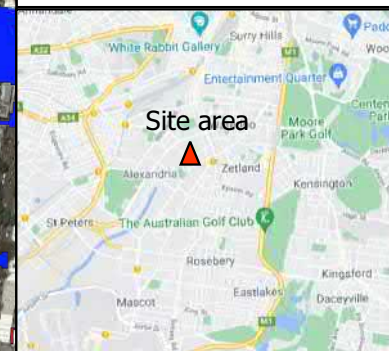


APPENDIX B – INUNDATION MAP



Waterloo OSD North Building Inundation Analysis

MAP TITLE: Time of inundation | 1% AEP flood event



Legend

- Proposed buildings
- Cadastre

Time of inundation (hours):

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5



0 80 160 m

Scale: 1:7,000

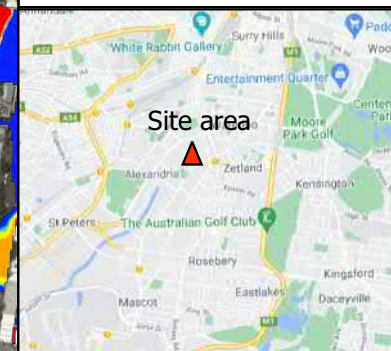
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Waterloo OSD North Building Inundation Analysis

MAP TITLE: Time of inundation | PMF event



Legend

- Proposed buildings
- Cadastre

Time of inundation (hours):

- <= 0.25
- 0.25 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5



0 80 160 m

Scale: 1:7,000

Date: 16/06/2021

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