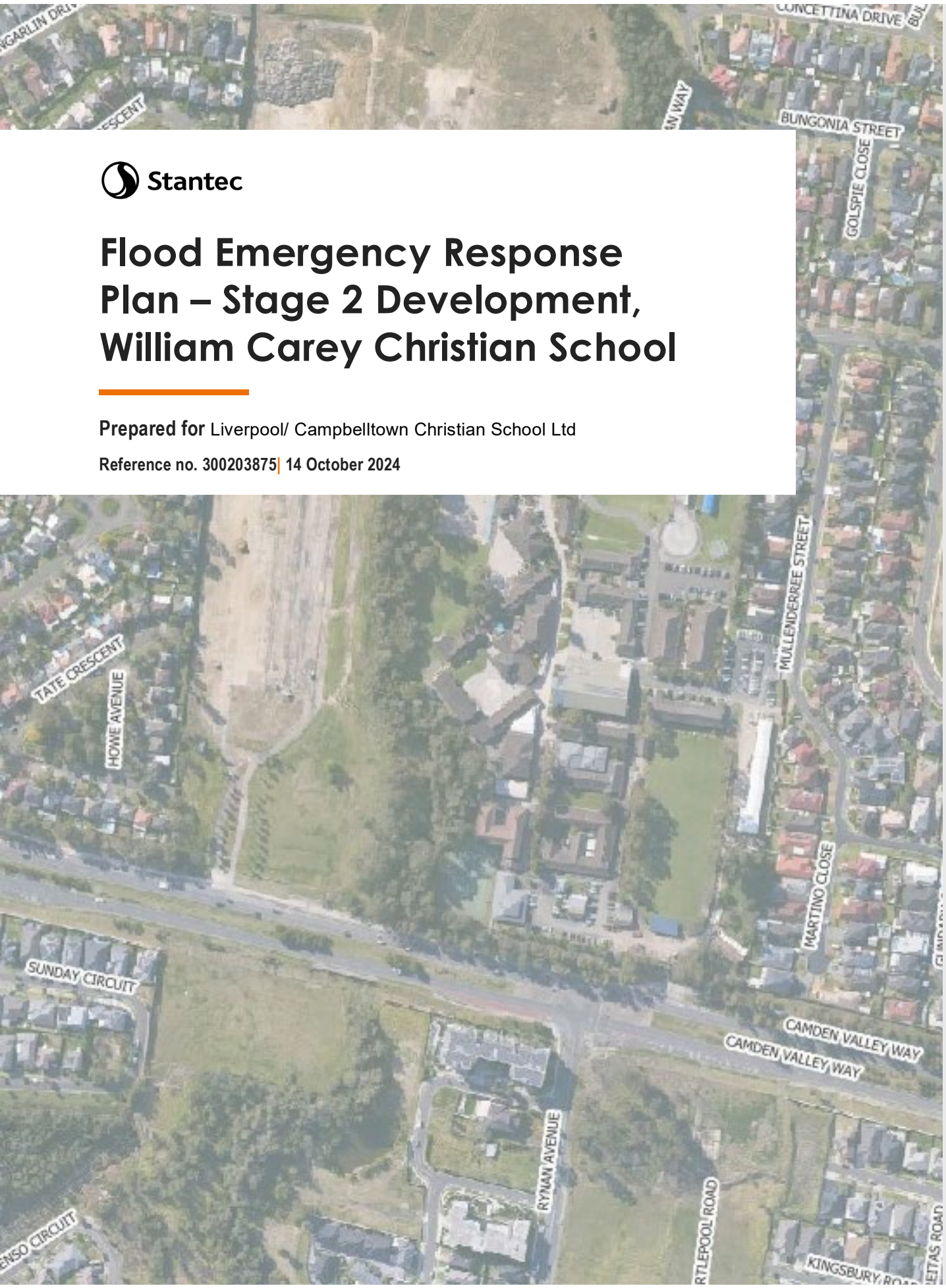
Stantec

Flood Emergency Response Plan – Stage 2 Development, William Carey Christian School

Prepared for Liverpool/ Campbelltown Christian School Ltd

Reference no. 300203875| 14 October 2024



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Revision Schedule
Project Number: 300203875 PCN1

Revision	Date	Description	Author	Reviewed By Check	Approve for Issue
1	02/10/2024	WCCS Stage 2 FERP	HR, SG	BCP, EL	MG
1A	14/10/2024	WCCS Stage 2 FERP	HR, SG	BCP, EL	MG

Quality statement

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Executive Summary

This report details a Flood Emergency Response Plan (FERP) for the William Carey Christian School – Stage 2 development. The Report describes:

- Flood behaviour on the site in floods up to a Probable Maximum Flood (PMF),
- A Flood Emergency Response Plan for the development, including:
  - Flood risks both on the site and external to the site;
  - Evacuation strategy, measures, procedures and plan; and
  - A FloodSafe Plan

The following actions must be co-ordinated by the Flood Wardens.

- Monitoring rainfall and any runoff entering the site and any flooding on the site;
- Assessing if site operations can continue safely during inclement weather;
- Restricting any site operations that continue during inclement weather to areas well away from any flooding on the site;
- If it is unsafe for site operations to continue when flooding in the car parks becomes unsafe and/or floodwaters are approaching the entry to proposed Stage 2 development classroom then directing all building teaching staff and students retreat to Level 1; and
- Monitoring any regional flooding and road closures through SES's Flood Information webpage and the Live Traffic Website and advising whether it is safe for workers to depart the site depending on their planned destination(s).

Emergency Contacts

Emergency contact numbers are as follows:

Agency	
Ambulance	Emergency Telephone: 000
Bureau of Meteorology (BoM)	http://www.bom.gov.au/nsw/warnings/ Telephone: 1300 659 219 (for flood warnings)
Police	Liverpool PAC, 148 George St LIVERPOOL NSW 2170 Telephone: 02 9765 9499 Emergency Telephone: 000
Fire & Rescue NSW	Emergency Telephone: 000
State Emergency Services (SES)	Emergency Telephone: 132 500 (fir Flood Warnings) General enquiries: (02) 4251 6111

Liverpool City Council Flood Information Webpage

The information, resources and links included on this page are provided under the following headings:

Flood Information

Liverpool City Council is supporting the **State Emergency Service** **as the lead agency for anyone affected by the February flood event.**

Please visit their website **ses.nsw.gov.au** or call 132 500 if you need assistance with evacuation or damage to your home.

Council will prioritise the collection of waste and debris material in coming weeks.

Visit: Our Warnings | NSW State Emergency Service

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 Introduction

This Report details a Flood Emergency Response Plan (FERP) for the planned Stage 2 development of William Carey Christian School, Prestons. Stantec was engaged to provide information on the current flooding risks at William Carey Christian School – Stage 2 Development to ensure the safe evacuation of staff and students from inundated areas during a flood event.

The development comprises of a multi (2) storey classroom building within the existing school extents, surrounded by existing buildings, with an approximate building footprint of approximately 246 m^2. The proposed site building's ground level is set above the 1% AEP level plus freeboard and exceeds the reported PMF water level of 40.56m AHD. The proposed building's ground level is at 40.90m AHD and the first floor is at 44.58m AHD.

1.1 Background

This plan outlines the expected emergency response procedures for the facility during a flood event. It recommends both evacuation and shelter-in-place (vertical evacuation) strategies for major and extreme flood events, ranging from the 1% AEP to the Probable Maximum Flood (PMF), due to the anticipated low hazard flood conditions on the regional road network during these scenarios.

It is important to note that this plan has been prepared as a preliminary document for approval purposes. It is expected to be updated prior to the issuance of the Construction Certificate to incorporate additional information, such as detailed floor plans and the standard emergency procedures of the future operator.

1.2 Location

The site is bound by Camden Road to the south, Cabramatta Creek to the west, existing residential and commercial developments to the east, and Bumbera Street to the North. A subject site and proposed building locations are presented in **Figure 1-1**.

1.3 Scope of Work

This Flood Emergency Response Plan (FERP) has been developed to:

- Enhance awareness of anticipated flood behaviour and associated flood risks at the site.
- Identify measures for monitoring weather forecasts and highlight available warning systems.
- Outline potential evacuation and shelter-in-place procedures, including evacuation routes where applicable, and flood refuge options.

This document includes a detailed explanation of the methodology and data used to prepare the report, a summary of likely flood behaviour, and recommendations for flood preparedness and response actions during a flood event.

Figure 1-1 Study Site Location (Source: Metro Map)

2 Available Data

2.1 Previous Studies

2.1.1 Cabramatta Creek Flood Study and Basin Strategy Review (Bewsher, 2011)

In the 2011 Cabramatta Creek Flood Study and Basin Strategy Review prepared by Bewsher:

> *"The study is divided into two parts. Part 1 aims to provide an advanced computer model of flood behaviour in the catchment for existing (2008) flood conditions. The model is also to be used to assess flood behaviour under previous (1989) catchment conditions, and to review the performance of Council's detention basin strategy to mitigate the impact of catchment development on flood behaviour within this time frame. Part 2 investigates the performance of the basin strategy under future (2026) conditions, including full development of the new release areas and construction of the remaining basins from the basin strategy.*
>
> *The adopted modelling approach has been to update an existing RAFTS hydrologic model of catchment runoff, and to input these flows to a new TUFLOW hydraulic model to estimate flood levels, velocities and extents. TUFLOW is a two-dimensional computer model that has been used in over 200 applications in NSW, Queensland, Victoria, South Australia, Tasmania, and in the UK.*
>
> *The models have been calibrated to historic data collected in the August 1986 and April 1988 floods. Both floods were significant, with the 1988 event being estimated to be close to a 100-year event throughout much of the catchment. Calibration data consisted of stage and flow hydrographs at a gauging station at Orange Grove Road, 29 flood height observations for the 1988 flood, and 44 flood height observations for the 1986 flood.*
>
> *Two different flood models have been developed representing existing (2008) and previous (1989) catchment conditions. A third model was developed representing future (2026) catchment conditions during Part 2 of the Study.*
>
> *Culvert Blockage Assumptions*
>
> *The current study makes no allowance for the potential blockage of culverts, bridges, or detention basin outlets. It is recommended that sensitivity testing be undertaken as part of any subsequent investigations to determine how flood behaviour may be affected under various blockage scenarios.*
>
> *Review of Flood Behaviour*
>
> *Design flood behaviour has been analysed for a range of floods for existing (2008) and previous (1989) catchment conditions. A map showing the extent of flood inundation and design flood level contours for the 100-year flood is provided on Figure 6.1 under existing (2008) conditions. Results for other events will be provided digitally for incorporation in Council's GIS. A flood risk management map is also provided on Figure 6.2 for the floodplain.*
>
> *A map showing the difference in the latest estimate of the 100-year flood from the previous estimate from the RMA-2 model is provided on Figure 6.3. The mapping indicates some localised areas where flood level estimates have either increased or reduced, although the majority of the study area has not changed significantly (within 0.2m).*
>
> *A map showing the difference in TUFLOW estimates over the period from 1989 to 2008 is provided on Figure 6.4. With the exception of some localised areas, the majority of the study area shows relatively minor changes (within 0.2m) over this period."*

It is our understanding that the flood extents mapped by Council ePlanning portal in the vicinity of the subject site are based on the results of the 2011 Cabramatta Creek Flood Study.

2.1.2 Flood Impact Assessment, 1895 Camden Valley Way, Horningsea Park (Cardno now Stantec, 2021)

In August 2021 an assessment was reported of flooding under benchmark conditions and assessments of the impact or otherwise of proposed development schemes to address the flood risks on 1895 Camden Valley Way, Horningsea Park was undertaken using a 1D/2D floodplain model supplied by Liverpool City Council.

2.1.3 Liverpool Overland Flow Path Study Stage 2 (BMT WBM, 2008)

The aims of the Liverpool Overland Flowe Path Part 2 study[1] included to:

- Define overland flow behaviour within the study area including flow rates, velocities, water depths;
- Assess the extents for the 5% AEP, 1% AEP and PMF events; and
- Produce high quality mapping describing the catchment flooding.

The Council's adopted overland flow has been analysed to better understand the overall flood behaviour, particularly for the evacuation of the proposed stage 2 development. The site is generally adequate for evacuation from mainstream flooding. This FERP which includes detailed considerations of overland flow, is based on the findings of the Stage 2 Flood Evacuation strategy.

2.1.4 Stage 2 William Carey Christian School Stage 2 Development Flood Impact Assessment (Stantec 2024)

Flood impact assessment for WCCS Stage 2 development was conducted using the flood model adopted by Council for the purpose 1895 Camden Valley Way LLC Flood Impact Assessment. The model was updated by including:

- The WCSS study survey to better reflect the Existing conditions of the site;
- The proposed new building footprints using high roughness values (n=1) to simulate the structures and to better reflect the Proposed conditions of the site.

The Existing and Proposed Conditions models were run for the 5% AEP, 1% AEP, and PMF events to assess flood depths, velocities, and hazards.

The results indicate that:

- The WCCS site remains flood-free during the 20% AEP and 1% AEP events;
- In the PMF event, the flood level difference plots disclose that negligible adverse impacts;
- PMF flood hazards under the proposed Conditions remain unchanged (compared to Existing Conditions).
- The study confirms that the proposed development will not exacerbate existing flood conditions the proposed

The proposed site building's ground level is set above the 1% AEP plus flood freeboard and exceeds the reported PMF water level. No additional flood control measures, other than evacuation, are to be considered.

Details on flood evacuation and response actions will be provided in the Flood Emergency Response Plan (FERP) to be prepared by Stantec, considering the site contains overland flow.

[1] BMT WBM (2008) Liverpool Overland Flow Path Study Stage 2", Final Report, Revision 2, prepared for Liverpool City Council.

3 Flood Risks

The flood risks experienced on Stage 2 development at William Carey Christian School, Prestons are discussed as follows.

3.1 Terminology

Book 1, Chapter 2, Section 2.2.5. Adopted Terminology in Australian Rainfall & Runoff, 2019 describes the adopted terminology as follows:

> *"To achieve the desired clarity of meaning, technical correctness, practicality and acceptability, the National Committee on Water Engineering has decided to adopt the terms shown in Figure 2-1 and the suggested frequency indicators.*

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very Frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.5
	1	63.21	1.58	1
Frequent	0.69	50	2	1.44
	0.5	39.35	2.54	2
	0.22	20	5	4.48
	0.2	18.13	5.52	5
	0.11	10	10	9.49
Rare	0.05	5	20	19.5
	0.02	2	50	49.5
	0.01	1	100	99.5
Very Rare	0.005	0.5	200	199.5
	0.002	0.2	500	499.5
	0.001	0.1	1000	999.5
	0.0005	0.05	2000	1999.5
Extreme	0.0002	0.02	5000	4999.5
			↓	
			PMP/ PMP Flood	

Figure 3-1 Australian Rainfall and Runoff Preferred Terminology

As shown in the third column of Figure 2-1, the term Annual Exceedance Probability (AEP) expresses the probability of an event being equalled or exceeded in any year in percentage terms, for example, the 1% AEP design flood discharge. There will be situations where the use of percentage probability is not practicable; extreme flood probabilities associated with dam spillways are one example of a situation where percentage probability is not appropriate. In these cases, it is recommended that the probability be expressed as 1 in X AEP where 100/X would be the equivalent percentage probability.

For events more frequent than 50% AEP, expressing frequency in terms of annual exceedance probability is not meaningful and misleading, as probability is constrained to a maximum value

of 1.0 or 100%. Furthermore, where strong seasonality is experienced, a recurrence interval approach would also be misleading. An example of strong seasonality is where the rainfall occurs predominately during the Summer or Winter period and as a consequence flood flows are more likely to occur during that period. Accordingly, when strong seasonality exists, calculating a design flood flow with a 3-month recurrence interval is of limited value as the expectation of the time period between occurrences will not be consistent throughout the year. For example, a flow with the magnitude of a 3-month recurrence interval would be expected to occur or be exceeded 4 times a year; however, in situations where there is strong seasonality in the rainfall, all of the occurrences are likely to occur in the dominant season.

Consequently, events more frequent than 50% AEP should be expressed as X Exceedances per Year (EY). For example, 2 EY is equivalent to a design event with a 6-month recurrence interval when there is no seasonality in flood occurrence."

3.2 Likelihood of Floods

Based on the 2023 Flood Risk Management Manual:

"The likelihood of a flood is a measure of its relative severity in terms of the annual exceedance probability (AEP) or the average recurrence interval (ARI) of the flood. These terms give a measure of the chance of a flood of a given magnitude being reached or exceeded in any given year. For example, a 5% AEP flood will have a 5% or 1 in 20 chance of being exceeded in a given year. This equates to a 20-year ARI.

*This can also be represented as the chance of experiencing a flood in an 80-year period, as shown in **Table 2.1**. Using this example, a person living in a location for 80 years has a 98.4% chance of experiencing one 5% AEP flood and a 91.4% chance of experiencing two 5% AEP floods.*

Modelling how the full range of floods up to the probable maximum flood (PMF) vary across the landscape provides an understanding of the areas of the floodplain affected by flood events of different likelihoods. It can also provide the basis for:

- *assessing the severity of the consequences of flooding on the community*
- *understanding how effective FRM measures may be at altering the likelihood of an area flooding and the associated consequences to the community.*

Table 3-1 Probability of experiencing the Given Flood once or twice in a 70-year Period

Annual exceedance probability %	Average recurrence interval (1 in x years)	Chance of experiencing in an 80-year period	
		at least once %	at least twice %
20	5	100	100
10	10	99.9	99.8
5	20	98.4	91.4
2	50	80.1	47.7
1	100	55.3	19.08
0.5	200	33	6.11
0.2	500	14.8	1.14
0.1	1000	7.69	0.3
0.01	10000	0.8	0.003

3.3 Overland Flow Hydrology

Hydrological modelling is undertaken to establish inflow boundaries to the TUFLOW hydraulic model (flow hydrographs from external catchments and local rainfall directly on to the flood-prone area). A conventional RAFTS model was developed for each of the sub areas.

Council provided an IFD table adopted as standard for the LGA (ARR1987).

No areal reduction factor was considered appropriate for the study.

In the absence of historical flow records, the values below were adopted as representative of the catchment for design purposes:

- Pervious surfaces: Initial Loss: 20 mm and Continuing Loss: 2.5 mm/hr; and
- Impervious surfaces: Initial Loss: 5 mm and Continuing Loss: 0 mm/hr.

For the PMF event an initial loss of 0 mm and continuing loss of 0 mm/hr were adopted. For the PMF event it is assumed that fully saturated catchment conditions would be present.

3.4 Overland Flow Hydraulics

The TUFLOW software was applied in this study using a linked 2D / 1D flood modelling approach.

Considering the design event magnitudes being investigated, i.e. 5%, 1% and PMF, Council resolved to include only the pipe network with diameter larger than or equal to 600 mm.

Council provided information where available on the existing drainage system.

Adopted Hydraulic Roughness Coefficients Based on Land Use Manning's 'n'

Road Reserve	0.020
Other hardstand (eg industrial/car parks)	0.015
Concrete pipe/channel	0.015
Parks/Reserves (maintained)	0.03
Residential Land (non-building)	0.05
Residential/Industrial Buildings	0.20
Vegetated Floodplain (variable)	0.06 – 0.10
Channel (variable)	0.03 – 0.06

The high Manning's value for residential/industrial buildings was adopted to account for inundation within buildings (accounting for storage) but not simulating significant flow through the building.

The flood mapping series included each of the design event magnitudes simulated in the study, the 5% AEP, 1% AEP and PMF flood events.

A range of design event storm durations including 15 minutes, 30 minutes, 60 minutes, 90 minutes, 120 minutes, 180 minutes and 360 minutes were simulated for each of the study areas.

The critical duration for the majority of the study areas for overland flooding (not mainstream flooding) was of the order of 60 mins to 90 mins.

3.5 Flood Hazard

The 2023 Flood Risk Management Guideline FB03 released on 30 June by NSW DPE includes a plot of flood hazard vulnerability curves based on six hazard categories H1 – H6.

3.5.1 Overall Site Consideration

The flood hazard categories experienced in the vicinity of the William Carey Christian School in the 1% AEP and PMF events are disclosed in **Figures 3-2** and **3-3. (BMT WBM, 2008)**

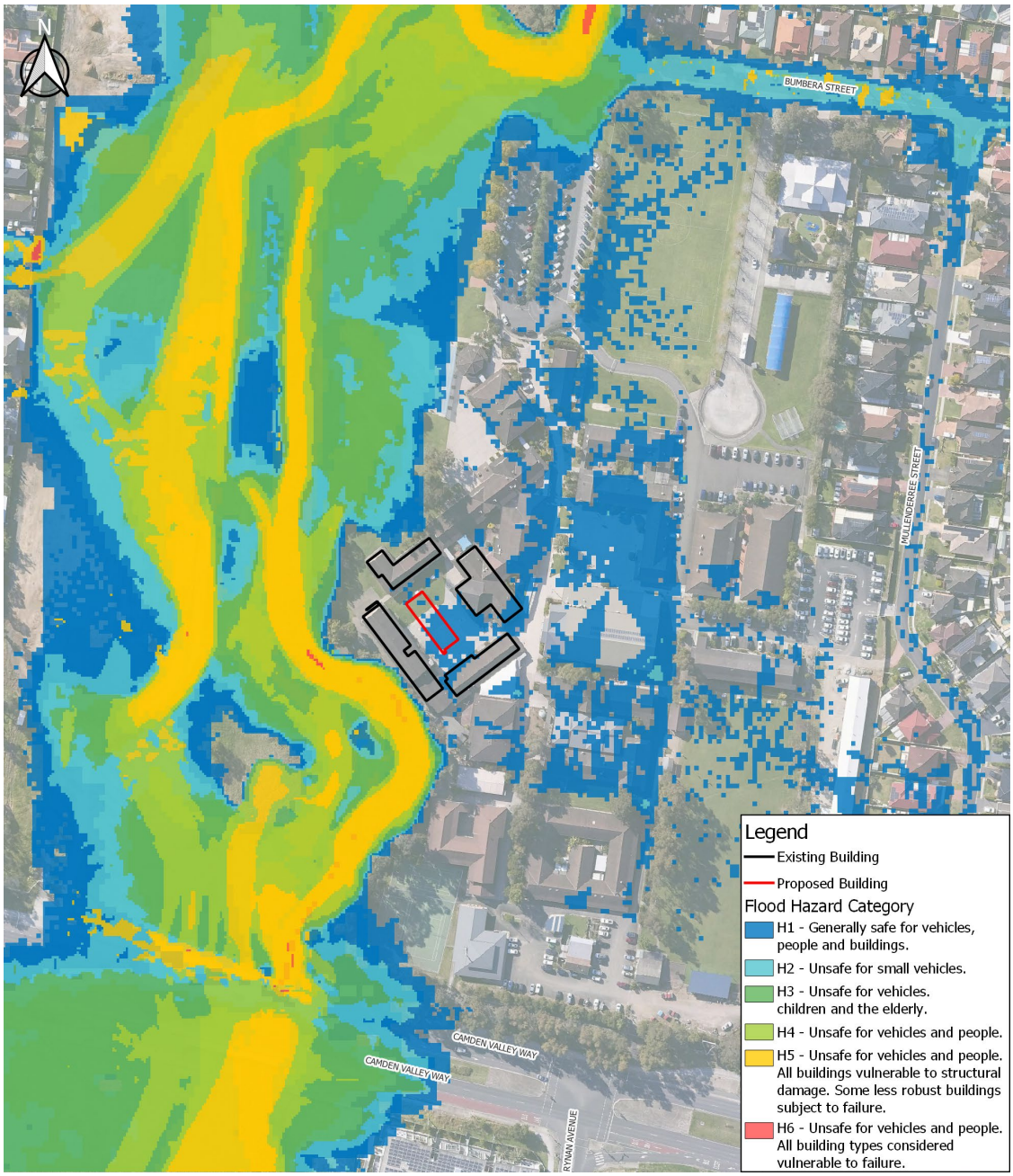


Figure 3-2 1% AEP Proposed Flood Hazard

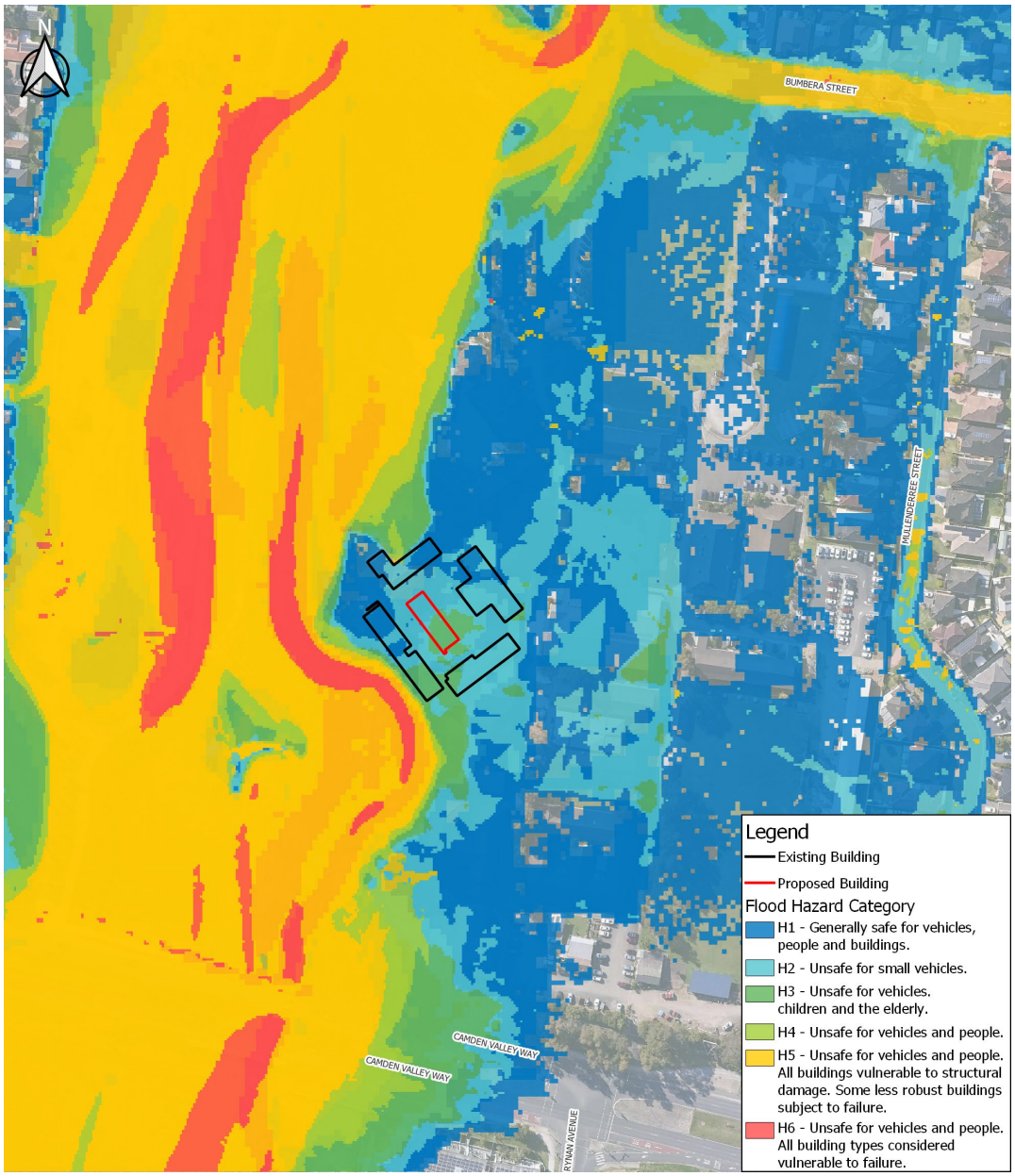


Figure 3-3 PMF Proposed Flood Hazard

3.5.2 Flood Hazards on Bumbera Street and Mullenderree Street

The potential impact of overland flow risks on vehicle evacuation were assessed by analysing the flood hazards at the reference locations (refer **Figure 3-4**) during the 1% AEP and PMF overland flow floods. The reference locations are at the low point in the current WCCS western driveway entry (D1), in Bumbera Street in the vicinity of the WCCS eastern driveway entry (B1), in Bumbera St in the vicinity of the Braidwood Drive roundabout (B2) and at the intersection of Bumbera St and Mullenderree St (M1).

Figure 3-4 Reference Locations

Time series results have been extracted at four (4) locations identified in **Figure 3-8**

The plots collated in **Appendix A** plot the temporal variations at the four reference locations for the following:

- 1% AEP depth time series
- 1% AEP hazard time series (H1-H6)
- 1% AEP pedestrian hazard time series
- PMF depth time series
- PMF hazard time series (H1-H6)
- PMF pedestrian hazard time series

The estimated duration of unsafe conditions at Locations D1, B1, B2 and M1 and the estimated time from the start of the extreme events until unsafe conditions are reached at Locations D1, B1, B2 and M1 for vehicles and pedestrians in the 1% AEP (100 yr ARI) flood and the PMF under overland flow flood conditions are given in **Tables 3-2** and **3-3** respectively.

Table 3-2 Duration (mins) of Unsafe Conditions for Vehicles and Pedestrians at Reference Locations

Duration **(mins)** it is Unsafe for:

	Small Vehicles	Large Vehicles	Small Vehicles	Large Vehicles
Location	100yr ARI		PMF	
D1	60	50	130	110
B1			115	95
B2			110	85
M1	30		125	105

Duration **(mins)** it is Unsafe for:

	Children	Adults	Children	Adults
Location	100yr ARI		PMF	
D1	50		125	75
B1			110	95
B2			105	45
M1			110	105

Table 3-3 Elapsed Time(mins) for Unsafe Conditions to be reached at Reference Locations

Elapsed Time from Start of Storm Burst until Unsafe Conditions Reached **(mins)**:

	Small Vehicles	Large Vehicles	Small Vehicles	Large Vehicles
Location	100yr ARI		PMF	
D1	35	40	10	15
B1			15	20
B2			15	15
M1	35		15	20

Elapsed Time from Start of Storm Burst until Unsafe Conditions Reached **(mins)**:

	Children	Adults	Children	Adults
Location	100yr ARI		PMF	
D1	40		10	25
B1			15	20
B2			15	15
M1			20	20

It is noted from **Table 3-2** that:

- As already identified, the western driveway entry is unsafe for small and large vehicles and for pedestrians in 1% AEP and PMF events;
- In a 1% AEP flood it remains safe to exit car parking via the eastern driveway and to drive east along Bumbera St notwithstanding overland flow flooding along the road;
- Likewise, it would be safe for children and adults to evacuate by foot along Bumbera St notwithstanding overland flow flooding along the road;
- It is unsafe for small vehicles to attempt to turn from Bumbera St into Mullenderree St in a 1% AEP flood for 30 mins;
- It is unsafe for both small and large vehicles and pedestrians to exit the car parking onto Bumbera St and to attempt to drive or walk east along Bumbera St in the PMF for durations between 95 mins and 115 mins depending on the vehicle and pedestrians;
- It is also unsafe for vehicles or pedestrians to attempt to turn from Bumbera St into Mullenderree St in a PMF for 105 mins to 125 mins depending on the vehicle or pedestrians.

It is noted from **Table 3-3** that:

- When unsafe conditions develop in a 1% AEP flood this is typically within 35 - 40 mins from the start of the storm burst; and
- In a PMF unsafe conditions can develop within 10 – 20 mins depending on the vehicle and pedestrians

It is concluded that in a 1% AEP flood:

- It remains safe to exit car parking via the eastern driveway and to drive east along Bumbera St notwithstanding overland flow flooding along the road;
- It would be safe for children and adults to evacuate by foot along Bumbera St notwithstanding overland flow flooding along the road;
- When unsafe conditions develop in a 1% AEP flood this is typically within 35 - 40 mins from the start of the storm burst

It is concluded that in a PMF:

- It is unsafe for both small and large vehicles and pedestrians to exit the car parking onto Bumbera St and to attempt to drive or walk east along Bumbera St in the PMF for durations between 95 mins and 115 mins depending on the vehicle and pedestrians; and
- In a PMF unsafe conditions can develop within 10 – 20 mins depending on the vehicle and pedestrians.

3.6 Pedestrian and Vehicular Stability in Floods

The latest edition of Australian Rainfall and Runoff released in 2019 provides guidance on both pedestrian and vehicle stability in floods as does the 2023 Flood Risk Management Guideline FB03 released on 30 June by NSW DPE. Refer to Figure 2-4 for the flood hazard vulnerability curves based on six category H1-H6.

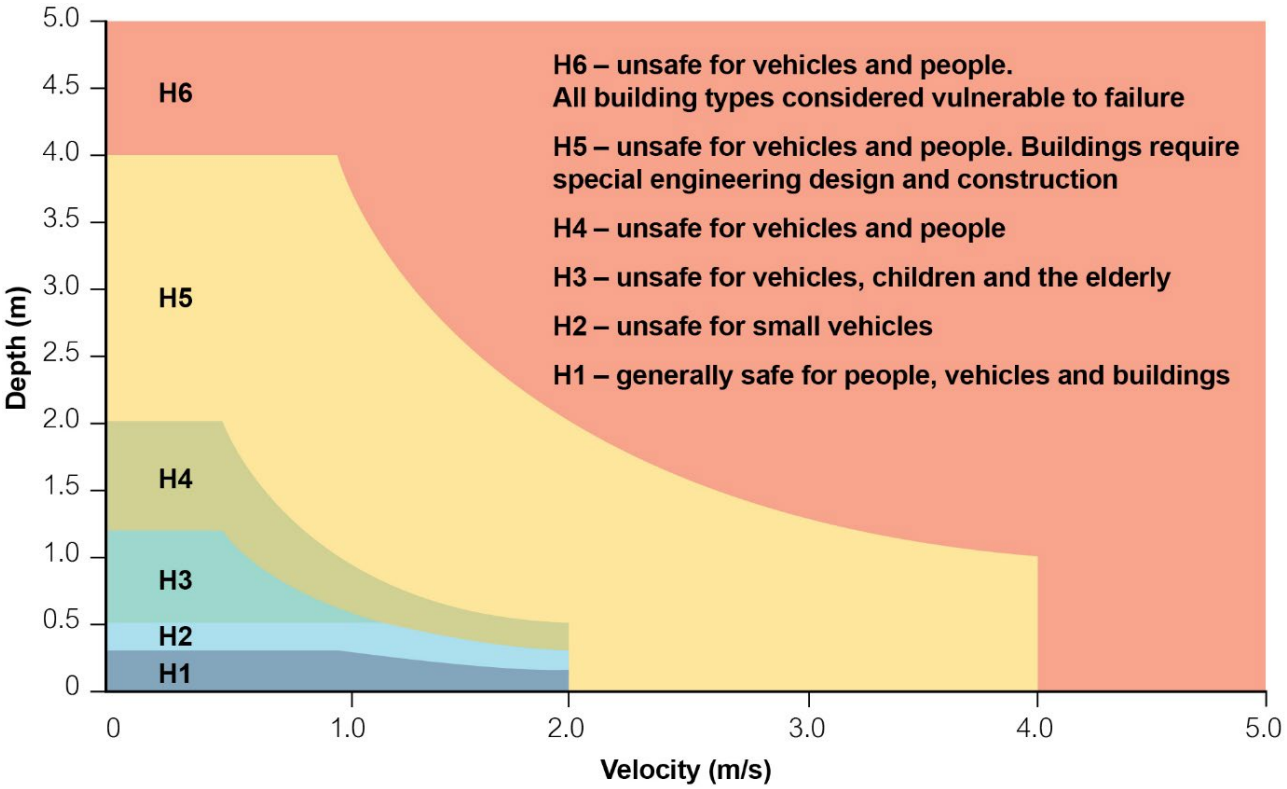


Figure 3-5 General flood hazard vulnerability curve (Source: 2023 FRMG)

3.6.1 Pedestrian Stability

The 2023 Flood Risk Management Guideline FB03 released on 30 June by NSW DPE includes a plot of thresholds for the stability of people in floods. (See **Figure 3-5**)

A comparison of the pedestrian stability thresholds and the flood hazard categories is given in **Figure 3-6**.

It is concluded from the comparison that:

(i) Adults could safely evacuate through areas subject to H3 hazards

(ii) Children could safely evacuate through areas subject to H2 hazards where the velocity is < 0.8 m/s however if velocities increase to 1.0 m/s or greater then it would be only safe to evacuate through areas subject to H1 hazards

(iii)

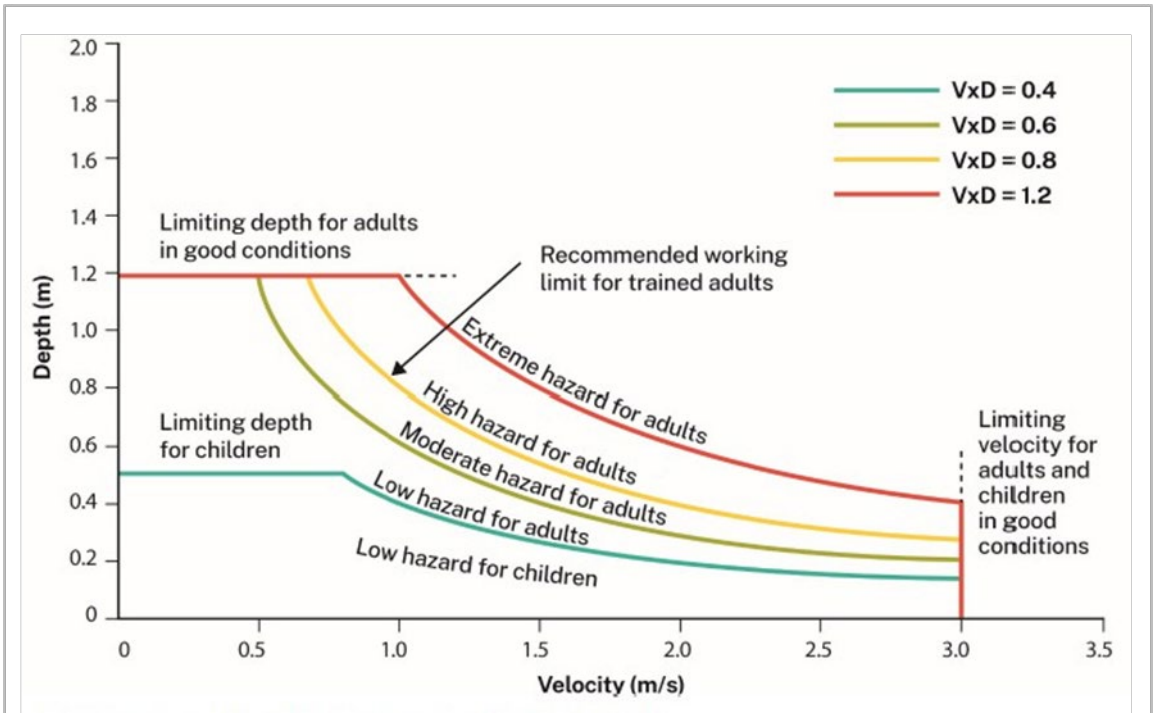


Figure 3-6 Thresholds for Pedestrian Stability

3.6.2 Vehicle Stability

The 2023 Flood Risk Management Guideline FB03 released on 30 June by NSW DPE includes the following plot of thresholds for vehicle stability in floods (see **Figure 3-7**).

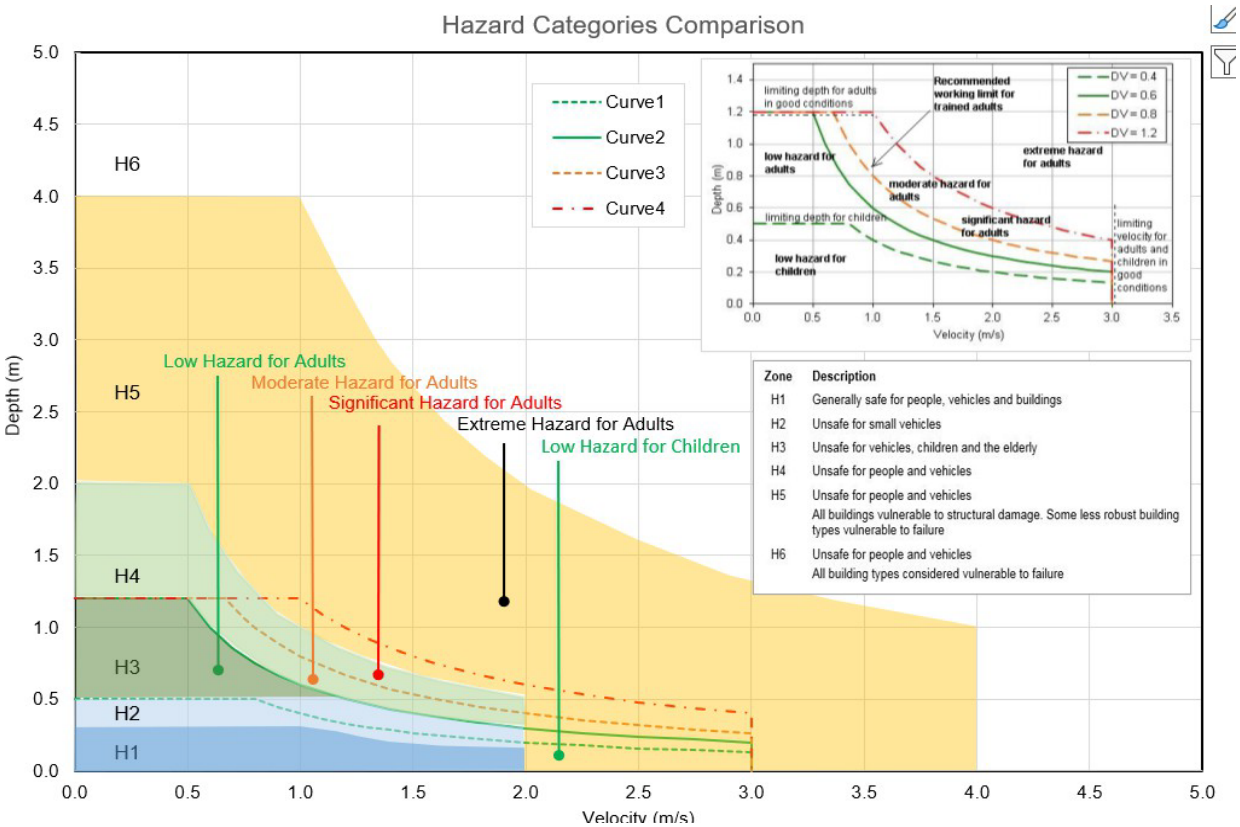


Figure 3-7 Comparison of pedestrian stability thresholds and the flood hazard categories

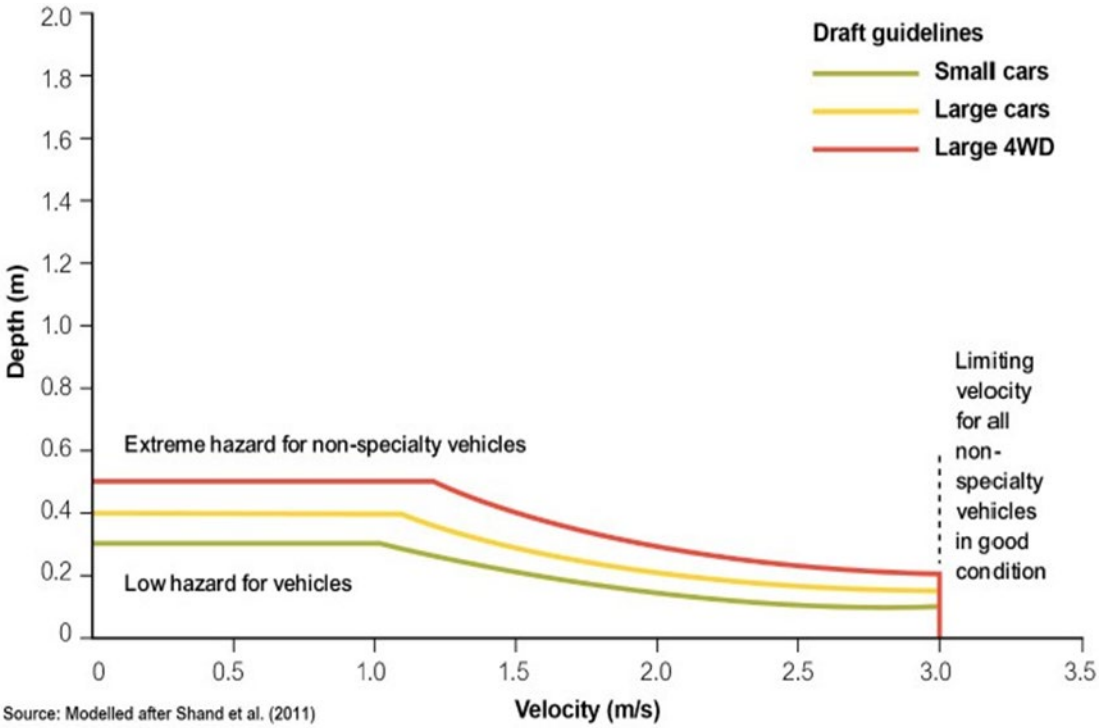
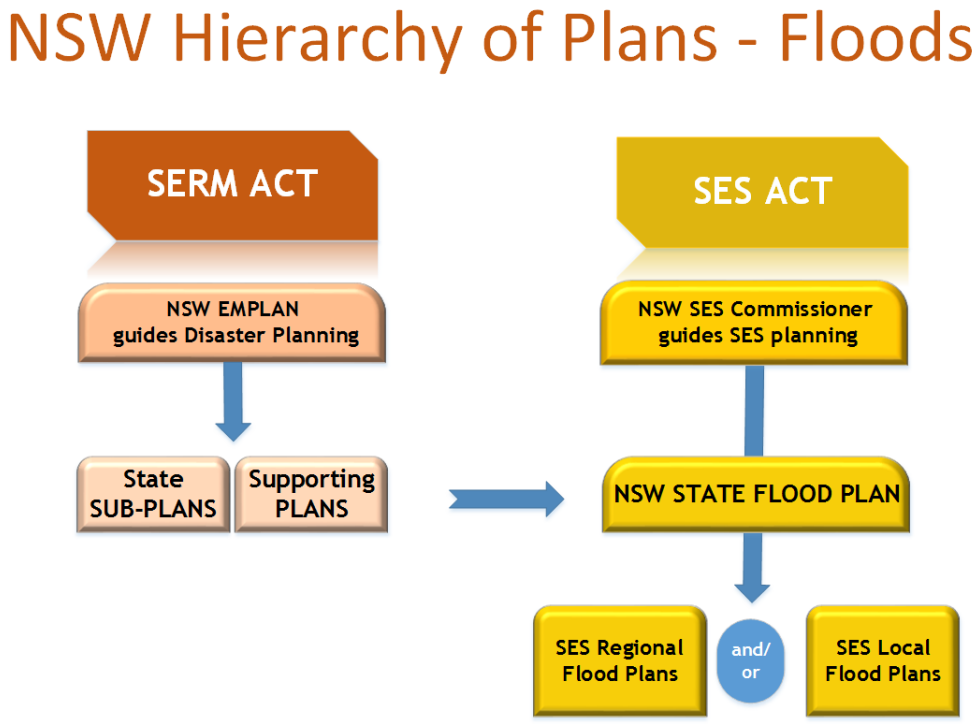


Figure 3-8 Thresholds for Vehicular Stability

H1 and H2 categories have been adopted as representative categories for vehicular stability respectively for small vehicles and large (4WD) vehicles.

4 Flood Emergency Planning

The hierarchy of flood emergency plans is NSW is as follows:



4.1 2018 New South Wales State Emergency Management Plan

The NSW State Emergency Management Plan (EMPLAN) is overviewed as follows:

3.1.1 Aim

The State Emergency Management Plan (EMPLAN) describes the New South Wales approach to emergency management, the governance and coordination arrangements and roles and responsibilities of agencies. The Plan is supported by hazard specific sub plans and functional area supporting plans.

3.1.2 Objectives

Consistent with the State Emergency and Rescue Management Act 1989 (SERM Act), the objectives of the EMPLAN are to:

a) provide clarity as to command and control, roles and coordination of functions in emergency management across all levels

b) emphasise risk management across the full spectrum of prevention, preparation, response and recovery

c) emphasise community engagement in the development and exercise of plans as well as in their operational employment

d) ensure that the capability and resourcing requirements of these responsibilities are understood.

The Plan promotes a comprehensive approach based on:

Prevention:	*to eliminate or reduce the level of the risk or severity of emergencies*
Preparation:	*to enhance capacity of agencies and communities to cope with the consequences of emergencies*
Response:	*to ensure the immediate consequences of emergencies to communities are minimised*
Recovery:	*measures which support individuals and communities affected by emergencies in the reconstruction of physical infrastructure and restoration of physical, emotional, environmental and economic well-being.*

4.2 2021 New South Wales State Flood Plan

The NSW State Flood Plan is overviewed, in part, as follows:

3.2.1 Purpose

The purpose of this plan is to set out the state level multi-agency arrangements for the emergency management of flooding in New South Wales including Lord Howe Island

3.2.2 Scope

The Plan sets out the state level emergency management arrangements for prevention, preparation, response, and initial recovery for flooding at the strategic level.

In this plan a flood is defined as a relatively high-water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake, or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves (including tsunami) overtopping coastline defences. …..

3.2.3 Types of Flooding

Riverine Flooding

a) 'Riverine' flooding differs in characteristics between the coastal and inland areas of the state. Maps of Inland and Coastal Rivers can be found in the State Flood Plan Supplementary and Supporting Documentation on the NSW SES Website ….

Flash Flooding

a) Flash flooding occurs quickly (within 6 hours) after rain causing overland flood and rapid stream rises. It can occur anywhere in the state when the intensity of the rainfall overwhelms natural or artificial drainage systems

b) Larger urban areas of Sydney, Newcastle, the Central Coast and Wollongong and in near-coastal environments where communities have been developed on, and immediately below, steep escarpments (such as at Coffs Harbour) are at risk of flash flooding. Flash flooding also occurs when urban drainage systems are overwhelmed by intense rainfall and roads become "rivers" with flooding occurring at their low points. In steeply sloping areas such flooding can have dangerously high flow velocities.

c) Whilst flash flooding is quick to occur, when it occurs in the low-lying, flat, western parts of the state, floodwaters may take long periods of time to dissipate due to a lack of flow of water towards main rivers.

4.3 2017 South West Metropolitan Regional Emergency Plan

The South West Metropolitan Regional Emergency Management Plan is outlined, in part, as follows:

3.3.1 Purpose

Details arrangements for, prevention of, preparation for, response to and recovery from emergencies within the Emergency Management Region covered by this plan. ……

3.3.2 Scope

The plan describes the arrangements at Regional level to prevent, prepare for, respond to and recover from emergencies and provides policy direction for the preparation of Sub Plans and Supporting Plans. Further:

- This plan relies on effective implementation of the Governance framework for Emergency Management;
- Arrangements detailed in this plan are based on the assumption that the resources upon which the plan relies are available when required; and
- The effectiveness of arrangements detailed in this plan are dependent upon all involved agencies preparing, testing and maintaining appropriate internal instructions, and/or standing operating procedures.

3.3.3 Principles

The following principles are applied in this plan:

a) *The Emergency Risk Management (ERM) process is to be used as the basis for emergency planning in New South Wales. This methodical approach to the planning process is to be applied by Emergency Management Committees at all levels.*

b) *Responsibility for preparation, response and recovery rests initially at Local level. If Local agencies and available resources are not sufficient, they are augmented by those at regional level.*

c) *Control of emergency response and recovery operations is conducted at the lowest effective level.*

d) *Agencies may deploy their own resources from their own service from outside the affected Region if they are needed.*

e) *The Regional Emergency Operations Controller (REOCON) is responsible, when requested by a combat agency, to co-ordinate the provision of resources support. EOCONs would not normally assume control from a combat agency unless the situation can no longer be contained. Where necessary, this should only be done after consultation with the State Emergency Operations Controller (SEOCON) and agreement of the combat agency and the appropriate level of control.*

f) *Emergency preparation, response and recovery operations should be conducted with all agencies carrying out their normal functions wherever possible.*

g) *Prevention measures remain the responsibility of authorities/agencies charged by statute with the responsibility.*

4.4 2021 Liverpool City Local Flood Emergency Sub Plan

As described, in part, by Liverpool City Council and NSW SES, 2021*:*

> *The purpose of this plan is to set out the multi-agency arrangements for the emergency management of flooding in Liverpool City Local Government Area (LGA). …..*

This Plan is written and issued under the authority of the State Emergency and Rescue Management Act 1989 (NSW) ('SERM Act'), the State Emergency Service Act 1989 (NSW) ('SES Act') and the NSW State Emergency Management Plan (EMPLAN).

This plan is a sub plan to Liverpool City Council Local Emergency Management Plan (EMPLAN) and is endorsed by Liverpool Local Emergency Management Committee (LEMC).

This plan is also a sub plan to the Hawkesbury Nepean Flood Emergency Sub Plan. …..

The Liverpool City Council Emergency Management Plan (EMPLAN) is active at all times in anticipation of the need to coordinate support and provide resources requested by combat agencies, including the NSW State Emergency Service (NSW SES).

The Plan sets out Liverpool City's local arrangements for prevention, preparation, response and initial recovery for flooding in Liverpool City LGA. Hazard and Risk information can be found in Volume 2 of this document and NSW SES Response Arrangements can be found in Volume 3. ….

As described in Section 5.4, in part:

PROVISION OF INFORMATION AND WARNINGS TO THE COMMUNITY

Strategy: Timely and effective warnings are distributed to the community.

Actions:

a. *The BoM issues public weather and flood warning products before and during a flood. These may include:*
   - *Severe Thunderstorm Warnings with reference to heavy rainfall,*
   - *Regional Severe Thunderstorm Warnings with reference to heavy rainfall,*
   - *Detailed Severe Thunderstorm Warnings (for Sydney / Newcastle / Wollongong) with reference to heavy rainfall,*
   - *Severe Weather Warnings with reference to heavy rainfall and/or storm surge,*
   - *Flood Watches, and*
   - *Flood Warnings;*

b. *Dam Owners will utilise Dam Failure Warning Systems to provide warnings and information to NSW SES and communities (where appropriate);*

c. *NSW SES Incident Controllers will issue the following NSW SES flood information products incorporating warnings from the above, expected consequences and safety messages:*

   - *Livestock and Equipment (pump) Warnings,*
   - *Local Flood Advices,*
   - *Flood Bulletins,*
   - *NSW SES Evacuation Warning,*
   - *NSW SES Evacuation Order, and*
   - *NSW SES All Clear;*

d. *NSW SES will contact the Bureau of Meteorology to discuss the development of flood warnings as required;*

e. *NSW SES will provide alerts and deliver flood information to affected*

communities using a combination of the following methods:

- *Mobile and fixed public address systems,*
- *Two-way radio,*
- *Emergency Alert (SMS and voice message alerting system),*
- *Telecommunications (including Auto dial systems),*
- *Facsimile,*
- *Standard Emergency Warning Signal,*
- *Doorknocking,*
- *Mobile and fixed sirens,*
- *Variable message signs,*
- *Community notices in identified hubs,*
- *Distribution through established community liaison networks, partnerships and relationships, and*
- *NSW SES social media and website;*

f. *NSW SES may request supporting agencies redistribute NSW SES alerts and information, including through the provision of doorknocking teams;*

g. *Road closure information will be provided to the community through the following agencies/methods:*

- *Local Government Council websites, and*
- *My Road Info*
- *Transport for NSW 'Live Traffic' website:* www.livetraffic.com *or 'Transport InfoLine' 131 500. VMS messaging on roadways may also be used to advise motorists.*

h. *The Public Information and Inquiry Centre will be established by the NSW Police Force where required to provide information regarding evacuees and emergency information. Contact details will be broadcast once the centre is established; and*

i. *The Disaster Welfare Assistance Line will be established by Disaster Welfare Services where required to provide information on welfare services and assistance. Assistance line contact details will be broadcast once Disaster Welfare Services commence.*

As described in Section 5.6, in part:

ROAD AND TRAFFIC CONTROL

Strategy: Coordinate the closing and re-opening of flood affected roads.

Actions:

a. *Liverpool City Council will coordinate the closure and reopening of council managed roads;*

b. *The Transport Management Centre (TMC) in coordination with RMS will coordinate the closure and reopening of the state road network;*

c. *The NSW Police Force may close and re-open roads but will normally only do so (if Penrith City Council or the RMS have not already acted) and if public safety requires such action; and*

d. *NSW SES will assist with erecting road closure signs and barriers when time and resources permit.*

Strategy: Coordinate traffic control measures in flood affected areas.

a. *The NSW SES Incident Controller may direct the imposition of traffic control measures into flood affected areas in accordance with the provisions of the State Emergency Service Act, 1989 and the State Emergency Rescue Management Act, 1989; and*

b. *The NSW SES Incident Controller may request the Local Emergency Operations Controller provide suitable personnel to assist with traffic coordination.*

5 Flood Warning

In summary, the actions are:

- Monitor rainfall and any runoff entering the site and any flooding on the site;
- Assess if site operations can continue safely during inclement weather;
- Any site operations which continue during inclement weather should be restricted to areas well away from any flooding on the site;
- If it is unsafe for site operations to continue then students and staff on the site should retreat to the designated flood refuges on Level 1 in buildings.
- Monitor any regional flooding and road closures through SES Flood Information webpage and the Live Traffic Website and monitor whether it is safe for students and staff to depart the site depending on their planned destination(s).

5.1 Flood Warning on the Site

Given the magnitude of flooding experienced on the site, it is proposed that flood warning on the site will be based on visual observation of floodwaters. Specifically, this includes observing floodwaters at the four flood reference points (**Section 3.5.2**) along Bumbera Street and Mullenderree Street, and/or upstream overland flow entering the site. The conveyance of floodwaters through the site will be monitored during major floods, ranging from a 1% AEP event up to an extreme flood (the PMF).

5.2 Signage

It is proposed that signs be installed in prominent locations within the study area, including key entrances to the proposed Stage 2 Building and along visible points on the evacuation route. The proposed sign is attached in **Figure 5-1.**

Figure 5-1 Flood Signage

The signage draws awareness to flooding on site and to evacuate to the flood refuges or to remain in the refuges if external roads become unsafe due to regional scale flooding which does not permit workers or staff to depart the Site.

The sign should comply with the relevant requirements of Australian Standards, in particular AS2416, AS1319 and AS2293.

5.3 Regional Flood Warning

The information, resources and links included on Council Flood Information web page (see below) (Visit: Flood Information | Liverpool City Council (nsw.gov.au)) are provided under a number of headings including:

- Evacuation Warnings and Orders
- Evacuation Centre
- Road Closures
- Emergency Flood Warnings
- Weather Warnings
- Emergency Contact details

5.4 Other Sources

An important indication of likely imminent flood activity would be intense local rainfall. During any severe storms which occur designated staff should monitor the Bureau of Meteorology website.

5.4.1 The Bureau of Meteorology

The Bureau of Meteorology issues Severe Thunderstorm Warnings and Severe Weather Warnings for Sydney.

Severe Thunderstorm Warnings are issued together with maps indicating the current location and predicted path of thunderstorms. Severe Weather Warnings are for severe weather not related to thunderstorms, cyclones or fire, such as “east coast lows” or other causes of intense rainfall or storm surge.

These warnings are available at:
http://www.bom.gov.au/nsw/warnings/.

BoM also provides real time rain radar coverage for Sydney at:
http://www.bom.gov.au/products/IDR713.loop.shtml.

5.4.2 The NSW SES

The applicable zone is the Southern Sydney – Metro Zone which operates a Facebook page for informing members of the public (https://www.facebook.com/SouthernSydney.NSWSWES)

Metro Zone Headquarters

Suite 5, Level 9, 1 Rider Boulevard Rhodes NSW 2138

PO BOX 3696 Rhodes NSW 2138

Phone 02 4251 6111

Email mtz.admin@ses.nsw.gov.au

Office Hours 8:30am - 4:30pm Monday – Friday

The local SES unit is Liverpool located at Hoxton Park Road LIVERPOOL, Liverpool, NSW – Phone 132 500.

The SES issues Local Flood Advices. These are issued on the basis of localised valley watch information for locations for which the BoM does not issue Flood Warnings. They normally predict which class of flooding

(minor, moderate or major) will occur, and must not contradict any Flood Warnings provided by the BoM for other gauges on the same river. Local Flood Advices are to be clearly identified as being issued by the SES.

5.4.3 Local Emergency Management

As outlined in Section 4.4, the 2021 Liverpool City Local Flood Emergency Sub Plan, A Sub Plan of the Local Emergency Management Plan (EMPLAN) describes how timely and effective warnings are distributed to the community and how the closing and re-opening of flood affected roads is to be co-ordinated.

5.4.4 Local television and radio stations

Local television and radio stations would disseminate warnings from the Bureau of Meteorology, SES and other relevant sources.

6 Flood Evacuation

6.1 Riverine Flooding

The proposed Stage 2 development site can be evacuated up to the PMF for riverine flooding.

6.2 Overland Flow Flooding

When considering overland flow up to the PMF, the extents of flooding experienced in the vicinity of William Carey Christian School during the 1% AEP and PMF events are shown in Figures 3-2 and 3-3.

6.2.1 Proposed Evacuation Routes

The proposed evacuation routes for students and school staff include three options:

1. Option 1- Vehicle Entrance to Bumbera Street (Figure 6-1) – Northern Route
2. Option 2 - Emergency Services Access from Camden Valley Way (Figures 6-2 and 6-3) Southern Route
3. Option 3 - Shelter in Place for Stage 2 Development

The northern route is designed to be safe for pedestrian use during a 1% AEP flood event. In contrast, the southern route is suitable for both 1% AEP and PMF events, ensuring safety during severe flood storms. However, the southern route requires someone to open the school's gate during a storm to maintain accessibility from Camden Valley Way.

6.2.2 Option 1 - Main Vehicle Entrance

It was noted that during the Stage 2 development, if vehicles evacuate from the main access point at Bumbera Street, they will encounter overland flows that are expected to hamper evacuation for a period. The development will continue to adopt the procedures recommended for Stage 1. While Mullenderree Street might offer a secondary evacuation route after Stage 1 construction is completed (Figure 6-1), this street also experiences overland flows which would likely to impact evacuation for a period.

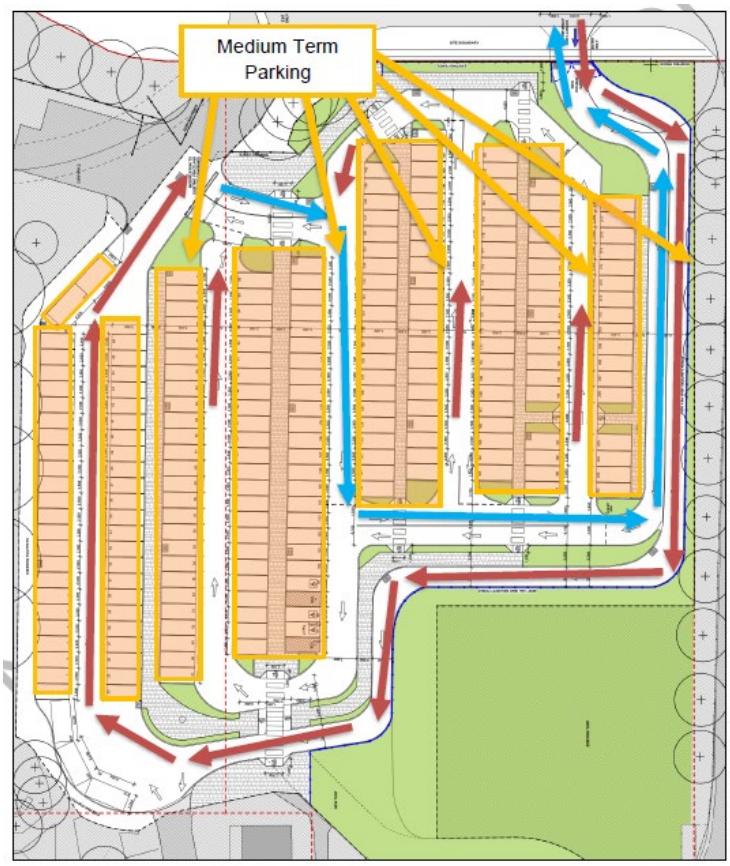


Figure 6-1 Possible Flood Scenario Stage 1 **Car Park Operations**

During Construction of stage 1, appropriate evacuation signage will be erected within the car park to direct drivers to this exit during a flood event, as necessary. Large vehicles could evacuate via this proposed route through mainstream flooding subject to the vehicles using the outgoing lane to avoid the area of H3 hazard. Consideration could be given to installing a colour coded flood marker beside the main (western) entry and exit at the low point in the driveway. If Stage 1 development does not occur, vehicle access during the 1% event can be considered through bus access, as shown in Figure 6-2.

The coding could be:

Green: up to a flood depth on the driveway of 0.3 m which would be safe for both small and large vehicles subject to velocities less than 1 m/s (H1 conditions);

Amber: flood depths on the driveway between 0.3 m and 0.5 m which would be safe for large vehicles subject to velocities less than 1 m/s (H2 conditions); and

Red: flood depths on the driveway greater than 0.5 m (H3 or greater conditions)

The potential impact of overland flow risks on evacuation was assessed by analysing the flood hazards at the reference locations (refer to Figure 6-2) during the 1% AEP and PMF overland flow floods, refer to section 3.5.2 and appendix A for details.

During a 1% AEP flood, it remains safe to exit car parking via the Stage 1 eastern driveway and to drive east along Bumbera St notwithstanding overland flow flooding along the road. Unsafe conditions typically develop within 35-40 minutes from the start of the storm burst.

In relation to evacuation by small vehicle through the driveway low point, it is only safe to do so if floodwaters at the marker beside the planned evacuation route still register in the “green” section of the

marker. For large vehicles, evacuation through the driveway low point is only safe if floodwaters at the marker still register in the “amber” section of the marker. If floodwaters are in the red zone, vehicles must exit via the alternative route and not through the driveway low point.

Given the assessment of overland flow flood hazards in Bumbera Street, consideration could be given to also installing colour coded flood marker beside along the reference locations identify when it would be unsafe to attempt to evacuate along Bumbera Street in extreme floods greater than a 1% AEP flood. The reference locations are:

1. D1: Low point in the current WCCS western driveway entry
2. B1: Bumbera Street in the vicinity of the WCCS eastern driveway entry
3. B2: Bumbera Street in the vicinity of the Braidwood Drive roundabout
4. M1: Intersection of Bumbera Street and Mullenderree Street

In a PMF, where it would be unsafe to attempt evacuation along Bumbera Street for durations between 95 and 115 minutes depending on the vehicle and pedestrians, it is recommended that any staff, students, and parents shelter in place within school buildings on levels higher than the PMF or prioritise pedestrian evacuation to Camden Valley Way until it is safe to depart along Bumbera Street.

In a 5% AEP flood, it would be safe for vehicles to exit the car park via the eastern driveway and drive east along Bumbera Street, as it is safe to do so in a 1% AEP flood.

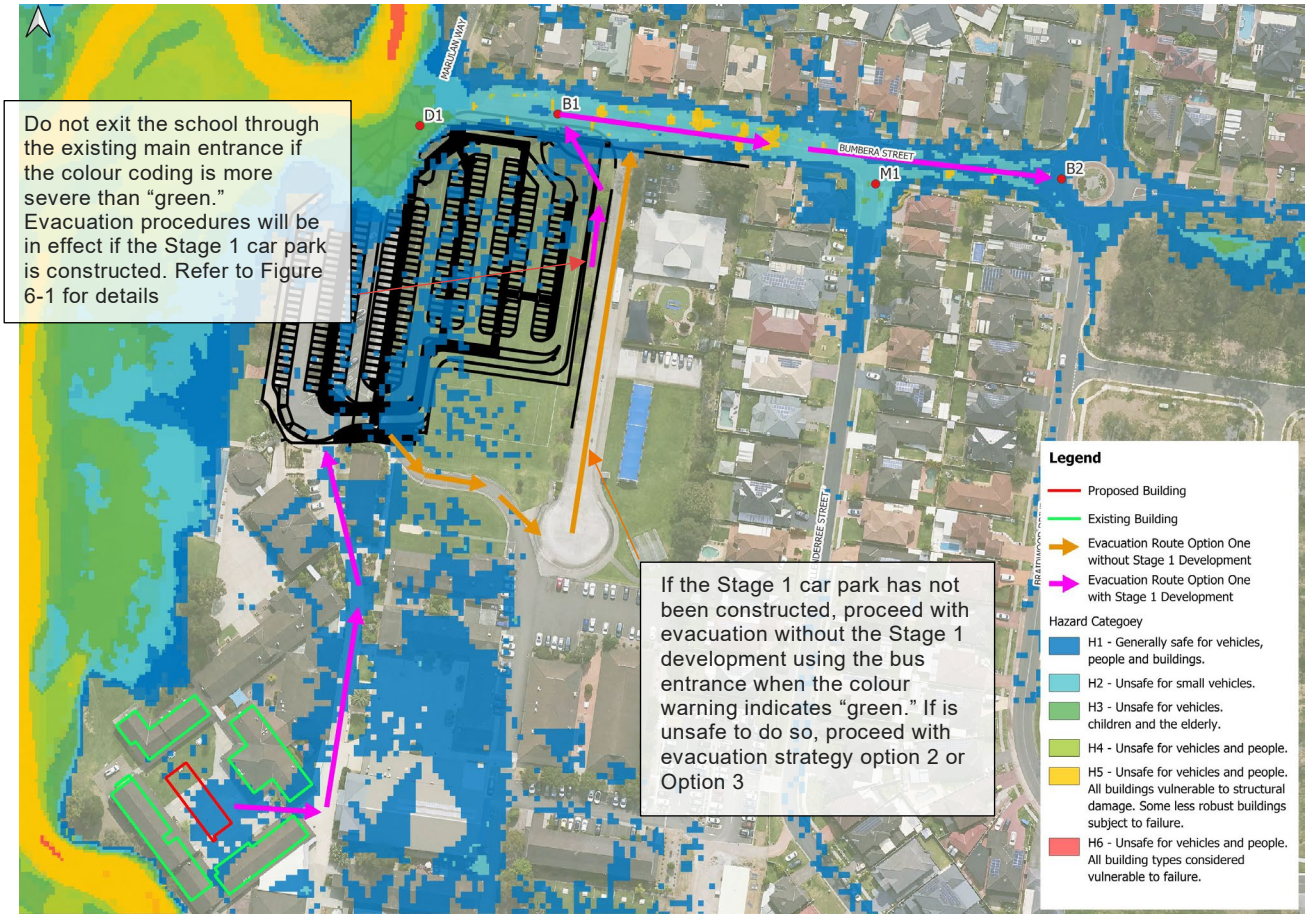


Figure 6-2 Option1 Evacuation Routes 1% AEP Flood Hazard

6.2.3 Option 2 Emergency Services Access from Camden Valley Way

The southern route is designed to be safe for use during both 1% AEP and PMF events, providing a reliable evacuation path even during severe overland flow flood conditions. Refer to **Figures 6-3** and **6-4** for the Options evacuation path.

This route does not cross Cabramatta Creek, further ensuring its reliability during flood events. It ensures that vehicles can access the driveway without being affected by floodwaters, maintaining a one-way flow of traffic.

However, the effectiveness of this route depends on someone being available to open the school's gate during a storm. This action is crucial to maintain accessibility from Camden Valley Way, ensuring that the evacuation route remains viable and unobstructed during emergency situations. Additionally, students will be able to evacuate on foot to reach the evacuation exit and meet the vehicles near Camden Valley Way, facilitating a smooth and coordinated evacuation process.

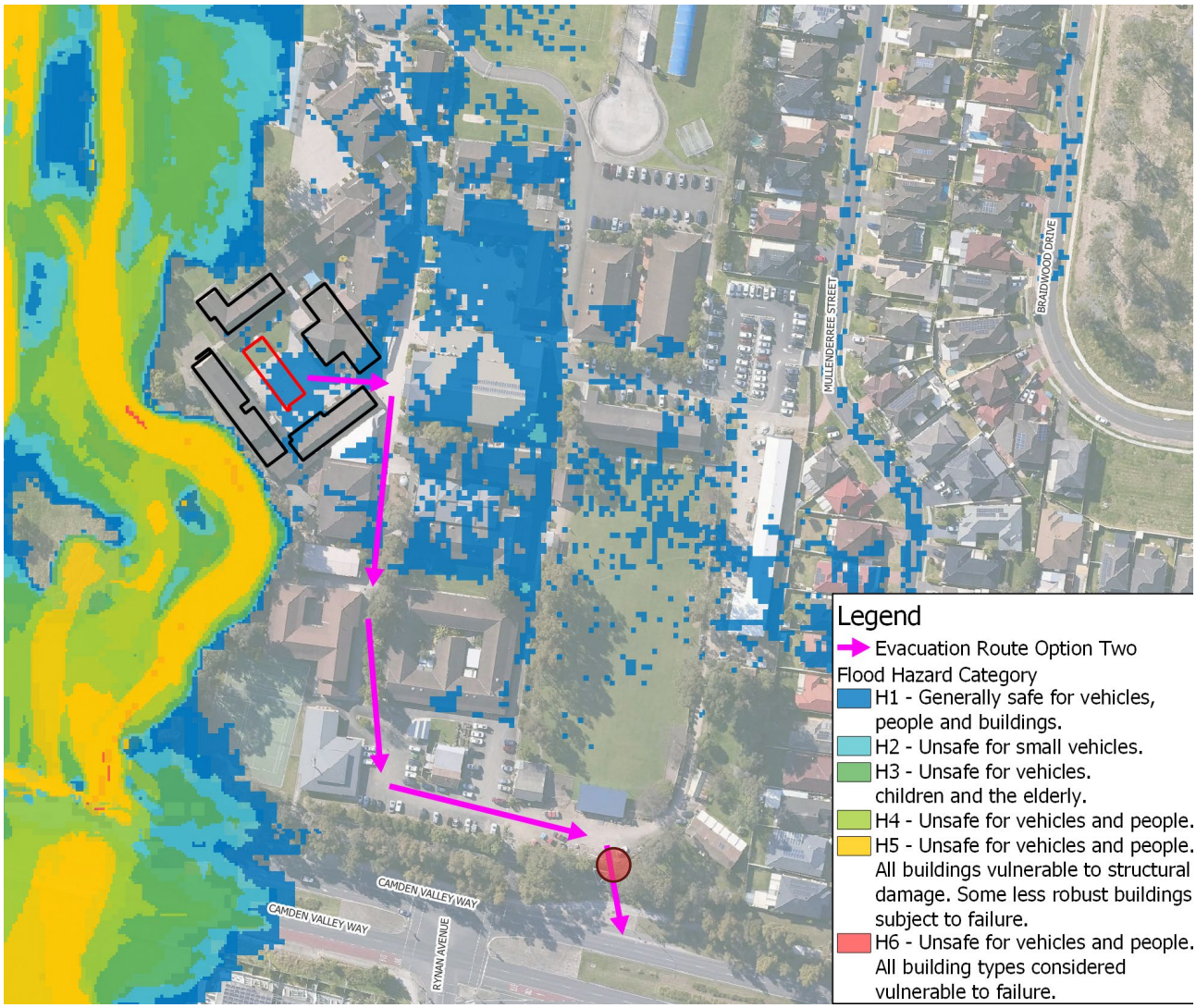


Figure 6-3 Option2 Evacuation Routes 1% AEP Flood Hazard

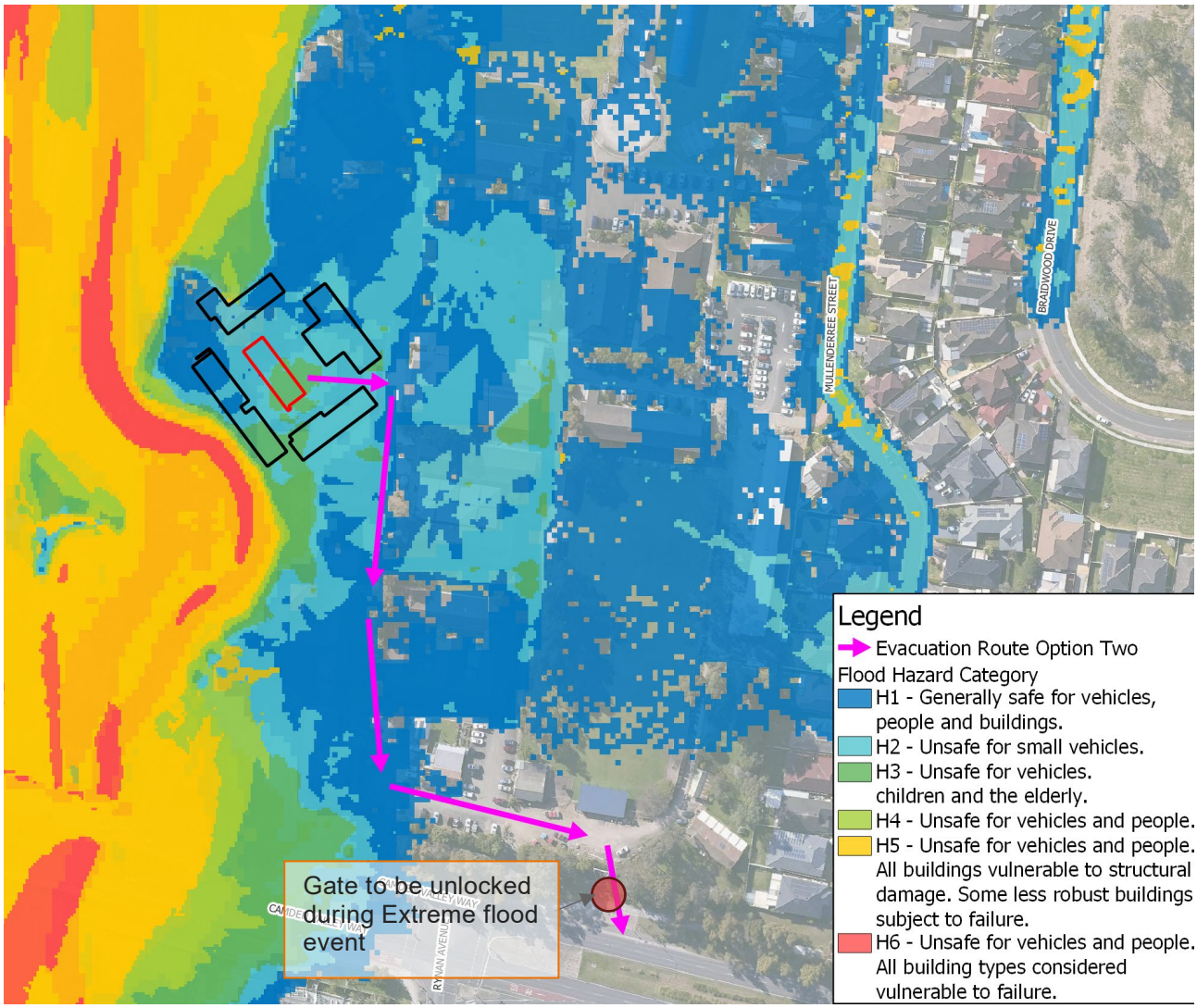


Figure 6-4 Option2 Evacuation Routes PMF Flood Hazard

6.2.4 Option 3 Shelter in Place for Stage 2 Development

The proposed site building's ground level is set above the 1% AEP plus flood freeboard and exceeds the reported PMF water level of 40.56m. The proposed building's ground level is at +40.900 and the first floor is at +44.580.

The Level 1 in the proposed Stage 2 classroom building is designated as a flood refuge, on Level 1 could shelter up to 123 persons based on an allowance of 2 m² per person, excluding any allowance for furniture (desks, tables, etc.).

7 Flood Response

7.1 Flood Awareness

In William Carey Christian School the principal and any designated staff will be made aware of the flood hazard and evacuation procedures through a combination of measures.

Evacuation plans detailing the evacuation procedures will be provided at a key location of each designated as a flood refuge.

Flood warning signs and should be provided at key locations to raise awareness of flooding during dry times, but also to alert staff and students to flooding of the site during extreme weather events.

Evacuation drills will be carried out at intervals no longer than 12 months and possibly more frequently if there is significant staff turnover on site.

7.2 FloodSafe Plan

A preliminary FloodSafe Plan has been prepared and supplied as **Appendix B**. This preliminary Plan will need to be finalised to include evacuation procedures developed by staff and management prior to commencement of operations.

The FloodSafe Plan will need updating in the future in response to evolving operations.

7.3 Critical Infrastructure

The following items have been identified as infrastructure relevant in flood emergencies: electricity, telephone, gas and water.

During significant storms, interruptions may be experienced to electricity and telephone services due to lighting strikes, fallen trees and high winds, which affect the networks.

Water and gas may also become unavailable during severe flood events due to offsite network issues.

Any back-up measures in the event that there is a disruption to the provision of utilities should also be documented in the FloodSafe Plan.

7.4 Operations and Responsibilities

Flood Wardens will be present on site in each affected school building and able to co-ordinate the flood emergency response at all times. The school principal is the Chief Flood Warden. An organisational chart is shown in Figure 7-1.

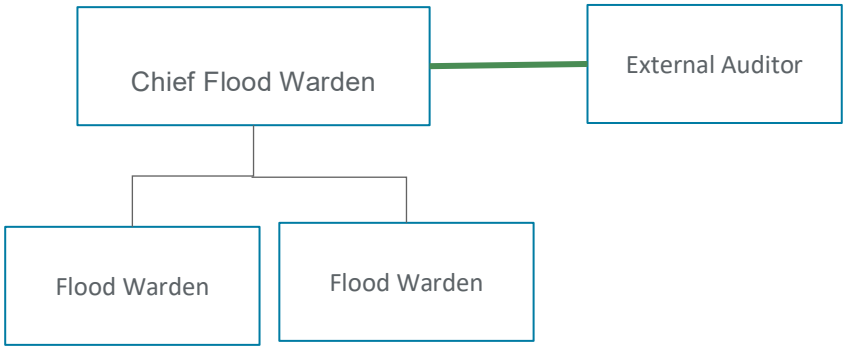


Figure 7-1 Emergency Response Organisational Chart

The Flood Warden will follow the instructions of the Chief Flood Warden during floods, especially if vehicle evacuation is needed near the main school car park entry points on Bumbera Street and Mullenderree Street, even though these roads are not inundated. The Flood Warden needs to alert the Chief Flood Warden of any potential unsafe conditions for staff or students seeking to leave the classroom building.

For the Stage 2 building, if flooding occurs, the Flood Warden will either remain in place to shelter or guide evacuation and emergency access to the designated point at Camden Valley Way, as directed by the Chief Flood Warden.

7.5 Emergency Response Organisational Chart for the proposed Stage 2 Development

Flood Wardens will be trained by suitable person. A training register will be maintained by the school principal with annual audits to ensure that sufficient flood wardens are trained in the procedures. An external auditor will review the documentation to ensure compliance with requirements.

Notwithstanding warnings and orders given by the SES, police or other authorities, Flood Wardens are responsible for issuing directions and warnings to staff and workers and visitors.

A copy of this FERP or (a) future version(s) will be stored on site in hardcopy in a weatherproof, easily accessible location in each classroom that is clearly marked and available to emergency services. Additional copies will be available for staff training and reference in an emergency.

7.5.1 Auditing

A schedule will be implemented to ensure appropriate auditing of the FERP operations.

Evacuation drills will also be required.

7.5.2 Operation and Maintenance

The flood markers and signage will be maintained to ensure that staff and students are aware of the flood hazards under extreme weather conditions and that the markers can provide clear guidance when needed.

7.6 Emergency Procedure

7.6.1 Informal Monitoring

Weather conditions and on flooding can be monitored through the Liverpool City Council's Flood Information webpage and at the websites listed in **Sections 4.3** and **4.4.**

7.6.2 Flood Warden Actions

The following actions must be co-ordinated by the Flood Wardens.

- Monitoring rainfall and any runoff entering the site and any flooding on the site;
- Assessing if site operations can continue safely during inclement weather;
- Restricting any site operations that continue during inclement weather to areas well away from any flooding on the site;
- If it is unsafe for site operations to continue when flooding in the school become unsafe and/or floodwaters are approaching the entry to classrooms then directing students, visitor and staffs to retreat to Level 1 of each classroom; and
- Monitoring any regional flooding and road closures through Council's Flood Information webpage and the Live Traffic Website and advising whether it is safe for students and staff to depart the site depending on their planned destination(s).

7.7 Recovery

The Chief Flood Warden, Flood Wardens or in the case of widespread regional flooding State Emergency Service will advise when it is safe to:

- Leave the flood refuge(s) at the stage 2 development and to re-commence site operations and/o any clean-up; and/or
- Leave the site.
- Re-entry and clean-up of the areas that are inundated is to take account of the storage of any hazardous materials and/or any surface ponding of water which may be hazardous.

8 References

a) Bewsher Consulting (2011) “Cabramatta Creek Flood Study and Basin Strategy Review”, *Final Report,* prepared for Liverpool City Council, September, 86 pp + App.

b) BMT WBM (2008) “Liverpool Overland Flow Path Study Stage 2”, Final Report,

c) Cardno (2021) “Flood Risk Assessment, 63 Jedda Road, Prestons”, *Final Report*, Version 1, prepared for Jedda II Trust, 19 pp + Apps.

d) Cardno now Stantec (2021) “Flood Impact Assessment, 1895 Camden Valley Way, Horningsea Park”

e) NSW Government “Flood Risk Management Plan 2023 - 2023 Flood Risk Management Guideline FB03

f) NSW Government (2005*). Floodplain Development Manual, The management of flood liable land*, April, 29 pp + Apps

g) NSW Government (2018) *New South Wales State Emergency Management Plan*

h) NSW Government (2011) *South West Metropolitan Regional Emergency Management Plan*

i) NSW Government (2021) *New South Wales State Flood Plan, A Sub Plan of the State Emergency Management Plan (EMPLAN)*

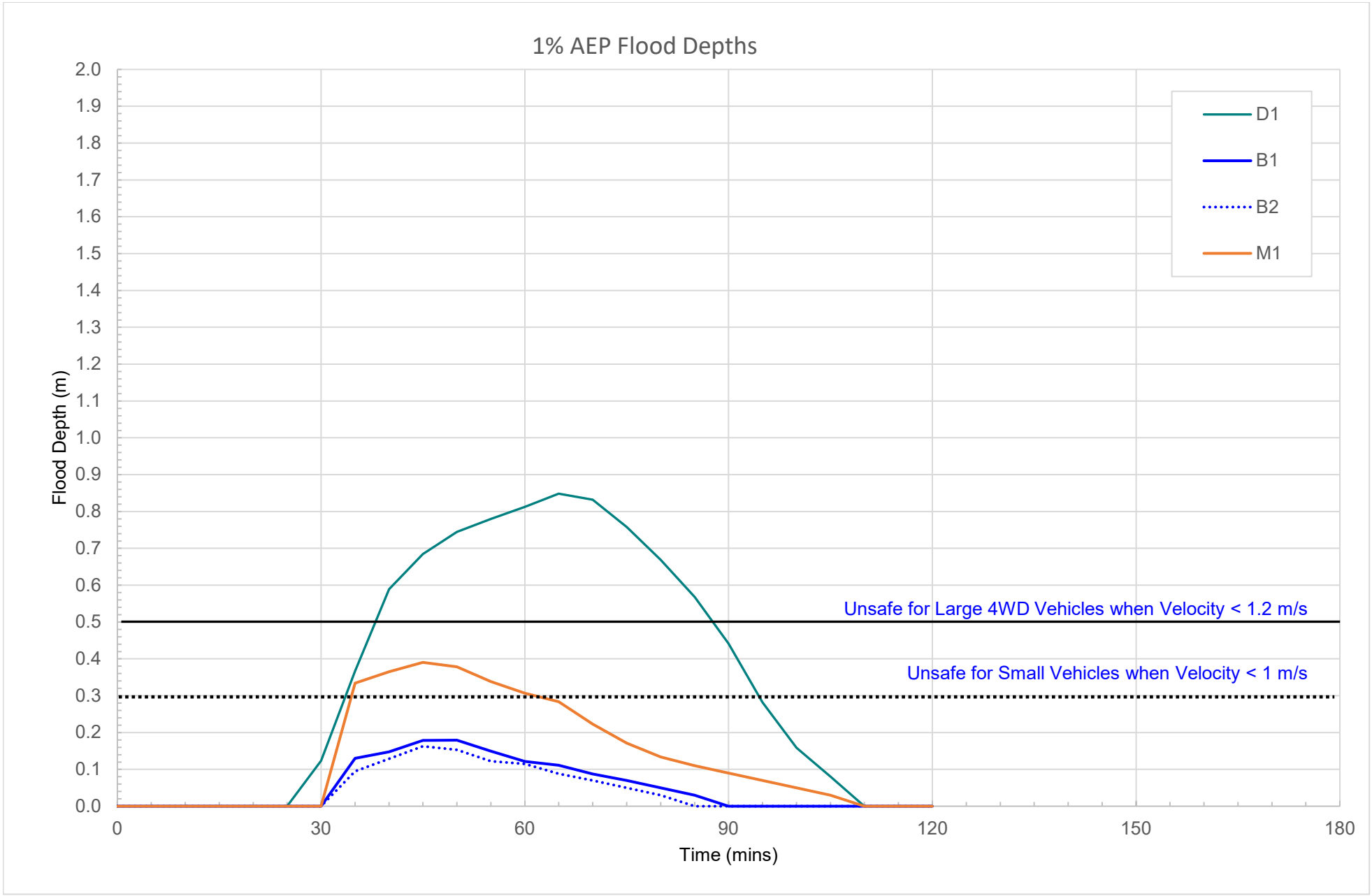
j) NSW SES (2017) *Liverpool City Local Flood Plan, A Sub-Plan of the Liverpool City Local Emergency Management Plan (EMPLAN*)

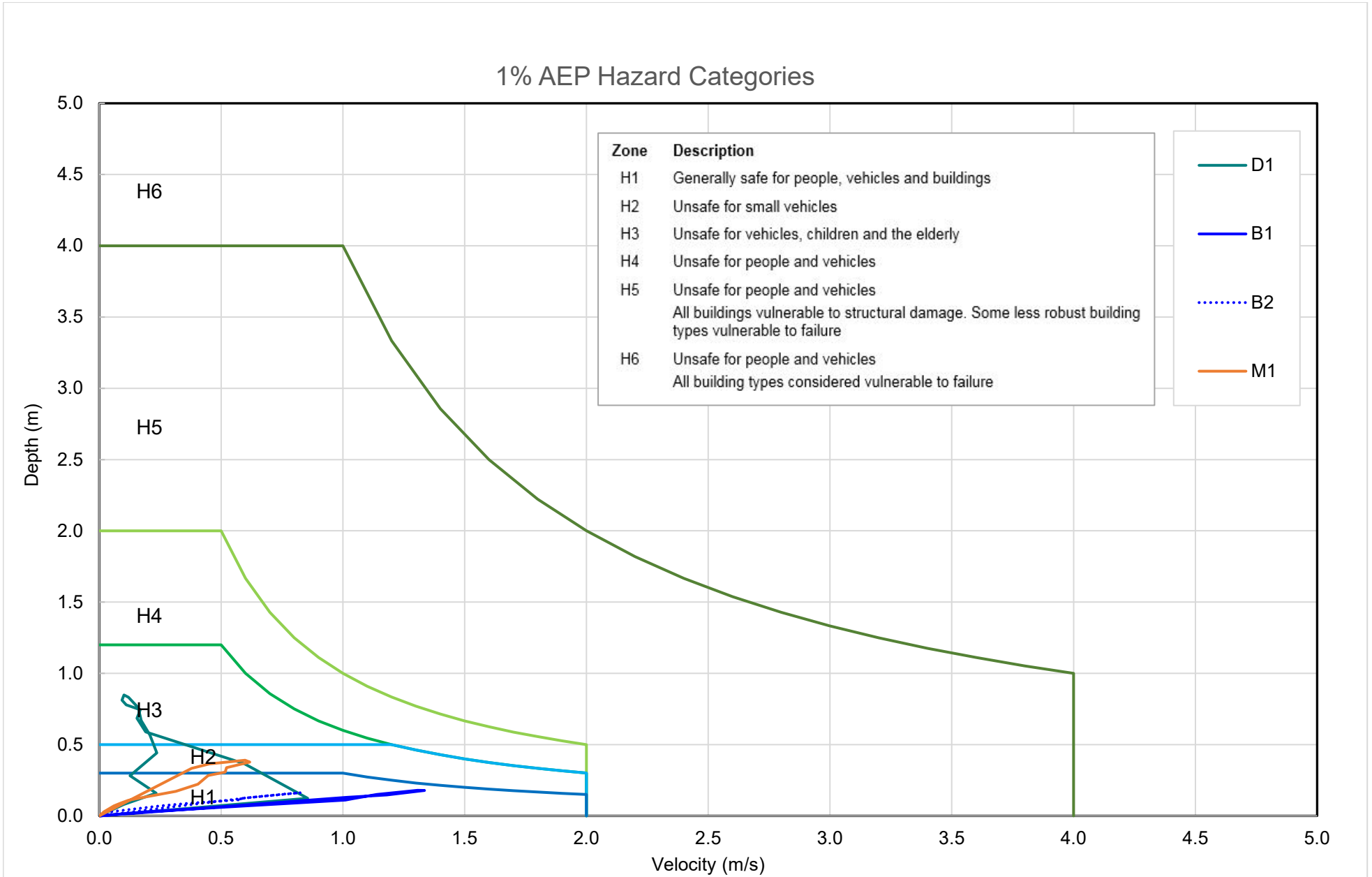
k) McLaren (2023) “Traffic and Parking Impact Assessment of The Proposed Increase in Student Population at William Carey Christian School (WCCS) at Bumbera Street, Prestons”, Draft Report, Version C, prepared for William Carey Christian School c/- Gardner Wetherill, December.

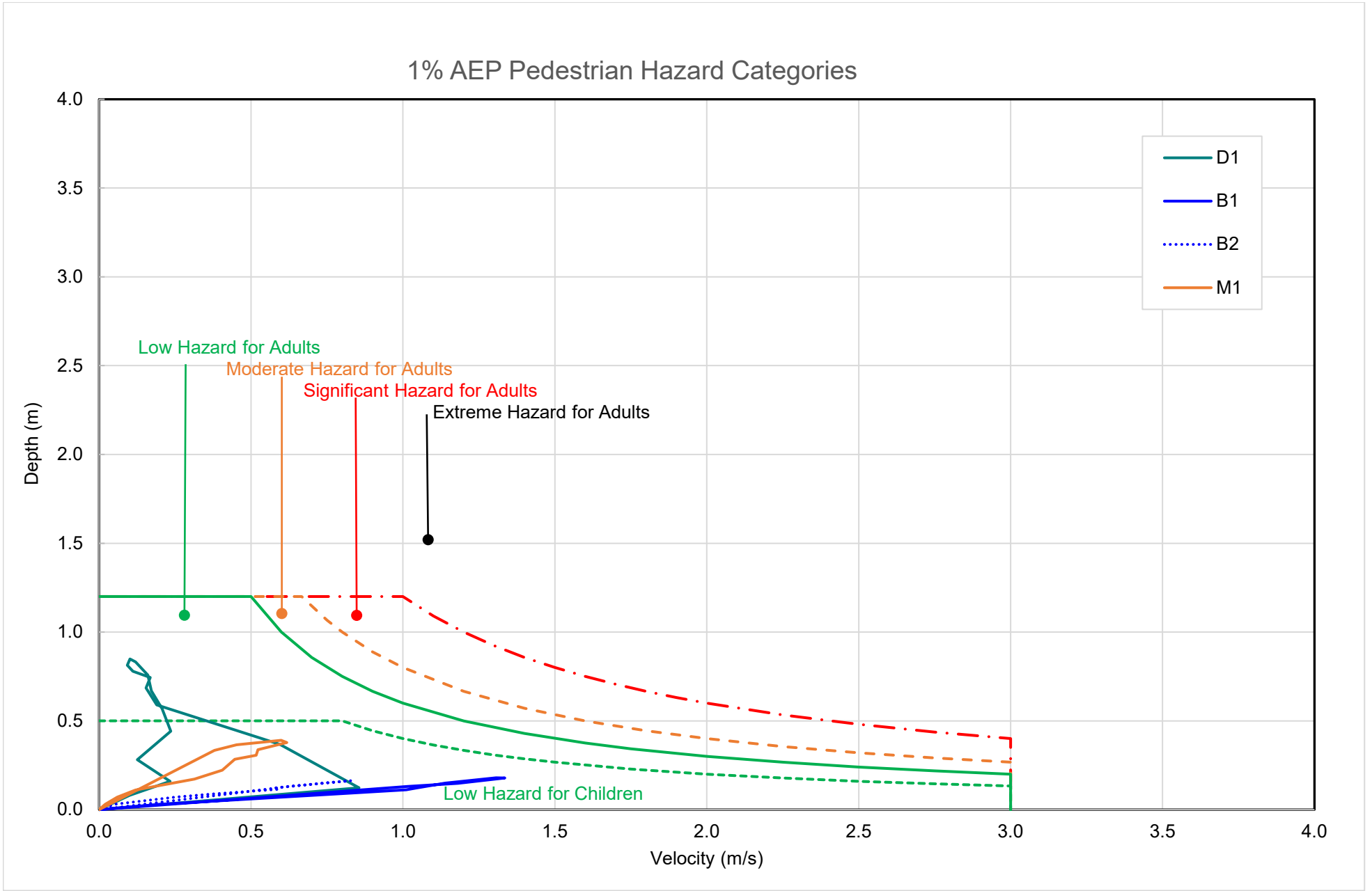
Appendices

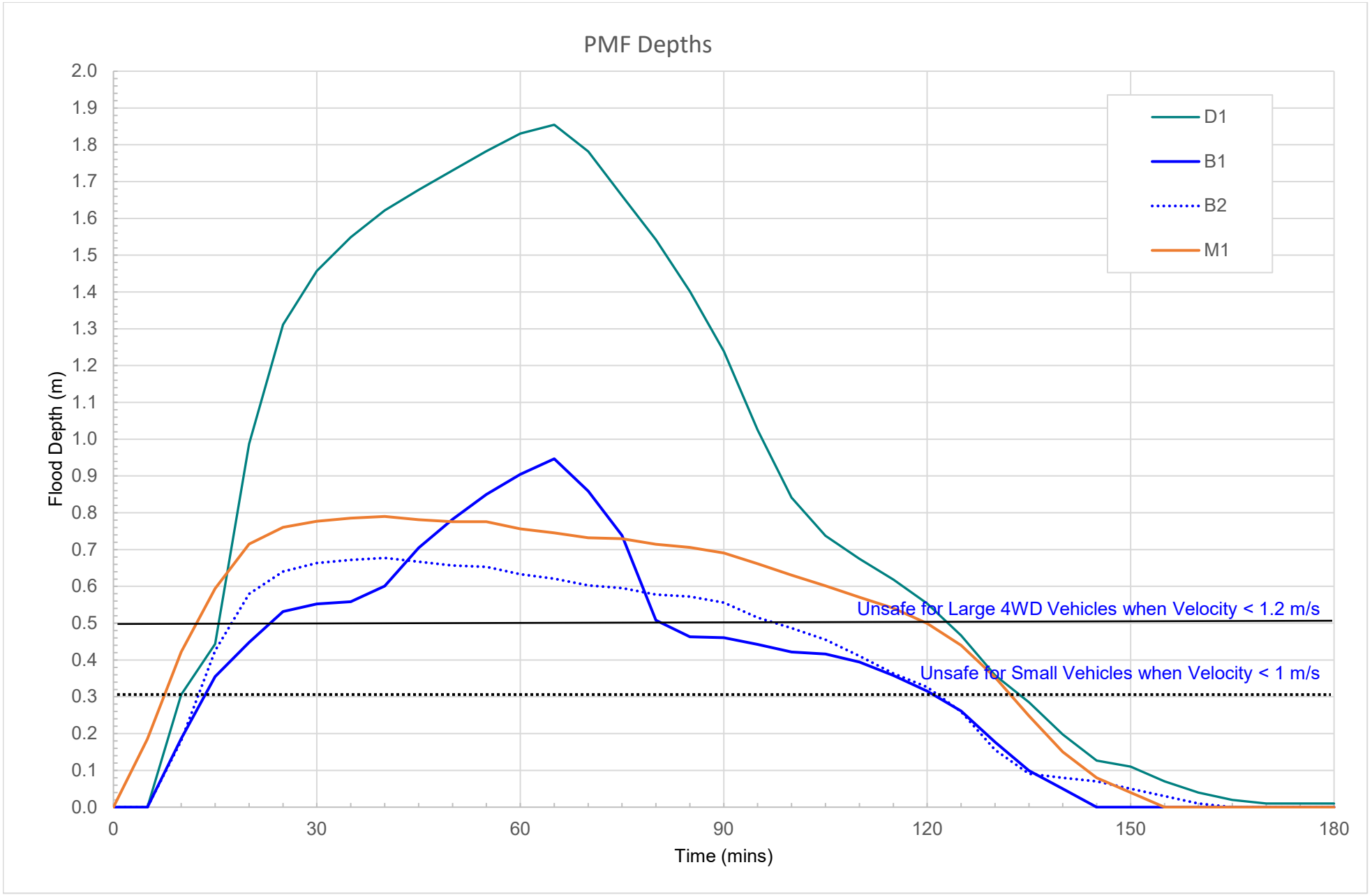
Appendix A: Temporal Variation Analysis at Four Reference Locations

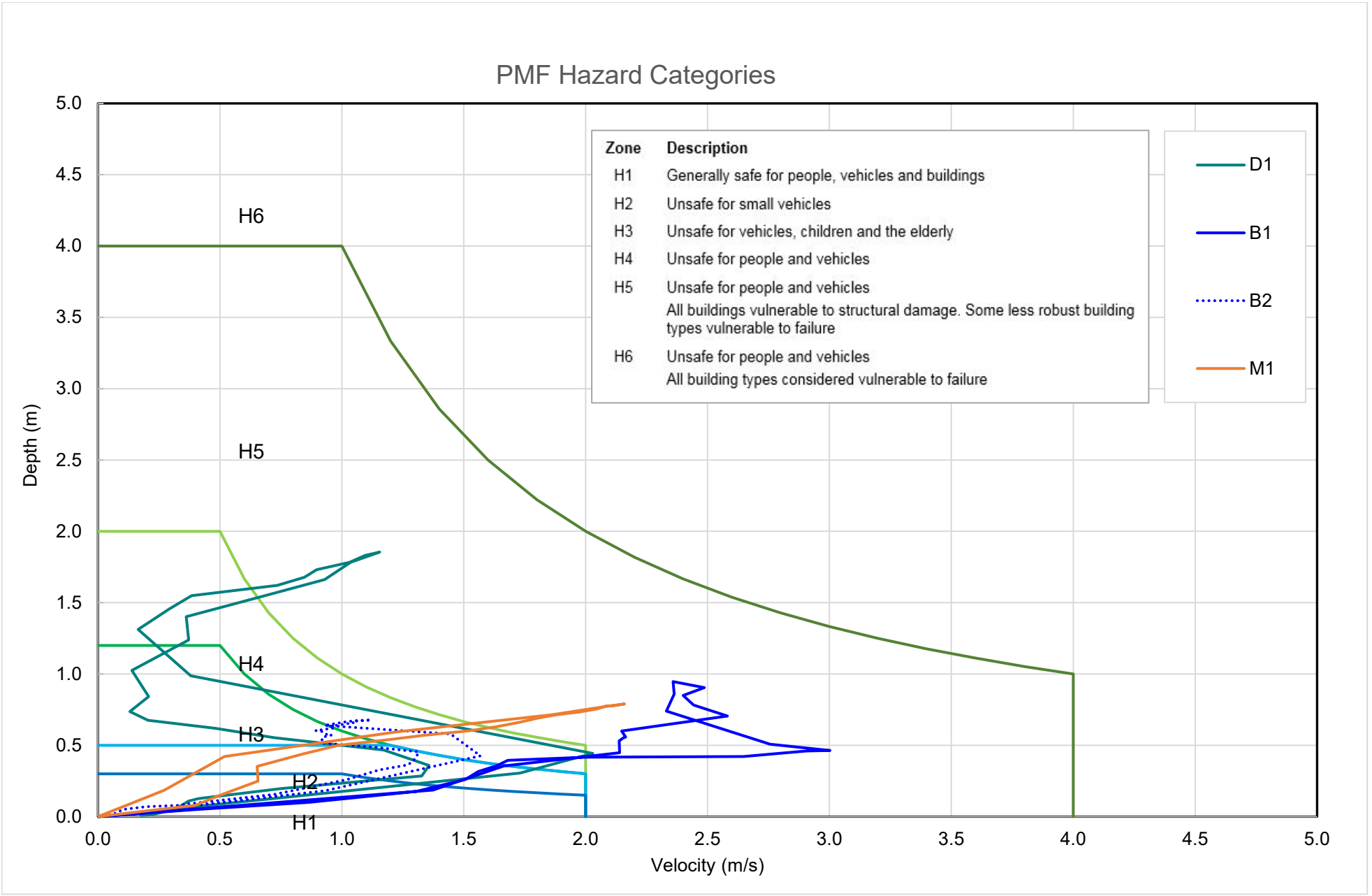
Attachment A

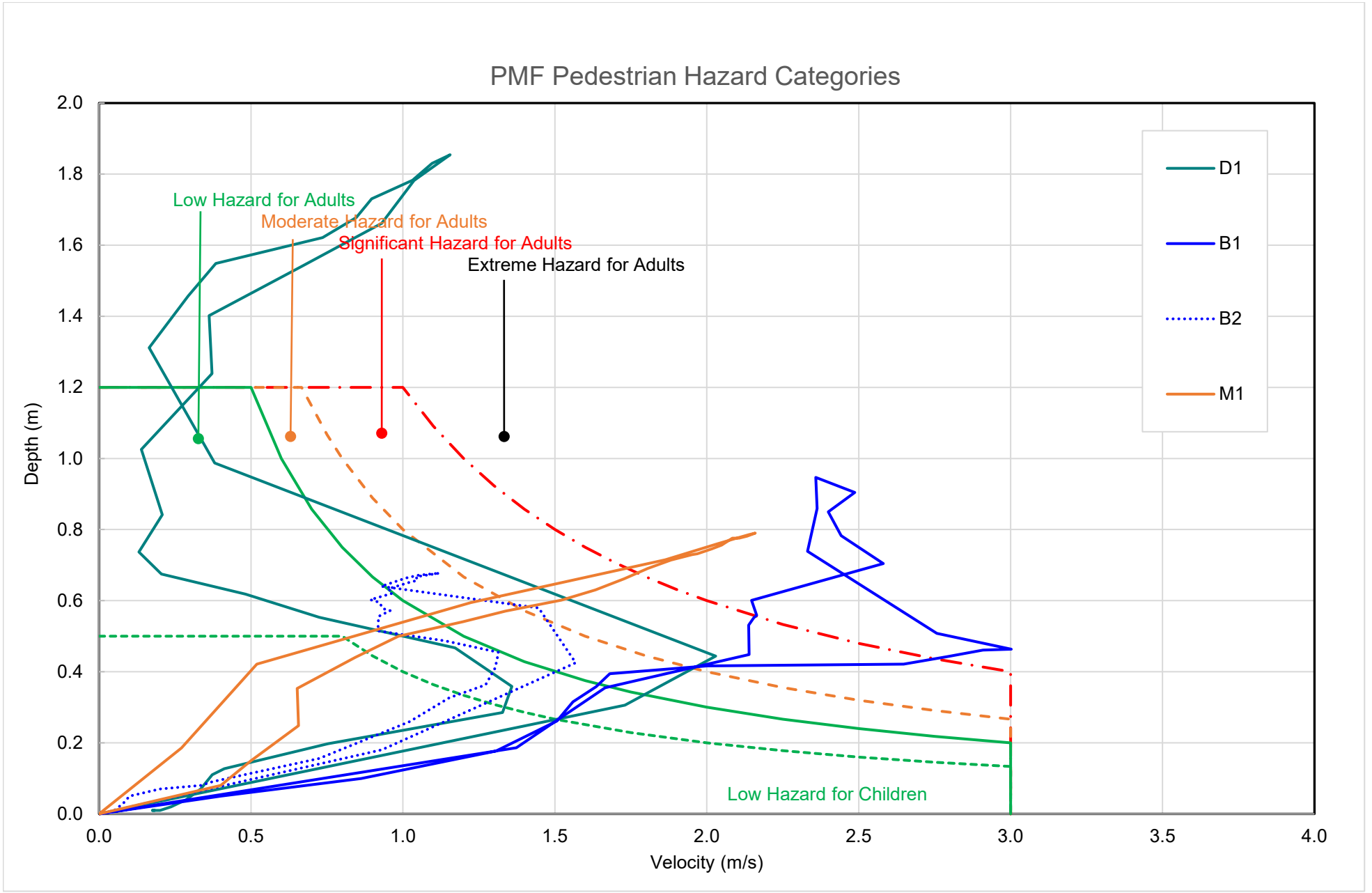



1% AEP Hazard Categories
Zone
Description
H1
Generally safe for people, vehicles and buildings
H2
Unsafe for small vehicles
H3
Unsafe for vehicles, children and the elderly
H4
Unsafe for people and vehicles
H5
Unsafe for people and vehicles
All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
H6
Unsafe for people and vehicles
All building types considered vulnerable to failure
D1
B1
B2
M1
H6
H5
H4
H3
H2
H1
Depth (m)
Velocity (m/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0


1% AEP Pedestrian Hazard Categories
Depth (m)
Velocity (m/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
D1
B1
B2
M1
Low Hazard for Adults
Moderate Hazard for Adults
Significant Hazard for Adults
Extreme Hazard for Adults
Low Hazard for Children


PMF Depths
Flood Depth (m)
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
30
60
90
120
150
180
Time (mins)
D1
B1
B2
M1
Unsafe for Large 4WD Vehicles when Velocity < 1.2 m/s
Unsafe for Small Vehicles when Velocity < 1 m/s


PMF Hazard Categories
Zone
Description
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 people and vehicles
All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
H6
Unsafe for people and vehicles
All building types considered vulnerable to failure
D1
B1
B2
M1
H6
H5
H4
H3
H2
H1
Depth (m)
Velocity (m/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0


PMF Pedestrian Hazard Categories
Depth (m)
Velocity (m/s)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Low Hazard for Adults
Moderate Hazard for Adults
Significant Hazard for Adults
Extreme Hazard for Adults
Low Hazard for Children
D1
B1
B2
M1

Appendix B: FloodSafe Plan

FloodSafe Plan for proposed Stage 2 Development, WCCS, Prestons

Potential impacts of flooding on Staff and any Workers	Severity level
People's health and safety are compromised	Moderate
Property is damaged or destroyed	Low - Medium
Cars and other property can be damaged	Medium
Flooding of the Site stops operations	Moderate
Profits are lost or site operations stopped	Low - Moderate
Paperwork and records are ruined	Low

Triggers for Actions now and always

- Actions that can be done immediately and maintained to reduce the potential impact of flooding are:

Actions

Action	How to do it	Who will do it	What you will need	Estimated time needed	Completed
Inform teachers, students and occupants that flooding is a real but small risk	Train flood wardens	School principal, Flood Wardens	Training procedures and policies, this plan	1 hour for training	[ ]
Make the FloodSafe Plan and the Flood Emergency Response Plan readily available	Store copies of the FloodSafe Plan Flood Emergency Detailed Response Plan in locations readily available to the Flood Wardens and School principal	School principal	Copies of the FloodSafe Plan and the Flood Emergency Response Plan (FERP)	30 minutes	[ ]
Encourage flood wardens to participate in development & implementation of this plan	Meeting	School principal Flood Wardens	FloodSafe Plan and computer	2 hours	[ ]
Ensure OH&S procedures cover specific risks associated with floods	Management to formulate/update evacuation procedures where necessary	School principal	Copies of the FloodSafe Plan and the FERP	1 hour	[ ]
Maintain an up-to-date list of emergency contact numbers for staff and services	Review contact details	School principal	Various updated contact details and maintain database	30 minutes	[ ]
Train flood wardens in flood procedures	Training session(s)	School principal	Copies of the FloodSafe Plan and the FERP	1 hour	[ ]

Incorporate flood awareness in staff induction training	Staff induction manual	School principal	Staff induction manual	1 hour	[ ]
Prepare Emergency Kits	Gather items and store in suitable location in each flood refuge.	School principal	Emergency kits[1]	1 hour	[ ]
Ensure flood wardens know flood evacuation routes	Staff training and emergency drills	School principal	Copy of the FERP	30 mins	[ ]
Action plan for securing the classroom operations against flooding if needed	Identify actions to secure the classroom operations against flooding as required	School principal	Knowledge of vulnerability of any plant and stockpiles to flooding	2 hours	[ ]
Store backups of important computer files and critical paper records off-site and out of floodplain.	Create computer backups and paper copies of critical documents and store off-site.	School principal	Off-site storage location	1 hour	[ ]
Ensure staff know when to retreat to the flood refuges	Staff training	School principal	Copy of the FERP	30 minutes	[ ]

[1] Emergency kit to contain torch with spare batteries, portable radio with spare batteries, first aid kit, candles, waterproof matches, waterproof bag for valuables and mobile phone, and a copy of the emergency contacts list

Triggers for actions when flooding is likely
• Heavy rainfall • The Bureau of Meteorology issuing a Flood Watch • The Bureau of Meteorology issuing a Severe Weather Warning or Severe Thunderstorm Warning indicating a likelihood of flash flooding • The State Emergency Service issues a Flood Bulletin

Actions

Action	How to do it	Who will do it	What you will need	Estimated time needed	Completed
Notify flood wardens, staff, workers and any visitors of any warnings	In person and using wardens	School principal, and Flood Wardens	Flood warden list and Visitor list	15 minutes	[ ]
Notify staff when it is unsafe to leave the site depending on their destination	In person and using wardens	School principal, and Flood Wardens	Flood warden list and Visitor list	15 minutes	[ ]
Prepare to secure site operations and retreat to the flood refuges if flooding in the car parks become unsafe and/or floodwaters are approaching the entrance of stage 2 classroom.	Undertake actions identified by flood wardens to secure classroom operations and retreat to the flood refuges. If evacuation is to be proceed through Camden Valley Way, Flood Warden will need to unlock the driveway gate.	School principal, and Flood Wardens	Checklist of actions identified by staff to secure site operations and retreat to the flood refuges	Time available varies – see Note 1	[ ]
Keep radio tuned to local radio station, keep in contact with SES and monitor relevant websites	Tune radio to Alive 90.5 mHz FM http://www.bom.gov.au/nsw/warnings/ http://www.bom.gov.au/products/IDR713.loop.shtml Flood Incidents | Disaster Dashboard (disasterdashboards.com)	School principal	Radio, 3G enabled device and spare batteries	While flooding is likely	[ ]

Triggers for Actions during a Flood
• Observations of flooding in the car parks at flood markers becoming unsafe and/or floodwaters are approaching the entry to Stage 2 - classroom • Any regional flood warnings or flooding disseminated via Liverpool City Council's Flood Information webpage (Visit: Flood Information | Liverpool City Council (nsw.gov.au)); • Any road closures in the vicinity of the Site as disseminated by the Live Traffic Website.

Actions

Action	How to do it	Who will do it	What you will need	Estimated time needed	Completed
Keep in contact with flood wardens and keep them updated on the situation	Implement contacting strategies using meetings, telephone calls and emails if a school principal is away from the school. The Flood Warden to alert the Chief Flood Warden of potential unsafe conditions for any staff or occupant seeking to depart from classroom	School principal	Radio to obtain up-to-date information and if needed liaise with the SES; computer or mobile device to check websites	Ongoing during event	[ ]
Observations of flooding in the car parks at flood markers is in green zone	Manage and monitor any staff, workers and any visitors evacuating the site by foot or vehicle along the eastern driveway to access high ground.	School principal, and Flood Wardens	Latest information and FloodSafe Plan	Ongoing during event	[ ]
Observations of flooding in the car parks at flood markers is in amber zones	Prevent any staff, workers or any visitors evacuating the site by foot or by small vehicle. Manage and monitor any staff, workers or any visitors evacuating the site by foot, or large vehicle or truck to access high ground.	School principal, and Flood Wardens	Latest information and FloodSafe Plan	Ongoing during event	[ ]
Observations of flooding in the car parks at flood markers is in the red zone and/or floodwaters are approaching the entrance of classroom	Evacuate any remaining staff, students and visitors to Level 1 refuges	School principal, and Flood Wardens	Latest information and FloodSafe Plan	Ongoing during event	[ ]
Do not enter flood waters or attempt to leave the protected flood refuges while site operations remain unsafe, or it is unsafe to travel on local roads due to overland flooding	Ensure Chief Flood Warden, and Flood Wardens are trained and providing relevant information to staff, workers and any visitors	School principal, and Flood Wardens	Latest information and FloodSafe Plan	Ongoing during event	[ ]
Keep radio tuned to local radio station, if needed keep in contact with SES and monitor relevant websites	Tune radio to ABC Local Radio 702 AM http://www.bom.gov.au/nsw/warnings/	School principal, and Flood Wardens	Radio, spare batteries, phone, computer and mobile device	During event	[ ]

	http://www.bom.gov.au/products/IDR713.loop.shtml Flood Incidents | Disaster Dashboard (disasterdashboards.com)				
Back up important computer files and critical paper records and store these in the flood refuges	Back up important computer files and critical paper records and store these in one of the flood refuges	School principal, and designated staff	Computer and storage media (External HD and/or USB drive)		[ ]

Triggers for Actions after a Flood
• School flood wardens issue an all clear • The NSW State Emergency Service issues an all clear

Actions					
Action	**How to do it**	**Who will do it**	**What you will need**	**Estimated time needed**	**Completed**
Before restarting classroom operations undertake an OH&S risk assessment	Conduct a visual risk assessment of external areas and plant for any structural damage, damage to services, dangerous debris, etc.	School principal, and Flood Wardens	May require specialist assistance to assess whether floodwaters have damaged any equipment		[ ]
Remove debris and clean the site area as needed	With appropriately skilled personnel	School principal, and Flood Wardens	May require external assistance depending on the debris trapped on the site		[ ]
Repair or replace damaged equipment as needed	With appropriately skilled personnel	School principal, Wardens to organise			[ ]
If needed restore critical records, computer equipment and files	Retrieve critical paper records from storage and restore any important computer files that have been lost.	School principal, and designated staff	Computer and storage media (External HD and/or USB drive)		[ ]

Staff Contact List

Name	Number	Mobile	Flood role / issues
School principal, (Chief Flood Warden)			Responsible for implementing the FERP and the FloodSafe Plan for proposed Stage 2 development
Flood Wardens 1 and 2			Responsible for managing staff and Students sheltering classroom, unlock the driveway gate at Camden Valley Way and deputising or the Chief Flood Warden if needed.

Emergency Contact List

Name	Number	Mobile
Ambulance	000	
Gas		
NSW SES	132 500	
Sydney Water - Faults	13 20 90	
Fire - Emergency	000	
Police - Emergency	000	
Electricity		
Bureau of Meteorology (for flood warnings)	1300 659 219	
Liverpool Police Station	02 9765 9499	
Electrician		

For emergency help in floods and storms phone the SES on 132 500

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We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

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Design with community in mind