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Flood Emergency Response Plan

Willyama High School

Prepared for NSW Department of Education / 2 June 2025

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Rev	Date	Prepared By	Approved By
1	16/04/2025	AV	EC
2	02/06/2025	AV	EC

Executive Summary

This Flood Emergency Response Plan (FERP) has been prepared for Willyama High School, located at 300 Murton Street, Broken Hill NSW 2880. Given that the school site is located within a major overland flow path (based on the flood modelling results). this plan outlines appropriate strategies to manage flood-related risks during the operational phase of the development, with a particular focus on flash flooding, which poses a significant challenge due to its rapid onset and potential to cut off access routes.

Hydrological and hydraulic modelling has confirmed that the site is impacted in all assessed flood events, including the 10% Annual Exceedance Probability (AEP), 1% AEP, and the Probable Maximum Flood (PMF). While minor events typically result in shallow flood depths and low-velocity flows, overland flow paths still traverse the site, and certain areas may become isolated due to flooding of surrounding roads. In a PMF event, inundation is more severe, and portions of the road network adjacent to the school are subject to high flood hazards, significantly reducing the ability to safely evacuate or access the site.

Recognising these risks, the preferred flood emergency strategy is the **pre-emptive closure** of the school when sufficient warning is available—particularly outside of operational hours. This approach allows students to remain at home, avoids unnecessary exposure to hazardous travel conditions, and reduces the need for emergency evacuations. However, flash flooding may develop with minimal or no warning. In such cases, a **shelter-in-place (SIP)** strategy is recommended. All proposed school buildings have been designed with finished floor levels above the PMF level, ensuring that students and staff can safely remain indoors until floodwaters recede.

This FERP establishes a clear framework for flood preparedness and response. It defines the roles and responsibilities of school staff during flood events, outlines the procedures for monitoring weather conditions and emergency warnings, and provides recommended actions based on observed and forecast conditions. It also includes essential preparation measures such as flood-specific signage, staff induction and training, and the provision of a flood emergency kit.

By implementing the measures outlined in this plan, the school can reduce flood-related risks, protect the wellbeing of site users, and maintain continuity of operations during extreme weather events—ensuring that safety remains the top priority.

1.0 Introduction

TTW have been engaged by Department of Education (DoE) to prepare a Flood Emergency Response Plan (FERP), to be implemented during the operation of the proposed development at Radium St, Broken Hill NSW 2880. Access to the site is subject to flood inundation during significant rainfall events and a response plan is required to address the management of site users during flood events.
The purpose of this FERP is to summarise the flood risks associated with the site, identify preparation measures that should be undertaken to mitigate such risks, and provide an action plan with steps to be completed during a flood event.

1.1 Reference Documents

This FERP has been prepared with reference to the following:

- Australian Institute of Disaster Resilience (AIDR) Guideline 7-3: Flood Hazard (2017):
- NSW Department of Planning and Environment (2025) Shelter-in-place Guideline – Preamble (https://shared-drupal-s3fs.s3.ap-southeast-2.amazonaws.com/master-test/fapub_pdf/NSW%2BPlanning%2BPortal%2BDocuments/Shelter+in+place+guideline+for+flash+flooding.pdf);
- NSW Department of Planning and Environment (2023) Flood Risk Management Manual https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual;
- NSW State Emergency Service (SES) Guidelines;
- Broken Hill City Council – Urban Stormwater Master Plan, Broken Hill (2006), Ref. No. 20050089RA2C
- Broken Hill City Council – *Development Control Plan* (2016)

1.2 Proposed Site

The site is located at 300 Murton Street, Broken Hill NSW 2880, and is legally described as Lot 5858 in Deposited Plan 757298. It is situated on the northeastern edge of Broken Hill, with frontages to Radium Street to the northwest, Murton Street to the southwest, and McGowan Lane to the southeast. The site lies approximately 230 metres north of Williams Street, the main arterial road through Broken Hill, and about 480 metres west of the Silver City Highway.

The site has a total area of approximately 8.067 hectares, with around 40% of the land currently undeveloped.

1.3 Proposed Development

The new proposed masterplan option, as illustrated in Figure 1 the proposed buildings along McGowan Lane to minimise disruption to the site's natural overland flow paths. This arrangement ensures that floodwaters can continue to traverse the site without obstruction, reducing the risk of upstream afflux or redirection of flows toward sensitive areas.

All proposed building floor levels are set above the Probable Maximum Flood (PMF) level, providing a high level of flood immunity. Further details on the flood levels are provided in Section 2.2.

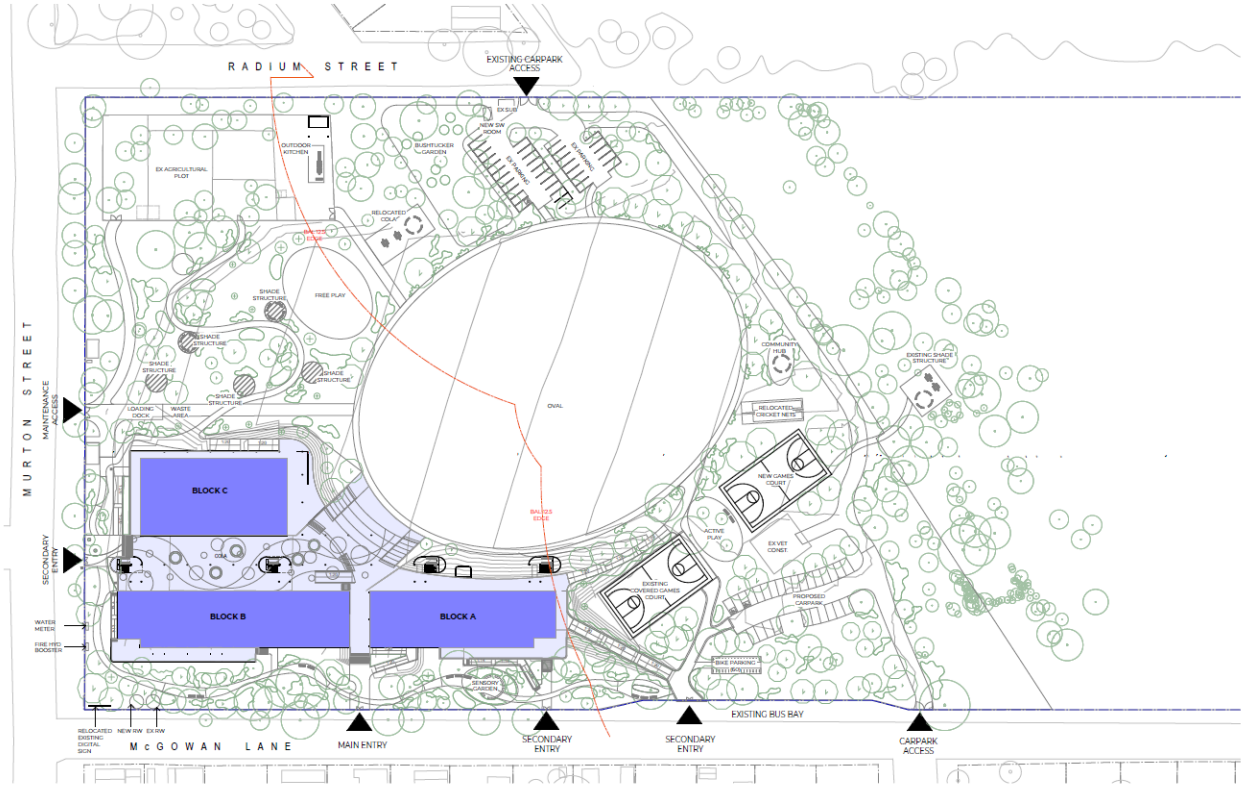

Figure 1- Site Architectural Plan Provided by Woods Bagot

2.0 Flood Behaviour

2.1 Historical Flooding Events in Broken Hill

An analysis of newspaper articles and social media reports highlights that Broken Hill has experienced major flash flooding events, particularly in March 2022 and January 2024. In March 2022, certain areas of the city received around 140 mm of rain—twice the usual amount for a typical rainfall event—resulting in street flooding. In January 2024, over 100 mm of rain fell within just two days, surpassing the total rainfall the city had recorded in the previous six months. The existing drainage system in Broken Hill was not equipped to handle such heavy rainfall, leading to reports of sewage overflows. Flooded roads and power outages were also reported in the nearby town of Silverton, located adjacent to Broken Hill.

2.2 Hydraulic and Hydrologic Modelling

A flood risk assessment has been prepared to assess the flood risk associated with the redevelopment of Willyama High School and is submitted with this report. Based on the information provided, a hydrological model was developed, and a TUFLOW hydraulic model was prepared for the site. The flood model was run for multiple design flood events, including the 10% AEP, 1% AEP, 0.2% AEP, and PMF.

For all events except the PMF, flood levels within the project boundary ranging from 290 to 293 m AHD. Flow velocities are generally low (below 0.5 m/s), flood depths are typically less than 200 mm, and the hazard classification is mostly H1—indicating safe conditions for people, vehicles, and buildings. Under these conditions, the school is not affected by flooding from the unnamed creek.

During the PMF event, flood levels range between 291.0 m AHD and 293.5 m AHD, with flood depths generally between 0.5 m and 1.5 m. Hazard classifications vary across H2, H3, and H4. These increased flood levels, depths, and hazard categories result from the significantly higher rainfall intensity used in the PMF, which is based on the Generalised Short-Duration Method (GSDM), in contrast to other events that use intensities derived from IFD curves.

Flood levels for the 1% AEP and PMF events at the proposed buildings are presented in Table 1. Flood maps showing post-development conditions for the 1% AEP and PMF events are provided in Figures 1 to 6.

Table 1- Proposed Flood Levels

Location	1% AEP Flood level (m AHD)	PMF (m AHD)	Proposed buildings FPL (m AHD)
Block A	292.20	293.270	293.300
Block B	292.40	293.270	293.300
Block C Hall	291.50	292.66	292.700

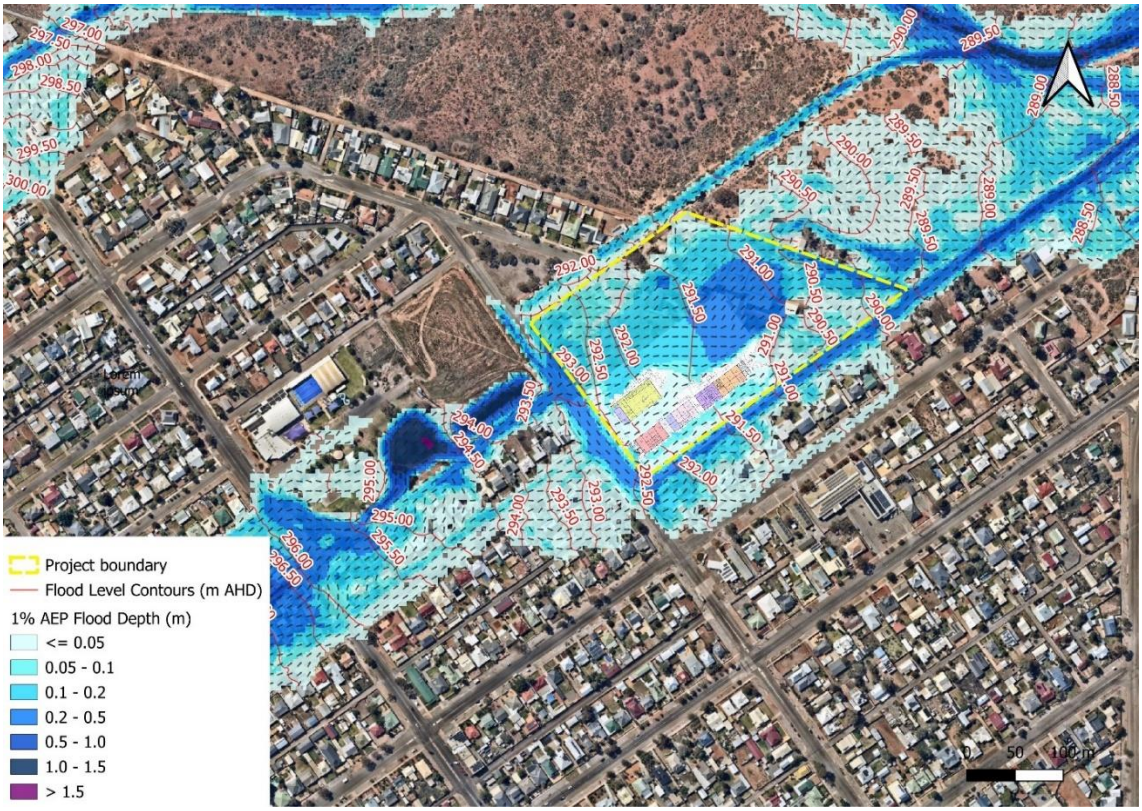

Figure 2- 1% AEP flood depths and levels-Post Development Scenario

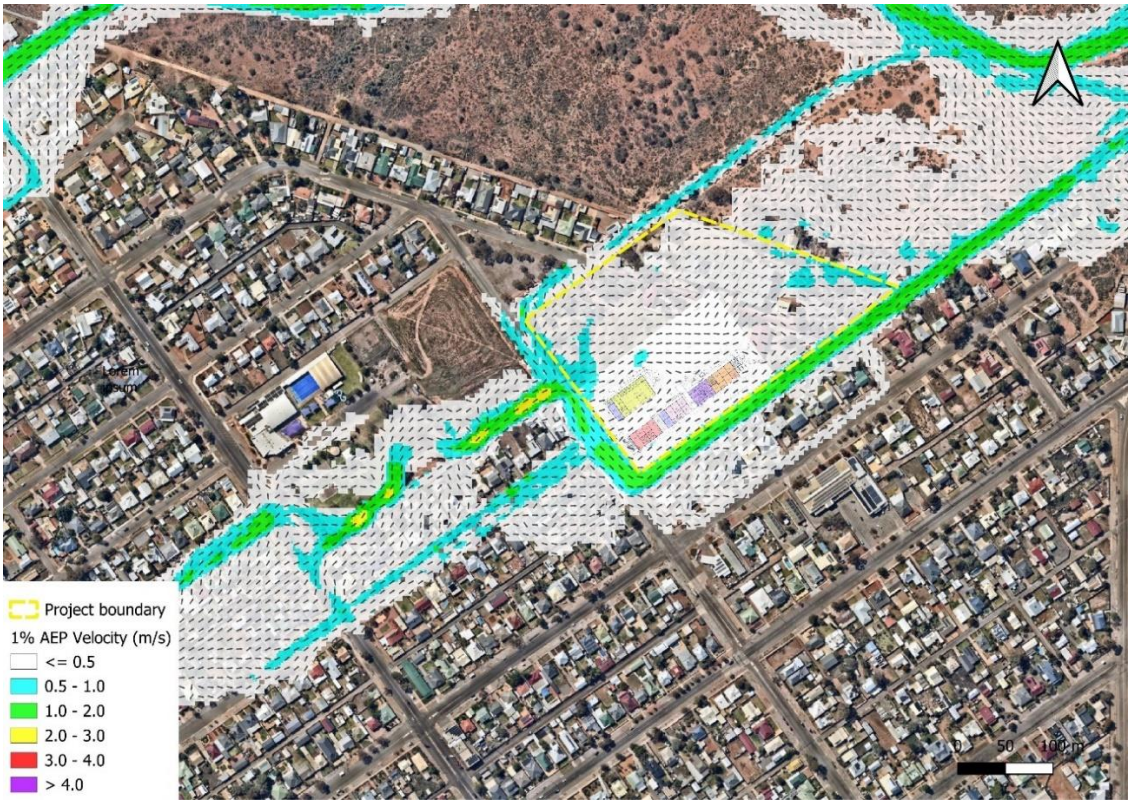

Figure 3-1% AEP flood velocities- Post Development Scenario

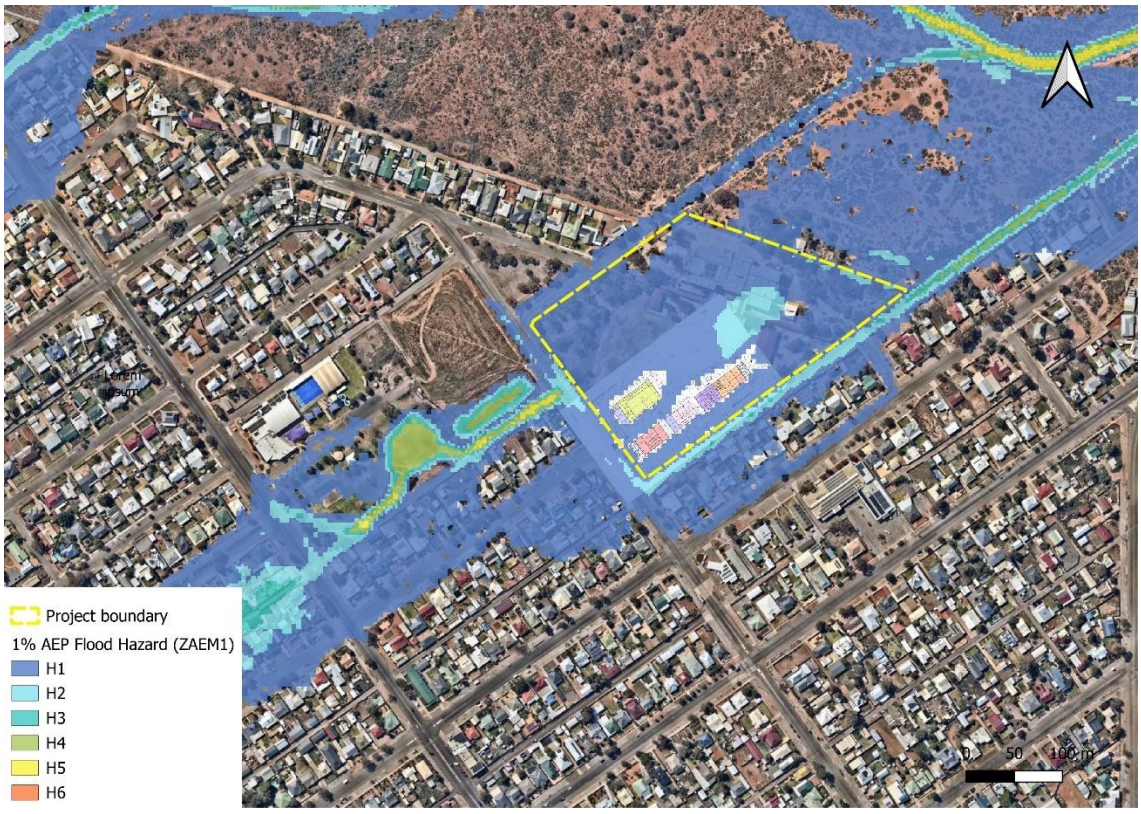

Figure 4- 1% AEP flood hazard – Post Development Scenario

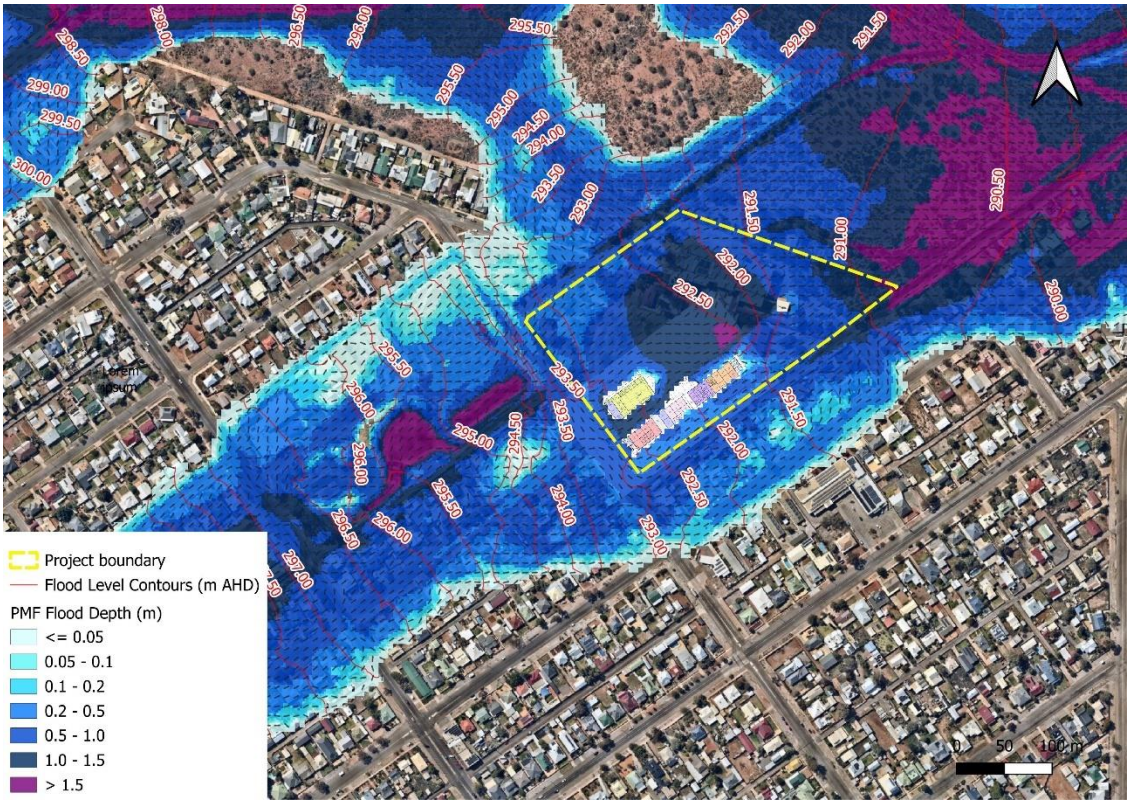

Figure 5- PMF Flood Depths and Levels -Post Development Scenario

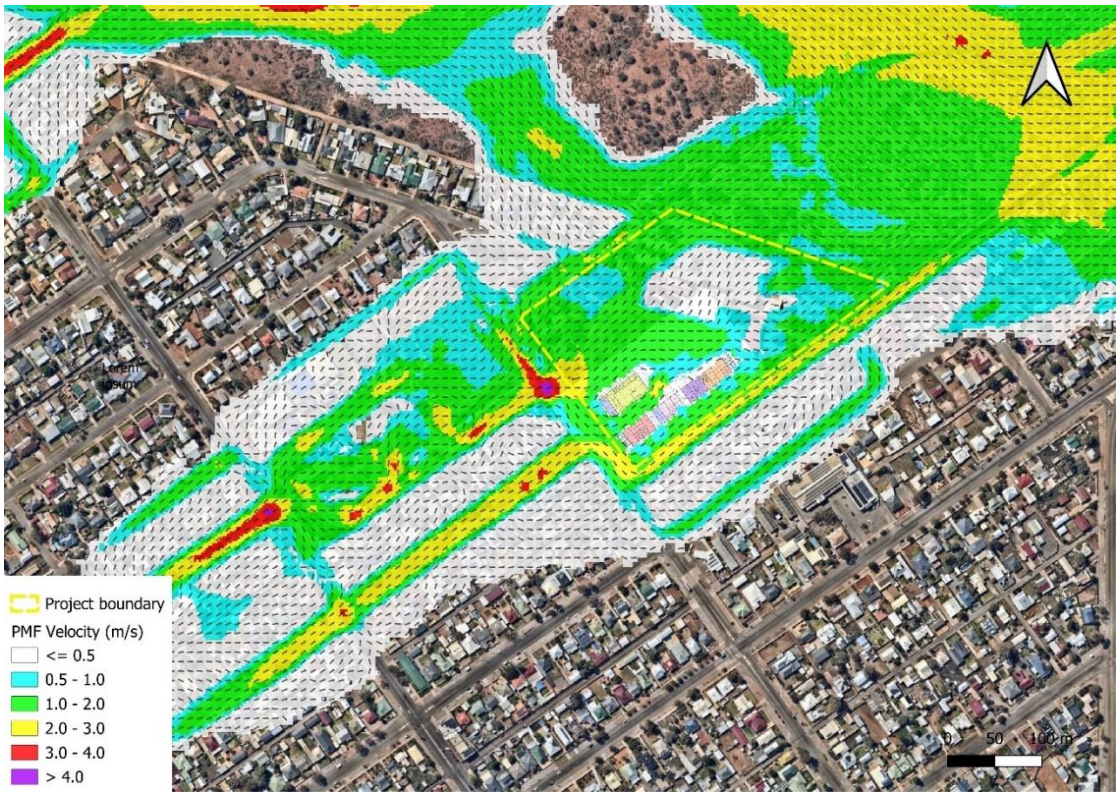

Figure 6 - PMF Flood Velocities- Post Development Scenario

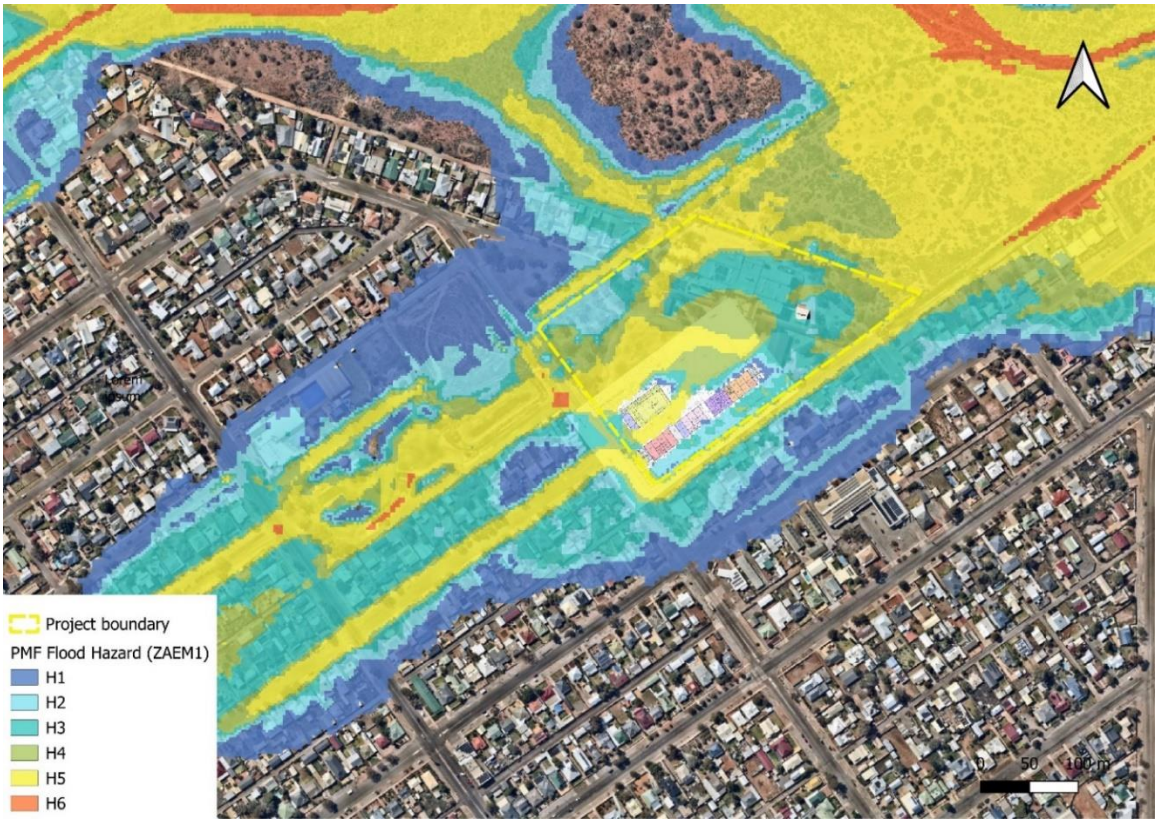

Figure 7- PMF Food hazard – Post Development Scenario

2.3 Inundation and Recession Times

The PMF flood model was run for a range of storm durations, from 30 minutes to 3 hours. The 30-minute storm produced the most critical flood depths within the school area. The time to peak and recession time are summarised in Table 1, which indicates that the maximum duration for which the school would be surrounded during the PMF event is less than 4.4 hours. It should be noted that the maximum PMF storm duration that can be generated using the Generalised Short-Duration Method (GSDM) for Broken Hill is 3 hours.

Table 2- Summary of time to peak and recession time for PMF event

PMF Duration	Time to peak (hr)	Time of recession (hr)
30 mins	0.4	1.5
1 hour	0.5	2
2 hours	0.75	3
3 hours	1.25	4.40

The table indicates that the site is subject to flash flooding (i.e., flooding lasting less than six hours), with potentially little to no warning time. As such, evacuation may pose a higher risk than temporarily sheltering in place.

3.0 Flood Response Strategy

The Broken Hill Local Flood Emergency Subplan – Volume 1 was obtained from the NSW SES for this project. This subplan was endorsed by the Broken Hill Local Emergency Management Committee in February 2024. It covers the Broken Hill City LGA, including its principal towns, villages, rivers, and creeks, as shown in Figure 8.

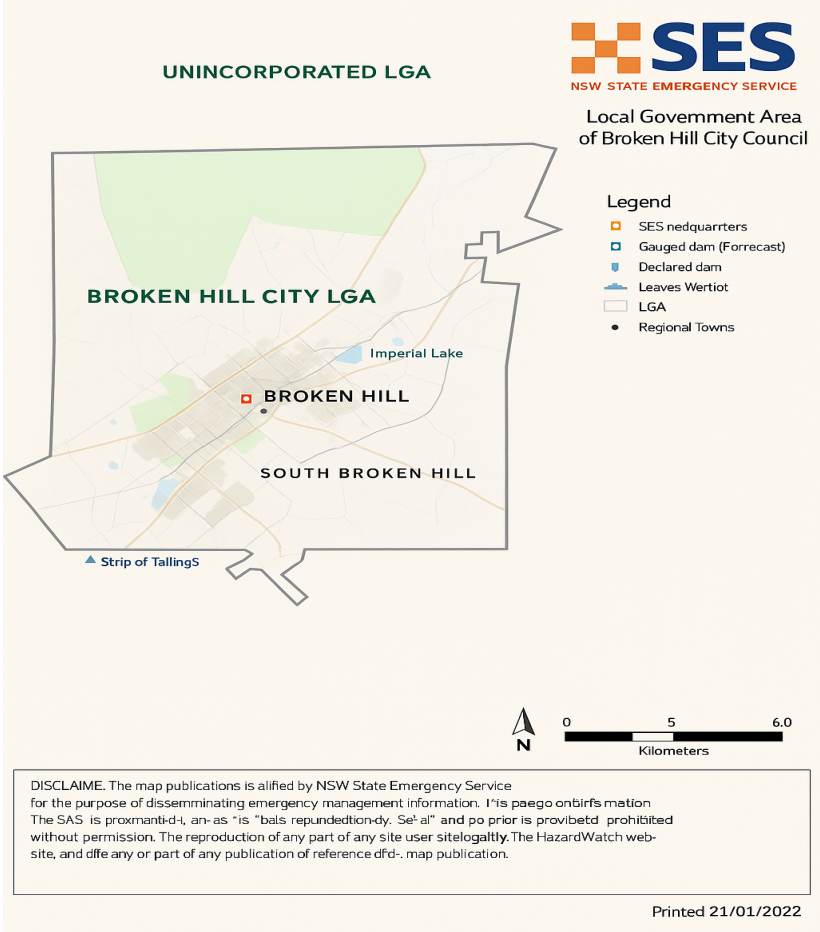

Figure 8- Broken Hill SES Subplan Scope

Volumes 2 and 3 of the subplan were not available at the time of writing this report.

3.1 Preferred Strategy

3.1.1 Pre-Emptive Closure

Section 1.6.2 of the Broken Hill Local Flood Emergency Sub Plan states that evacuation is the primary response strategy for people impacted by flooding. Pre-emptive closure of the school is the preferred flood emergency strategy for the school site if advanced warning is received outside of school hours, or where a severe event is forecast several hours in advance.

Although flash flood events are characterised by minimal warning times, there may be advanced notice of the extreme rainfall experienced in a 1% AEP–PMF event. During the operational phase, where there is enough warning prior to school opening hours, the school should be closed in advance of the flood event so children can be safe at home and parents do not have to drive through roads that could become hazardous.

In this strategy School administration offices (NSW Department of Education) will coordinate the evacuation of schools in consultation with the NSW SES and Welfare Services, if not already closed.

An SMS must be sent to staff and parents at the earliest opportunity (once the severe weather warning is issued by BOM) to ensure no site users enter dangerous road conditions.

3.1.2 Shelter-in place

While extreme rainfall events such as those associated with a 1% AEP–PMF event may be preceded by some level of warning, this cannot be relied upon. Flash flooding may occur with minimal or no lead time, making it impractical to implement a pre-emptive closure of the school.

Guidance issued by the NSW Department of Planning and Environment (DPE) in January 2025 identifies shelter-in-place (SIP) as an appropriate emergency management strategy when the flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter-in-place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall. Given that inundation of the surrounding road network is expected to occur within 24 minutes of the onset of a PMF event at the subject site, preparation for a shelter-in-place response is recommended.

As illustrated in Figure 7, all access routes to and from the site subject to high flood hazard (H4 and H5 hazard) during a PMF event. The NSW SES advises that evacuation should not require individuals to travel through floodwaters. Due to the rapid onset and short duration of flooding in the area, access to the site may be restricted for approximately 1.5 hours during a critical PMF event, increasing to up to 4.4 hours in longer-duration scenarios. Importantly, all proposed buildings are to be constructed above the PMF level, ensuring they remain free from above-floor inundation. Consequently, all buildings are considered safe for sheltering purposes from the ground floor and above.

The DPE SIP guideline recommends a minimum of 2 m² of indoor floor area per person. Based on information which provided by the project Architect (woods Bagot) the combined indoor floor area across all proposed buildings is approximately 6524 m2. Applying a conservative 60% reduction to allow for furniture, storage, and amenities results in a usable shelter-in-place area of approximately 2609 m2. This area is sufficient to accommodate more than 1304 occupants, thereby meeting the shelter requirements for the proposed 730 students, along with staff and visitors.

4.0 Flood Warnings and Notifications

4.1 Bureau of Meteorology

Severe weather and thunderstorm warnings are issued by the Bureau of Meteorology (BoM). These warnings are continually updated with descriptions of the likely conditions, including predicted extreme rainfall depths. Flood warnings are issued by the BoM when flooding is occurring or is expected to occur in an area. Warnings may include specific predictions of flood levels dependent on real-time and projected rainfall and river level data. These warnings are distributed by BoM to councils, Police and the relevant local SES, as well as being available on the BoM website.

- A ***Flood watch*** is issued by the BoM up to four days prior to a flood event. A watch is generally updated daily and may be issued before, during, or after rainfall has occurred.
- ***Flood warnings*** are issued by the BoM when flooding is occurring or expected to occur in a particular area. Warnings may include specific predictions of flood levels dependent on real-time and projected rainfall and river level data. These warnings are distributed to local councils, Police, and the relevant local SES, as well as being available on the BoM website, through telephone weather warnings and radio broadcasts. New South Wales weather warnings can be found at the following link: http://www.bom.gov.au/nsw/warnings/.

In addition to the above-listed warning products, the BoM provides forecast rainfall maps that estimate the expected rainfall over the next eight and four days, as well as the upcoming hours. This information is available at the following website: http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp

4.2 NSW SES Australian Warning System

NSW SES has recently implemented the Australian Warning System (AWS) which replaces their previous evacuation orders and warnings system. The AWS is a new national approach to information and 'Calls to Actions' for hazards including flooding. The System uses a nationally consistent set of icons, with three warning levels: Advice, Watch and Act, and Emergency Warning. The flood warnings are described in Figure 9.

Figure 9: Australian Warning System - Three Warning Levels

The NSW SES utilises a range of sources to build detailed flood intelligence within local communities, including information from flood studies and historical flood data. As part of the transition to the Australian Warning System, the NSW SES has increased flexibility to tailor warnings at the community level, based on the expected consequences of severe weather events.

Impacted communities will continue to receive flood warnings through the NSW SES website, NSW SES social media channels and by listening to local ABC radio stations. The NSW SES has also developed an all-hazards warning platform, Hazard Watch, to provide an additional channel for communities to access important warning information.

Each warning has three components:

1) **Location and hazard**: The location and the type of hazard impacting the community.
2) **Action statement**: For each warning level there are a range of action statements to guide protective action by the community. These statements evolve as the warning levels increase in severity. Statements range from 'stay informed' at the Advice level, to 'prepare to evacuate' at the Watch and Act level, to 'evacuate now' in the Emergency Warning level. As the situation changes and the threat is reduced, the level of warning will decrease accordingly.
3) **The warning level**: The severity of the natural hazard event based on the consequence to the community.

Relevant links can be accessed here:

https://www.ses.nsw.gov.au/https%3A/nswsesstage.prod.acquia-sites.com/plan-and-prepare/%5Bnode-title%5D-0

https://www.ses.nsw.gov.au/

https://www.hazardwatch.gov.au/

4.3 Triggers

Given the rapid onset of flooding at this site and the typically limited warning time, it is possible that NSW SES may be unable to issue flood alerts and recommended actions with sufficient notice. As a result, standard warnings may not always be available or may arrive with minimal lead time.

To enhance flood preparedness, it is recommended that alternative triggers be adopted to monitor potential flood conditions. These may include Bureau of Meteorology severe weather alerts, local radio broadcasts, and updates via social media. While the Chief Warden is responsible for monitoring the Automated Weather Station (AWS), NSW SES encourages all site personnel—including staff and wardens—to regularly consult the Hazard Watch website and the Hazards Near Me app.

Additionally, during periods of heavy rainfall, it is recommended that the Chief Flood Warden routinely inspect the low points at the intersections of Murton Street and Radium Street, and Murton Street and McGowen Street. If water begins to pond at these locations and the flood event is anticipated to impact the site, or if access becomes difficult and forecasts indicate flooding is likely to reach or exceed the moderate flood level, this should be used as a trigger to initiate shelter-in-place procedures. It should be noted that, due to the site's vulnerability to flash flooding, conditions can escalate rapidly.

5.0 Flood Response Team

5.1 Staff Responsibilities

In the event of a severe flood event, various staff members will be responsible for specific tasks as detailed in Table 3. Before the site is in operation, these roles must be delegated to specific staff members.

Table 3: Staff Flood Responsibilities

Role	Responsibilities
Chief Flood Warden	To monitor the warnings/alerts and inform accordingly Inform staff of flood risk Coordinate flood evacuation drills Decide if pre-emptive closure of the site is required prior to warnings from NSW SES Delegate emergency response actions if necessary – e.g. to designated "Building Wardens" who are responsible for a specific building.
First Aid Officer	Coordinate assistance for less able staff and students Prepare a Flood Emergency Kit that includes a portable radio, torch, spare batteries, first aid materials, emergency contact numbers, candles, waterproof matches, waterproof bags.

5.2 Key Contact Details

In the event of a severe flood event, key telephone numbers applicable to the site area have been listed in Table 4 below.

Table 4: Key Contact Numbers

IMPORTANT TELEPHONE NUMBERS	
Principle- Chief Flood Warden	tba
Deputy Principle- Chief Flood Warden	tba
Safety/First Aid Officer	tba
External Contacts	
Police/Ambulance	000
NSW State Emergency Services (SES)	132 500
Fire & Rescue NSW –	0880846238
Broken Hill Police Station	0880870299
Broken Hill Hospital	0880801300

6.0 Preparation for Flood Response

6.1 Education

As part of the preparation for a flood event, all staff must be made aware and advised of the flood risks present on site and the flood protocols & procedures adopted for the site. This should form part of the mandatory site inductions that all staff must undertake prior to commencing work at the site. A copy of this FERP will be made available to all new staff and managers. Completion of site induction and safety training for existing and new staff is the responsibility of the Site Manager.

6.2 Signage

As the site itself is subject to flooding, there is requirement for flood warning signage. Staff should be advised to stay alert and be aware of possible signage across access routes to the site, including “road subject to flooding” signs. A copy of a detailed FERP should be made available at communal areas within the site as well as the main office.

Figure 10- Flood signs

6.3 Flood Emergency Kit

A Flood Emergency Kit should be prepared prior to a flood event taking place and regularly checked (once per year) to ensure that supplies within the kit are sufficient and in working condition. The kit should, at a minimum, include:

- Radio with spare batteries.
- Torch with spare batteries.
- First aid kit and other medicines.
- Candles and waterproof matches.
- Waterproof bags.
- A copy of the Site Emergency Management Plan; and
- Emergency contact numbers.
- This Emergency Kit should be stored in a waterproof container, and it is the responsibility of the Site Manager to make sure that this kit is maintained, available and functioning during an emergency.

More information is available at:

https://www.ses.nsw.gov.au/plan-and-prepare/emergency-kit

7.0 Flood Response Actions

The flood response actions are outlined in Table 5.

Table 5: Flood Emergency Response Actions for the site

Flood Emergency Response Plan	
Flood Warning and Notification Procedures	**Evacuation and Refuge Protocols**
1) Weather forecast predicts significant rainfall event in the area or BoM issues a **FLOOD WATCH** or NSW SES issue a yellow "**ADVICE**" warning 	The following actions must be undertaken by the Site Manager: 1) Notify all staff, site users and parents of the flood watch via SMS and email and confirm availability of relevant staff to assist with emergency actions if required. 2) Ensure the emergency kit is ready to use. 3) Listen to the local radio station for updates on forecasted flood heights and timings. Monitor updates on social media and NSW SES platform Hazard Watch. 4) Ensure staff are familiar with their responsibilities.
2) Flash flooding is reported in the media / via visual observation at low points at surrounding roads or BoM issues **FLOOD WARNING** or NSW SES issue an amber "**WATCH AND ACT**" or red "**ACT NOW**" warning  	If the flood event is not anticipated to impact the site (either directly or indirectly), the **Chef Warden** is to continue hourly check-ins and postpone high risk activities (e.g. unnecessary deliveries etc.) If flood event is anticipated to impact the site, the **Chief Flood Warden** must undertake the following actions: • **For life-threatening emergencies phone 000 immediately.** **If outside of operational school hours or where several hours of notice has been given:** • Implement pre-emptive closure of school. Send SMS to staff and parents to inform them and advise them of closure. **If during school hours or where warning time is deemed insufficient:** • An alert and warning message should be broadcast over the PA system confirming a significant flood event, notifying all students and staff to begin **shelter-in-place** procedures. • Ensure no one is outdoors. • Send SMS to parents, advising them of SIP strategy and asking them not to travel to school. • Direct all students and staff to shelter in their classrooms. Unnecessary movement between buildings should be avoided. Staff must check student registers and complete a headcount to ensure all site users are accounted for. • The **Chief Flood Warden** is to follow any action statements provided via the AWS. **NOTE: Avoid driving or walking through floodwaters. These are the main causes of death during flooding.**

3)	Visual observation shows floods are receding or the alert has been downgraded by the relevant authorities and any flood event that occurred has passed. 	• The **Chief Flood Warden** is to confirm floodwater has subsided below the ground level and that there is no ponding within the site. • Flooded areas are to remain off limits until ponding has cleared. Site is to be inspected by the **Chef Flood Warden** if required. Once it has been confirmed that the water level has reduced to a suitable level, and if determined safe, the **Chief Flood Warden** may announce that staff and students no longer need to shelter-in-place.

8.0 Limitations and Revision of the Flood Emergency Response Plan

This FERP outlines shelter-in-place procedures for managing extreme flood events affecting students and staff on-site. It is intended as a general guide only and does not cover individual travel arrangements or situations where safe access to or from the site is impacted by flooding or road closures. It also does not take into account the decisions of individuals—such as visitors—who may choose not to stay in a safe location above the PMF level for the duration of a flood or who may attempt to access hazardous areas.

The contents of this FERP are based on the best available information at the time of preparation and will need to be updated after the detailed design phase and before the site becomes operational. As a 'living document,' the FERP must be reviewed regularly once the school is in use to ensure it remains effective, reflects current risks, can be practically implemented, and incorporates lessons from any recent flood events.

The responsibility for keeping this FERP up to date lies with the NSW Department of Education & Communities. Updates must align with relevant standards, policies, legislation, and the Regional State Emergency Management Plan to safeguard the health, safety, and wellbeing of staff, students, and visitors.

9.0 Mitigation Measures and Recommendations

Mitigation Number	Aspect/Section	Mitigation Measures	Reason for Mitigation Measure
1	Design, operation	Regularly review and update FERP.	This FERP is based on the currently available information for the proposed site, and must be updated following the detailed design stage, prior to the site becoming operational.
2	Prior to commence of operation	Delegate staff responsibilities.	To ensure all staff are aware of their specific roles and associated flood response actions.
3	Prior to commence of operation	Education and signage	As part of the preparation for a flood event, all staff and students must be made aware and advised of the flood risks present on site and the flood protocols & procedures via signage. This will enhance preparedness for a flood.
4	Prior to commence of operation	Flood emergency kit	A Flood Emergency Kit should be prepared prior to a flood event taking place and regularly checked to ensure that supplies within the kit are sufficient and in working condition.
5	Prior to commence of operation	Flood emergency kit	A Flood Emergency Kit should be prepared prior to a flood event taking place and regularly checked to ensure that supplies within the kit are sufficient and in working condition.
7	During operation	Flood drills	It is recommended that flood drills be held by staff annually to ensure all staff workers and students are familiar with the sound of the alert and their subsequent flood response actions. It needs to be prior to the commencement of the Wet season (Typically November to April)
8	During operation	Responsibilities and display the notice	School administration to undertake responsibilities as set out in the FERP and Ensure that the Flood Warning Notice is maintained and permanently visible

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