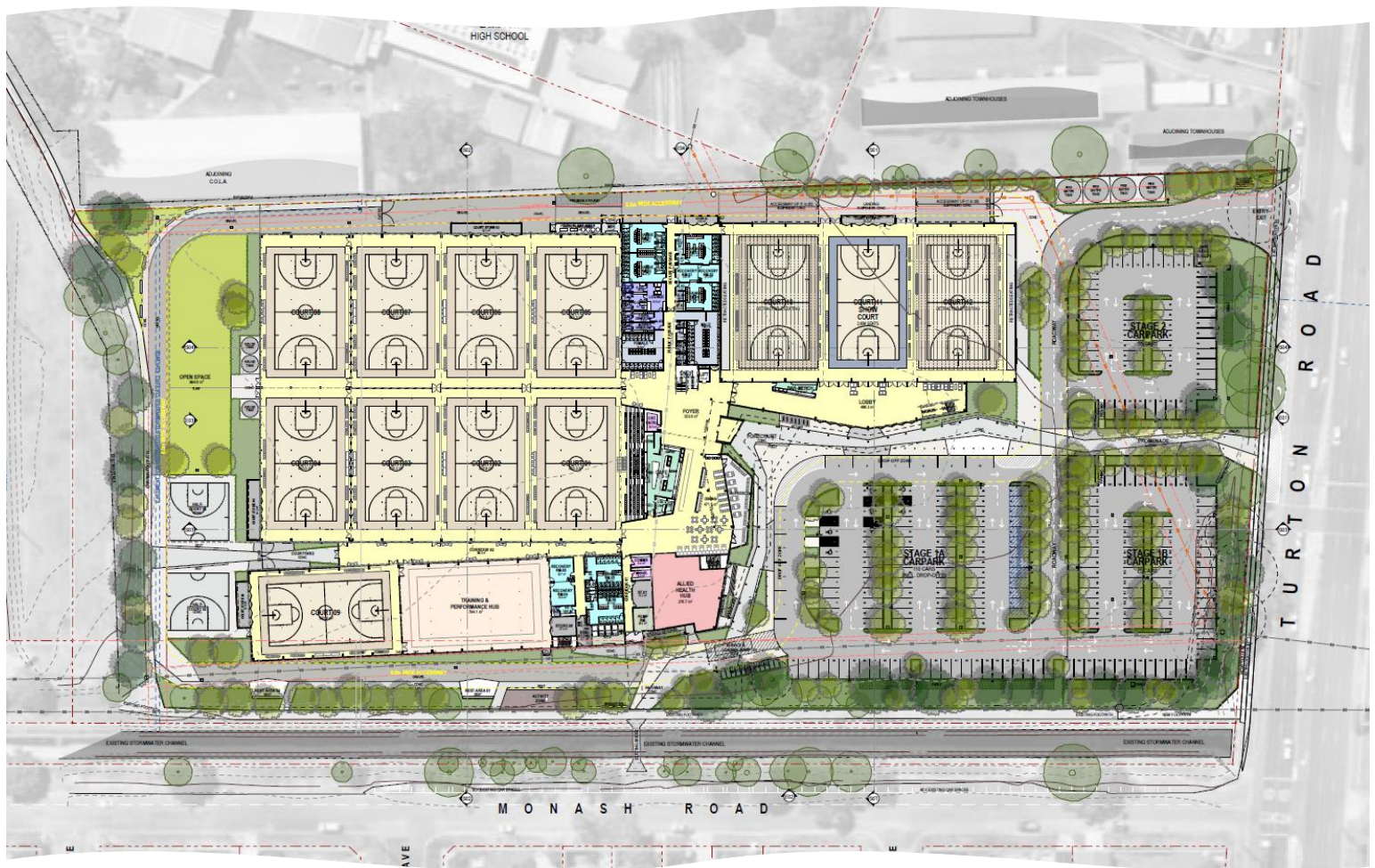


Hunter Indoor Sports Centre Flood Emergency Response Strategy

R.T2468.002.01



July 2024

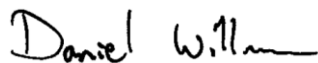
Final Report

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Prepared: Verified:



Synopsis

Flood Emergency Response Strategy for proposed development on the Hunter Indoor Sports Centre at 2 Monash Road and 24 Wallarah Road, New Lambton, NSW.

Revision History

Revision	Description	Date
01	Final	8/07/2024

Disclaimer

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Executive Summary

This Flood Emergency Response Strategy is prepared to support the proposed development of the Hunter Indoor Sports Centre at 2 Monash Road and 24 Wallarah Road, New Lambton NSW. This document outlines the overall strategy for Flood Emergency Response Management, which will be developed into a more detailed Flood Emergency Response Plan prior to occupation of the proposed development.

The key requirements for development of an effective FERP have been established. The development and adoption of an FERP requires full integration with the site management, health and safety and incident management structures and is typically required prior to occupation. However, the overall flood emergency response strategy, flood intelligence and key components of the FERP were assessed.

The staff members responsible for the FERP should monitor BoM severe weather warnings and be subscribed to the Newcastle Flood Alert Service. The recommended flood emergency response (if people are present on the Site during a flood) is to seek refuge from flooding within the Site, only vacating the Site when it is safe to do so following the recession of flood inundation. There is however an opportunity to evacuate people from the Site (if required and safe to do so) and for flood emergency egress/ingress during a flood event, from the rear building access to Womboin Road.

The Flood Refuge area is the first-floor level of the building. With an available floor area of around 2000 m², the Flood Refuge can accommodate up to 2000 people potentially present on the Site. Being a fully functioning part of the building, the Flood Refuge is inherently well-equipped to service the needs of potential occupancy for an expected period of a few hours.

On-site flood refuge requires structural certification that the proposed building can withstand the expected hydraulic loads of the PMF event. Given the heavy construction type of the building this is expected to be readily achieved. The modelled flood depths adjacent to the building at the PMF event are locally as high as 1.4 m, with peak velocities typically no higher than up to 1.6 m/s. However, the modelled peak velocity is locally as high as 2.1 m/s at the south-eastern corner of the proposed Allied Health Club.

The site management should consider the need to cancel or postpone events if a relevant severe weather warning is issued by the BoM. Travel is typically discouraged in such circumstances due to the risk of heavy rainfall and strong winds increasing the risk of driving. Such advice was in place across Newcastle prior to the April 2015 flood event.

Contents

1	Introduction.....	5
1.1	Project Overview	5
1.2	Scope of Assessment	5
2	Flood Emergency Management	7
2.1	Likely Flood Behaviour.....	7
2.1.1	Flood Probabilities.....	7
2.1.2	Flooding at the Site	7
2.2	Flood Warning Systems	9
2.2.1	Bureau of Meteorology	9
2.2.2	Newcastle Flood Alert Service	10
2.3	Education Awareness Program.....	11
2.4	Evacuation and Evasion Procedures.....	11
2.5	Evacuation Routes and Flood Refuges	11
2.6	Flood Preparedness and Awareness Procedures for Visitors	12
3	Project Staging	14
4	Conclusions	15
5	References	16

List of Figures

Figure 1-1	Locality Plan	6
Figure 2-1	Flood Probability Terminology.....	8
Figure 2-2	Flood Egress / Ingress Route	13

1 Introduction

1.1 Project Overview

Torrent Consulting has been commissioned by Basketball Association of Newcastle Limited (BANL) to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD- 65595459) for the proposed Hunter Indoor Sport Centre with courts, indoor stadium, amenities and associated civil and landscaping works, at 2 Monash Road and 24 Wallarah Road, New Lambton (the Site).

The site is located at 2 Monash Road and 24 Wallarah Road, New Lambton (refer to Figure 1-1), within the Newcastle local government area (LGA). The site comprises multiple parcels of land and is legally described as:

- Lot 2380 DP755247
- Lot 2379 DP755247
- Lot 2378 DP755247
- Lot 2377 DP755247

The project area also includes the land on which the existing amenities block is located.

The Site is located beside Lambton Ker-rai Creek, which is a tributary of Styx Creek, located some 450 m downstream. The Site is known to be flood-prone, as identified in the Newcastle City-wide Floodplain Risk Management Study (BMT WBM, 2012) and the recent update to the Throsby, Styx, and Cottage Creeks Flood Study (Rhelm, 2023).

1.2 Scope of Assessment

This document outlines the overall strategy for Flood Emergency Response Management, which will be developed into a more detailed Flood Emergency Response Plan prior to occupation of the proposed development.



Title:
Study Locality

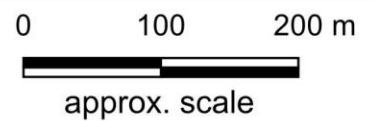


Figure: **1-1** *Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.*

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2 Flood Emergency Management

This section addresses the key requirements of an effective FERP. The development and adoption of an FERP requires full integration with the site management, health and safety and incident management structures and is typically required prior to occupation. However, the overall flood emergency response strategy, flood intelligence and key components of the FERP are provided below.

Ultimately the FERP will be developed within a standalone document, including triggers, actions, roles, and responsibilities. The FERP document is typically finalised for approval prior to issuing of an Occupation Certificate. At this stage of the approval process the key objective is to present the overall flood emergency management strategy for review and acceptance, as this will underpin the subsequent development of the adopted FERP.

2.1 Likely Flood Behaviour

2.1.1 Flood Probabilities

The Australian Rainfall and Runoff (ARR) 2019 guidelines describe two approaches that are typically used to express the probability of flood events:

- Annual Exceedance Probability (AEP) – the probability of an event being equalled or exceeded within a year. Typically, the AEP is estimated by extracting the annual maximum in each year to produce an Annual Maxima Series (AMS); and
- Average Recurrence Interval (ARI) – the average period between occurrences equalling or exceeding a given value. Usually, the ARI is derived from a Peak over Threshold series (PoTS) where every value over a chosen threshold is extracted from the period of record.

A summary of flood probability terminology from ARR 2019 is reproduced in Figure 2-1.

Very frequent flood events are expressed as exceedances per year (EY). At the other end of the probability spectrum, the Probable Maximum Flood (PMF) event is a function of the Probable Maximum Precipitation (PMP), which is the most rainfall that can be practically considered as being possible to occur over a given location or area. It is an extreme event with an approximate probability of between a 1-in-10,000 and a 1-in-10,000,000 AEP, dependant on catchment area. For small catchments such as Lambton Ker-rai Creek the approximate probability of the PMF event is a 1-in-10,000,000 AEP.

2.1.2 Flooding at the Site

The flood-producing weather events most-likely to affect the Site include East Coast Lows (ECL). The Bureau of Meteorology (BoM) defines ECLs as being very intense low-pressure systems characteristic of the eastern coastline of Australia, occurring on average several times each year. Although they can occur at any time of the year, they are more common during autumn and winter with a maximum frequency in June. East Coast Lows will often intensify rapidly over a period of 12-24 hours making them one of the more dangerous weather systems to affect the eastern coast.

Other weather systems that present a flood risk at the Site include ex-tropical cyclones that occasionally move south into NSW and severe thunderstorms that can develop quickly and affect relatively small areas.

Flood risk at the Site is principally from the capacity of the Lambton Ker-rai Creek stormwater channel being exceeded. Flood waters are typically relatively-well contained upstream of Wallarah Road but floodplain inundation becomes more extensive at the Site and further downstream. When the capacity of Lambton Ker-rai Creek is exceeded at Turton Road, flood waters inundate the floodplain at the Site and the residential area to the south of Monash Road. The obstruction presented by Turton Road forces excess flows northwards through the Site towards the Turton Road – Griffiths Road intersection.

Frequency Descriptor	EY	AEP (%)	AEP	ARI
			(1 in x)	
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
Intermediate	0.11	10	10	9.49
	0.05	5	20	19.5
Rare	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
Extreme	0.0005	0.05	2000	1999.5
	0.0002	0.02	5000	4999.5
			↓	
			PMP/ PMP Flood	

Figure 2-1 Flood Probability Terminology

The extent, depth and hazard of flood waters affecting the Site are shown in the flood mapping of Section 5.2 and Appendix B of the Flood Impact and Risk Assessment (R.T2468.001.03). The frequency of flooding can be impacted by the extent and magnitude of debris blockage to hydraulic structures within the stormwater drainage network and through the potential increase of rainfall

intensity resulting from future climate change conditions. However, flood inundation is expected to occur at the Site from around the 10% AEP event.

Because of the urban and small catchment context of the local flood environment the rate of rise of flood waters can be rapid, particularly in an extreme event. However, this environment also produces floods of a relatively short duration, with flood waters quickly receding following the peak conditions.

For flood events such as the 10% AEP or 1% AEP, the rate of rise of flood waters within the Lambton Ker-rai Creek channel is in the order of 4 m per hour, increasing to over 10 m per hour for extreme flood event such as the PMF. Once the flood levels exceed the channel capacity the rate of rise reduces significantly, to around 1 m per hour across all events. The duration of floodplain inundation will vary on an event-specific basis but is expected to be in the order of between one to four hours.

2.2 Flood Warning Systems

2.2.1 Bureau of Meteorology

The BoM has a few generalised warning services that can provide an indication of an increased likelihood of flooding, including:

- Severe Weather Warnings
- Severe Thunderstorm Warnings
- Flood Watches
- Flood Warnings

The BoM issues Severe Weather Warnings whenever severe weather is occurring in an area or is expected to develop or move into an area. The warnings describe the area under threat and the expected hazards. Warnings are issued with varying lead-times, depending on the weather situation, and range from just an hour or two to 24 hours or sometimes more.

Severe Weather Warnings are issued for:

- Sustained winds of gale force (63 km/h) or more
- Wind gusts of 90 km/h or more (100 km/h or more in Tasmania)
- Very heavy rain that may lead to flash flooding
- Abnormally high tides (or storm tides) expected to exceed highest astronomical tide
- Unusually large surf waves expected to cause dangerous conditions on the coast
- Widespread blizzards in Alpine areas

The BoM issues Severe Thunderstorm Warnings to alert communities of the threat of these more dangerous thunderstorms. A severe thunderstorm is one that produces any of the following:

- Large hail (20 mm in diameter or larger)
- Giant hail (50 mm in diameter or larger)
- Damaging or destructive wind gusts (generally wind gusts exceeding 90 km/h)
- Heavy rainfall which may cause flash flooding
- Tornadoes

Most thunderstorms do not reach the level of intensity needed to produce these dangerous phenomena, so the BoM does not warn for all thunderstorms.

Standard public forecasts will include information when there is a reasonable risk of severe storms. This information will allow people to prepare for the potential severe weather. Severe thunderstorms can be quite localised and can develop quickly. The exact location of severe thunderstorms can be hard to predict. As it is difficult to forecast the precise location and movement of severe storms before they have started to develop, detailed warnings will generally be provided once they have been observed or detected. The detailed warnings are usually issued without much lead-time before the event.

Flood Watches and Flood Warnings are issued for catchments that have a formal flood warning system operated by the BoM, which typically have a critical duration for the generation of flood conditions exceeding six hours. This is for catchments much larger than Lambton Ker-rai Creek.

The current BoM Warnings active in NSW can be accessed at <http://www.bom.gov.au/nsw/warnings/>

The rainfall recently recorded by rainfall warning gauge locations across Newcastle can be accessed at <http://www.bom.gov.au/nsw/flood/newcastle.shtml>

Current rainfall radar monitoring for the Newcastle (Williamtown Airport) 64 km radius loop can be accessed at <http://www.bom.gov.au/products/IDR044.loop.shtml#skip>

2.2.2 Newcastle Flood Alert Service

City of Newcastle and partners 'NSW State Emergency Service', 'Bureau of Meteorology', 'Department of Planning, Industry and Environment' and 'Hunter Water Corporation' engage Early Warning Network (EWN) to administer a flash flood alert service for flood affected areas of Newcastle. This is an action of the Newcastle City Wide Floodplain Management Plan 2012.

Council trialled the flash flood alert service in Wallsend in 2016. A minor flood event occurred in January 2016, which was sufficient in testing the alert service to its full potential. The results of the trial were positive, and the registered users commended the service and expressed their approval to see it continue.

In 2017, Council expanded the alert service so that it can provide similar alerts in other flood affected areas of Newcastle. The service is permanent and free of charge to registered users and is managed by EWN.

The Newcastle Flood Alert Service comprises some ten continuous (pluviograph) rainfall gauges across the city. EWN constantly monitor the rainfall recorded by the gauges and issue flood warning alerts for eight different flood alert areas. The 'Lambton, Hamilton, Islington, Broadmeadow and Mayfield' flood alert area is the one in which the Site is located. There are three flood alert rainfall gauges within 2 km of the Site, located at Lambton Reservoir, Waratah Reservoir and Broadmeadow. EWN uses rainfall intensity thresholds recorded at the gauges to issue Minor, Moderate or Major Flood Warnings.

Whilst there would be limited time between a Flood Warning being issued through the Newcastle Flood Alert Service and inundation of the car park area at the Site, it would provide in the order of a 45-minute period prior to internal inundation of the building in an extreme flood event.

Once operational, the appropriate emergency management team for the Site should be subscribed to the Newcastle Flood Alert Service.

2.3 Education Awareness Program

All staff with FERP responsibilities are to undertake the required training. Ensuring that this training is provided is the responsibility of the emergency management team. Most training is consistent with the broader Emergency Management Planning and Critical Incident Management requirements and not specific to the FERP. This includes standard training for Wardens and First Aid Officers, etc.

Familiarisation with the FERP should form part of the induction and regular training for relevant staff. In addition, a full drill of a flood emergency response will be undertaken annually. The performance outcomes of the drill will be reviewed by the site management team.

Specific training is also to be provided to the Chief Warden and members of the emergency management team as to the accessibility and interpretation of the available flood warning information and how this can improve the decision-making process during the management of a flood emergency response.

2.4 Evacuation and Evasion Procedures

Frequent to intermediate flood events, whilst potentially resulting in localised inundation within the Site, only produce low to medium hazard flood conditions that do not present a significant risk to people located there. However, for an extreme flood event most of the Site will be inundated, including the potential for internal flooding of the building.

The flood hazard within the local and broader city-wide road network can be higher than within the Site and so leaving the Site during or immediately prior to a flood event can increase the level of risk, particularly given the context of the local “flash flood” environment. Coupled with a relatively short warning time, these conditions make evacuation from the Site prior to a flood challenging, from both a logistical and risk-based perspective.

The recommended flood emergency response (if people are present on the Site during a flood) is therefore to seek refuge from flooding within the Site, only vacating the Site when it is safe to do so following the recession of flood inundation. There is however an opportunity to evacuate people from the Site (if required and safe to do so) and for flood emergency egress/ingress during a flood event, from the rear building access to Womboin Road.

2.5 Evacuation Routes and Flood Refuges

The Flood Refuge area is the first-floor level of the building, which is above the PMF level of 9.45 m AHD. The 2400 m² first-floor mezzanine has around 2000 m² suitable for use as a Flood Refuge, which can accommodate up to 2000 people potentially present on the Site. A minimum of 1 m² per person is typically adopted for flood refuges within short duration (< 6-hour) flood environments, with 2 m² per person for long duration flood environments.

Being a fully functioning part of the building, the Flood Refuge is inherently well-equipped to service the needs of potential occupancy for an expected period of a few hours and includes the following:

- Emergency lighting (as implemented during construction of the building)

- Access to clean water (via the mains water supply)
- Access to bottled water and emergency snack foods
- Two-way radios for Wardens
- External battery source to power a mobile phone and laptop
- Torches and spare batteries
- First aid kits (to include basic first aid supplies, plus EpiPen and Defibrillator (AED))
- Fire-fighting equipment including fire extinguishers and fire blankets

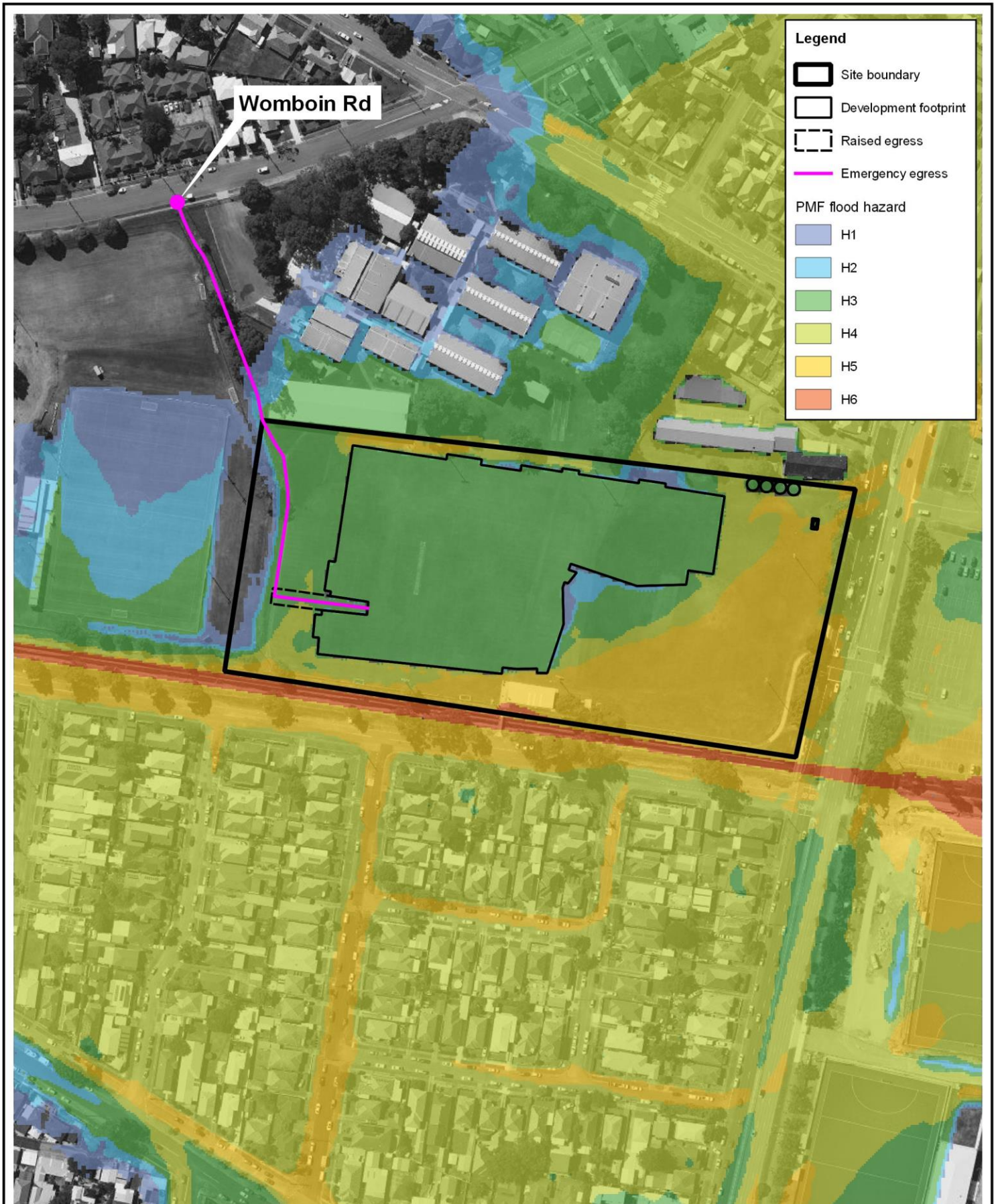
The flood emergency egress / ingress route from Womboin Road is shown in Figure 2-2. A length of around 45 m between the rear doors of the building and an existing footpath has been raised to the FPL to provide a rising pedestrian access to Womboin Road. Flood-free land above the PMF event is reached around 165 m from exiting the building. The flood hazard condition during the peak of the PMF event is H3, which is suitable for wading by adults. This will enable access to the building by emergency services personnel, if required and/or to evacuate people from the Site.

2.6 Flood Preparedness and Awareness Procedures for Visitors

Visitors to the Site are to be directed by staff as to what to do in the event of a flood. It is recommended that a simple two-sided 'Summary FERP' document be produced that can be wall-mounted alongside fire emergency information.

The principal risk to visitors from flooding is the potential of inundation within the car park, as it is far more likely than that of internal inundation within the building. Signage should be displayed within the car park advising of the risk of flash flooding during intense rainfall. Regular visitors to the Site should be advised to park off-site (such as on Womboin Road) or arrange alternative transport if they are concerned about the potential risk to their vehicle during periods of heavy rainfall.

The site management should consider the need to cancel or postpone events if a relevant severe weather warning is issued by the BoM. Travel is typically discouraged in such circumstances due to the risk of heavy rainfall and strong winds increasing the risk of driving. Such advice was in place across Newcastle prior to the April 2015 flood event.



Title:
Flood Egress / Ingress Route

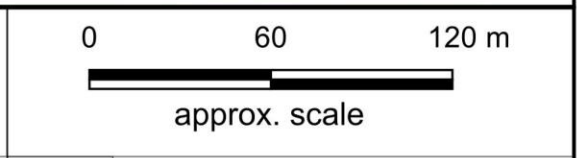


Figure: **2-2** Information shown on this figure is compiled from numerous sources and may not be complete or accurate. Torrent Consulting cannot be held responsible for the misuse or misinterpretation of any information and offers no warranty guarantees or representations of any kind in connection to its accuracy or completeness. Torrent Consulting accepts no liability for any loss, damage or inconvenience caused as a result of reliance on the information.

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3 Project Staging

The proposal has been designed so that the project can be delivered as an initial block of six courts with subsequent additions to be delivered over several construction stages, as described below:

Stage 1A

A single storey building with total gross floor area (GFA) of approximately 10 218 m² comprising:

- Ground floor: 6 x basketball courts, amenities to support the functioning of the complex including bathrooms, change rooms, lobby and foyer, retail tenancy and café.
- Car park with 110 spaces.

Stage 1B

- Ground floor extension to the west to provide 2 x courts with a GFA of approximately 1630 m².
- Additional 75 car parks, total 185 spaces at completion of Stage 1b.
- Mezzanine level: function rooms, administration space and training areas.

Stage 2

Extension to the northern and southern sides of the existing building with total additional GFA of approximately 7180 m² comprising:

- Ground floor 3 x courts including show court with retractable grandstand seating over the two adjacent courts.
- Extension to the southern side of the building to provide 1 x court plus high-performance training area.
- Mezzanine level: extension of mezzanine to provide additional corporate spaces.
- Expansion of existing car park to provide 240 spaces.

The development of an FERP will need to be updated to be correct for the current development at the time of occupation. The key impacts of the proposed staging on flood emergency response management are:

- The raised pathway providing egress to Womboin Road should be extended to enable access from a rear door of the building.
- The first-floor level at the completion of the Stage 1A development is limited to an unutilised area to facilitate subsequent Stage 1B extension. As a Flood Refuge it can accommodate up to around 600 people but will need to be provisioned accordingly (refer Section 2.5).
- Most of the first-floor area nominated for Flood Refuge is constructed as part of the Stage 1B development, albeit with a reduced capacity to accommodate up to around 1600 people.

4 Conclusions

This Flood Emergency Response Strategy is prepared to support the proposed development of the Hunter Indoor Sports Centre at 2 Monash Road and 24 Wallarah Road, New Lambton NSW. This document outlines the overall strategy for Flood Emergency Response Management, which will be developed into a more detailed Flood Emergency Response Plan prior to occupation of the proposed development.

The key requirements for development of an effective FERP have been established. The development and adoption of an FERP requires full integration with the site management, health and safety and incident management structures and is typically required prior to occupation. However, the overall flood emergency response strategy, flood intelligence and key components of the FERP were assessed.

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On-site flood refuge requires structural certification that the proposed building can withstand the expected hydraulic loads of the PMF event. Given the heavy construction type of the building this is expected to be readily achieved. The modelled flood depths adjacent to the building at the PMF event are locally as high as 1.4 m, with peak velocities typically no higher than 0.8-1.2 m/s. However, the modelled peak velocity is locally as high as 1.5-1.8 m/s at the south-eastern corner of the proposed Allied Health Club and at the western end of the northern side of the building, between the building and the higher ground of the adjacent Lambton High School.

The site management should consider the need to cancel or postpone events if a relevant severe weather warning is issued by the BoM. Travel is typically discouraged in such circumstances due to the risk of heavy rainfall and strong winds increasing the risk of driving. Such advice was in place across Newcastle prior to the April 2015 flood event.

5 References

AIDR (2017) *Guideline 7-3, Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia*

City of Newcastle Council (2023) *Development Control Plan*

Geoscience Australia (2019) *Australian Rainfall and Runoff: A Guide to Flood Estimation*

Rhelm (2023) *Throsby, Styx, and Cottage Creeks Flood Study*