

R h e i m

Louise Collier*, Dr Brett Phillips and Martin Griffin

Basement Development in the Floodplain – Quantifying and Managing Risk

Basement Development in the Floodplain – Quantifying and Managing Risk

Overview of Presentation

Overview

- Quantifying risk
- What is at risk?
- Examples of damage to property in basements
- Examples of loss of life in basements
- Preliminary industry survey results
- Current guidance and development control policy review
- Realities of basements in flood prone areas
- Managing risk: Options for controls for basements in flood prone areas



Basement Development in the Floodplain – Quantifying and Managing Risk

Quantifying Risk

Risk Assessment Matrix

Likelihood	Equivalent Probability*	Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	5	Medium	Medium	High	Extreme	Extreme
Likely	0.5%	Low	Medium	High	High	Extreme
Possible	0.05%	Low	Low	Medium	High	High
Unlikely	0.005%	Low	Low	Medium	Medium	High
Rare	0.0005%	Low	Low	Low	Medium	Medium
Very rare	Undefined	Low	Low	Low	Low	Medium
Almost incredible	< 0.0005%	Low	Low	Low	Low	Low

Source: *Managing the floodplain: a guide to best practice in flood risk management in Australia* – Australian Emergency Management Handbook Series - Handbook 7 (Australian Institute for Disaster Resilience, 2013) and *Australian Geomechanics Society (2007) for the equivalent probabilities.

Example Basement Carpark Risk Assessment

Likelihood	Equivalent Probability*	Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	5	Medium	Medium	High	Extreme	Extreme
Likely	0.5%	Low	Medium	High	High	Extreme
Possible	0.05%	Low	Low	Medium	High	High
Unlikely	0.005%	Low	Low	Medium	Medium	High
Rare	0.0005%	Low	Low	Low	Medium	Medium
Very rare	Undefined	Low	Low	Low	Low	Medium
Almost incredible	< 0.0005%	Low	Low	Low	Low	Low

Probability of a basement that has a crest level set at the 1%AEP flood level plus a freeboard of 0.5 m rapidly filling to become fully inundated may be less than 1% (likely)

Consequence - death of occupants by drowning as they are unable to escape from the basement ('catastrophic')

Basement Development
in the Floodplain -
Quantifying and
Managing Risk

What is at Risk?

Items Located in Basements (Australia)

- Vehicle/Motorbike parking
- Bicycle storage/parking
- Storage (e.g. residential storage cages or enclosures which may contain files, clothing, memorabilia, cellaring of wine, retail goods storage (including stock and consumables), commercial premises storage (including hazardous and toxic materials).
- Car wash facilities
- Plant and equipment
- Laundry facilities
- Other utility type uses
- Infrastructure (sumps for groundwater pumps for seepage, treatment systems for groundwater capture, flood storage tanks).

Basement Development
in the Floodplain:
Quantifying and
Managing Risk

Examples of Damage to Property

JANUARY 29, 2011

Unit owners face massive flood bills

Marissa Calligeros [Show comments](#)

[SHARE](#) [TWEET](#) [+](#) [MORE](#)

The pain is not over for Brisbane unit owners, who may be alighted with huge body corporate levies to repair flood damage.

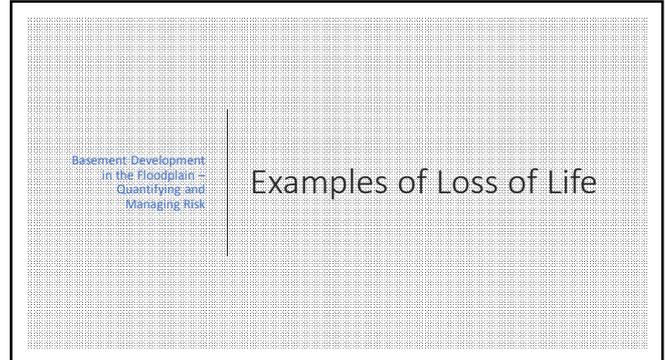
CTS Management director Coralie Mott said some bodies corporate were facing costs close to \$1 million as electrical wiring, switch boards, lift wells and garage roller doors were destroyed when basement carparks flooded.



[SHARE](#)

Floodwaters cross over Concession Drive near Toombul on January 23. Photo: AFP





Sheriff's office: Man died in flooded Idaho basement

By Times-News | Posted May 20th, 2017 @ 7:33pm

KETCHUM, Idaho — A 56-year-old Ketchum landscaper helping a couple with flooding issues died Wednesday after he was trapped in more than 6 feet of water in a flooded basement, the Blaine County Sheriff's Office said.

Wirth, the owner of a landscaping company, was at 85 Eagle Creek Road, north of Ketchum, helping John and Andrea Hastings with flooding issues in their home, the sheriff's office said.

At 11:10 a.m., the Hastings called 911 and reported Wirth was trapped and calling for help in the basement. Blaine County Communications dispatched deputies from the Blaine County Sheriff's Office and a technical rescue team from the Ketchum Fire Department.

The rescue team went into the basement and were able to locate and retrieve Wirth, who was unconscious in a secondary room of the unlit basement in about 6 feet of water.

The Blaine County Sheriff's Office is investigating whether something else like a medical emergency may have contributed to Wirth becoming trapped, a spokeswoman said. His cause of death is still undetermined.

Wirth was unconscious and not breathing when he was pulled from the basement, and medics performed CPR immediately and on the way to the hospital, the spokeswoman said. They were never able to resuscitate him and doctors at the hospital pronounced him dead upon arrival.

Woman drowns when elevator floods in basement

ROSANNA RUIZ, Copyright 2001 Houston Chronicle. Published 5:30 am, Saturday, June 9, 2001

An unidentified 42-year-old law firm employee drowned when water rushed into an elevator while at the basement level of a downtown building, police said.

The woman intended to move her car at about 5:30 a.m. from the Bank of America's four-level underground parking garage at 700 Louisiana, said Robert Hurst, a police spokesman.

"The woman went down in the elevator after a broadcast was made in the building by the security department that water was coming into the parking garage and anyone in the building should go down and move their cars," Hurst said. The woman, who was the only elevator occupant at the time, drowned when water rushed into the elevator while on the third level of the garage, Hurst said.

"It appears that water began rushing into the elevator and it malfunctioned and she drowned in the elevator," Hurst said. "She didn't even make it to her car parked on the fourth level."

The woman's body was discovered about 8:30 after maintenance crews noticed that the elevator had stalled and they manually brought the elevator to the lobby level.

Flood deaths in Jakarta rise to 14

© JANUARY 16, 2017 7:38PM

THE death toll from floods in Indonesia's capital Jakarta has climbed to 14 after searchers pulled three more bodies from the waters.

Indonesia's national disaster management agency said on Saturday that the body of a 35-year-old member of the city's search and rescue team was found on the banks of an overflowing river late on Friday. Another man was found dead near his flooded home in western Jakarta.

The third body of a male worker was found on Saturday in the flooded basement parking of a building in a central area of the city.

The agency said most victims were electrocuted or drowned. Electricity supplies have been cut to several flooding areas to prevent electrocutions.

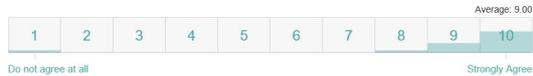
A dike in central Jakarta collapsed late on Wednesday amid floods that swamped the city. Successive governments have done little to mitigate the flooding threat.

Basement Development
in the Floodplain:
Quantifying and
Managing Risk

Preliminary Industry Survey Results

Question 1: I think that flood waters entering a basement may pose a risk to life

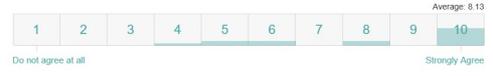
15 out of 15 people answered this question



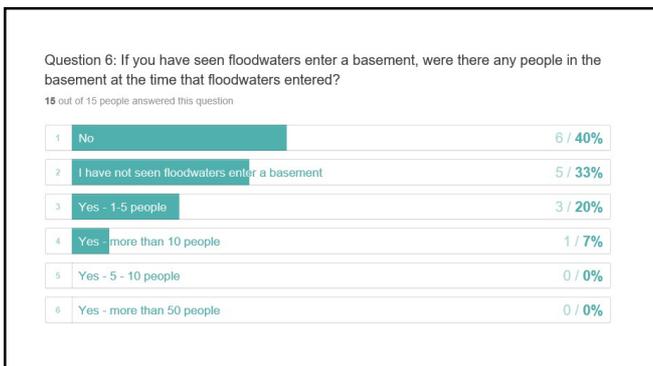
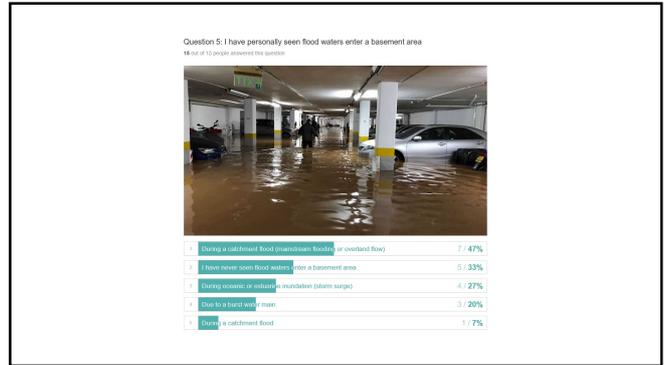
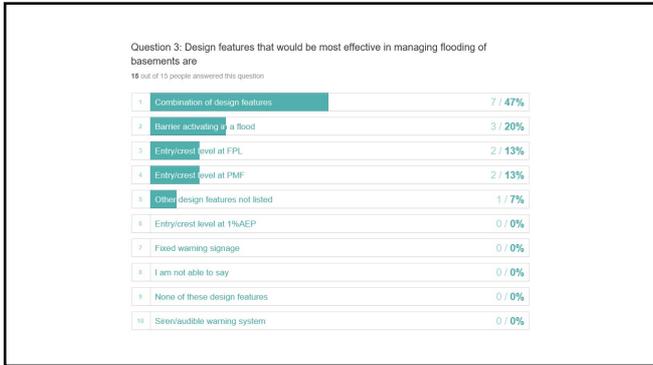
► Hide detail

Question 2: I think that flood waters entering a basement may pose a risk to property

15 out of 15 people answered this question



► Hide detail



Basement Development
in the Floodplain -
Quantifying and
Managing Risk

Current Guidance and Controls

Guideline/Policy	Guidance/Control
Floodplain Development Manual (2005)	No specific guidance
FRMG (Various)	No specific guidance
ARR (2016)	No specific guidance
Managing the floodplain: a guide to best practice in flood risk management in Australia (2013)	No specific guidance
National Construction Code (2016)	No specific guidance, note that NCC Performance Requirements for flood are also limited to Class 1, 2, 3, 4, 9a health care and 9c buildings. Basement carparks can be defined as Class 7 parts of a building.
Hawkesbury Nepean Strategy (2006) Managing Flood Risk Through Planning Opportunities – Guidance on Land Use Planning in Flood Prone Areas	Preferred crest levels for basement carparks at PMF.
Malaysian Guideline on Flood Prevention for Basement Car Parks (2006)	Substantive guidance, including surveillance cameras, warning systems and the like.

Guideline/Policy	Guidance/Control
City of Sydney Interim Floodplain Management Policy (2014)	Two definitions – basements/below ground parking – open to interpretation and definitions for controls are important but have ambiguity Have imposed some consent conditions for new developments involving: Evacuation Management Manual to demonstrate, fill time from onset of inundation, Flood free access potential, Floodwater prevention methods.
Parramatta City Council (DCP, 2011)	Design principles strongly discourage basement carparks in the floodplain. Basements to be protected for all events up to the PMF.
Northern Beaches Council (Pittwater 21 DCP)	Crest of basements for vulnerable development (seniors living, childcare centres) at the PMF.
Brisbane City Council	Crest levels for basement entries (non-habitable) vary depending on the source of flooding: Brisbane River - 2% AEP flood level + 300mm Creek/waterway - 1% AEP flood level + 300mm Overland flow - 2% AEP level + 300mm Other requirements for pumps managing inflows or post flood pump outs

Basement Development in the Floodplain – Quantifying and Managing Risk

Realities of Basements

Design and Operational Considerations

- Accessibility: wheelchair, person with cane
- Safety: fire, warning signs (lightning bolt, low voltage)
- Infrastructure: water tower, car, buildings

Basement Development in the Floodplain - Quantifying and Managing Risk

Managing risk: Options for Controls

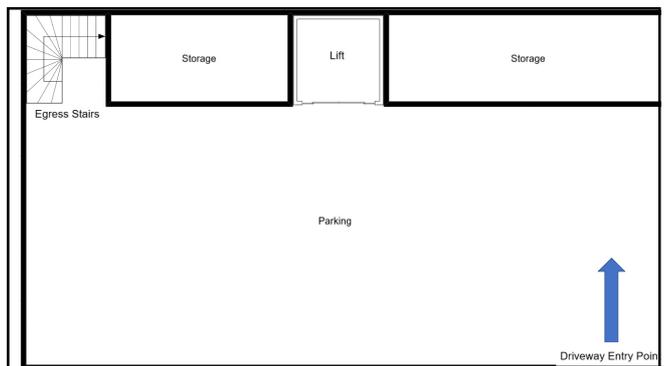
Options for Controls

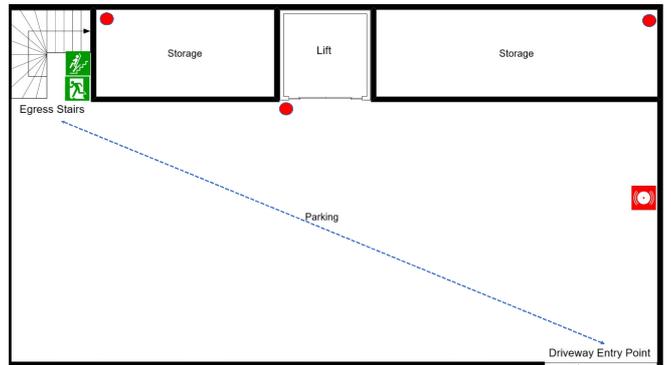
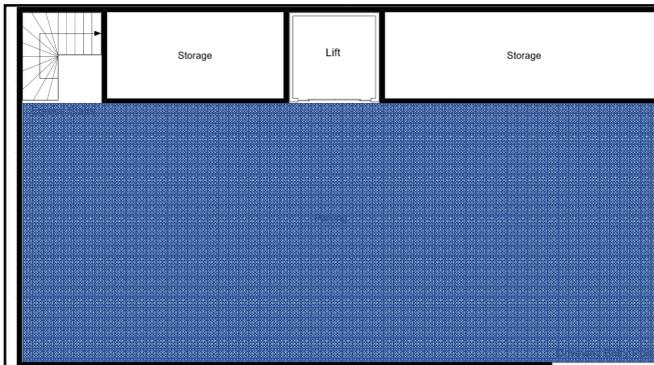
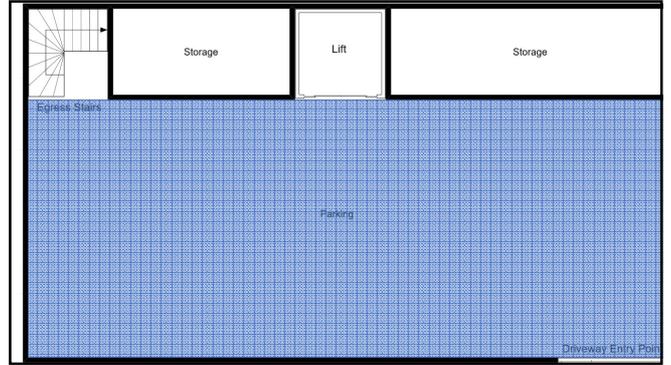
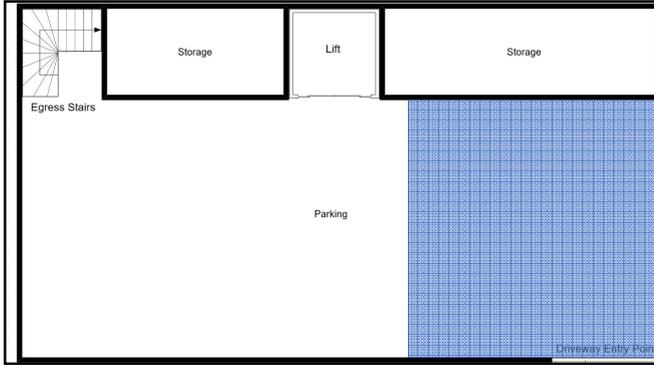
- New Development – Crest level considerations – consider how flows will ingress, at what rate? Consider setting maximum depth in the basement to not exceed an H3 depth classification (1.2 m) for PMF, Other requirements for design, safety systems and their maintenance
- Vulnerable Development – PMF crest level to prevent ingress of waters under all circumstances (case law in the Land and Environment Court)
- Alterations/Additions – Alternate entry point as part of building re-purposing, barrier solutions where no other option presents?



Basement Development in the Floodplain - Quantifying and Managing Risk

Managing risk: Simple Design Example





Basement Development
in the Floodplain –
Quantifying and
Managing Risk

Conclusions

Where to for Design and Planning Controls

- Re-think how we consider risk for flood-related controls for basements – these need to be integrated with the meeting of traffic/parking standards, access requirements (e.g. ramp grades), urban design and architectural guidelines, ventilation requirements and other design requirements specific to the type of building
- Consider the manner in which a basement might fill and what risk the rate and depth might pose – can this risk be managed through design or other means (ideally through passive design features)
- Consider supplementary design features to manage risk where ingress of floodwaters will occur (e.g. where PMF level is greater than the crest level)

ALARP for Basements?

Likelihood	Equivalent Probability*	Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	5	Medium	Medium	High	Extreme	Extreme
Likely	0.5%	Low	Medium	High	High	Extreme
Possible	0.05%	Low	Low	Medium	High	High
Unlikely	0.005%	Low	Low	Medium	Medium	High
Rare	0.0005%	Low	Low	Low	Medium	Medium
Very rare	Undefined	Low	Low	Low	Low	Medium
Almost incredible	< 0.0005%	Low	Low	Low	Low	Low

